

## **SPIN-OFF EFFICIENCY ANALYSIS OF INDONESIAN ISLAMIC BANKS**

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*Abstract* - Since the Law No.21 of 2008 concerning Islamic Banking, there are only 4 Islamic business unit that have conducted spin-off which are BRI Sharia, BNI Sharia, Bukopin Sharia and BJB Sharia. The number of study regarding spin-off efficiency is still quite small. The study uses input-oriented VRS DEA model with intermediation approach to measure efficiency. Since the results show non-parametric data, Mann-Whitney test is used for hypothesis testing to examine the significant level of the efficiencies before and after conducting spin-off. The average efficiency of BRI Sharia, BNI Sharia, and BJB Sharia has improved after conducting spin-off. In the contrary, average efficiency of Bukopin Sharia has decreased after conducting spin-off. Looking at the trend-line, those four Islamic Banks possess better movement post spin-off than pre spin-off. There is no significant difference of BRI Sharia and BNI Sharia for both before and after conducting spin-off based on Mann-Whitney test. A significant difference occurs in Bukopin Sharia and BJB Sharia. Conventional commercial bank which has an Islamic business unit can learn about efficiency of pre and post-spin-off performances of 4 Islamic Commercial Banks that have performed spin-off to prepare adequate insight before actually conducting spin-off.

*Keywords:* Data Envelopment Analysis, efficiency, intermediation approach, Islamic banks, spin-off

### **Introduction**

Islamic banking in Indonesia started to develop significantly since Law No.7 of 1992 has been amended into Law No.10 of 1998 about banking, which allows conventional banks to conduct their operations based on Islamic laws and principles by offering a feature named Islamic business unit. To date, this feature is still becoming a favorite for many conventional banks that want to earn profit regarding the development of Islamic banking (Rongiyati, 2015). Based on statistics, there are 13 Islamic commercial banks and 21 Islamic business units up until November 2016.

The development of Islamic banking for the last ten years has grown quite rapidly. This proves that Islamic banks can serve what is needed at current time. As a regulator, the government through Bank Indonesia and Financial Services Authority are struggling to accelerate the development of Islamic banking. Through Law No.21 of 2008 concerning Islamic Banking, they expect to drive the development and growth of Islamic banks in Indonesia more quickly and be able to act to encourage the national economy more broadly.

Undeniably, by carrying out the function of national financial intermediation and financial stability, Islamic banking has made important contributions to national development (Andriansyah, 2009). In the past half-decade, the average growth of Islamic banking is at 40.5% per year. Bank Indonesia also projected that the Islamic banking industry could achieve a market share of 15% in the next few years (around 2022) if it is able to achieve stable growth (Purwanto, 2012). However, the market share today is still about 4% in terms of assets.

Indonesian government continues to improve and strengthen the Islamic banking, either through banking regulation or other policies. For example, with the concept of office channeling, branch office of a conventional commercial bank which already has Islamic business unit allowing sharia transaction services to occur. In addition, the concept of Islamic windows, a conventional bank can establish Islamic business unit. In fact, there were only 5 banks that opened a business bank directly in the form of Islamic commercial bank among the 24 existing Islamic banks. The rest remains Islamic business unit or transformation into an Islamic commercial bank through the acquisition or conversion or spin-off.

In 2009, there are two banks conducted spin-off, namely BRI Sharia on January 1, 2009 and Bukopin Sharia on July 10, 2009. A year later in 2010, the number of Islamic banking increased up to five banks. They were formed as the result of conversion (Islamic business unit of conventional commercial bank to Islamic bank) and spin-off. This conversion produced Victoria Sharia Bank, BCA Sharia, and Maybank Sharia Indonesia Bank. While BNI Sharia and BJB Sharia were formed through spin-off process. BNI Sharia conducted spin-off on June 19, 2010 and BJB Sharia on May 6, 2010.

From the existing 13 Islamic Banks, there are four banks that were formed through the spin-off, namely BRI Sharia, BNI Sharia, BJB Sharia and Bukopin Sharia. To accelerate the business, those banks needed time for about two years to prepare their infrastructures, operations, and human resources (Outlook Perbankan Syariah, 2011). During that period of time, which are BRI and Bukopin Sharia conducted spin-off in 2009 and followed by BNI Sharia and BJB Sharia in 2010, Islamic commercial banks were experiencing a quite significant growth of assets. While the Islamic business units in conventional banks were experiencing negative growth since some of the Islamic business units had conducted spin-off to become Islamic commercial banks. Overall, the assets growth of Islamic banks showed a relatively high results.

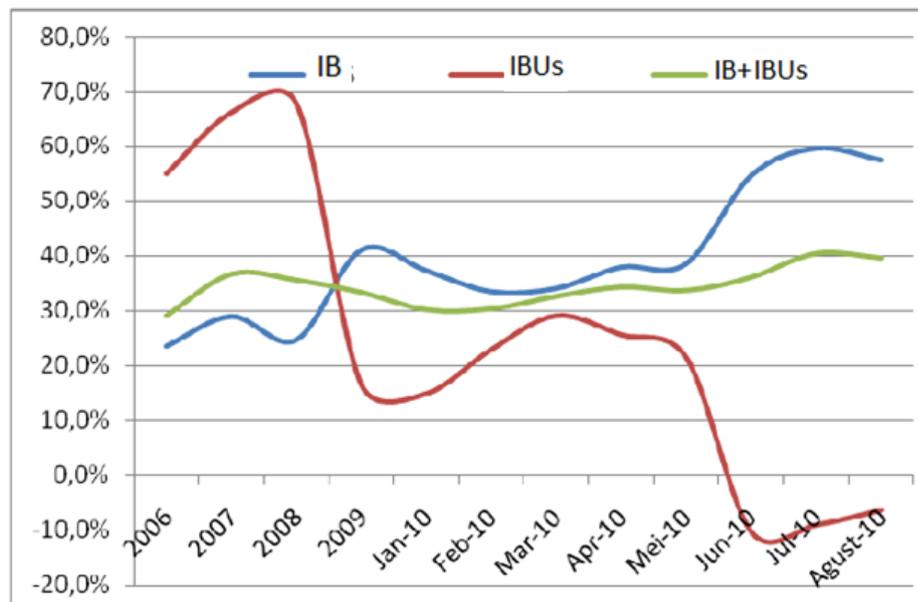


Figure 1 Asset Growth of Islamic Banks (Source : Outlook Perbankan Syariah Indonesia 2011)

The existence of Islamic business units as units or divisions of conventional banks is temporary (Rashid, 2016). This is confirmed in Article 68 paragraph 1 of Law No. 21 of 2008 concerning Islamic Banking, which states: "In the case of conventional commercial bank that has Islamic business units reaching out its asset value for at least 50% (fifty percent) of the total value of its assets of the parent bank or 15 (fifteen) years since the enactment of this Act , the Conventional bank is obliged to do separation of Islamic Business Unit into Islamic Commercial banks ". The Article requires that a conventional commercial bank which has an Islamic business unit to separate their Islamic business unit into Islamic commercial bank if the asset value of its Islamic business unit has achieved at least

50 percent of the total assets of its parent bank, or at least 15 years since the enactment of the Act (before 2023).

Responding to the provision of Articles above, Bank Indonesia formed a Bank Indonesia Regulation Number 11/10/PBI/2009 regarding Islamic business units. Separation (spin-off) is defined as the separation of the business from a conventional commercial bank into two entities or more in accordance with the provisions of the applicable legislation. Based on these regulations, Spin-off mechanism is divided into two mechanisms. Firstly, by establishing a new Islamic commercial bank. This can only be done with the permission of Bank Indonesia (now Financial Services Authority). Paid-up capital of at least five hundred billion (500,000,000). If the paid-up capital are insufficient, the addition can be done in the form of cash and/or land and buildings used for the operations of Islamic commercial Bank separation results. Paid-up capital by Islamic commercial bank separation results, shall be increased to at least one trillion (1,000,000,000,000) no later than 10 (ten) years after the Islamic commercial Bank business license has been granted.

Islamic commercial Bank granting permits the establishment of the separation which is carried out in two phases: a) approval in principle, meaning that it is an approval to conduct preparations for the establishment of an Islamic commercial Bank from separation result; and b) operating license, which is granted after an Islamic commercial Bank separation results are ready for operational activities. If permission has been given to the principle of a conventional commercial bank, and if after the license is granted for a conventional commercial bank which does not have a business license Islamic commercial Bank separation results in a period of six months, the approval becomes invalid. Therefore, the conventional commercial banks have to prepare all the necessary requirements to the maximum possible extent (Rosyid, 2016).

The second mechanism is to transfer the rights and obligations of IBU to Islamic commercial bank that already exist and can only be done with the approval of Bank Indonesia (now Financial Services Authority). If the approval of the transfer plans have been obtained, then the conventional commercial Bank which has a Islamic business unit shall announce it in a national newspaper no later than 10 (ten) days and transfer the rights and obligations of Islamic business unit to the Islamic commercial Bank later than 30 (thirty) days after the date of approval of the transfer is given. If within 30 days of the transfer of rights and obligations of sharia business unit to the receiver Islamic commercial Bank separation has not been done, then the given approval will be reviewed. Subsequently, the receiver of separation is also required to report its financial condition after receiving a transfer of rights and obligations of Islamic business units no later than 10 (ten) days after the execution date. The separation of Islamic Business Units from conventional banks was done by taking rights and obligations of Islamic Business Units to Islamic Commercial Banks that are already having ownership-relation with the respective conventional banks which had the Islamic Business Units.

A regulation regarding spin-off conduction of Islamic Banks in Indonesia has been issued through Law No. 21 of 2008 concerning Islamic Banking. There are only 4 choose to conduct spin-off in response to its government regulation. Nevertheless, Conventional banks that have Islamic business unit must strengthen their internal factors before conducting spin-off. Financial Services Authority claims that many of Islamic Business Unit are still not ready and prepared to conduct spin-off, particularly from 15 Regional Development Banks that have not had basic sufficiency of total capital which should be prepared by both parent company and their own business working capital (Mahendra, 2014).

Based on the explanation above, it will be necessary to conduct a performance assessment of Islamic banks which have implemented the regulation. A research of bank efficiency is substantial because financial sector development is a crucial substance for positive economic growth. Pratikno

(2011) stated that banks efficiency assessment is used as the foundation of health and growth of banks. Efficiency is the root for their health and the source of banking growth (Suseno, 2008). Parametric or non-parametric methods that accounts multiple variables to efficiency assessment are considerably more suitable. It simultaneously accounts the interaction between multiple inputs and outputs. One example is Data Envelopment Analysis (DEA) that is used in this research. DEA is an excellent to measure or assess banking efficiency (Cronje & Mutezo, 2000). Data envelopment analysis (DEA) is a non-parametric mathematical programming to measure the inefficiency a number of output variables given certain inputs and vice versa. DEA measures the efficiency of decision-making units relative to a similar decision-making unit in which all of these units are at or below its efficient frontier curve (Charne et al., 1978).

DEA does not inflict both a specific functional relationship between production output and input, and any assumption on the specific statistical distribution of the error terms. Therefore, this model has an advantage of possessing minimal specification error. It is possible to use multiple inputs and outputs in DEA. It also produces detailed information on the units' efficiencies, not only relative to the frontier efficiency, but also to specific efficient units, which can be identified as role models or comparators (Hawdon in Mostafa, 2011). DEA gives an efficiency score to each unit by comparing the efficiency score of each unit with that of its peers. It identifies a frontier which has the best performers. Those units that are lying on the frontier are recognized as efficient, and those that are not, as inefficient. DEA also involves the solution of a linear programming (LP) problem to fit a non-stochastic, non-parametric production frontier based on the actual input-output observations in the sample.

Sun and Lu in Mostafa (2011) had mentioned that DEA approach has been becoming popular method to evaluate or assess the relative efficiencies of decision-making units (DMUs) within a relatively homogenous set. There are two scale assumptions that commonly use in DEA approach, which are Constant Return to Scale (CRS) model and Variable Return to Scale (VRS) model. The CRS model introduced by Charnes, Cooper, and Rhodes in 1978. Later on, in 1984 the VRS model introduced by Banker, Charnes, and Cooper as the improvement of CRS model.

The objectives of this research are to find out the efficiency of Islamic banks before and after spin-off based on DEA Approach, and also find out whether there are significant differences toward the efficiency of Islamic banks before and after spin-off.

## Methods

There are 4 (four) Islamic Banks that were formed through spin-off process, namely BRI Sharia, BNI Sharia, Bukopin Sharia and BJB Sharia. The longer time period used for the research will show better results. In this research, each of those Islamic Banks would be split into two periods, in which each period would need 4 years (16 quarters) before conducting spin-off and after conducting it. Financial statements of Islamic banks from 2004-2013 were collected to conduct this research. The researchers use balance sheet and income statement of each bank (BRI Sharia, BNI Sharia, BJB Sharia, dan Bukopin Sharia) which consist of 4 years (16 quarters) before conducting spin-off and 4 years (16 quarters) after conducting spin-off. Those quarterly financial reports are taken from Otoritas Jasa Keuangan (Financial Services Authority) official website and *Infobank Indonesia*. Furthermore, annual financial reports from each Bank sample had been collected to see their financial performances. The following table shows the quarterly financial report of each bank sample:

**Table 1** Table of Pre Spin-off Period

Bank	2005				2006				2007				2008				2009				2010
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1
BRI Sharia	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v					

BNI Sharia					v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v
Bukopin Sharia			v	v	v	v	v	v	v	v	v	v	v	v	v	v	v			
BJB Sharia					v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v

Note : 1 = Quarter 1 (March), 2 = Quarter 2 (June), 3 = Quarter 3 (September), 4 = Quarter 4 (December)

Table 2 Table of Post Spin-off Period

Bank	2009				2010				2011				2012				2013				2014
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1
BRI Sharia	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v					
BNI Sharia					v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v
Bukopin Sharia			v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v			
BJB Sharia					v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v	v

Note : 1 = Quarter 1 (March), 2 = Quarter 2 (June), 3 = Quarter 3 (September), 4 = Quarter 4 (December)

In this research, intermediation approach are applied. This is in line with the banking function that considers the bank as an institution of funds from the excess funds to those who need funds. Ascarya and Yumanita (2008) reveals that intermediation approach illustrates the real Islamic banking activities. The definition of input and output variables of this study adopted Sufian (2006). Below is the table representing the inputs and outputs variables of this research:

Table 3 Inputs and Outputs Variables

Variable	Source
<b>Input Variables</b>	
Total Deposits	
Wadiah fund	Balance sheet
Unrestricted investment funds (Mudharaba Muthlaqah)	Balance sheet
Labor costs	Income statement
Fixed asset	
Fixed asset	Balance sheet
Accumulated depreciation of fixed assets	Balance sheet
<b>Output Variables</b>	
Income	
Income from fund disbursement	Income statement
Other operating income	Income statement
Income of provision for asset possible losses	Income statement
Income for estimated losses of commitment and contingencies	Income statement
Non-operating income	Income statement
Total loans	
Murabaha receivables	Balance sheet
Salam receivables	Balance sheet
Istishna receivables	Balance sheet
Qardh receivables	Balance sheet
Financing	Balance sheet
Ijarah	Balance sheet

Source: Faturohman (2013)

This research uses VRS model to comprehend the actual efficiency rate (without being limited by anything) which is possessed by Islamic Banks in Indonesia, for both before and after conducting spin-off. While in the orientation model, input orientation is being used, since it wants to seek for number of inputs can be reduced proportionately without changing the amount of output produced. Maharani (2012) mentioned that with input-oriented, banks' management are able to supervise the inputs to reduce burdens, costs, or even employees. Easier supervision from input will minimize cost, so the profit will increase. Coelli (1999) said that input-oriented is the primary decision variable.

Assume that, for each N banks, there are K inputs and M outputs. Column vectors  $x_i$  and  $y_i$  represents the  $i^{\text{th}}$  bank. The data of all banks are represented by the  $K \times N$  input matrix, X, and the  $M \times N$  output matrix, Y. The objective of a DEA model is to construct a non-parametric envelopment frontier, where the entire observed points lie on or below the frontier. The envelopment form of the input-orientated VRS model can be derived as follows:

$$\begin{aligned} & \min \theta, \lambda \\ & \text{subject to } -y_i + Y\lambda \geq 0, \\ & \theta x_i - X\lambda \geq 0, \\ & N1'\lambda = 1 \\ & \lambda \geq 0. \end{aligned}$$

**Equation 1** Variable Return to Scale (Source : Coelli, 1996)

Where  $\theta$  is a scalar with value between 0 and 1.  $\lambda$  is a  $N \times 1$  vector of constants.  $N1$  is a  $N \times 1$  vector of ones. The value of  $\theta$  represents the VRS efficiency score of the  $i^{\text{th}}$  bank. The value of 1 indicates full efficiency and lies on the frontier. The VRS model presents a technical efficiency score, which is higher than or equal to technical efficiency score (CRS model). The  $\theta-1$  is the proportional increase in outputs that could be achieved by the  $i^{\text{th}}$  bank, with input quantities held constant, while  $1/\theta$  explains the technical efficiency scores between 0 and 1.

There are single-multi year efficiency that calculated using VRS DEA model in this research. The data of 4 Islamic banks (BRI Sharia, BNI Sharia, Bukopin Sharia, and BJB Sharia) before and after spin-off compiled into one file data and then measure the efficiency using VRS DEA model.

Mann-Whitney test applied to compare the efficiency of Islamic banks in two periods, which are Islamic banks before spin-off and after conducting spin-off. The null hypothesis of this non-parametric test for two independent samples is the medians of compared groups are same (Fay & Proschan, 2010). If the value of asymptotic significances (2-tailed) is below 0.05, it means that we need to accept  $H_1$ . Otherwise, if the value of asymptotic significances (2-tailed) is above 0.05, it means that we need to accept the null hypothesis. Here are the listed hypothesis of Mann-Whitney test :

- BRI Sharia  
 $H_0$  = There is no significant difference toward the efficiency of BRI Sharia in pre and post-spin-off period  
 $H_1$  = There is significant difference toward the efficiency of BRI Sharia in pre and post-spin-off period
- BNI Sharia  
 $H_0$  = There is no significant difference toward the efficiency of BNI Sharia in pre and post-spin-off period  
 $H_1$  = There is significant difference toward the efficiency of BNI Sharia in pre and post-spin-off period
- Bukopin Sharia  
 $H_0$  = There is no significant difference toward the efficiency of Bukopin Sharia in pre and post-spin-off period

$H_1$  = There is significant difference toward the efficiency of Bukopin Sharia in pre and post-spin-off period

- BJB Sharia

$H_0$  = There is no significant difference toward the efficiency of BJB Sharia in pre and post-spin-off period

$H_1$  = There is significant difference toward the efficiency of BJB Sharia in pre and post-spin-off period

## Results and Discussion

**Table 4** Descriptive statistics of DEA results

<b>BRI-S</b>	<b>Mean</b>	<b>Median</b>	<b>Std. Dev</b>	<b>Maximum</b>	<b>Minimum</b>
Pre-spin-off	0.7724	0.7299	0.1730	1.0000	0.5823
Post-spin-off	0.7946	0.8107	0.1694	1.0000	0.4117
<b>BNI-S</b>	<b>Mean</b>	<b>Median</b>	<b>Std. Dev</b>	<b>Maximum</b>	<b>Minimum</b>
Pre-spin-off	0.7444	0.8103	0.2545	1.0000	0.4092
Post-spin-off	0.9483	0.9701	0.0650	1.0000	0.7964
<b>Bukopin-S</b>	<b>Mean</b>	<b>Median</b>	<b>Std. Dev</b>	<b>Maximum</b>	<b>Minimum</b>
Pre-spin-off	0.8428	0.9415	0.1997	1.0000	0.3891
Post-spin-off	0.4602	0.3820	0.1644	0.8062	0.2718
<b>BJB-S</b>	<b>Mean</b>	<b>Median</b>	<b>Std. Dev</b>	<b>Maximum</b>	<b>Minimum</b>
Pre-spin-off	0.6793	0.7017	0.1928	1.0000	0.3884
Post-spin-off	0.8373	0.8196	0.1281	1.0000	0.6422

Table 4 presents the average technical efficiency result of Islamic banks before and after conducting spin-off based on VRS DEA input-oriented measurement. The VRS efficiency analysis finds that the average technical efficiency score of BRI Sharia post-spin-off is higher than the average technical efficiency score of BRI pre-spin-off. The average technical efficiency of BRI Sharia pre-spin-off is 77.24%. Meanwhile, the average technical efficiency of BRI Sharia post-spin-off is 79.46%. The VRS efficiency analysis finds that the average technical efficiency score of BNI Sharia post-spin-off is higher than the average technical efficiency score of BNI pre-spin-off. The average technical efficiency of BNI Sharia pre-spin-off is 74.44%. Meanwhile, the average technical efficiency of BNI Sharia post-spin-off is 94.83%. The VRS efficiency analysis finds that the average technical efficiency score of Bukopin Sharia post-spin-off is lower than the average technical efficiency score of Bukopin pre-spin-off. The average technical efficiency of Bukopin Sharia pre-spin-off is 84.28%. Meanwhile, the average technical efficiency of Bukopin Sharia post-spin-off is 46.02%. The VRS efficiency analysis finds that the average technical efficiency score of BJB Sharia post-spin-off is higher than the average technical efficiency score of BJB pre-spin-off. The average technical efficiency of BJB Sharia pre-spin-off is 67.93%. Meanwhile, the average technical efficiency of BJB Sharia post-spin-off is 83.73%.

Based on descriptive statistic for four Islamic banks, the average input variable (total deposit, labor cost, fixed asset) and output variable (income, total loan) increased after conducting spin-off. The average technical efficiency of BRI Sharia, BNI Sharia, and BJB Sharia after conducting spin-off tend to increase compared to before conducting spin-off. Otherwise, the average technical efficiency of Bukopin Sharia after conducting spin-off tend to decrease compared to before conducting spin-off. The decreased of technical efficiency is probably due to Bukopin Sharia has increased significantly in fixed asset, especially on land rights, buildings, and machineries. The value of fixed asset of Bukopin Sharia before conducting spin-off per December 2008 is 2,550 million rupiahs and after conducting spin-off per December 2009 is 37,423 million rupiahs, or increased significantly 1.368%. After

conducting spin-off in 2009, Bukopin Sharia continually strive to improve service standards by strengthening IT systems and infrastructure.

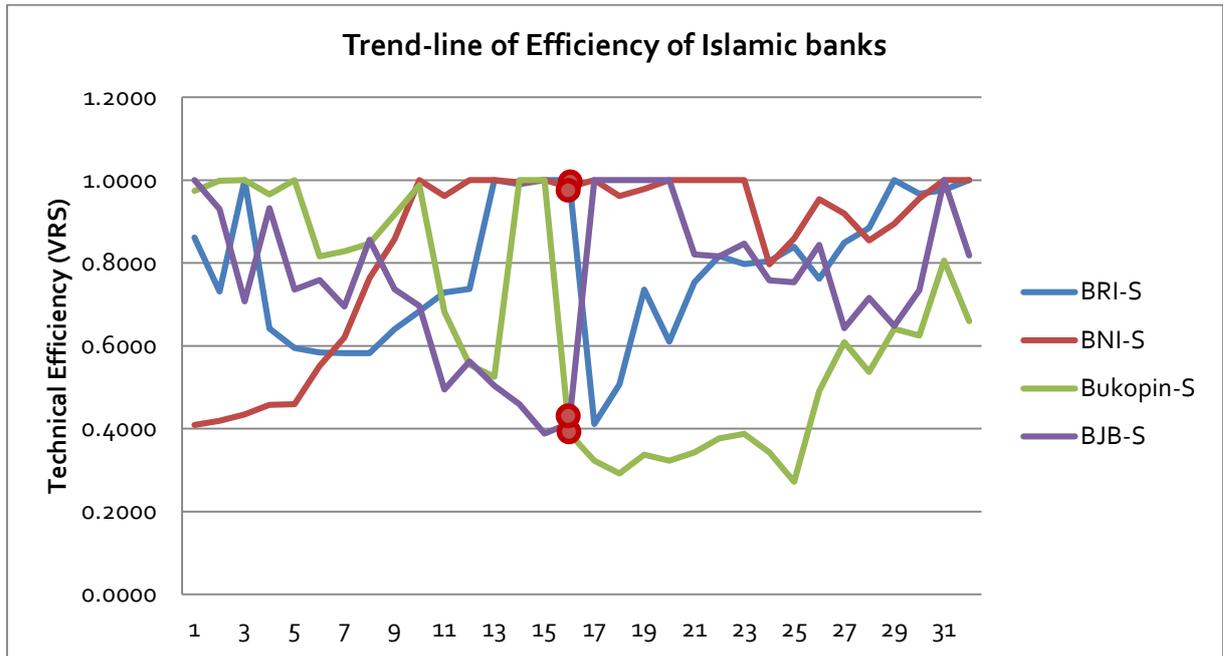


Figure 2 Trend-line of Efficiency of Islamic banks

Figure 2 presents trend-line of efficiency of Islamic banks. The line movement on technical efficiency of BRI Sharia for pre and post-spin-off tends to increase even though it is fluctuating. Yet, the line movement on technical efficiency of BRI Sharia after spin-off shows the better movement compared to before spin-off period. The line movement on technical efficiency of BNI Sharia for pre-spin-off tends to increase, and relatively stable for post-spin-off period. This indicates that the line movement on technical efficiency of BNI Sharia after spin-off shows the better and stable movement compared to before spin-off period. the line movement on technical efficiency of Bukopin Sharia for pre-spin-off tends to decrease, while its line movement on efficiency for post-spin-off tends to increase. This indicates that the line movement on technical efficiency of Bukopin Sharia for post-spin-off is better movement compared to pre-spin-off period. The technical efficiency of BJB Sharia for pre and post-spin-off tends to decline, but the line movement on technical efficiency of BJB Sharia for post-spin-off are more sloping than pre-spin-off period. This indicates that the line movement on technical efficiency of BJB Sharia for post-spin-off shows the better movement compared to the pre-spin-off period.

Based on the Mann-Whitney test, there are no statistically significant differences in VRS efficiency between BRI Sharia pre and post spin-off, because significance level of statistic 0.564, is higher than 0.05, it means this result is retain the null hypothesis. The efficiency results of BNI Sharia have asymptotic significances (2-tailed) score of 0.056 in the Mann-Whitney test. With significance level of 0.056, it means there are no statistically significant differences in VRS efficiency between BNI pre and post-spin-off. The average median technical efficiency of Bukopin Sharia post-spin-off is 38.20% and pre-spin-off is 94.15%. There are statistically significant differences in VRS efficiency between Bukopin Sharia pre and post-spin-off based on the Mann-Whitney test. The significance level of statistic 0.00039, is lower than 0.05, it means this result is reject the null hypothesis. The average median technical efficiency of BJB Sharia post-spin-off is 81.96% and pre-spin-off is 70.17%. There are statistically significant differences in VRS efficiency between BJB Sharia pre and post-spin-off based on the Mann-Whitney test. The significance level of statistic 0.019, is lower than 0.05, it means this result is reject the null hypothesis.

## Conclusions

Based on DEA results, the average efficiency of BRI Sharia, BNI Sharia, and BJB Sharia has improved after conducting spin-off. In the contrary, the average efficiency of Bukopin Sharia has decreased after conducting spin-off. A big number of output variable (income and total loan) and followed by a big number of input variable (total deposit, labor cost, fixed asset) as well, does not mean that efficiency of Islamic banks tend to be better. Looking at the trend-line, those four Islamic banks possess better movement post spin-off than pre spin-off. This research finds that there is no significant difference of BRI Sharia and BNI Sharia for both before and after conducting spin-off based on Mann-Whitney test. This indicates that average median of BRI Sharia and BNI Sharia for pre and post of spin-off are lying on the same level. A significant difference occurs in Bukopin Sharia and BJB Sharia. Average median of Bukopin Sharia for pre spin-off is significantly better compared to its' post spin-off result. In the contrary, average median of BJB Sharia for post-spin-off is significantly better compared to its' pre spin-off.

Based on the results of the research, the management team of Islamic banks, particularly those with lower efficiency scores after spin-off, should improve the optimization of Islamic banks' resources, whether by using input approach or output approach. Meanwhile, the conventional banks that have Islamic business unit need a good internal decision and appropriate strategy to respond to spin-off regulation that forces conducting spin-off before 2023 in order to obtain optimum efficiency. The optimization based on both input variables (total deposit, labor cost, fixed assets) and output variables (income and total loans). The variables should be breakdown into the supporting components. The management team of bank should increase the supporting components in the output variable and optimize the supporting components in the input variable. Furthermore, using longer period of time and also asset and production approach can be considered to apply in the future research to get better insight.

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