

Efficiency in Islamic and Conventional Banking in Indonesia

Faiza Husnayeni Nahar^{1,2}, Mufti Alam Adha³, Rofiul Wahyudi³

¹Department of Economics (Undergraduate), Universitas Muhammadiyah Yogyakarta, Yogyakarta, Indonesia

²Faculty of Business and Economics, Universidad de Granada, Granada, Spain

³Department of Sharia Banking (Undergraduate), Universitas Ahmad Dahlan, Yogyakarta, Indonesia

Article Info

Article history:

Received: July 19, 2022

Revised: September 4, 2022

Accepted: September 5, 2022

Published: September 8, 2022

JEL Classification Code:

G14, G21, G28

Author's email:

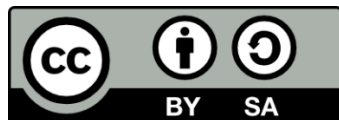
faizahusnayeni@umy.ac.id

mufti.alam@pbs.uad.ac.id

rofiul.wahyudi@pbs.uad.ac.id

DOI:

10.20885/jielariba.vol8.iss1.art11



Abstract

Islamic banking, as the relatively new player in financial services, also take parts as contributor to the growth of Indonesian economy along with the conventional one. The main purpose of this research is to analyze the efficiency of Islamic and Conventional banking in Indonesia. This research used non-parametric frontier approach, Data Envelopment Analysis (DEA), to examine the efficiency in Islamic and Conventional banks in Indonesia. It is focused on measuring technical efficiency (TE), pure technical efficiency (PTE) and scale efficiency (SE) of Islamic and Conventional banking. The finding reveals that both of Islamic and Conventional banks are relatively high on scale efficiency. On the other hand, technical is found as the least contributor to gain efficiency for banks after pure technical efficiency level. Therefore, it is suggested to bank, to manage the resources maximally, utilize information technology optimally and operate at optimum operation scale.

Keywords: Islamic banking, Conventional banking, Efficiency, Indonesia, Data Envelopment Analysis.

INTRODUCTION

Islamic banking has been growing rapidly in Indonesia as it is shown by the raising number of Islamic banks since its first establishment in the year of 1992. It is reported that there are 14 of Islamic banks existing within last two decades (OJK, 2020b). Conventional banking also plays an important role to introduce Islamic banking system to a larger segment of population by creating Islamic Business Unit in their services. Financial Services Authority of Indonesia (known as OJK) stated that there are 19 of Islamic Business Unit in Conventional banking. It is also reported that many of them which fully convert as Commercial Islamic bank eventually (Fakhrunnas et al., 2018). The main difference between Islamic and Conventional banking are in the activity of banking system its selves. Activity that involves interest is prohibited in Islam as it is known implemented in all products of Conventional banking (Masood & Ashraf, 2012). Hence, Islamic banking provide services which has interest-free banking. It is interesting to note that Islamic banking is also well known for many non-Muslim customers. Salman & Nawaz, (2018) disclose that there are more than 300 Islamic financial institution which operated in more than 75 countries in the world.

In term of performance, Islamic and Conventional bank shows significant positive trend. In 2017, Islamic banking earns total asset with approximately IDR 0.28 trillion while Conventional banking receive IDR 7.09 trillion of total asset (OJK, 2020a). Even though Islamic banking get lesser total asset, but its growth rate has grown sharply compared to the conventional one. On the other way around, conventional has superior market share compare to Islamic banking which only receive 5.44% of market share (Fakhrunnas et al., 2018).

Both Islamic and Conventional banking need to maintain their quality of performance, and efficiency can be used as indicator to evaluate it. According to Farrell (1957), firm is more efficient if they could produce as many as possible output from a given set of input. In the context of banking, input and output can be defined from financial activity such as collecting funding from the surplus party or lending the money for business or education purposes. Input can be measured from total deposit (Alam, 2013), operational cost (Fakhrunnas et al., 2018) and fixed asset (Yahya et al., 2012). While output can be calculated from total loans, liquid asset and other income (Drake & Hall, 2003; Ascarya & Yumanita, 2006).

Good efficiencies could lead to rise of an economic growth of a country. Bank Indonesia as an Indonesian regulator and supervisor of banks can take a further action if they face serious economic problem caused by instability of bank. It will cause a nightmare economic for its country if there is a failure on banking performance (Nahar & Prawoto, 2017). Merger could be exemplified of Bank Indonesia's policy in order to boost up efficiency for particular banks (Hadad et al., 2003).

Most study reported that measuring efficiency of banking lead to strengthening banking structure as intermediation function. In addition, it also helps both Islamic and Conventional banking to have fair competitiveness among each other (Ascarya & Yumanita, 2006). Therefore, further analyze is needed to identify the causes of inefficiency (if any). Hence, Bank Indonesia or policy maker could take a strategy to increase an efficiency for bank who suffer for inefficiency outcome and maintain the bank who already have a good efficiency score. Based on the above

discussion, the major objectives of the study are to measure efficiency level of each bank and compare the level of efficiency for Islamic and Conventional Banking. In addition, this study aims to understand two issues regarding the efficiency of banking. The research questions are: (1) What are the distinguish between Islamic and Conventional banking in term of efficiency level? And (2) How to gain efficiency for bank who experience inefficiency level?

LITERATURE REVIEW

Many researchers have analyzed the efficiency of banking either Islamic or Conventional banking in over the world. Alam (2013) examined whether bank regulation could increase the efficiency of 70 Islamic banking in 11 countries from 2006 to 2010. It is found that regulation has positive relationship to efficiency. The stricter the regulation, the higher the technical efficiency of Islamic banking. In other word, Islamic banking can perform well within strict regulation ambience. This might be since Islamic bank is not only following national banking laws, but also following the Shariah laws which indirectly eliminating the undesired activity inside the bank. In addition, this study also showed that Saudi Arabia and Kuwait achieve higher average technical efficiency score among 11 countries. On the other hand, Turkey and Bahrain experience the lower efficiency level. The possible justification for high efficiency score in Saudi Arabia and Kuwait is due to high Islamic banking asset and fewer Islamic banks. It is interesting that fewer Islamic banks tend to increase efficiency level.

Moreover, in the case of Japan, Drake & Hall (2003) analyzed the efficiency in Japanese banking by using non-parametric frontier approach (DEA model) with three outputs and inputs in 1997. They use total loans, liquid asset, and other income as outputs while general and administrative expenses, fixed asset, retail, and wholesale deposits as inputs. It is interesting to note that, from 149 Japanese bank, overall Japanese banks have inefficiency level with 72.36 of technical efficiency. However, the scale efficiency score pointed out at 92.78. It means that failure in minimizing the cost gives serious impact than disable to operate at minimum efficiency scale.

In Malaysia, Yahya et al. (2012) tried to find the difference between all Islamic banking and Conventional banking in regard to efficiency level from 2006 to 2008. It was found that the average efficiency score for both banking system are relatively equal. It means that there is no statistically significant difference in efficiency level for both systems. Due to fact that Islamic bank should implement Islamic tenets or Shariah laws in all their financial activity, they are still able to perform well which equivalent to Conventional banking's performance. From 2006 analysis, the finding shows that there are 5 out of 7 Islamic banks and 5 out of 20 Conventional banks where their level of efficiency frontier pointed out at value of one. On the other hand, even though most Islamic banks still perform well with efficiency frontier of 1, it was found that there is declining efficiency level for two Islamic banks which fall to the bottom ranks. Yet it still good movement for Islamic banks compare to conventional bank's efficiency level, particularly many Islamic banks can manage their position to be at efficiency frontier in 2009. In addition, it also explained that Islamic banks have a higher efficiency score compared to conventional bank on average. Islamic banks receive 0.944, 0.92 and 0.83 of efficiency level while Conventional banks

get level of efficiency by 0.776, 0.89 and 0.81 for the year 2006, 2007 and 2008, respectively. However, based on T-test, it shows that there is no significant difference between both banking system particularly in the year of 2007 and 2008. Since all Islamic banks also differ from its size of bank, capital asset and the age of establishment within this period of study, it might cause different result in average. Besides, foreign bank which included as data might distort the result since they have different structure and purposes compare to the local banks.

Following the above research, Ismail et al. (2013) also examine the efficiency level from all banks in Malaysia from 2006 to 2009. Based on scale efficiency and allocative efficiency, it is stated that Islamic banks is relatively more efficient than the conventional one. In other word, it could be explained that Islamic banks are better in utilizing their resources. Hence, Conventional commercial banks need to utilize their resources efficiently in purposing to gain more profit and enable to compete at international level. Even though Islamic banks are greater in resource allocation with 88.8 percent, it was found that they are needed to improve their technology to boost up more profit (technical efficiency is 74.8 percent). It was lesser compared to Conventional banks where better in utilizing information technology and electronics (technical efficiency is 97.7 percent). Overall, it is advocate for all banks to improve their size to achieve as high as possible of efficiency level. There are three Conventional banks which stood at the highest level in efficiency (pure technical efficiency, technical efficiency, and cost efficiency) due to its larger bank size. It is reported that one of these three banks have total asset with more than RM 350 billion. It was also claimed that the lowest efficiency level at banks is due to their small size and ignoring the technological innovation.

While in Thailand, Sufian & Shah Habibullah (2010) found an average technical efficiency pointed at 86.9 percent which indicated that banking has good performance in term of intermediation function such as transforming deposits into loan. It is interesting that due to minimum input waste (13.1 percent), bank could produce same amount of output by the 86.9 percent given input. However, within the period 1999 to 2008, bank suffer for inefficiency condition with greater scale inefficiency level compare to technical efficiency. It is indicating that Thailand banking sector has been successful on managing the performance, yet it failed to exploit scale of economies. Regarding the determinant of bank's efficiency, it was found that loan has positive relationship to efficiency of banking. The higher the loan intensity, the greater the efficiency level. Although the higher loan led to the reducing level of liquid asset, higher loan is claimed as the valuable output compared to investment and securities. As Ismail et al. (2013) finding, this research also stated that size would be a matter that determining efficiency level. The finding shows that the higher size tends to reduce the efficiency level. As expected, it was found that credit risk has negative relationship with efficiency level. The higher the credit risk, the greater the inefficiency level would be. Hence, all in all, it is advocating that Thailand banking sector need to manage credit risk properly and collecting deposit into loan as many as possible to maintain their efficiency level.

In the case of Indonesia, Fakhrunnas et al. (2018) examined about the effect of macroeconomics factors towards efficiency in 11 Islamic banks and 15 Conventional banks from period of 2007 until 2016. Their findings showed that Conventional banking has higher efficiency (85.78 percent) compared to Islamic banking (74.54 percent) on average period of study. It is

interesting to note that there are 6 Conventional banks which highly contribute on increasing the efficiency of Conventional banking in 2009. These 6 Conventional banks reach 100 percent efficiency for each bank, and it is resulting to boost up the overall Conventional banking's efficiency by 96.48 percent. The lower score of average efficiency in Islamic banking indicates that Islamic banking need to improve their performance, especially in maintaining the stability of financial performance.

Furthermore, Ascarya & Yumanita (2006) examined about the efficiency in Islamic banking in Indonesia by using 2 phase, first phase is starting from the year 2002 to 2004 while second phase is begun from 2005 until 2008. The first phase is focused on the Islamic banking growth while the second one is concern on improving the Islamic banking structure. By using DEA methodology, it is found that Islamic banking reach good efficiency score in term of technical and scale efficient. In 2004, the technical efficient of Islamic bank reach 100 percent and 85 percent for intermediation and production approach, respectively. However, Islamic banks still need to improve their financial performance, particularly in improving their liquid asset and operational income. Islamic banking is still categorized as newcomer in banking industry; hence their operational cost is still relatively high. Expansion is exemplifying the causes of high cost which resulting many offices cannot reach break-even condition. Therefore, they could increase the efficiency by increasing the operational income.

In regard to Conventional banking efficiency in Indonesia, Hadad et al. (2003) explain that input and output in the context of financial institution could be found from two approaches namely stochastic frontier approach (SFA) and distribution free approach (DFA). It is very interesting that this study also analyzed the effect of merger or acquisition from national banks after measuring the efficiency level of each bank from 1995 to 2003. The finding shows that both approaches resulting the same answer for the most efficient bank. In addition, it also reveals that bank is more efficient after bank are merged. However, it is only applied for one bank only, while the rest of merger banks pointed out the decreasing amount of efficiency level. The possible justification is due to different size of bank. Even though bank has low efficiency score after merger, in fact bank is operating efficiently. In short, table 1 exhibit a summary from the previous studies.

Table 1. Literature Review and Its Findings

Author	Country	Method	Variable	Finding
Alam (2013)	11 countries	DEA	<ul style="list-style-type: none"> - Input: personnel expenses, fixed assets, deposits plus short-term funding - Output: total loan, total earning assets - Technical efficiency - Banks' supervision, and regulation risk 	Regulation & strict monitoring has positive relationship to technical efficiency of Islamic banks.
Drake & Hall (2003)	Japan	DEA	<ul style="list-style-type: none"> - Input: general and administrative expenses, fixed assets, retail and wholesale deposits. - Output: total loans and bills discounted, liquid assets and 	<ul style="list-style-type: none"> - Conventional bank size has positive relationship to overall technical and scale efficiency - Pure technical efficiency contributes more on increasing

Author	Country	Method	Variable	Finding
			other investments in securities, other income - Technical Efficiency, Pure Technical Efficiency, Scale efficiency, bank size	inefficiency than scale efficiency
Yahya et al. (2012)	Malaysia	DEA	- Input: deposits, fixed asset, other earning asset - Output: loan amount, interest revenue, net income. - Technical Efficiency	- There is no significance difference on technical efficiency score for Islamic and Conventional banks
Ismail et al. (2013)	Malaysia	DEA and Tobit	- Cost Efficiency, Scale Efficiency, Technical efficiency, Pure Technical Efficiency, Allocative efficiency - bank size, profitability, capitalization, loan quality.	- TE, PTE and CE of Conventional banks are higher than Islamic banks. - SE and AE of Islamic banks are the higher one.
Sufian and Shah Habibullah (2010)	Thailand	DEA and Tobit	- Input: total deposits, fixed asset, labor. - Output: total loan, investment, non-interest income. - Technical Efficiency, Pure Technical Efficiency, Scale Efficiency - 12 independent variables (TE as dependent)	- Greater scale inefficiency rather than technical efficiency - Loan has positive relationship to efficiency of banking. - Higher bank size tends to reduce the efficiency level
Fakhrunnas et al. (2018)	Indonesia	DEA and Panel Data	- Input: total deposit, operational cost - Output: total payment, earning asset. - Inflation, interest rate, economic growth.	- Conventional banks have higher efficiency compare to Islamic banks. - Conventional banks are relatively sensitive to crisis
Ascarya & Yumanita (2006)	Indonesia	DEA	- Intermediation approach: Input: labor cost, fixed asset, third-party fund Output: total loan, other income, current asset - Production approach: Input: interest cost, personal cost, other operational cost Output: interest income, other operating income - Technical efficiency, scale efficiency	- From intermediation approach, improvement of liquid asset led to raise efficiency of Islamic banks. - From production approach, operational income can boost up efficiency of bank.
Hadad et al. (2003)	Indonesia	DEA	- Input: labor price, fund price - Output: credit from other party to bank, credit given by other party, securities - Stochastic frontier approach and distribution free approach	- Bank merger is not always as a solution for increasing an efficiency level of bank.

RESEARCH METHODS

This research used non-parametric frontier approach, Data Envelopment Analysis (DEA), to examine the efficiency in Islamic and Conventional banks in Indonesia. DEA was firstly

introduced by Farrell (1957) and its becoming widely used method in order to evaluate the efficiency level in many sectors (Charnes et al., 1978). Some of sectors are hotel (Botti et al., 2009), hospital (Haris et al., 2000), and banking as well. In the context of efficiency banking, many researchers examined the efficiency bank by using this tools such as Drake & Hall (2003; Sufian & Shah Habibullah, 2010; Yahya et al. 2012; Salman & Nawaz, 2018). Barros (2005) stated that DEA is most promising technique to measure efficiency based on multiple input and output. In addition, Fakhrunnas et al. (2018) added that DEA could easily detect the fund flow from one unit to another, hence, as financial intermediary between saver and borrower, it might help bank to solve the inefficiency score effectively.

In this study, it is focused on measuring technical efficiency (TE), pure technical efficiency (PTE) and scale efficiency (SE) of Islamic and Conventional banking. According to Alam (2013), the technical efficiency of bank is determined based on the difference of observed input and output with respect to optimal input and output. In other word, technical efficiency is measuring the ability of the firm to get maximum output from the given amount of input (Yahya et al., 2012). Based on Charnes, Cooper and Rhodes (CCR) which knowns as basic DEA model (Mostafa, 2011), it is said that firm (in this case is bank) is considered as an efficient if their efficiency are constrained to one. On the other way around, the value stood at zero level if they bear the inefficient level. Good technical efficiency also led the bank to earn more profit (Sufian et al., 2008). The higher the technical efficiency, the greater the profit of the bank. In addition, the other advantage of being technical efficiency bank is tend to deter foreign competition as long as bank could increase its national market integration (Lozano-Vivas et al., 2001).

When banks could save input for producing more output based on specified input, it so called as pure technical efficiency. In other word, pure technical efficiency is refer to the ability of bank which can manage their resources maximally (Sufian et al., 2008) and it is being a commonly used for measuring the productive usage of resources (Drake & Hall, 2003). Furthermore, scale efficiency has been used as a measure for firm to achieve the average productivity when they operate it at optimum scale of operation (Taib et al., 2018). Hence, if firm get higher scale inefficiency it led to failure on exploiting scale economies (Sufian & Shah Habibullah, 2010). However, if firm could reach the scale efficient, it means this bank could operate well at optimal level operation.

The efficiency formula for Islamic and Conventional bank can be expressed as follows (Fakhrunnas et al., 2018):

$$\text{Efficiency: } \frac{\sum_{k=1}^p u_k y_{kjo}}{\sum_{l=1}^m v_l x_{ljo}}$$

Whereas m and p as input and output respectively, u_k is input portion, v_l is output portion. While x_{ljo} and y_{kjo} are total input and output of bank, respectively. This study used 2 inputs and 2 outputs and 20 total DMU or banks (further explanation are in the data and model section). According to Banker & Morey (1986), it is suggested to fulfil minimum DMU's criteria where it should be at least greater than three times of total input plus output. Hence, due to this case, the total minimum bank should be more than 12 banks and the total bank of this study is

20 which is greater than minimum unit ($20 \geq (3(2+2))$). In other word, the total banks are satisfying the minimum number criteria then the next step could be proceeded afterwards (Barros, 2005; Popović et al. 2020).

DATA AND MODEL

Central bank of Indonesia classified banking into many categories, such as Islamic Commercial bank, Islamic Business Unit, Conventional Commercial banks, and Islamic and Conventional Rural bank. However, due to limitation of data, this research would focus on measuring the efficiency for Islamic and Conventional Commercial banks. In addition, total asset and reserve bank also being consideration on collecting the data. Narrowing down the characteristic of both banks into the same boat would reduce the widening gap on data (Fakhrunnas et al., 2018).

The data were collected from annual financial report of 20 banks (10 Islamic Commercial banks and 10 Conventional Commercial banks) from period of 2010 until 2013. We found out that few banks are having good efficiency during this certain period, as we might see in the table of scale efficiency in the study of Fakhrunnas et al. (2018). Thus, we would like to analyze in which efficiency of the bank need to settle, like on how the bank earn profit, on how they use recourse optimally and so on only for this specific period. Hence, the three type of efficiency already represent the character of banking ratio (Nahar & Prawoto, 2017). The name of each bank can be seen from the table 2.

Table 2. Name of Islamic banks and Conventional banks

Islamic banks	Conventional banks
Bank Muamalat Indonesia	Bank Artha Graha
Bank Syariah Bukopin	Bank Mayapada,
Bank Panin Syariah	Bank of Indonesia India,
Bank BCA Syariah	Bank BNP
Bank BNI Syariah	Bank Bumi Arta
Bank Mega Syariah	Bank QNB
Bank Syariah Mandiri	Bank Windu
Bank BRI Syariah	Bank Ekonomi
Bank Maybank Syariah Indonesia	Bank BRI Argo
Bank Victoria Syariah	Bank Sinarmas

Source: OJK, 2020.

This study used DEA model with two inputs and two outputs. The input variables consist of total deposit (x_1) and operational cost (x_2) while output variables are total payment (y_1) and earning asset (y_2). All these variables were collected from the balance sheet. Table 3 shows the summary related to inputs and outputs.

Table 3. Research Variable and Its Previous Studies

	Definition	Unit	References
Input (x1)	Total Deposit	Million Rupiah	Drake & Hall (2003), Sufian & Shah Habibullah (2010), Alam (2013), Yahya et al. (2012), Fakhrunnas et al. (2018)
Input (x2)	Operational Cost	Million Rupiah	Ascarya & Yumanita (2006), Fakhrunnas et al. (2018)
Output (y1)	Total Payment	Million Rupiah	Fakhrunnas et al. (2018)
Output (y2)	Earning Asset	Million Rupiah	Drake et al. (2005), Yahya et al. (2012), Alam (2013), Sharma et al. (2013), Fakhrunnas et al. (2018)

Source: proceed by researcher

RESULTS AND DISCUSSION

The discussion for the result study would be divided into three parts, the first part is explanation about the efficiency of Islamic bank, second part is efficiency for Conventional bank, while the last part is the comparison between both of banks.

EFFICIENCY IN ISLAMIC BANK

Based on figure 1, the technical efficiency of Islamic banks shows a fluctuate movement for over 4 years. At the year of 2010, it was found that Bank Syariah Mandiri (BSM) earned the highest technical efficiency with 0.94. It is followed by Bank BRI Syariah and Bank Muamalat Indonesia (0.84 and 0.81 respectively). Surprisingly, almost all Islamic banks experience lower technical efficiency at the year of 2011 with range between 0.17 to 0.39 for each inefficiency bank. It is not even reaching a fifty percent of efficiency level. However, the technical efficiency score tends to move positively afterwards. For instance, Bank Panin Syariah achieve higher efficiency (TE=0.81) among the others in 2012. It is interesting to note that Bank Victoria Syariah (BVS) is the only Islamic banks which achieve a perfect technical efficiency level during this period of study. In other word, Bank Victoria Syariah is the most efficient sector in Islamic banking in 2013(in term of technical efficiency).

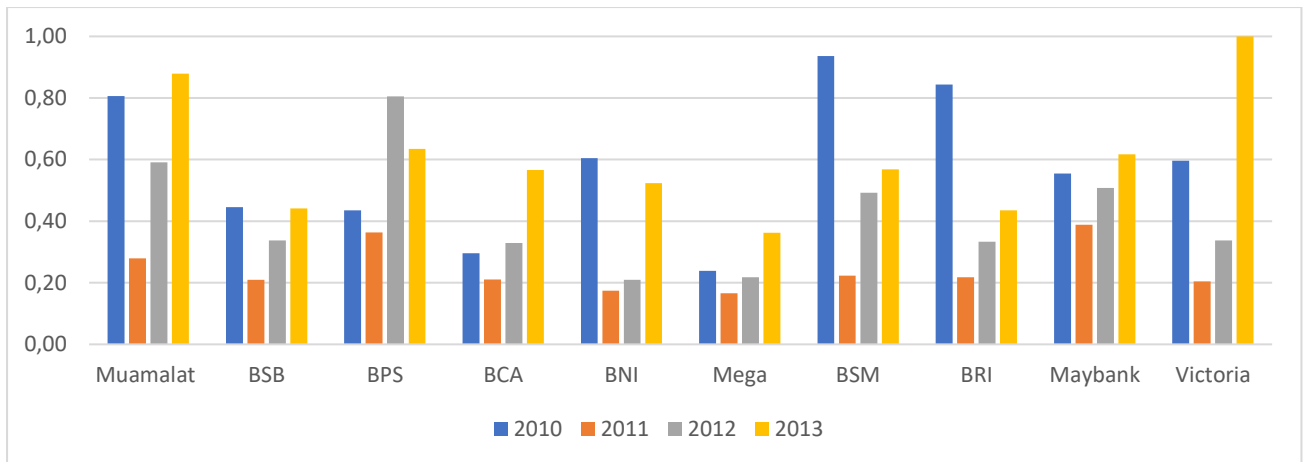


Figure 1. Technical Efficiency Score for Islamic banks in 2010-2013

On the other way around, figure 2 exhibit the positive trend of pure technical efficiency. It can be seen that almost all Islamic banks experience upward trend. It is interesting to note that Bank Syariah Mandiri and Bank Victoria have the maximum pure technical efficiency for over the year. It is indicating that BSM and BVS are clearly the most efficient Islamic bank (in pure technical efficient). In other word, both banks could manage their resources to the fullest. While Bank BNI Syariah and Bank Maybank Syariah reach the maximum efficient level in the year of 2013 only. In case of Bank Muamalat, this bank achieves maximum efficiency level in two years in a row (2012 and 2013).

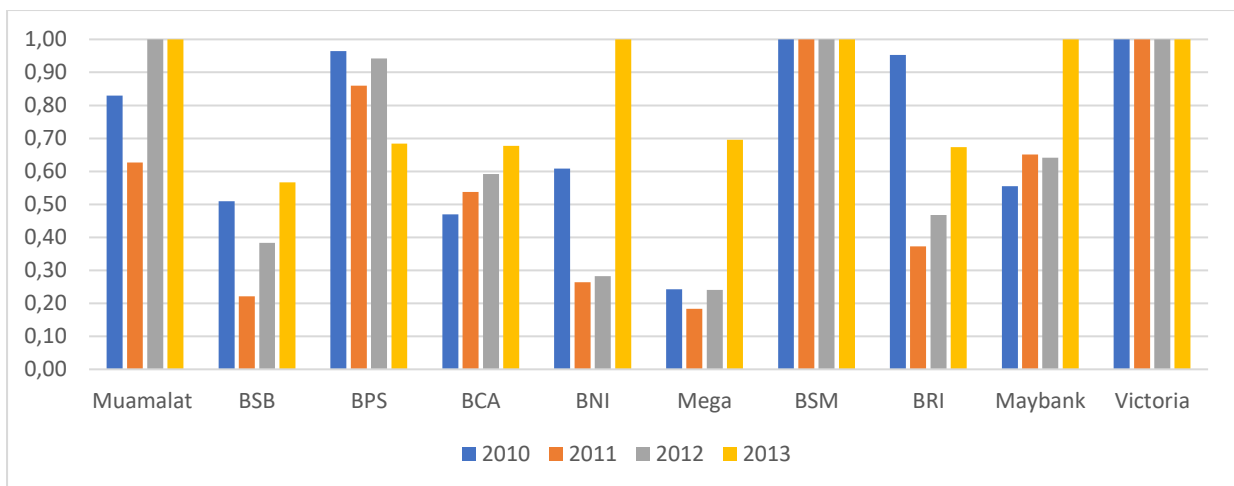


Figure 2. Pure Technical Efficiency Score for Islamic banks in 2010-2013

Furthermore, in case of scale efficiency, it is revealing that Bank Maybank and Bank Victoria are the most efficient bank in 2010 and 2013, respectively (see figure 3). However, unexpectedly, the movement of scale efficiency level for all Islamic banks are declining over the year (Except Bank Victoria Syariah). While at beginning, banks were starting at good scale efficiency as it shown from the blue line (2010) such as Bank Muamalat, Bank BNI Syariah, Bank Mega Syariah. It is indicating that Islamic banks face inefficiency scale economy with average scale efficiency of 0.70 (see table 2).

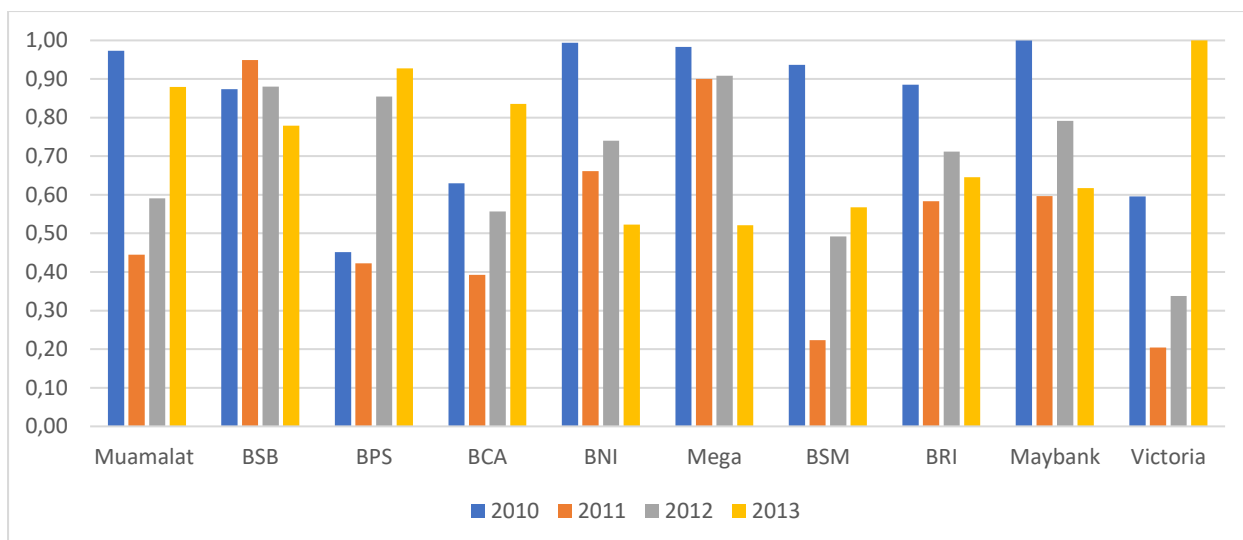


Figure 3. Scale Efficiency Score for Islamic banks in 2010-2013

To summarize, with respect to the higher level of pure technical efficiency, it implies that Bank Syariah Mandiri (BSM) and Bank Victoria Syariah (BVS) are on the efficient frontier (PTE=1) in 2010 and 2013, respectively. It means that both banks are able to use their resources to the fullest at that period. In contrast, it is surprising when BSM and BVS are experience lower efficiency level in context of scale efficiency (SE=0.55 and 0.53 respectively) since they get maximum pure technical efficiency for over the period. It is reported that Bank Syariah Mandiri has total asset IDR 63 billion (increased by 17.95 percent compare to the previous year) which indicating that BSM is larger Islamic bank (Bank Syariah Mandiri, 2013). It is contradict to the finding of Ismail et al. (2013) who stated that small bank size tend to get higher inefficiency level. it was said that size of bank might contribute on raising the inefficiency level of bank. Hence, due to this case, the possible justification is although BSM and BVS have greater total asset, they still need to operate at optimal operation scale in order to gain efficiency (Sufian et al., 2008).

In addition, the average pure technical inefficiency outweighs the scale inefficiency in Islamic banks. Therefore, it is advocating that Islamic banks need to use their resources maximally. It is supported by the finding of Ismail et al. (2013) which stated that scale efficiency is the main sources of both Islamic and Commercial banks.

EFFICIENCY IN CONVENTIONAL BANK

The next part is examining the efficiency of conventional bank. From these figures (figure 4, 5 and 6), it is showing the efficiency level for Conventional banks in the context of technical efficiency, pure technical efficiency, and scale efficiency. Regarding technical efficiency (figure 4), it is clear to see that Bank of Indonesia India is the most efficient bank for over the period with the maximum level if efficiency. On the other hand, Bank Atha Graha, Bank BNP, Bank Ekonomi and Bank Sinarmas which achieve the maximum efficient score in 2010, experiencing the declining efficiency level afterwards with 0.77, 0.58, 0.84 and 0.52 of efficiency level,

respectively. Bank BRI Argo also in the same boat, but they reach maximum efficiency at the year of 2011. It is interesting to note that Bank Bumi Arta get the lowest efficiency level over the period among all Conventional banks, started at 0.44 efficiency level in 2010 and 0.38 efficiency level in 2013.

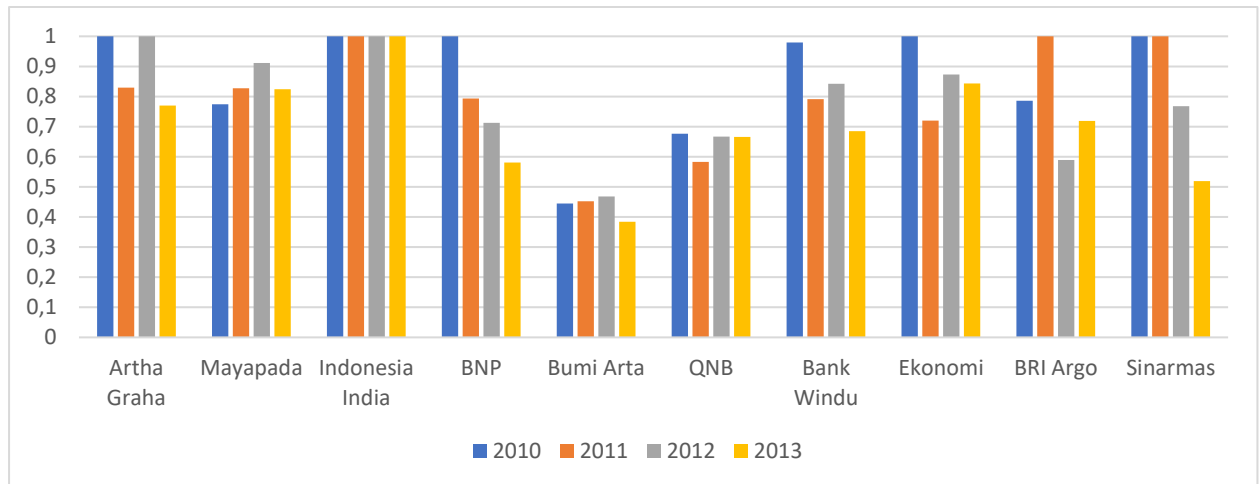


Figure 4. Technical Efficiency Score for Conventional banks in 2010-2013

The most striking feature in the figure of 5 is Bank of Indonesia India and Bank Ekonomi are being the most efficient banks for over the period. It is indicating that both banks could use their resources maximally. On the other hand, Bank Artha Graha could not utilize their resource optimally due to declining efficiency level at the year of 2013 (PTE=0.89), in fact that this bank has maximum efficiency level last three years in a row. It is surprisingly that Bank Bumi Arta also has the lowest efficiency level for over the period with the range between 0.49-0.61.

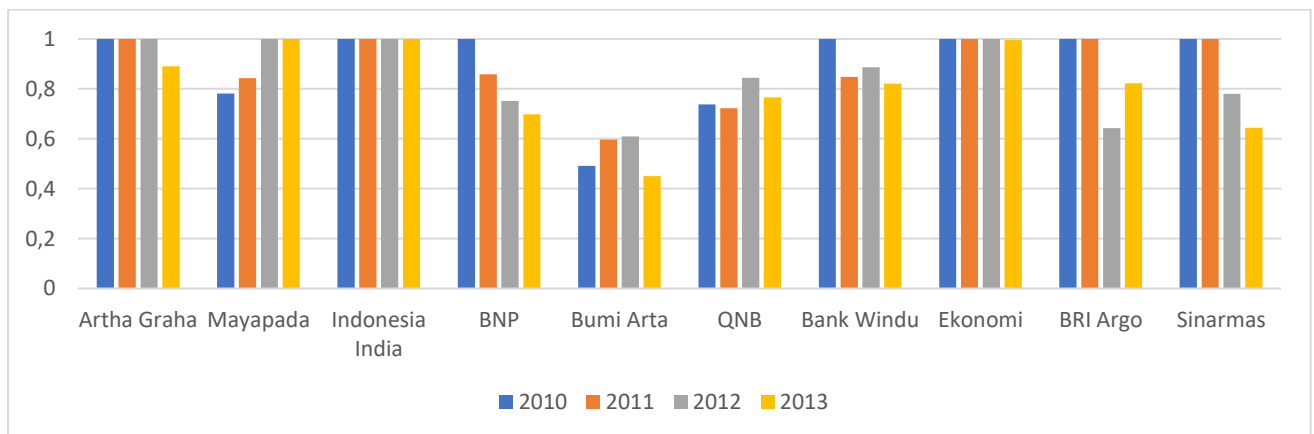


Figure 5. Pure Technical Efficiency Score for Conventional banks in 2010-2013

After then, in case of scale efficiency of Conventional banks (figure 6), it is not surprising to see that Bank of Indonesia India reach the maximum efficiency level four year in a row. It is also interesting to note that although Bank Bumi Arta still has the lowest number of efficiency level compare to others, but it was a big number with range between 0.77 to 0.90. It means that

Bank Bumi Arta has potential to achieve the average productivity when operating at optimum operation scale which resulting to the increment of efficiency level afterwards.

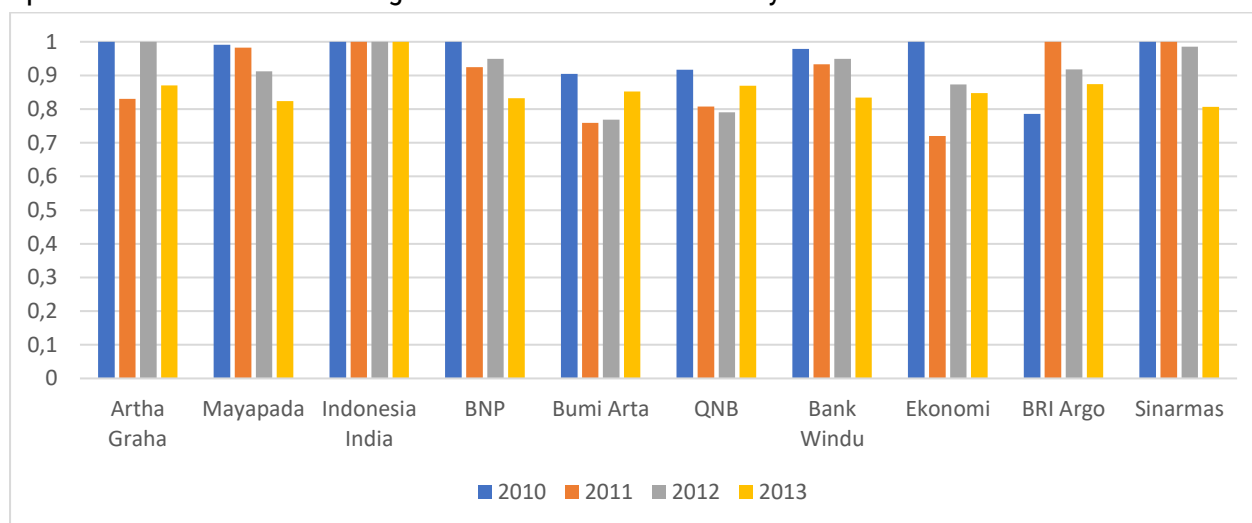


Figure 6. Scale Efficiency Score for Conventional banks in 2010-2013

To summarize, Bank Indonesia India is the most efficiency Conventional bank sector in Indonesia with all TE, PTE and SE at maximum efficiency level for over the period. While regarding pure technical efficiency level, Bank Ekonomi is also one of the most efficient banks. It means that they can manage the resources optimally. However, Bank Ekonomi suffer for scale inefficiency, therefore, it is suggested to improve their management at optimal scale of operation to gain more efficiency level ($PTE > SE$). Another interesting case is bank Sinarmas who experience the maximum efficiency level (TE, PTE and $SE=1$) in 2010 and 2011. Then the efficiency level start to declining gradually which resulting to pointed at inefficiency level in last two period in 2012 and 2013.

COMPARISON EFFICIENCY BETWEEN ISLAMIC AND CONVENTIONAL BANK

This subsection would present the result of DEA efficiency from Islamic and Conventional banks. From the table 4, 5 and 6, it is illustrated the result from DEA namely technical efficiency (TE), pure technical efficiency (PTE) and scale efficiency (SE). From table 4, the result shows that average efficiency level in Conventional bank tend to relatively higher compare to Islamic banks' efficiency level (except PTE in 2013). It is found that scale efficiency is the main source for conventional bank in obtaining efficiency level. It means that Conventional bank has an ability to earn more efficiency level by operating the average productivity at optimum scale of operation. The second source is pure technical and followed by technical efficiency. It is in line with Ismail et al. (2013) finding which stated that their scale efficiency is greater (0.97) than the others. In short, Conventional banks is advocated to improve their technological innovation and manage their resources maximally.

On the other hand, although Islamic banks encountered the higher scale efficiency in 2010 and 2012, yet pure technical efficiency found to be higher in 2011 and 2013. Due to this case, scale efficiency and pure technical efficiency could be considered as the main resources

for Islamic banking to boost up the efficiency level. However, it is better for Islamic banks to improve their efficiency through managing resource maximally and as well as operating average productivity optimally since they have not reached the maximum level of efficiency at one (Najib & Iskandar, 2022).

In addition, it is interesting to note that, although it was only small gap, pure technical efficiency in Islamic banks is obviously seen to be greater number compare to Conventional bank's scale efficiency in 2013 with 0.82 and 0.80, respectively. Hence, by managing the resources effectively and maximally might contribute well on increasing the efficiency level to the fullest in afterwards.

Table 4. Efficiency Score for all Islamic and Conventional banks

Year	Bank	TE	PTE	SE
2010	Islamic	0,57591	0,71327	0,83239
	Conventional	0,86616	0,90115	0,95781
2011	Islamic	0,24366	0,57166	0,53792
	Conventional	0,80031	0,88664	0,89623
2012	Islamic	0,41597	0,65483	0,6864
	Conventional	0,78329	0,85125	0,9146
2013	Islamic	0,60272	0,82979	0,7296
	Conventional	0,69959	0,8085	0,86126

Notes: TE: Technical Efficiency, PTE: Pure Technical Efficiency, SE: Scale Efficiency

On average, based on table 5, it is found that both Islamic and Conventional banks are relatively high on mean scale efficiency, it is indicated that both are significantly efficient at operating the optimum scale of operation. Bank size becoming an important measurement for improving efficiency. On the other hand, technical is found as the least contributor to gain efficiency for banks especially to Islamic banks due to smallest number of technical efficiencies compare to conventional bank. Therefore, it is suggested to bank, particularly Islamic banks to utilize information technology efficiently in order to earn more profit (Ismail et al., 2013).

There are several possible justifications on why Islamic banks has higher inefficiency compare to Conventional bank. As stated by Alam (2013) that fewer Islamic banks with larger total asset might cause efficiency increment level in Saudi Arabia and Kuwait. Hence, in case of Indonesia although the total Islamic banks is not as larger as Conventional one, but the total Islamic banks is also not considering as few numbers. It is reported that Indonesia has total 14 Islamic Commercial banks and 19 Islamic Business unit (OJK, 2020). In other word, total number of banks does a matter for an efficiency of Islamic banks, especially for Islamic bank case.

Table 5. Mean Technical Efficiency, Pure Technical Efficiency and Scale Efficiency of Islamic and Conventional banks

	TE	PTE	SE
Islamic Bank	0,46	0,69	0,70
Conventional Bank	0,78	0,86	0,90

Source: proceed by researcher

In average, Islamic banks experience higher inefficiency level in technical (TE=0.46) and lower efficiency level in scale (SE=0.70). It means that Islamic bank has an issue on how to minimize the cost, where the cost is exceeded from the given input (Prior & Solà, 2000). It is supported by Drake and Hall (2003) findings which explain that it becoming serious impact for bank who cannot reducing the cost rather than unable to operate at minimum efficiency scale. In addition, since Islamic banking is categorize as newcomer, it is not surprising when their operational cost are still relatively high (Ascarya & Yumanita, 2006). Therefore, since Islamic banks has higher efficiency level in scale efficiency compared to technical and pure technical efficiency which indicating Islamic banks success to operate at optimum operation scale. It is suggested to Islamic banks to improve on technology innovation (Ismail et al., 2013).

CONCLUSION

To sum up, Islamic banks and Conventional banks are experiencing different result on getting efficiency level. However, in average both banks are suffering for the inefficiency level due to unable to reach maximum efficiency level at value of one. Hence, it is suggested for both Islamic and Conventional banks to improve their efficiency level by managing the resources maximally, fulfilling to get maximum output from the given specified input and operating at optimum operation scale. In the context of efficiency level for each bank, it is interesting to note that Bank Indonesia India has shown as the most efficient conventional bank (TE, PTE, SE=1). While Bank Syariah Mandiri and Bank Victoria are found to be the most efficient Islamic banks in term of pure technical efficiency level.

REFERENCES

- Alam, N. (2013). Impact of banking regulation on risk and efficiency in Islamic banking. *Journal of Financial Reporting and Accounting*, 11(1), 29–50. <https://doi.org/10.1108/JFRA-03-2013-0010>
- Ascarya, & Yumanita, D. (2006). Analisis efisiensi Perbankan Syariah di Indonesia dengan Data Envelopment Analysis. *TAZKIA Islamic Finance and Business Review*, 1(2), 101–124.
- Bank Syariah Mandiri. (2013). *Laporan Tahunan 2013*. <https://www.mandirisyariah.co.id/assets/pdf/annual-report/AR-BSM-2013-Lap-Manajemen.pdf>
- Banker, R. D., & Morey, R. C. (1986). The Use of Categorical Variables in Data Envelopment Analysis. *Management Science*, 32(12), 1613–1627. <https://doi.org/https://doi.org/10.1287/mnsc.32.12.1613>
- Barros, C. P. (2005). Measuring efficiency in the hotel sector. *Annals of Tourism Research*, 32(2), 456–477. <https://doi.org/10.1016/j.annals.2004.07.011>
- Botti, L., Briec, W., & Cliquet, G. (2009). Plural forms versus franchise and company-owned systems: A DEA approach of hotel chain performance. *Omega*, 37(3), 566–578. <https://doi.org/10.1016/j.omega.2007.12.002>
- Charnes, A., Cooper, W. W., & Rhodes, E. (1978). Measuring the efficiency of decision making units. *European Journal of Operational Research*, 2(6), 429–444. [https://doi.org/10.1016/0377-2217\(78\)90138-8](https://doi.org/10.1016/0377-2217(78)90138-8)

- Drake, L., & Hall, M. J. B. (2003). Efficiency in Japanese banking: An empirical analysis. *Journal of Banking and Finance*, 27(5), 891–917. [https://doi.org/10.1016/S0378-4266\(02\)00240-6](https://doi.org/10.1016/S0378-4266(02)00240-6)
- Drake, L., Hall, M. J. B., & Simper, R. (2005). The impact of macroeconomic and regulatory factors on bank efficiency: A non-parametric analysis of Hong Kong's banking system. *Journal of Banking and Finance*, 30(5), 1443–1466. <https://doi.org/10.1016/j.jbankfin.2005.03.022>
- Fakhrunnas, F., Nahar, F. H., & Albana, H. F. (2018). Effects of Macroeconomics Factors toward Efficiency in Banking. *JEJAK: Jurnal Ekonomi Dan Kebijakan*, 11(2), 390–400. <https://doi.org/10.15294/jejak.v11i2.16059>
- Farrell, M. J. (1957). The Measurement of Productivite Efficiency. In *Journal of the Royal Statistical Society* (Vol. 120, Issue 3, pp. 253–290). [http://www.aae.wisc.edu/aae741/Ref/Farrell 1957.pdf](http://www.aae.wisc.edu/aae741/Ref/Farrell%201957.pdf)
- Hadad, M. D., Santoso, W., Mardanugraha, E., & Ilyas, D. (2003). Pendekatan Parametrik Untuk Efisiensi Perbankan Indonesia. *Bank Indonesia*, 1–26.
- Haris, J., Ozgen, H., & Ozcan, Y. (2000). Do mergers enhance the performance of hospital efficiency? *Journal of the Operational Research Society*, 51(7), 801–811.
- Ismail, F., Shabri Abd. Majid, M., & Rahim, R. A. (2013). Efficiency of Islamic and conventional banks in Malaysia. *Journal of Financial Reporting and Accounting*, 11(1), 92–107. <https://doi.org/10.1108/JFRA-03-2013-0011>
- Lozano-Vivas, A., Pastor, J. T., & Hasan, I. (2001). European Bank Performance Beyond Country Borders: What Really Matters? *European Finance Review*, 5(1–2), 141–165. <https://doi.org/10.1023/a:1012742232030>
- Mostafa, M. M. (2011). Modeling Islamic banks' efficiency: a non-parametric frontier approach. *International Journal of Islamic and Middle Eastern Finance and Management*, 4(1), 7–29. <https://doi.org/10.1108/17538391111122186>
- Nahar, F. H., & Prawoto, N. (2017). Bank's Profitability In Indonesia : Case Study Of Islamic Banks Period 2008-2012. *Jurnal Ekonomi & Studi Pembangunan*, 18(2), 164–172.
- Najib, M. I. A., & Iskandar, D. D. (2022). Efficiency Analysis of Sharia Commercial Banks (BUS) In Indonesia During 2015 – 2019. *Journal of Islamic Economics*, 4(1), 1–11.
- OJK. (2020). Sharia Banking Statistics. In *Statistik Perbankan Syariah: Vol. (Issue)*. -
- Popović, M., Savić, G., Kuzmanović, M., & Martić, M. (2020). Using data envelopment analysis and multi-criteria decision-making methods to evaluate teacher performance in higher education. *Symmetry*, 12(4), 1–19. <https://doi.org/10.3390/SYM12040563>
- Prior, D., & Solà, M. (2000). Technical efficiency and economies of diversification in health care. *Health Care Management Science*, 3(4), 299–307. <https://doi.org/10.1023/A:1019070113893>
- Salman, A., & Nawaz, H. (2018). Islamic financial system and conventional banking: A comparison. *Arab Economic and Business Journal*, 13(2), 155–167. <https://doi.org/10.1016/j.aebj.2018.09.003>
- Sharma, D., Sharma, A. K., & Barua, M. K. (2013). Efficiency and productivity of banking sector. *Qualitative Research in Financial Markets*, 5(2), 195–224. <https://doi.org/10.1108/QRFM-10-2011-0025>
- Sufian, F., Noor, M. A. M., & Abdul-Majid, M. Z. (2008). The efficiency of Islamic banks: Empirical evidence from the MENA and Asian countries Islamic banking sectors. *Middle East Business and Economic Review*, 20(1), 1–19. <https://doi.org/10.1108/17538390910965149>
- Sufian, F., & Shah Habibullah, M. (2010). Developments in the efficiency of the Thailand banking sector: a DEA approach. *International Journal of Development Issues*, 9(3), 226–245. <https://doi.org/10.1108/14468951011073316>

- Taib, C. A., Ashraf, M. S., & Razimi, M. S. B. A. (2018). Technical, pure technical and scale efficiency: A non-parametric approach of Pakistan's insurance and takaful industry. *Academy of Accounting and Financial Studies Journal*, 22(Specialissue), 1–11.
- Yahya, M. H., Muhammad, J., & Hadi, A. R. A. (2012). International Journal of Islamic and Middle Eastern Finance and Management Article information : *International Journal of Islamic and Middle Eastern Finance and Management*, 5(1), 48–62. <https://doi.org/10.1108/IMEFM-07-2014-0063>