COMPARISON OF PRODUCTIVITY AND EFFICIENCY BETWEEN SHARIA AND CONVENTIONAL BANKS OWNED GOVERNMENT PERIOD 2011-2018

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The purpose of this study is to analyze the comparison of the level of efficiency between time and the productivity of state commercial banks in Indonesia. State commercial banks in this case are grouped into 4 major groups including BUS, BUK, BPD, UUS. Measurement of the value of efficiency in this study uses the method of Data Envelopment Analysis (DEA). The use of the DEA method can measure the efficiency of banking by using many inputs and outputs. The continued application of the use of DEA is to use DEA Window Analysis, the result is the BUS has the best efficiency stability value with an average of 0.03 LDY then BUK with an average of 0.04, BPD with an average of 0.05 and UUS with an average an average of 0.09. Also this study wants to see the extent of the productivity of the country's commercial banks, the results using the Malmquist Index obtained BUS with the highest level of productivity with an average value of 1.008 then BPD with a value of 1.004, continued BUK 0.986 and UUS 0.964. Malmquist Index can also be used to identify where the source of the productivity value of an entity is obtained whether it comes from efficiency change or technological change so that by knowing these productivity factors it is expected that each bank can make corrections to the management of each company to increase their productivity.

Keywords: Productivity, Intertemporal Efficiency, MPI, Window Analysis

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INTRODUCTION

The formation of the ASEAN Economic Community or better known as AEC is accelerated to 31 December 2015, from the initial plan that will only be formed in 2020. With the existence of the ASEAN Economic Community (AEC), ASEAN market opportunities will certainly be wide open for Indonesia, including for the country's banking industry, as well as the competition challenges that will be faced. The main opportunity for the formation of the ASEAN Economic Community (AEC) is that there will be economic integration. The ASEAN community has three pillars of mutually beneficial economic cooperation, namely economic, political, and social and cultural cooperation. Of course, the three of them are expected to be able to support each other to achieve stability, peace and security in the Southeast Asian region.

With the implementation of the AEC in the ASEAN region, there are two possibilities that will have an impact on the domestic financial industry, both Islamic Banks and Conventional Banks. Among them are the first, the potential for the development of the banking industry itself, with the holding of the AEC, the entire banking industry in the ASEAN region will really compete with one another to seize the market potential of 632 million people. Of course, leading to a strong and ready industry requires preparation and management of a company that is really good, high productivity and efficient in its operation, so that when productivity and efficiency can reach maximum points, of course the output will be better and hopefully can / be able to compete in this free market. Or the second possibility is that it cannot compete with other countries' financial industry companies, it is not even possible that this happens in our own country the cause is due to poor company management, low productivity, inefficient company management, or less competitive due to the amount of asset value that is more small and so on. In essence, the readiness of domestic bank financial institutions in facing the AEC needs to be considered, because bank financial institutions are institutions that have an important role in the economy of a country. The bank becomes an intermediary institution between the owner of excess funds (surplus unit) who keeps their funds in the bank and the party that is lacking in funds (deficit unit) who borrows funds from the bank. Therefore, trust in banks is very important so that the intermediation function can run well. So that when the intermediation function runs well, the use of funds will be more optimal and efficient.

Bank financial institutions in Indonesia are divided into two types, namely banks that run their business on the principle of interest or what are commonly known as conventional banks and banks that run their business on the principle of profit sharing or commonly known as Islamic banks. Sharia banking in Indonesia from year to year continues to experience rapid increase. This does not rule out the possibility that competition between Islamic banks and conventional banks will also affect the survival of conventional banks that have already existed. According to Machmud et al. (2010), the growth of Islamic banks in Indonesia is an interesting phenomenon where the total population of Indonesia has exceeded 250 million, which is a potential market for banking businesses in Indonesia. On the other hand, it can be seen that the high profitability of the sharia bank business is reflected in the many foreign bank players who have taken part in opening bank units based on sharia principles, including CitiBank, ABN Amro, HSBC which are examples of successful Islamic banks in Middle East and Malaysia.

With the development of Islamic banks, the still strong position of domestic conventional banks and the upcoming banking MEA in 2020, the quality of work and health of each bank is in the spotlight. The performance and health condition of a bank are important matters for related parties, such as the owner or manager of the bank, the public, and Bank Indonesia as the supervisor of banking in Indonesia. Mansyur (2012) states that one of the important aspects in measuring performance and competition in the banking world is efficiency.

In addition to efficiency, the productivity of the banking industry is also important to pay attention to because it is an important factor for achieving company success, because besides affecting production costs, productivity also affects employee motivation and performance (Hutabarat & Husaini, 2006), both Islamic banking and conventional banking. In addition, a higher level of productivity will certainly have a broad impact on the company, including savings in the company's daily operating costs. With these savings, it will have an impact on increasing company profits.

Productivity and efficiency are two very important things in a business unit / company, as well as the relationship between efficiency and productivity where these two things are interrelated with one another. Efficiency according to Atmawardhana (2006) is one of the parameters that underlies the entire performance of an organization. The ability to produce maximum output with existing inputs is a measure of the expected efficiency performance. So far, the measurement of the efficiency of financial performance in companies has been carried out using a traditional approach that measures the level of efficiency with financial ratios, such as measuring ROA (Return On Assets), ROE (Return On Equity), BOPO (Operating Expenses / Operating Income). However, according to Farrel (1957), efficiency measurement can also be done with a frontier approach which consists of two kinds of approaches. The first is a parametric approach which includes SFA (Stochastic Frontier Approach), DFA (Distribution Free Approach), and TFA (Thick Frontier Approach) and the second with a non-parametric

approach including DEA (Data Envelopment Analysis), and FDH (Free Disposable Hall).

The approach that the researcher will use in analyzing the comparison of productivity and efficiency between Islamic and conventional government-owned banks in Indonesia for the 2011-2018 period is the non-parametric approach, namely DEWA (DEA Window Analysis) and the Malmquist Productivity Index. The Malmquist index is part of the DEA which specifically looks at the level of productivity of each business unit, so that there will be changes in the efficiency level of each business unit based on the predetermined input and output variables. The advantages of the Malmquist Index are, (1) The Malmquist Index is a non-parametric method in which this method does not require a specification model / form of production, (2) The Malmquist Index does not require assumptions about the economic behavior of production units such as minimizing costs or minimizing profits so of course it will be very useful if producers have different or even unknown objectives, (3) this index does not require a list of prices which are often difficult to obtain or even unavailable, (4) this index can be broken down into two components, first changes in efficiency and the second is technological change (Rusydiana, 2018). Solving this component is very useful so that later the analysis to be carried out can be more specific (Avenzora and Jossy, 2008).

Based on the background above, the problem formulation that the writer raises in this research is:

a. What is the level of efficiency between Islamic and conventional government-owned banks during the 2011-2018 period?

b. What was the productivity level of state-owned Islamic and conventional banks during the 2011-2018 period?

LITERATURE REVIEW

Definition of Efficiency

Efficiency can be defined as a measure of the assessment of a resource in a process. The greater the ratio of output to input, the more efficient the process is. In various literatures, efficiency is also often discussed together with productivity because it both assesses input and output variables. According to Daniel (2010) in his calculations there is a fundamental difference, namely efficiency is calculated by dividing the value of input by output, while productivity is calculated by dividing the value of output by input.

Efficiency and productivity are indices that show how the results are compared between input and output. Both (input and output ratios) indicate that the efficiency and productivity index can be controlled by manipulating the management of the two ratios, namely input and output. Oscan (2008) explains that efficiency is divided into 4 parts, namely technical efficiency, scale efficiency, cost efficiency, and allocative efficie.

Definition of Productivity

Productivity is a simple ratio between the output and input of a company (Summanth, 1984). Many methods have been proposed by researchers and experts in explaining this ratio. Among them are the APC (The American Productivity Center) Mundel model (Marvin E. Mundel), and the Objectives Matrix model (Nasution, 2006). However, these methods can only measure the level of productivity of one company, so it is not good if a researcher wants to use it to rank the productivity of many companies simultaneously.

In measuring the productivity level of a business unit/company, the method most widely used is the total factor productivity (TFP) method. TFP measurement is done using index numbers that can measure changes in price and quantity over time. In addition, TFP also measures comparisons between entities and can overcome weaknesses in calculating efficiency which has more than one input and output variables (Rusydiana, 2018). There are several indices used to measure TFP, some of which are frequently used are the Malmquist Index, Laspeyres Index, Pasche Index, Fisher Index, and Tornqvist Index. In this study, the index that I will use is the Malmquist Index.

Efficiency in Islam

One of the goals of efficiency is to achieve optimal profit, Islam does not recognize the word / term efficiency as well as reducing costs as much as possible to get the maximum profit, in producer theory it will result in dzalim acts that are not combined with the spirit of Islam, so that in Islam, the realization of optimal profits is generated through optimal efforts (hard work) to produce something optimally while maintaining balance (ta'adul) and sharia ethics (Ali, 2010). The resulting profit must be balanced with the hard work and the burden incurred. Rasulullah S.A.W said, Al-Kharaj bid-Dhaman (every profit earned must be in accordance with the burden incurred) (HR. Abu Daud No. 3044). Balance also means that in realizing value added, producers must pay attention to social, economic and environmental aspects. To achieve optimization and balance, Islam provides some guidance, including:

1. Utilizing All Potential Natural Resources

Islam wants its people to work to prosper the earth and utilize all the potential of natural resources. Allah says:

"... He has created you from the earth (land) and made you prosperous .." (QS Huud: 61).

2. Work Specialization

The concept of work specialization was once expressed by Ibn Khaldun in his Muqaddimah. According to him, with a larger population, there will be a division and specialization of labor so that it will

increase the surplus and international trade. The international division of labor will depend more on differences in the skills and skills of the population than on the availability of natural resources. In Islam, the basic principles of specialization can be explored in the Prophet's hadith which explains the concept of itqan and ihsan. Regarding itqan, the Messenger of Allah said:

It means, "Allah loves if someone does work (produces) carefully and diligently (itqan)" (Narrated by Thabrani).

3. Prohibition Against Riba

One of the Islamic ways to achieve efficiency by minimizing production costs is by prohibiting usury (interest). As part of the fixed cost element in production, the elimination of interest will make production costs lower (efficient).

4. Prohibition of Israf and Tabdzir in Production

The difference between israf and tabdzir is conveyed by Al-Mawardi (2003). Al-Mawardi explained that israf is an error in using the right amount, while tabdzir is ignorance in using the correct allocation. Allah says: "Eat from the fruit when it bears fruit and fulfill its rights on the day of reaping the results (by paying zakat) and don't overdo it. Indeed, Allah does not like people who are excessive. " (Surah Al-An'am: 141).

The Concept of Productivity in Islam

The religion of Islam which is based on the Koran and al-Hadith as a guide and guidance for Muslims has a function not only to regulate in terms of worship but also to regulate in providing demands in matters relating to work activities in daily life. In a phrase it is also said: Hands above are better than hands below, Carying wood is more noble than begging, a strong believer is better than a weak believer. Allah loves the strong working believers. In fact, most of us behave and behave in precisely the opposite direction of those expressions. Whereas in the current conditions, we are required to show a work ethic that is not only diligent, persistent, loyal, but always balances with Islamic values which of course cannot go beyond the tracks that have been established by the Koran and as-Sunnah (Annam , 2015).

Islam strongly recommends that humans can work well and actively. Islam encourages believers to work hard, because in essence the life of this world is an opportunity that will never be repeated to do something good or something useful for others. This is at the same time to test the believers, which of them is the best and most diligent at work.

Hafiduddin and Tanjung (2003) explain that appreciation of the value or meaning of life, religion, experience and education should be directed to create a professional work attitude, while appreciation of applicable values will produce good morals, including: Ash-Sholih (good and useful) , Al-Itqon (stability), Al-Ihsan (doing your best or better), Al-Mujahadah (working hard and optimally), Tanafus and Taawun (competing and helping) and observing the value of time.

Previous Research

Research that discusses the efficiency of Islamic Commercial Banks and Conventional Commercial Banks has been carried out by previous researchers, but even so, of course there are differences in the scale of the analysis, input output variables, and the research methods used.

The following are some previous studies that have discussed the efficiency of Islamic banking and conventional banking, both domestic and international:

The first research was Hadad et.al (2003). This study was entitled "Parametric Approach to Indonesian Banking Efficiency." The approach used in this study is the Stochastic Frontier Analysis (SFA) and Data Frontier Analysis (DFA) approaches. The determination of the input and output variables in this study is to use the cost frontier approach. The variables used in this study include labor costs, price of funds as the input variable and the output variable, which are loans from related parties to banks, loans to other parties, and securities owned. The results of this study explain that not all merger activities can increase efficiency, foreign joint venture banks became the most efficient banks in the 2002 period, then by using DFA it was found that the national private foreign exchange bank was the most efficient bank. Then, Muharam and Pusvitasari, 2007 examined the "Comparative Efficiency Analysis of Islamic Banks in Indonesia" using the Data Envelopment Analysis (DEA) method. The input variables used in this study are savings and other operating costs, while the output variables are financing, current activities, and other operating income. The sample used in this study is Islamic banks in Indonesia in 2005. The results of this study explain that there is no difference in efficiency values between BUS and UUS, there is no difference in efficiency values between BUMN Islamic banks and non-BUMN Islamic banks, there is no difference. efficiency of private foreign exchange and non-foreign exchange Islamic banks. Only Bank BTN syariah, Bank Niaga Syariah, and Bank Permata Syariah can achieve 100% efficiency levels in the year of observation.

Further research by Ascarya and Yumanita (2008), measures and compares the level of efficiency of Islamic banks in Malaysia and Indonesia during the period 2002-2005. The method used in this research is Data Envelopment Analysis (DEA). The variables used are total deposits, labor, assets, as input variables, and loans, income as output variables. The results of this study show that Islamic banks in Indonesia experienced a greater increase in efficiency compared to Islamic banks in Malaysia during the study period, namely 2002-

2005. Then (Muhammad et al., 2008) who examined "Efficiency of Conventional versus Islamic Banks: International Evidence using the Data Envelopment Analysis (DEA)" the method used is in accordance with their research title, namely Data Envelopment Analysis with the selection of labor variables, fixed assets. , total funds as input and total loans, other earnings assets, off-balance sheet item as output. The results of this study indicate that there is no significant difference between the efficiency values of Islamic and conventional banks. Then his research by Sufian (2006), research entitled "The Efficiency Of Islamic Banking Industry In Malaysia: Foreign vs Domestic Bank" discusses and measures the relative efficiency level between foreign Islamic banks and domestic banks in Malaysia using the Data Envelopment Analysis (DEA) method. The variables chosen are total deposits, money, fixed assets as input and total loans, income as output. The results of this study reveal that Malaysian Islamic banking experienced a decrease in efficiency levels in the 2002 period and again became slightly better in the 2003 and 2004 periods. And domestic Islamic banks have a slightly higher level of efficiency than foreign Islamic banks.

Apart from the above research, the author has collected many other literatures related to the efficiency and productivity of banking using DEA Window Analysis around the world, some of which are research conducted by Dastgir (2012), Sufian (2009), Sufian (2011), Anouze and Hamad (2019), Avkiran (2004), Shawtari et. al (2018), Sufian and Abdulmajid (2007), Shawtari and Razak (2015), Violeta and Savić (2017), Nguyen et. al (2014), Degl'Innocenti et. al (2017), Webb (2010), Zeitun et. al (2013), Çınar (2009), Paradi1 et. al (2014), Arefrad and Alipoor (2015), Kisielewskaa et. al (2007), Phan et. al (2018), Sufian (2009), Sami and Ali (2016), Sufian (2007), Řepková (2014), Řepková (2014), and Degl'Innocenti et. al (2016).

Apart from that, several studies on the Malmquist Productivity Index that were successfully summarized include, Abbas et. al (2015) in his research on the calculation of the Malmquist Index of Islamic and conventional banks to compare their performance in the sample period 2005-2009. Islamic banks have shown tremendous growth around the world in recent times. The results in his research indicate that the productivity of Islamic banks decreased in 2007, but increased in 2008 to 2009. Islamic banks had higher productivity growth from 2005 to 2006, but they experienced lower growth compared to the previous year compared to some conventional banks.

Besides that, the author has also collected several journals that discuss the Malmquist Productivity Index which then the authors refer to in writing this research, including Degl'Innocenti et. al (2016), Arjomandi et. al (2011), Desta (2016), Azad et. al (2016).

RESEARCH METHOD

1. The MPI (Malmquist Productivity Index) method

In the early generation model developed by Caves et.al (1982), there are two malmquist productivity index models (Bjurek, 1996). The first is' Malmquist input quantity index 'and the second is' Malmquist output quantity index. The Malmquist input quantity index for a production unit, at observation times t and t + 1, for reference technology in the period k, k = t and t + 1. The Malmquist input quantity index only measures the change in the observed quantity of input between times t and t + 1, where:

$$MI_k\ (y_k,\ x_t,\ x_{t+1}) = \frac{E_k^I\ (y_k, x_t)}{E_k^I\ (y_k, x_{t+1})}\ ,\quad k = t,\quad t+1 \qquad (1)$$

Furthermore, for the Malmquist output quantity index of all production units, at the time of observation t and t + 1, for reference technology in the period k, k = t and t + 1. The Malmquist output quantity index only measures the change in the quantity of output observed between t and t + 1, where:

$$MO_k\ (y_t,\ y_{t+1},\ x_k) = \frac{E_k^O\ (y_{t+1}, x_k)}{E_k^O\ (y_t, x_k)}\ ,\quad k = t,\quad t+1 \qquad (2)$$

Bjurek (1996) introduced a new definition of the Malmquist productivity index for units of production between t and t + 1 based on the level of technology at times k, k = t and k = t + 1, following the tradition of most productivity indices. Adjusting to the Tornqvist productivity index index, the index built is a ratio between an output index and an input index:

$$MTFP_k = \frac{MO_k(y_t, y_{t+1}, x_k)}{MI_k(y_k, x_t, x_{t+1})} = \frac{E_k^O\ (y_{t+1}, x_k)/E_k^O\ (y_t, x_k)}{E_k^I\ (y_k, x_t)/E_k^I\ (y_k, x_{t+1})}\ ,\quad k = t,\quad t+1 \qquad (3)$$

The above equation describes the ratio between the input index and the Malmquist output index. If the value of the productivity index is greater than number 1, there has been an increase in productivity, if it is less than 1, it means that there is a decrease in productivity, and if it is equal to 1, the level of productivity remains unchanged.

2. DEA Window Analysis (DEWA)

Changes in the level of efficiency of Islamic and conventional banks from time to time can be seen using the DEA Window method (Charnes et.al, 1985). In this study, a four-year window analysis was used so that for each analysis 136 (4 times 34) DMUs were obtained, where the same DMU for different times would still be considered as different DMUs. Therefore, benchmarking is not only carried out against DMU peers but also on their own performance. The total

number of state-owned Islamic and conventional banks which were the objects of the research was 34 banks. The selection of 34 Islamic and conventional banks to be studied is because only these banks have started to exist and have financial reports since 2011 and have not experienced a significant change in the form of business organization during the study period, namely 2011-2018.

Input and output variable data are obtained from the balance sheet and profit and loss statements of each bank. Four inputs and three outputs are used to measure the productivity and efficiency of Islamic and conventional banks which are included in the observation. The input variables are Fixed Assets (X1), Total Deposits (X2), Interest Expense / Profit Sharing Expenses (X3) and Personnel Expense (X4). Meanwhile, the output variables are Loans (Y1), Net Income (Y2) and Liquid Assets (Y3).

The analysis tool used in this research is MaxDEA 8 to measure the level of efficiency of all DMUs of Islamic and conventional banks during the 2011-2018 period. Analysis for measuring efficiency will be carried out twice. First, the calculation of standard efficiency using the CRS or CCR approach was introduced by Charnes et.al (1978). Second, calculation of efficiency with window analysis. In general, the mathematical equation formulas commonly used for the DEA window are as follows, where M is the average efficiency level and K is the window length.

$$M_l = \frac{\sum_{t=1}^{M-K+1} \sum_{j=1}^{i+K-1} . E_{i,j}}{K \text{ x } (M - K + 1)}, l = 1, L, N$$

As recommended by Cooper et.al (2011), the table of window analysis results can be used to simultaneously check the relative efficiency stability through several summary statistics such as standard deviation (SD), Long Distance per Window (LDW), Long Distance per Period (LDP). and Long Distance per Year (LDY). These four measurements can be used as an analysis of the efficiency stability achieved by each DMU.

Standard deviation is the standard deviation that measures the difference in the average level of efficiency of the DMU for each window, the smaller the standard deviation value, indicating the more stable the efficiency value achieved by each DMU, in this case Islamic and conventional banks. Long Distance per Window (LDW) shows the largest difference from efficiency figures in one window. The smaller the LDW value indicates the more stable the efficiency value achieved by each Islamic bank, and vice versa.

Long Distance per all Periods (LDP) describes the largest difference from the efficiency figures in the entire observation period. The smaller the LDP value indicates the more stable the efficiency value achieved by each Islamic bank, and vice versa. The last one is Long Distance per Year (LDY). LDY shows the largest difference from the efficiency rate in one year. Similar to LDW and LDP, the smaller the LDY value indicates the more stable the efficiency value achieved by each DMU, and vice versa.

RESULT AND DISCUSSION

Results of the DEA Window Analysis Method

The data used in this study were 34 state commercial banks with observation data for the years 2011-2018. The input and output variables presented here are obtained from the income statement and balance sheet published by each bank. Four inputs and 3 outputs are used to measure the level of efficiency and productivity of each state commercial bank. Input variables include Fixed Assets (X1), Total Deposits (X2), and Interest Expense (X3). Meanwhile, the output variables include Loans (Y1), Net Income (Y2), and Liquid Assets (Y3). Descriptive statistics for each of the following input and output variables are presented in table 1 below.

Table 1. Descriptive Statistics of Input and Output

Indikator	Output			Input			
	Loans	Net Income	Liquid Aset	Personalia Expense	Fixed Aset	Total Deposits	Interest Expense
Mean	52.642.120	1.757.118	2.054.241	1.283.416	2.443.251	61.212.936	2.401.858
Max	804.356.813	31.701.975	28.470.316	20.752.724	46.767.089	898.032.564	31.398.467
Min	127.211	1.000	1.188	3.223	1.763	131.386	4.556
Std. Dev	134.849.435	5.227.371	5.181.447	3.062.531	7.097.738	15.435.773	5.295.777

The DEA approach with output orientation is applied to panel data, from 5 BUS, 4 BUK, 7 BPD Syariah, 18 BPD Conventional in Indonesia in 2011-2018. Thus, the total observation to calculate the efficiency value of all banking units is 272.The results of the data in the table below are a summary of the average efficiency scores of all state-owned banks during the 2011-2018 period, both Islamic banking and conventional banking which the author chose to be used as object of observation according to the criteria that have been previously set. Technical Efficiency (Technical Efficiency) has increased in the first 2 years, then tends to be stable in the next 3 years and fluctuates in the last 2 years but remains no less than the lowest overall rail during the study period, which is 77 percent. Hereby it can be read that by implementing better

management, both Sharia and Conventional Banks can produce output with the same volume (identical volume) by using only 77 percent of the total input. In this case, state-owned banks have a fairly good average value.

The results of the calculation of DEA window analysis for 34 state-owned banks, both BUS and BPD in Indonesia during the 2011-2018 period can be seen in the following table. For example, Bank Jatim Syariah has relatively not experienced significant changes from 2011-2014 in the first window (with efficiency values of 48%, 71%, 59% and 38%), thus 2012-2015 in the second window (with efficiency values 91%, 59%, 37% and 33%) also between 2013-2016 in the third window (with efficiency values of 58%, 36%, 33% and 38%). Bank Jatim Syariah experienced a slight increase in the efficiency value in the fourth window of 2014-2017 with efficiency values of 36%, 34, 39% and 31%, and decreased again in the fifth window of 2015-2018 with an efficiency value of 31%, 37%, 31% and 32%. This DMU is a state-owned bank with the lowest average efficiency value, namely 43% compared to other observed DMUs.

Of the total observed banks, banks that are in the top 5 based on the average overall annual efficiency value are BRI Bank in the first rank with an average efficiency value of 98.98 percent, followed by Bank Kalbar Syariah in the second rank with an average efficiency value of 98.95 percent then Bank Yogyakarta Syariah was ranked third with an average efficiency value of 98.50 percent, then Bank BTN was in fourth place with an average efficiency of 98.30 percent, and finally Bank Mandiri was in fifth place with an average efficiency value of 97.40 percent.

Then from the average efficiency value of each banking grouping, BUK was obtained as the first rank with an average value of 95 percent, followed by BPD with an average value of 83 percent in the second position, then BUS in the third position with an average value of 79 percent, and finally UUS is in fourth position with an average value of 76 percent (see table 2 in appendix).

Furthermore, as recommended by Cooper et.al (2010), the window analysis result table can be used for the analysis of relative efficiency stability through several summary statistics such as standard deviation (SD), Long Distance per Window (LDW), Long Distance per Period (LDP) and Long Distance per Year (LDY). These four measurements can be used as an analysis of the efficiency stability achieved by each DMU. The smaller the value of the four measurements above, the more stable the efficiency value achieved by each DMU, in this case the state-owned Islamic and conventional banks in Indonesia. Below are the results of the DEA window analysis for both state-owned Islamic and conventional banks in Indonesia for the period 2011 to 2018. Each analysis is divided into 5 windows with each year length per window is 4 years.

From the perspective of efficiency stability analysis through several summary statistics such as standard deviation (SD), Long Distance per Window (LDW), Long Distance per Period (LDP) and Long Distance per Year (LDY), state-owned commercial banks with relatively stable values are obtained. efficiency when viewed from the standard deviation value which is below 0.05 is Bank BRI, BPD Papua, Bank Kalbar Syariah, BPD Sulselbar, Bank Yogyakarta Syariah, BPD SulutGo, BPD Southeast Sulawesi, Bank Mandiri, BSM, BPD NTB Syariah, BPD Bali, BPD Kalbar, BPD Nagari, BPD Yogyakarta, BPD North Sumatra, BJB, Bank DKI, Bank DKI Syariah, BNI, BNI Syariah, Bank Aceh Syariah, Bank Kalsel Syariah, BPD East Java, BPD South Kalimantan, BPD Central Kalimantan, and BPD NTT.

Then state-owned commercial banks that have LDW and LDP values below 0.05 are Bank BRI and Bank BTN. Whereas for LDY values below 0.05, namely Bank BNI Syariah, BSM, BRI Syariah, BRI, BTN, Bank Jatim Syariah, BPD Bali, BPD East Java, BPD Kaltimtara, BPD NTT, BPD Papua, BPD Sulselbar, BPD Sultra, and BPD Yogyakarta.

Results of the Malmquist Productivity Index Method

In this study, the estimated TFA growth and its components refer to the Malmquist Index. The Malmquist TFP change index is formed from the value of efficiency change and technological change. Later, through the efficiency change value, it will be known whether there is a change in the level of efficiency from year to year. Meanwhile, technological change shows whether there is a change in productivity with the use of technology.

Then from the average TFP Change value of each banking grouping, the BUS is ranked first with an average TFP Change value of 1.008. followed by BPD with an average TFP Change value of 1.004, then BUK and UUS in the third and fourth positions with an average TFP Change value of 0.973 and 0.971.

State-owned banks are grouped into four quadrants based on the technical change level (TECH) category and the efficiency change (EFFCH) category. Quadrant 1 includes state commercial banks that have high technical efficiency and efficiency change so that they can be considered as commercial state banks with high productivity, among them are Bank Syariah Mandiri, BJB Syariah, Bank Jatim Syariah, Bank Kalbar Syariah, BPD Bengkulu, BPD Jatim, BPD Kalbar, BPD Kaltimtara. As explained in the research of Rusydiana and Firmansyah (2017) as well as Rusydiana and Al-farisi (2016), it shows that Bank Syariah Mandiri is included in the group of banks that have high efficiency and performance values.

Then Quadrant 2 includes state commercial

banks that have high technical change but on the other hand have low efficiency change, among the banks included in this quadrant are BNI Syariah, Bank Aceh, BRI, BPD Bali, Bank DKI, BPD BJB, BPD NTT, BPD Riau Kepri, BPD South Kalimantan, BPD Nagari, BPD Sulselbar, BPD Yogyakarta, BPD North Sumatra.

Furthermore Quadrant 3 is a state commercial bank that has low technical change but high efficiency change, including Bank BTN, Bank DKI Syariah, Bank Kalsel Syariah, Bank Yogyakarta Syariah, BPD Papua.

And finally the fourth quadrant, namely state commercial banks that have low technical change and efficiency change, including Bank BNI, Bank Mandiri, Bank NTB Syariah, Bank North Sumatra Syariah, BPD Central Kalimantan, BPD Southeast Sulawesi, BPD SulutGO. The distribution of state commercial banks that have been described above which are grouped into 4 quadrants can be influenced by the characteristics of the state commercial banks that exist in each of these groups. Several variables can explain the characteristics of each state commercial bank, such as research and development intensity, product innovation, sales orientation, location and bank network, and type of company ownership (Rusydiana, 2018). Of course, this picture is still indicative and of course still requires formal testing which is not covered in this study.

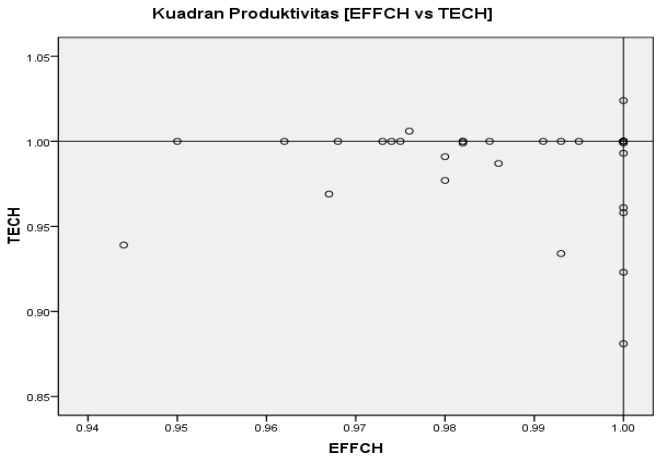

Figure 1. Mapping of quadrants 1 to 4 for each bank

Information:

Quadrant 1 (High TECH, High EFFCH): Bank Syariah Mandiri, BJB Syariah, Bank Jatim Syariah, Bank Kalbar Syariah, BPD Bengkulu, BPD Jatim, BPD Kalbar, BPD Kaltimtara

Quadrant 2 (High TECH, Low EFFCH): BNI Syariah, Bank Aceh, BRI, BPD Bali, Bank DKI, BPD BJB, BPD NTT, BPD Riau Kepri, BPD South Kalimantan, BPD Nagari, BPD Sulselbar, BPD Yogyakarta, BPD North Sumatra.

Quadrant 3 (Low TECH, High EFFCH): Bank BTN, Bank DKI Syariah, Bank Kalsel Syariah, Bank Yogyakarta Syariah, BPD Papua.

Quadrant 4 (Low TECH, Low EFFCH): Bank BNI, Bank Mandiri, Bank NTB Syariah, Bank North Sumatra Syariah, BPD Central Kalimantan, BPD Southeast Sulawesi, BPD SulutGO.

Discussions

Based on the analysis results of the DEA window and the Malmquist Index, 5 important points can be obtained related to research on banking efficiency and productivity. The research objects in this research are BUS, BUK, UUS and BPD which the authors categorize into "large Islamic banks" for BUS, "large conventional banks" for BUK, "small sharia banks" for UUS, and "small conventional banks" for BPD.

First, the efficiency (DEA) of large conventional banks outperformed the efficiency levels of large Islamic banks with an average value of 0.95 while large Islamic banks only obtained an average efficiency value of 0.79 and small conventional banks also outperformed small Islamic banks with an average value 0.83 while the small Islamic banks are adrift at 0.76.

Then the second is efficiency stability (LDY value in the DEA Window), in this case large Islamic banks are better than large conventional banks with an average value comparison of 0.03 for large Islamic banks and 0.04 for large conventional banks. On the other hand, small conventional banks have a higher average efficiency stability value compared to small Islamic banks with an average value ratio of 0.05 for small conventional banks and 0.09 for small Islamic banks.

The third is Productivity (TFPCH), large Islamic banks still outperform large conventional banks with an average value ratio of 1.008 for large Islamic banks and 0.986 for large conventional banks, meaning that in aggregate the average value of Islamic banks tends to increase productivity and vice versa conventional banks. experienced a decrease in productivity. In contrast to small conventional banks which actually outperformed small Islamic banks in terms of productivity with a comparison of the value of 1.004 for small conventional banks and 0.971 for small Islamic banks, it can also be concluded that small conventional banks are relatively more productive than small Islamic banks.

Fourth, Technological Change (TECH), large Islamic banks still outperformed large conventional banks with an average value of 1.006 and large conventional banks with an average value of 0.986, furthermore for small conventional banks still outperformed small Islamic banks in obtaining value for technological change. this technology, with an average value of 1.014 for small conventional banks and 0.964 for small Islamic banks. This issue is important in relation to the use of technology in the financial services industry or in this case known as fintech (financial technology).

The fifth is a quadrant grouping, where there are 4 quadrants as a whole with details of quadrant 1 (High

TECH, High EFFCH), quadrant 2 (High TECH, Low EFFCH), quadrant 3 (Low TECH, High EFFCH), and quadrant 4 (Low TECH, Low EFFCH). Large Islamic banks are on average in quadrants 1 and 2 when compared to large conventional banks whose average bank grouping is in quadrant 4, of course large Islamic banks are much better. On the other hand, for small conventional banks the average bank is included in quadrant 2, while small Islamic banks have the average spread of banks in quadrants 2 and 3, of course, small conventional banks are better than small Islamic banks.

The following is a summary comparison between the conditions of efficiency and productivity of Islamic and conventional banks in Indonesia.

Table 5. Comparison of the efficiency and productivity of Islamic banks (BS) and conventional banks (BK)

Factor	Big iB	Big cB	Small iB	Small cB
Efficiency (DEA)	0,79	0,95	0,76	0,83
Efficiency Stability (DEA Window)	0,03	0,04	0,09	0,05
Productivity (TFPCH)	1,008	0,973	0,971	1,004
Technological change (TECH)	1,006	0,986	0,964	1,014
Productivity Quadrant	1 dan 2	4	2 dan 3	2

In general, Islamic banks have relatively lower efficiency values when compared to conventional banks, but for efficiency stability, productivity, technological changes and the productivity quadrant, Islamic banks are much better. The same is the case in research conducted by Shawtari et.al (2018) which examines the efficiency comparison between Islamic and conventional banks using purely technical efficiency (TE) and scale efficiency (SE) with the result that Islamic banks outperform conventional banks in terms of technical efficiency. (TE) and efficiency scale (SE) however lag behind in terms of pure technical efficiency (PTE).

Abbas et al. (2016) examined the efficiency of banks in Pakistan in a comparison of Islamic and conventional banks using the DEA methodology. Their findings show that the efficiency of both Islamic and conventional banks is different, where the performance of Islamic banks is far behind conventional banks in Pakistan in terms of technical efficiency (TE) and pure technical efficiency (PTE), while their efficiency scale (SE) scores are not much different. In contrast, Shawtari et al. (2015) show that Islamic banks in Yemen are more efficient than conventional banks during the period 1996 to 2011.

Other results in this study also found that large commercial state banks were more efficient when compared to small commercial state banks in Indonesia during the period 2011 to 2018, both Islamic and conventional banks, this result is slightly different from the research findings. Sufian (2007) who uses Window DEA in his research, he concluded that the efficiency of Singaporean banks has increased in efficiency scores over time (SE) and that the efficiency of large banks is lower than that of small banks. It is also different from what was found by Řepková (2014) who examined the efficiency of the Republican banking sector using the DEA Window Analysis. The results of his research indicate that larger banks are less efficient than small banks and others. The reason is that the larger banks hold large deposits and an inappropriate size of operation.

CONCLUSION

The results of this study illustrate that the average efficiency score of state commercial banks in Indonesia which was included in the observation from 2011-2018 fluctuates throughout the study period, with a mean value of 82%. There has been an increase from 2012 to 2014 and tends to be stable until 2016 and the average value fluctuates in the last 2 years although not less than 80%. This can be explained by a number of things, starting from a fairly high level of competition, bank management, to micro and macro turmoil originating from both within and outside the country which affects the efficiency level of state commercial banks in Indonesia.

Based on the results of the DEA window analysis, Islamic commercial banks with the highest average value during the study period from 2011-2018 are BRI, BTN, Bank Kalbar Syariah, Bank Yogyakarta Syariah, Bank Sulselbar, all with the same average efficiency value of 99%. Then followed by Bank Mandiri with an average efficiency value of 98%. Then followed by BNI Syariah, Bank DKI Syariah with an average efficiency value of 97%. This result is not much different from the measurement results with the standard CRS approach. The difference is, first, there are 3 banks that in the standard CRS approach are included in 10 Banks with high efficiency values but the DEA window does not include Bank BPD Bali, Bank Nagari, BPD Kaltimtara. Then the second, the average efficiency value of the DEA window analysis results is relatively higher than the results of the standard CRS model. This can be understood because the more observations that are processed, the lower the efficiency value will be. The advantage of the DEA window analysis model is that it can measure the stability of the efficiency through several measurement statistics.

From the perspective of efficiency stability analysis through several summary statistics such as standard deviation (SD), Long Distance per Window (LDW), Long Distance per Period (LDP) and Long Distance per Year (LDY), state commercial banks that

are relatively stable in terms of efficiency are Banks BRI, BPD Papua, Bank Kalbar Syariah, BPD Sulselbar, Bank Yogyakarta Syariah, BPD SulutGo, BPD Southeast Sulawesi, Bank Mandiri, BSM, BPD NTB Syariah, BPD Bali, BPD Kalbar, BPD Nagari, BPD Yogyakarta, BPD North Sumatra, BJB, Bank DKI, Bank DKI Syariah, BNI, BNI Syariah, Bank Aceh Syariah, Bank of South Kalimantan Syariah, BPD East Java, BPD South Kalimantan, BPD Central Kalimantan, and BPD NTT.

This research also tries to analyze the CCR model as a basic model in the DEA which is used to see the level of efficiency of state commercial banks in Indonesia for the 2011-2018 period. Furthermore, the Malmquist Index is used to see the level of productivity of state commercial banks, both in terms of efficiency change and technology change, which is then displayed in quadrant 4 groups.

The results obtained from the Malmquist index score (TFP Change) show that 12 banks out of a total of 34 Islamic and conventional state-owned banks that were observed, both sharia and conventional, experienced increased productivity, or about 35% of all observed state commercial banks. While the rest shows a relatively low level of productivity. Then for the analysis of bank groups with the criteria for efficiency change (EFFCH) and technological change (TECH), there are 8 state-owned banks that are in quadrant 1 (technical change and high efficiency change), then there are 13 banks that are in quadrant 2 (technical change is high and efficiency change is low), and there are 5 banks that are in quadrant 3 (low technical change but high efficiency change), and finally for quadrant 4 there are 8 commercial state banks included in it (low technical change and efficiency change).

In general, it can be seen from the data previously presented that Islamic banks are relatively lower in efficiency when compared to conventional banks, but Islamic banks outperform conventional banks on the value of efficiency stability, productivity, technological changes and the productivity quadrant, meaning even though conventional banks have better efficiency. However, their productivity decreases, indicating that conventional banks are in a decline in performance, on the contrary, even though Islamic banks have a low level of efficiency, their productivity has increased, meaning that Islamic banks are in an upward stage in terms of company performance.

REFERENCES

Abbas, M., Azid, T. and Hj Besar, M.H.A. (2016). Efficiency, Effectiveness and Performance Profile of Islamic and Conventional Banks in Pakistan. Humanomics, 32(1), 2-18.

Ali, M Mahbubi. (2010). Analisis Efisiensi Baitul Maal wat Tamwil Dengan Pendekatan Two Stage Data Envelopment Analysis (Studi Kasus Kantor Cabang BMT MMU dan BMT UGT Sidogiri. Tazkia Islamic Finance & Business Review, 5(2).

Annam, Rahmad. (2015). Etos Kerja Dan Produktivitas Kerja Dalam Upaya Menjawab Permasalahan Ekonomi Islam (Perilaku Mendapatkan Uang/Harta). Al-MASHARIF: Jurnal Ilmu Ekonomi dan KeIslaman, 3(2).

Arjomandi, Amir; Valadkhani, Abbas, and Harvie, Charles. (2011). Analysing Productivity Changes Using the Bootstrapped Malmquist Approach: The Case of the Iranian Banking Industry. Australasian Accounting, Business and Finance Journal, 5(3), 35-56.

Ascarya, Diana Yumanita. (2008). Comparing The Efficiency of Islamic Banks in Malaysia and Indonesia". Buletin Ekonomi Moneter dan Perbankan, Tim IAEI, 95-119.

Asmild, Paradi, dkk. (2004). Combining DEA Window Analysis with the Malmquist Index Approach in a Study of the Canadian Banking Industry. Journal of Productivity Analysis, 21, 67–89. Kluwer Academic Publishers

Asmild, Paradi, dkk. (2004). Data Envelopment Analysis and Data Mining to Efficiency Estimation and Evaluation. Journal of Productivity Analysis, 21, 67–89. Kluwer Academic Publishers.

Atmawardhana, Angga. (2006). Analisis Efisiensi Bank Umum Syariah dan Bank Konvensional yang Memiliki Usaha Syariah di Indonesia Setelah Pemberlakuan Undang-Undang No.10 Tahun 1998 tentang Perbankan (Pendekatan Data Envelopment Analysis). Skripsi Dipublikasikan. Yogyakarta: Fakultas Ekonomi Universitas Islam Indonesia.

Avkiran N. K. (2004). Decomposing Technical Efficiency and Window Analysis. Studies in Economics and Finance, 22 (1), 61-91.

Azad1, Munisamy, Masum, Saona, dan Wanke. (2016). Bank Efficiency in Malaysia, A Use of Malmquist Meta-Frontier Analysis. Eurasia Business and Economics Society.

Bjurek, H. (1996). The Malmquist Total Factor Productivity Index. Scandinavian Journal of Economics, 98(2), 303–313.

Cooper, W.W., et al.. (2011). Data Envelopment Analysis: History, Models, and Interpretations, Dalam Cooper, W.W. et al. (Eds.), Handbook on Data Envelopment Analysis, Edisi Kedua, Springer, New York, 1-40.

Dastgir, Momeni, dkk. (2012). Analyzing Financial Statements by Using Window Data Envelopment Analysis Model (Output Oriented BCC) Evidence from Iran. TextRoad Publication. J. Basic. Appl. Sci. Res., 2(12), 12049-12055.

Sufian, Fadzlan. (2009). The Determinants of Efficiency of Publicly Listed Chinese Banks : Evidence from Two-Stage Banking Models, Macroeconomics and

Finance in Emerging Market Economies, 2(1), 93-133.
Sufian, Fadzlan. (2007). Trends in The Efficiency of Singapore's Commercial Banking Groups: A Non-Stochastic Frontier DEA Window Analysis Approach. International Journal of Productivity and Performance Management, 56(2), 99-136.
Farrel, M.J. 1957. The Measurement of Productive Efficiency. Journal of the Royal Statistical Society.Series A (General). 120(3), 253-290.
Fathoni, Ghozali. (2017). Analisis Konsep Produktivitas Kerja Konvensional Dalam Pandangan Islam. Al Tijarah, 3(1).
Fekri Ali Shawtari, Milad Abdelnabi Salem, Izzeldin Bakhit. (2018) Decomposition of Efficiency Using DEA Window Analysis: A Comparative Evidence From Islamic and Conventional Banks. Benchmarking: An International Journal, 25(6), 1681-1705.
Fekri Ali Shawtari, Mohamed Ariff, Shaikh Hamzah Abdul Razak. (2015). Efficiency Assessment of Banking Sector in Yemen Using Data Envelopment Window Analysis. Benchmarking: An International Journal, 22(6), 1115-1140.
Hafinuddin, Didin dan Hendri Tanjung. (2003). Manajemen Syariah dalam Praktik. Jakarta: Gema Insani Press.
Hien Thu Phan, Sajid Anwar & W. Robert J. Alexander. (2018). The determinants of banking efficiency in Hong Kong 2004-2014. Applied Economics Letters.
Hutabarat, Jemsley., dan Huseini, Martani. (2006). Pengantar Manajemen Strategik Kontemporer: Strategik Di Tengah Operasional. Jakarta: PT. Elex Media Koputindo.
Ilias S. Kevork, Jenny Pange, Panayiotis Tzeremes, Nickolaos G. Tzeremes. (2017). Estimating Malmquist Productivity Indexes using Probabilistic Directional Distances: An Application to the European Banking Sector. European Journal of Operational Research.

Jill Johnes, Marwan Izzeldin, Vasileios Pappas, Christos Alexakis. (2018). Performance and Productivity in Islamic and Conventional Banks: Evidence from the Global Financial Crisis.
Kantakji, Dr. Samir Mudzhar. (2003). Fiqh al-Muhasabah al-Islamiyah, Disertasi Doktor pada Fakultas Ekonomi Universitas Aleppo.
Khan, Tariqullah dan Habib Ahmed. (2008). Manajemen Risiko Lembaga Keuangan Syariah, Jakarta: Bumi Aksara.
Kutlar, A. & A. Kabasakal & A. Babakan. (2015). Dynamic Efficiency of Turkish Banks: a DEA Window and Malmquist Index Analysis for the Period of 2003-2012. Sosyoekonomi, 23(24), 71-97.
Machmud, Amir & Rukmana. (2010). Bank Syariah: Teori, Kebijakan, dan Studi Empiris di Indonesia. Jakarta: Erlangga.
Mansyur, Fakhruddin. (2012). Analisis Perbandingan Efisiensi Bank Umum Syariah dan Bank Umum Konvensional di Indonesia Menggunakan Metode Stochastic Frontier Approach (SFA). UIN Sunan Kalijaga.
Marta Degl'Innocenti, Stavros A. Kourtzidis, Zeljko Sevic, Nickolaos G. Tzeremes. (2016). Bank Productivity Growth and Convergence in the European Union during the Financial Crisis. Journal of Banking and Finance.
Muhamad, Shamsher, dkk. (2008). Efficiency of Conventional versus Islamic Banks: International Evidence using the Data Envelopment Analysis (DEA). Journal of Islamic Economics, Banking and Finance, 2365.
Muhammad Abbas Rayan S Hammad Mohamed Fathy Elshahat Toseef Azid. (2015). Efficiency, Productivity and Islamic Banks: an Application of DEA and Malmquist Index. Humanomics, 31(1), 118-131.
Muharam, H., dan Pusvitasari. (2007). Analisis Perbandingan Efisiensi Bank Syariah Di Indonesia Dengan Metode DEA. 2(3).
Muliaman D. Hadad, Maximilian J. B. Hall, Karligash A. Kenjegalieva, Wimboh Santoso & Richard Simper. (2011). Productivity changes and risk management in Indonesian banking: a Malmquist analysis. Applied Financial Economics, 21(12), 847-861.
Munisamy, Masum, Saona, dan Wanke. (2016). Bank efficiency in Malaysia, A Use of Malmquist Meta-Frontier Analysis. Eurasia Business and Economics Society.
Nasution., Arham Hakim. (2006). Management Iindustri. Yogyakarta : Andi Offset.
Oscan, Yazar. (2008). Health Care Benchmarking and Performance Evaluation an Asseement using Data Envelopment Analysis (DEA). Springer, Newton MA.
Pertiwi, Lela Dina. (2007). Efisiensi Pengeluaran Pemerintah Daerah di Propinsi Jawa Tengah. Ekonomi Pembangunan, 12(2), 123-139.
Raéf Bahrini. (2015). Productivity of MENA Islamic banks: a Bootstrapped Malmquist Index Approach. International Journal of Islamic and Middle Eastern Finance and Management, 8(4), 508-528.
Ramanathan, R. (2003). An Introduction to Data Envelopment Analysis: A Tool for Performance Measurement. London: Sage Publications.
Řepková, I. (2014). Efficiency of the Czech banking sector employing the DEA window analysis approach. Procedia Economics and Finance, 12, 587-596.
Robert Webb. (2003). Levels of efficiency in UK retail banks: a DEA Window Analysis, International Journal of the Economics of Business, 10(3), 305-322.
Rusydiana, A. Slamet dan Salman Al-farisi. (2016). The Efficiency of Zakah Institutions using Data Envelopment Analysis. Al-Iqtishad: Jurnal Ilmu

Ekonomi Syariah, 8(2), 213-226.
Rusydiana, Aam S., and Irman Firmansyah. (2017). Efficiency versus Maqasid Sharia Index: An Application on Indonesia Islamic Bank. Shirkah Journal of Economics and Business, 2(2), 154.
Rusydiana, A. Slamet dan Rafika Rahmawati. (2018). Intertemporal Efficiency Analysis on Indonesia Islamic Banks: A Window DEA Approach. SMART Indonesia.
Rusydiana, A. Slamet. (2018). Indeks Malmquist Untuk Pengukuran Efisiensi dan Produktivitas Bank Syariah di Indonesia. Jurnal Ekonomi Dan Pembangunan LIPI, 26(1), 47-58.
Sena, V.. (2016). Trademarking Activities and Total Factor Productivity: Some Evidence for British Commercial Banks Using a Metafrontier Approach. Journal of Banking & Finance.
Shawtari, F.A., Ariff, M. and Abdul Razak, S.H. (2018). Efficiency and Bank Margins: A Comparative Analysis of Islamic and Conventional Banks In Yemen. Journal of Islamic Accounting and Business Research, 9(5). forthcoming.
Shawtari, F.A., Saiti, B., Razak, S.H.A. and Ariff, M. (2015b). The impact of Efficiency on Discretionary Loans/Finance Loss Provision: A Comparative Study of Islamic and Conventional Banks. Borsa Istanbul Review, 15(4), 272-282.
Shawtari, F.A., Ariff, M. and Abdul Razak, S.H. (2015a). Efficiency Assessment of Banking Sector in Yemen Using Data Envelopment Window Analysis: A Comparative Analysis of Islamic and Conventional Banks. Benchmarking: An International Journal, 22(6), 1115-1140.
Sufian, Fadzlan. (2007). The Efficiency Of Islamic Banking Industry In Malaysia: Foreign vs Domestic Bank. Humanomics, 23(3), 174-192 : Emerald Group Publishing Limited.
Sufian, F. (2007). Trends in the Efficiency of Singapore's Commercial Banking Groups: a Non-Stochastic Frontier DEA Window Analysis Approach. International Journal of Productivity and Performance Management, 56(2), 99-136.
Sufian, F. and Majid, M.Z.A. (2009). Bank Efficiency and Share Prices in China : Empirical Evidence from a Three-Stage Banking Model. Int. J. Computational Economics and Econometrics, 1(1), 23-47.
Sufian, Fadzlan. (2007). Benchmarking the Efficiency of the Korean Banking Sector: a DEA Approach. Humanomics, 18(1), 2011: Emerald Group Publishing Limited.
Sufian, F. (2009). Determinants of Bank Efficiency During Unstable Macroeconomic Environment : Empirical Evidence from Malaysia. Research in International Businessand Finance, 23(1), 54-77.
Summanth, D.J. 1984. Productivity Engineering and Management. McGraw – Hill Book Company.
Tanna, Sailesh, Luo, Yun, De Vita, Glauco. 2017. What is the Net Effect of Fnancial Liberalization on Bank Productivity? A Decomposition Analysis of Bank Total Factor Productivity gGrowth. Journal of Financial Stability, 537.
Tesfatsion Sahlu Desta. (2016). Are the Best African Banks Really the Best? A Malmquist Data Envelopment Analysis. Meditari Accountancy Research, 24(4), 588-610.
Thanh Pham Thien Nguyen, Eduardo Roca & Parmendra Sharma. (2014). How Efficient is the Banking System of Asia's Next Economic Dragon ? Evidence from Rolling DEA Windows. Applied Economics, 46(22), 2665-2684.
Violeta Cvetkoska & Gordana Savić. (2017). Efficiency of Bank Branches : Empirical Evidence from a Two-Phase Research Approach. Economic Research-Ekonomska Istraživanja.
Zeitun, R., Abdulqader, K.S. and Alshare, K.A. (2013) 'On the relative efficiency of conventional and Islamic banks: a DEA-window approach', Int. J. Financial Services Management, Vol. 6, No. 3, pp.236–251.

APPENDIX

Table 2. CRS Efficiency Levels of state commercial banks in Indonesia 2011-2018

CRS EFICIENCY	2011	2012	2013	2014	2015	2016	2017	2018	MEAN	Rank	iB vs cB
BNI Syariah	0,76	0,82	1	1	1	1	1	0,99	0,946	8	
BSM	0,81	0,94	0,91	0,85	0,83	0,8	0,76	0,75	0,831	21	
BRI Syariah	0,82	0,84	0,81	1	0,65	0,66	0,58	0,56	0,740	28	BUS = 0,79
BJB Syariah	0,87	0,46	0,76	0,68	0,66	0,66	0,36	1	0,681	31	
Aceh Syariah	0,84	0,84	0,84	0,77	0,68	0,68	0,75	0,78	0,773	26	
BNI	0,74	0,85	1	0,94	0,9	0,92	0,87	0,93	0,894	14	
Mandiri	0,92	0,96	1	1	1	0,96	0,95	1	0,974	5	BUK = 0,95
BRI	0,98	1	1	1	1	0,96	0,97	1	0,989	1	
BTN	0,93	0,97	0,98	0,99	1	0,99	1	1	0,983	4	
NTB Syariah	0,63	0,73	0,89	0,83	0,84	0,84	0,76	1	0,815	23	
DKI Syariah	0,95	1	1	1	0,84	0,84	1	1	0,954	7	
Jatim Syariah	0,47	0,63	0,58	0,33	0,31	0,37	0,31	0,32	0,415	34	
Kalbar Syariah	1	1	1	0,94	1	1	0,97	1	0,989	2	UUS = 0,76
Kalsel Syariah	0,64	0,66	0,64	0,67	0,67	0,62	0,53	0,42	0,606	33	
Sumut Syariah	0,42	0,56	0,64	0,6	0,85	0,99	0,56	0,57	0,649	32	
DIY Syariah	1	0,99	1	1	0,9	0,99	1	1	0,985	3	
BPD Bali	0,78	0,86	0,95	1	1	0,97	0,9	0,95	0,926	9	
BPD Bengkulu	0,79	0,88	0,96	0,92	0,88	0,81	0,77	0,89	0,863	17	
Bank DKI	0,62	0,65	0,8	0,88	0,72	0,7	0,58	0,76	0,714	30	
BPD BJB	0,88	0,88	1	0,93	0,85	0,83	0,86	0,82	0,881	15	
BPD Jatim	1	1	1	0,94	0,9	1	0,69	0,63	0,895	13	
BPD Kalbar	0,63	0,78	0,81	0,77	0,71	0,75	0,69	0,72	0,733	29	
BPD Kalteng	0,63	0,95	0,81	0,82	0,9	0,92	0,9	0,82	0,844	20	
BPD Kaltimtara	1	1	1	0,92	0,97	0,92	0,81	0,71	0,916	10	
BPD NTT	0,79	0,79	0,85	0,82	0,83	0,92	1	0,99	0,874	16	
BPD Papua	0,67	0,84	0,97	0,87	1	1	1	0,89	0,905	12	BPD = 0,83
BPD Riau Kepri	0,63	0,7	0,81	0,73	0,94	1	0,81	0,84	0,808	24	
BPD Kalsel	0,63	0,58	0,81	0,82	0,9	0,92	0,9	0,82	0,798	25	
BPD Nagari	0,8	0,93	0,97	0,78	0,95	0,76	0,85	0,82	0,858	18	
BPD Sulselbar	0,84	0,94	0,99	0,96	1	1	1	1	0,966	6	
BPD Sultra	0,76	0,78	0,84	0,93	0,81	0,86	0,91	0,9	0,849	19	
BPD SulutGO	0,75	0,97	1	0,78	0,87	0,98	1	0,95	0,913	11	
BPD DIY	0,71	0,68	0,71	0,79	0,76	0,77	0,86	0,86	0,768	27	
BPD Sumut	0,73	0,84	0,9	0,84	0,82	0,82	0,8	0,85	0,825	22	
MEAN	0,77	0,8	0,8	0,85	0,85	0,85	0,81	0,83	0,820		

Table 3. DEA Window Analysis of state commercial banks in Indonesia 2011-2018

BANK	EFFICIENCY SCORE				
	LDY	MEAN	SD	LDW	LDP
BNI Syariah	0	0,97	0,03	0,18	0,18
BSM	0,03	0,87	0,02	0,13	0,15
BRI Syariah	0,01	0,76	0,09	0,42	0,44
BJB Syariah	0,02	0,67	0,05	0,64	0,64
Aceh Syariah	0,1	0,77	0,04	0,19	0,21
Mandiri	0,05	0,98	0,01	0,08	0,08
BNI	0,1	0,95	0,03	0,22	0,22
BRI	0,03	0,99	0,004	0,03	0,03
BTN	0,01	0,99	0	0,02	0,02
DKI Syariah	0,15	0,97	0,03	0,15	0,15
Jatim Syariah	0,03	0,43	0,09	0,58	0,6
Kalbar Syariah	0,06	0,99	0,008	0,06	0,06
Kalsel Syariah	0,07	0,66	0,04	0,35	0,36
Sumut Syariah	0,15	0,72	0,06	0,43	0,56
DIY Syariah	0,08	0,99	0,009	0,08	0,08
NTB Syariah	0,09	0,85	0,02	0,24	0,24
BPD DKI	0,05	0,75	0,03	0,28	0,35
BPD Bali	0,04	0,95	0,02	0,16	0,16
BPD Bengkulu	0,09	0,92	0,07	0,15	0,23
BJB	0,05	0,89	0,03	0,14	0,18
BPD Jatim	0,02	0,94	0,04	0,23	0,23
BPD Kalbar	0,03	0,76	0,02	0,18	0,18
BPD Kalsel	0,09	0,86	0,04	0,38	0,39
BPD Kalteng	0,14	0,96	0,04	0,17	0,2
BPD Kaltimtara	0,14	0,94	0,05	0,26	0,29
BPD Nagari	0,06	0,86	0,02	0,19	0,24
BPD NTT	0,02	0,87	0,04	0,15	0,19
BPD Papua	0,03	0,96	0,004	0,11	0,11
BPD Riau Kepri	0,06	0,84	0,05	0,3	0,33
BPD Sulselbar	0,03	0,99	0,007	0,07	0,07
BPD Sultra	0,04	0,87	0,01	0,15	0,17
BPD SulutGO	0,18	0,96	0,01	0,22	0,22
BPD Sumut	0,06	0,86	0,03	0,2	0,2
BPD DIY	0,04	0,78	0,02	0,13	0,19

Table 4. Productivity Levels of State Commercial Banks in Indonesia 2011-2018

DMU	EFFCH	TECH	PE Change	Ec Scale Change	TFP Change	iB vs cB
BNI Syariah	0.968	1.000	1.000	0.968	0.968	
BSM	1.005	1.003	0.996	1.009	1.008	
BRI Syariah	1.060	0.999	1.059	1.002	1.059	
BJB Syariah	1.000	1024	1.000	1.000	1.024	BUS = 1,008
Aceh Syariah	0.976	1006	1.000	0.976	0.982	
BNI	0.980	0.977	1.010	0.970	0.957	
Mandiri	0.986	0.987	1.000	0.986	0.973	
BRI	0.982	1.017	1.000	0.982	0.999	BUK = 0,973
BTN	1.003	0.961	1.000	1.003	0.964	
NTB Syariah	0.944	0.939	0.984	0.959	0.886	
DKI Syariah	1.019	0.923	1.000	1.019	0.940	
Jatim Syariah	1.053	1.015	1.063	0.990	1.068	
Kalbar Syariah	1.000	1.029	1.000	1.000	1.029	
Kalsel Syariah	1.066	0.993	1.066	0.999	1.058	UUS = 0,971
Sumut Syariah	0.967	0.969	0.969	0.998	0.937	
DIY Syariah	1.000	0.881	1.000	1.000	0.881	
BPD Bali	0.973	1.019	1.000	0.973	0.991	
BPD Bengkulu	1.006	1.089	1.003	1.003	1.095	
BPD DKI	0.975	1.003	0.999	0.976	0.978	
BPD BJB	0.993	1.027	1.009	0.984	1.020	
BPD Jatim	1.048	1.045	1.016	1.032	1.096	
BPD Kalbar	1.000	1.007	1.007	0.993	1.008	
BPD Kalteng	0.993	0.934	0.998	0.995	0.927	
BPD Kaltimtara	1.035	1.104	1.023	1.012	1.143	BPD = 1,004
BPD NTT	0.982	1.001	0.999	0.983	0.983	
BPD Papua	1.000	0.958	1.000	1.000	0.958	
BPD Riau Kepri	0.950	1.003	0.966	0.984	0.953	
BPD Kalsel	0.962	1.032	0.966	0.996	0.993	
BPD Nagari	0.991	1.025	1.005	0.986	1.016	
BPD Sulselbar	0.995	1.002	1.000	0.995	0.997	
BPD Sultra	0.982	0.999	1.008	0.975	0.981	
BPD SulutGO	0.980	0.991	1.000	0.980	0.972	
BPD DIY	0.974	1.000	0.989	0.985	0.974	
BPD Sumut	0.985	1.006	0.980	1.004	0.990	