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## **Total Factor Productivity and Efficiency Analysis on Islamic Banks in Indonesia**

### **Abstract**

The aims of this study are to measure productivity and efficiency, to analyze factors which affect the level of efficiency, and to analyze correlation between productivity and efficiency of Islamic banking in Indonesia. The objects of this study are 11 Islamic Banks (BUS) in Indonesia which are analyzed from the second quarter of 2010 to the third quarter of 2015. The result shows only 6 of the 11 banks that have a good productivity levels, otherwise for efficiency there are only 3 banks that efficient enough. Furthermore, the relationship between productivity and efficiency levels that are categorized into 4 quadrants. In quadrant I, 3 banks have high productivity and efficiency namely Syariah Mandiri, Panin Syariah, and Victoria Syariah. Quadrant IV, 2 banks in low level of productivity and efficiency namely Mega Syariah and Bukopin Syariah. While the quadrant II namely BCA Syariah, BRI Syariah, and Muamalat and quadrant III namely BJB Syariah, BNI Syariah, and Maybank Syariah required further research to determine the factors that affect the productivity and efficiency relationships that occur.

**Keywords:** Data Envelopment Analysis; Efficiency; Input-Output; Malmquist Productivity Index; Productivity; Tobit Models

**JEL Classification:** D24; D57; D61

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### **Abstrak**

*Tujuan penelitian ini adalah untuk mengukur tingkat produktivitas dan efisiensi, menganalisis faktor-faktor yang mempengaruhi tingkat efisiensi, dan menganalisis hubungan produktivitas dan efisiensi perbankan syariah di Indonesia. Objek penelitian ini menggunakan 11 Bank Umum Syariah (BUS) di Indonesia, selama kuartal II tahun 2010 sampai kuartal III tahun 2015. Hasil menunjukkan hanya 6 dari 11 bank yang mempunyai tingkat produktivitas yang baik, sedangkan untuk efisiensi hanya terdapat 3 bank yang cukup efisien. Selanjutnya hubungan produktivitas dan efisiensi dikategorikan dalam 4 kuadran. Pada kuadran I, 3 bank memiliki tingkat produktivitas dan efisiensi yang tinggi, yaitu Syariah Mandiri, Panin Syariah, dan Victoria Syariah. Kuadran IV, 2 bank dalam tingkat produktivitas dan efisiensi yang rendah, yaitu Mega Syariah dan Bukopin Syariah. Sedangkan kuadran II, yaitu BCA Syariah, BRI syariah, dan Muamalat serta kuadran III, yaitu BJB Syariah, BNI Syariah, dan Maybank Syariah diperlukan penelitian lebih lanjut untuk mengetahui faktor-faktor yang mempengaruhi hubungan produktivitas dan efisiensi yang terjadi.*

**Kata Kunci:** *Data Envelopment Analysis; Efisiensi; Input-Output; Malmquist Productivity Index; Produktivitas; Model Tobit*

Central Bank on Indonesia issued regulation number 15/50/DPBs about how to open branch office at Islamic bank (Surat Edaran Bank Indonesia Nomor 15/50/DPBs) with this regulation, numbers of branch office at Islamic banks increased significantly. The regulation is to push the target market of Islamic banking by 5 percent. Hands among Islamic banks are more competitive. As a consequences, productivity and efficiency of Islamic banks become something that needs to be paid attention (Indonesia, 2016).

According to Report of Statistical Data Central Bank Indonesia in 2016, total assets has increased from IDR188.19 M in 2010 to IDR213.423 M in 2016, third party funds (DPK) from IDR191.594 M in 2010 to IDR231.175 M in 2016, and financing from IDR68.181 M to IDR111.224 M in 2016. All those 3 indicators are increasingly fluctuating. Although the indicator of financing has decreased significantly in 2014 and 2015 amounted to IDR122.616 M and IDR86.079 M due to the economic slowdown (Indonesia, 2016).

Report of statistical data number 27, 2016 states that the ratio of FDR (Financing Deposit Ratio) of Islamic banks decreased from 92.15 percent to 92.06 percent due to the increasing of DPK which higher than finance. While the increasing of NPF (Non Performing Financing) Islamic banking ratio is relatively normal or has not had a significant impact on financial system stability (Bank Indonesia, 2016).

Some of these data reflect the constraints and competition of Islamic banking industry which is quite strict. This makes Islamic banking industry

required to closely assess its performance in the face of global competition era. One of the way is by assessing the level of productivity and efficiency. With these assessments, Islamic banking can evaluate and develop the strategies to expand its market share.

In this study, the performance of Islamic banking industry both its industry and individual will be analyzed by assessing its efficiency and productivity level. To assess the level of productivity can be using 3 methods which are Fisher Index, Tornqvist Index, and Malmquist Index.

From those 3 methods, Suzuki & Sastroswito (2011) states that the Malmquist index has 3 main advantages relative to the Fischer and Tornqvist Indices: (1) it does not require the profit maximization or the cost minimization assumption; (2) it does not require information on the input and output prices; and (3) if the researcher has panel data, it allows the decomposition of productivity changes into two components, i.e. technical efficiency change or catching up and technical change or changes in the best practice. Its main disadvantage is the necessity to compute the distance functions. However, the data envelopment analysis (DEA) technique can be used to solve this problem (Suzuki & Sastroswito, 2011).

DEA method is used in this study to measure the efficiency level. This technique is a performance measurement technique that can analyze the efficiency DMU that has multiple inputs and outputs. This method can also estimate Malmquist Index components such as, efficiency changes, technical changes, pure efficiency changes, and scale changes (Charnes, Cooper, & Rhodes, 1978) The

**Table 1.** Sharia Bank Progress Data in Indonesia Year 2014-2016

Indicator	2010	2011	2012	2013	2014	2015	2016
Number of Bank Umum Syariah (BUS)	11	11	11	11	12	12	13
Number of BUS office	1.215	1.401	1.745	1.998	2.163	1.990	1.869
Number of Unit Usaha Syariah (UUS)	23	24	24	23	22	22	21
Number of UUS office	262	336	517	590	320	311	332

Sources: Report of Statistical Data Central Bank Indonesia in 2016, data processed

## Total Factor Productivity and Efficiency Analysis on Islamic Banks in Indonesia

*Siti Aisyah, Muhamad Nadratuzzaman Hosen*

advantages of the DEA method are, it can handle multiple inputs and outputs, does not require the assumption of functional relationship between input and output, DMU can be compared directly with each other, and on input and output can have different measurement units (Yuniarti, 2008).

While Tobit calculation is used to measure factors which influence level of variables used in the level of efficiency and productivity. The results of Tobit can be understood the impact that may occurs on the influence of related variables.

Benli & Degirmen (2013) analyze the implementation of DEA in the Turkish banking. The results can be used to analyze Malmquist Total Factor Index from 2004-2009 at level of government, private, and foreign banks. During the study period, variable foreign banks in Malmquist Index has the highest score of 22.6 percent for efficiency changes, 16.3 percent for technological changes, and 20.9 percent for productivity (Benli & Degirmen, 2013).

Suzuki & Sastroswito (2011) state that state banks in the commercial bank sector in Indonesia during 1994-2008 have the highest level of average efficiency change compared to both private and foreign banks of 0.953 and 0.943 respective.

Another study of efficiency and productivity conducted by Afiatun & Wiryono (2010) show that studies analyzed the average value of technical efficiency (TE) of Islamic banks is lower than conventional banks by 86.01 percent and 87 percent respectively.

While the highest average level of efficiency in Islamic banking in Indonesia is generated at Bank Muamalat Indonesia of 93.82 percent. Result of Tobit Model found the variable return on equity (ROE), return on asset (ROA), and asset have significant positive effect. Other variables, bank branch, non-performing financing (NPF), and capital adequacy ratio (CAR), have significant negative effect. The results were found in studies by Firdaus & Hosen (2013).

The result of Endri (2011) studies show that total asset variable, the type of BUS or UUS bank, net operating income, and the financing quality has no significant positive influence, while the capital adequacy ratio variable negative influence is not significant. This study similar of Firdaus & Hosen (2013).

This research is conducted to fill the gaps. All researches are not focusing to in relationship between efficiency and productivity in Islamic bank. Primorac & Troskot (2005), Afiatun & Wiryono (2010), Färe et al. (2011), Suzuki & Sastroswito (2011), Benli & Degirmen (2013), and Thayaparan & Pratheepan (2014) regarding productivity and efficiency in Ali & Ascarya (2010), Endri (2011), Soetanto & Ricky (2011), and Firdaus & Hosen (2013).

Therefore, this research will analyze TFP change with MPI measurement and efficiency by using two-stage DEA at Islamic commercial bank in Indonesia during second quarter of 2010 until third quarter of 2015 and factors influencing efficiency level of BUS by using Tobit model. Finally, we will further analyze the productivity and efficiency relationship in BUS during the study period.

## METHODS

The object of this research is purposive sampling, done by taking sample of 11 out of 12 BUS during period of research. Sampling is to consider the completeness of the data that will be variable in this study. BUS that were established in 2014, are not included in this study due to insufficient data.

The data used are secondary data in the form of BUS financial report during the second quarter of 2010 until the third quarter of 2015 which was obtained through OJK website, among others, Bank BCA Syariah, Bank BJB Syariah, Bank Mega Syariah, Bank BNI Syariah, Bank BRI Syariah, Bank Syariah Mandiri, Bank Syariah Bukopin, Maybank Syariah, Bank Muamalat Indonesia, Panin Syariah Bank, and Bank Victoria Sharia.

Input-output selection using the intermediation approach, which is an approach where financial institutions are viewed as mediators between unit surplus and unit deficit. In this case, inputs can be labor cost, capital and interest payments, while the output can be a loan and investment (Hadad et al., 2003).

The output-oriented approach assumes that the bank wants a large output while maintaining its input (Firdaus & Hosen, 2013). Therefore, the output and input used in this research are third party funds/DPK ( $X_1$ ), fixed assets/AKT ( $X_2$ ), and personnel expenses/BP ( $X_3$ ). The output variables are total financing/ TP ( $Y_1$ ), operating income/PO ( $Y_2$ ), and other earning assets/APL ( $Y_3$ ).

Meanwhile, the application of Tobit model used DEA score efficiency as dependent variable and total asset/ TA variable, operational expenses/ BO, capital adequacy ratio (CAR), ROE, and net operating margin (NOM) as independent variables.

According to Thayaparan & Pratheepan (2014), Malmquist total factor productivity (TFP) calculates changes in productivity between 2 points by estimating the distance of each point associated with the same technology. The output-oriented TFP changes the productivity of the base period (t) and the next period (t + 1) defined as (Thayaparan & Pratheepan, 2014):

$$M(y_t, x_t, y_{t+1}, x_{t+1}) = \left[ \frac{d_{t+1}(y_{t+1}, x_{t+1})}{d_t(y_t, x_t)} \times \frac{d_t(y_{t+1}, x_{t+1})}{d_{t+1}(y_{t+1}, x_{t+1})} \right]^{1/2} \dots (1)$$

A value (M) greater than one implies a positive growth of TFP growth over period (t) for period (t + 1); otherwise, an "M" value of less than one indicates a decrease in TFP. Equation (1) is the geometric average of 2 TFP indices and the first index is calculated with respect to the period of technology "t", while the second index is evaluated with respect to the period "t + 1" technology.

According to Thayaparan & Pratheepan (2014), the equation can be written as follows:

Change of TFP Index  $TFP =$

$$\frac{D^t(y^t, x^t)}{D^{t+1}(y^{t+1}, x^{t+1})} \times \left[ \frac{D^{t+1}(y_{t+1}, x_{t+1})}{D^t(y^{t+1}, x^{t+1})} \times \frac{D^{t+1}(y^t, x^t)}{D^t(y^t, x^t)} \right]^{1/2} \dots (2)$$

Thus, the change of TFP = {Change Efficiency} x {Change technology} can be divided into 2 components such as, technological change and technical efficiency change and illustrated as (Thayaparan & Pratheepan, 2014):

$$\text{Technology Change Index} = \left[ \frac{D^{t+1}(y_{t+1}, x_{t+1})}{D^t(y^{t+1}, x^{t+1})} \times \frac{D^{t+1}(y^t, x^t)}{D^t(y^t, x^t)} \right]^{1/2} \dots (3)$$

$$\text{Index Efficiency Change} = \left[ \frac{D^{t+1}(CRS)(y_{t+1}, x_{t+1})}{D^t(CRS)(y^t, x^t)} \right] \dots (4)$$

Changes in technical efficiency can be further divided into two, namely Pure Technical Efficiency Changes where technical efficiency is *catching-up* to various *return-to-scale* (VRS) of technology borders, and Changes in Scale Efficiency that tend to move along borders or pure technical units inefficiency in changing positions by moving away from the predicted technology. Therefore, Technical Efficiency Change is the result of pure technical efficiency change (PECH) and scale efficiency change (SECH) and can be shown as follows (Thayaparan & Pratheepan, 2014):

$$\text{PECH Index} = \left[ \frac{D^{t+1}(VRS)(y_{t+1}, x_{t+1})}{D^t(VRS)(y^t, x^t)} \right] \dots (5)$$

$$\text{Index SECH} = \left[ \frac{D^{t+1}(CRS)(y_{t+1}, x_{t+1})}{D^t(CRS)(y^t, x^t)} \right] / \left[ \frac{D^{t+1}(VRS)(y_{t+1}, x_{t+1})}{D^t(VRS)(y^t, x^t)} \right] \dots (6)$$

Thus, TFP Changes = Technological Changes \* Pure Technical Efficiency Changes \* Changes in Scale Efficiency.

According to Abidin (2007), an efficiency assessment cannot be done partially but in full by taking into account all outputs and inputs.

DEA analysis was introduced by Charnes, Cooper, & Rhodes (1978) as the development of lin-

## Total Factor Productivity and Efficiency Analysis on Islamic Banks in Indonesia

*Siti Aisyah, Muhamad Nadratuzzaman Hosen*

ear mathematical programming. The DEA approach does not include random error, as a consequence DEA approach cannot take into account macro variables. However, Abidin (2007) state that DEA can identify the input or output of a bank that can be utilized as a reference to help locate possible problem sources and solutions of bank inefficiency. DEA formula starts from a simple formula in linear programming as follows:

$$\text{Max } h_j = \frac{\sum_{r=1}^s u_r y_{rj}}{\sum_{i=1}^m v_i x_{ij}} \dots\dots\dots (1)$$

$$\text{Subject for } \frac{\sum_{r=1}^s u_r y_{rj}}{\sum_{i=1}^m v_i x_{ij}} \leq 1 \dots\dots\dots \text{ for } j = 1 \dots n$$

$$v_i \geq 0 \text{ for } i = 1 \dots m, \text{ and } u_r \geq 0 \text{ for } r = 1 \dots s$$

Where:

- h<sub>j</sub> : value of bank efficiency j
- r : output
- i : input
- u<sub>r</sub> : the total of output r generated by bank j
- y<sub>rj</sub> : the total output r produced by the bank, calculated from r: 1 to s
- v<sub>i</sub> : the total of input i generated by bank j
- x<sub>ij</sub> : number of input I generated by the bank, calculated from i = 1 to m

However, Charnes, Cooper, & Rhodes (1978) transforms the above formula into the following linear programming problem (Abu-Alkheil, Burghof, & Khan, 2012):

$$\text{Max } h^o = \sum_{j=1}^J u_j^o y_j^o \dots\dots\dots (2)$$

$$\text{Subject to: } \sum_{i=1}^I v_i^o x_i^o = 1 \quad \sum_{j=1}^J u_j^o y_j^n - \sum_{i=1}^I v_i^o x_i^n \quad 0; \dots (3)$$

$$n = 1, \dots, N; v_i^o \geq \varepsilon; i = 1, 2, \dots, I \quad j = 1, 2, \dots, J$$

Where [ is a positive number, so all inputs and outputs can obtain a positive number. When H<sub>0</sub> = 1 then DMU<sub>0</sub> (Decision Making Unit 0) is efficient and otherwise. However if the input used is not effective, there will be slack input (excess input), as well as output. Slack is a necessary improvement in order to create an inefficient unit efficient until all slack inputs and outputs must be 0. This improvement was done in the form of an increase/ decrease in input or output.

Tobit standard model can be defined for observation (bank) i as follows (Endri, 2011):

$$y_i^* = \beta x_i' + \sigma \varepsilon_i, \dots\dots\dots (4)$$

Where:

$$y_i = y_i^* \text{ if } y_i^* > 0$$

$$y_i = 0 \text{ if } y_i^* \leq 0$$

Tobit model has additional scale coefficient information (SCALE), which is the scale factor to be estimated using σ. This scale factor can be used to estimate the standard deviation of residuals. Function of Likelihood (L) is maximally (maximum likelihood) to estimate β and σ parameters based on observation (bank) y<sub>i</sub> and x<sub>i</sub>:

$$L = \prod_{y_i=0} (1 - F_i) \prod_{y_i>0} \frac{1}{(2\pi\sigma^2)^{1/2}} x e^{-[1/2\sigma^2](y_i - \beta_i)^2} \dots (5)$$

Where:

$$F_i = \int_{-\infty}^{\beta x_i / \sigma} \frac{1}{(2\pi)^{1/2}} e^{-t^2/2} dt$$

The Tobit model is used to analyze the factors that affect the performance of Islamic commercial banks in Indonesia in the second quarter of 2010 until the third quarter of 2015. Factors estimated to affect the efficiency of BUS in Indonesia are total assets (TA), operational expenses (BO), capital adequacy ratio (CAR), return on equity (ROE), and net operating margin (NOM).

**RESULTS**

In industry, the average productivity rate (TFPCH) of Islamic banking in Indonesia has a score of 0.995, the average efficiency change (EFFCH) and technology (TECHCH) that affect it has a score of 0.997, as well as average pure technical efficiency change (PECH) and scale (SECH) has a score of 0.999. This indicates that the Islamic banking sector in industry has not yet reached the optimum level of productivity.

While individually, there are only 6 out of 11 BUS that have an optimal TFPCH score or  $\geq 1$ , namely

in Bank Victoria Syariah, Bank Muamalat Indonesia, Bank BRI Syariah, Bank BCA Syariah, Bank Syariah Mandiri, and Bank Panin Syariah. While the other 5 banks have a score TFPCH  $< 1$ .

In industry, the average level of efficiency of Islamic banks in Indonesia has a score of 56.61 percent. With category 4 which means inefficient. While individually, the highest efficiency score is only obtained by Maybank Syariah of 88.09 percent. With category 2 which means efficient. This shows the level of efficiency of Islamic banks in Indonesia, both industrially and individually, has not shown the optimal level of efficiency.

**Table 2.** Average Islamic Banking Productivity Rate in Indonesia

Bank	EFFCH	TECHCH	PECH	SECH	TFPCH
Victoria Syariah	0.996	1.058	0.998	0.998	1.054
Muamalat	0.998	1.028	1.000	0.998	1.026
BRI Syariah	1.000	1.015	1.000	1.000	1.015
BCA Syariah	1.000	1.009	1.000	1.000	1.009
Bank Syariah Mandiri	1.000	1.004	1.000	1.000	1.004
Panin Syariah	0.976	1.027	0.986	0.990	1.003
BJB Syariah	1.000	0.990	1.000	1.000	0.990
Maybank Syariah	1.000	0.977	1.000	1.000	0.977
Syariah Bukopin	1.000	0.974	1.000	1.000	0.974
BNI Syariah	1.000	0.957	1.000	1.000	0.957
Mega Syariah	1.000	0.937	1.000	1.000	0.937
Mean	0.997	0.997	0.999	0.999	0.995

**Table 3.** Average Results of Islamic Banking Efficiency Rate in Indonesia

Category	Bank	DEA Score	I-AKT	I-DPK	I-BP	O-TP	O-APL	O-PO
Efficiency	Maybank Syariah	88.09	97.17	100	99.27	85.56	88.1	85.91
	Bank Syariah Mandiri	72.68	99.04	100	100	72.68	28.93	67.91
Quite Efficient	BNI Syariah	69.86	100	100	99.89	69.85	42.95	53.60
	Panin Syariah	59.99	55.62	97.75	100	57.78	50.46	58.84
	BJB Syariah	55.98	62.55	96.94	98.45	55.73	43.78	49.37
	Victoria Syariah	54.47	62.7	100	100	38.02	51.54	52.85
	Bukopin Syariah	49.40	44.26	100	100	49.40	28.15	49.40
Not Efficient	Muamalat	48.84	56.14	99.84	100	48.85	31.85	48.85
	BCA Syariah	44.09	87.49	99.6	99.91	42.15	37.77	43.66
	BRI Syariah	42.59	99.85	100	100	42.59	21.98	41.68
	Mega Syariah	36.70	89.34	100	97.67	34.31	25.66	35.52
Highly Inefficient	Mean	56.61	77.65	99.47	99.56	54.27	41.02	53.42

## Total Factor Productivity and Efficiency Analysis on Islamic Banks in Indonesia

*Siti Aisyah, Muhamad Nadraturazzaman Hosen*

In industry, the variable of total assets has a positive and significant effect on the efficiency of Islamic banking. Meanwhile, individual TA variable can negatively affect the efficiency of syariah bank, such as BJB Syariah, and Maybank Syariah. Operational expenses variables that have a negative and significant influence, both industrially and individually.

In industry, CAR variables have positive and significant influence. But individually, CAR variables

can negatively affect efficiency such as Bank Syariah Mandiri, Bank Bukopin Syariah, Maybank Syariah, and Bank Panin Syariah.

In industry, ROE variables have positive and significant effect to bank efficiency. But individually variable of ROE can have negative effect that is on Bank BCA Syariah, BJB Syariah, Bank Bukopin Syariah, and Bank Muamalat. Meanwhile, the NOM variable has a negative and insignificant effect on bank efficiency, either industrially or individually.

**Table 4.** Results of Analysis of Factors Affecting Efficiency Levels Using the Tobit Model

Bank	Var	Z-Stat	Prob.	Bank	Var	Z-Stat	Prob.
Industry	C	7.35762	0.0000	Bank Syariah Mandiri	C	2.010929	0.0443
	TA	2.023797	0.0430		TA	1.308383	0.1907
	BO	-2.41206	0.0159		BO	-2.736228	0.0062
	CAR	6.644797	0.0000		CAR	-0.217951	0.8275
	ROE	3.977521	0.0001		ROE	1.887549	0.0591
BCA Syariah	NOM	-1.07315	0.2832	NOM	1.847421	0.0647	
	C	4.941052	0.0000	Bukopin Syariah	C	7.607954	0.0000
	TA	6.876442	0.0000		TA	5.676152	0.0000
	BO	-5.35793	0.0000		BO	-7.093122	0.0000
	CAR	2.483062	0.0130		CAR	-1.250018	0.2113
ROE	-0.378370	0.7052	ROE		-0.911259	0.3622	
BJB Syariah	NOM	0.505728	0.6130	NOM	-0.527870	0.5976	
	C	1.088183	0.2765	Maybank Syariah	C	2.919180	0.0035
	TA	-0.27123	0.7862		TA	-1.453919	0.1460
	BO	-0.35247	0.7245		BO	-1.961332	0.0498
	CAR	1.468566	0.1420		CAR	-0.657872	0.5106
ROE	-0.27785	0.7811	ROE		0.689111	0.4908	
Mega Syariah	NOM	-1.83719	0.0662	NOM	1.014459	0.3104	
	C	0.889297	0.3738	Muamalat	C	5.443139	0.0000
	TA	3.149965	0.0016		TA	0.723186	0.4696
	BO	-1.3318	0.1829		BO	-2.074248	0.0381
	CAR	0.328766	0.7423		CAR	0.719182	0.4720
ROE	0.176658	0.8598	ROE		-0.865319	0.3869	
BNI Syariah	NOM	-0.520160	0.6030	NOM	-0.862218	0.3886	
	C	0.706742	0.4797	Panin Syariah	C	2.926113	0.0034
	TA	0.926070	0.3544		TA	2.820847	0.0048
	BO	-2.50318	0.0123		BO	-0.476778	0.6335
	CAR	1.221778	0.2218		CAR	-0.589041	0.5558
ROE	1.597156	0.1102	ROE		0.570228	0.5685	
BRI Syariah	NOM	2.570019	0.0102	NOM	0.900437	0.3679	
	C	0.345858	0.7294	Victoria Syariah	C	1.316402	0.1206
	TA	1.899989	0.0574		TA	1.374245	0.0655
	BO	-2.53874	0.0111		BO	1.432088	0.010508
	CAR	1.980819	0.0476		CAR	1.489931	-0.0445
ROE	0.942973	0.3457	ROE		1.547774	-0.0995	
	NOM	0.177905	0.8588	NOM	1.605617	-0.1546	

### Results Analysis of Efficiency, Productivity, and Technology Changes (TECHCH) at Islamic (BUS) Commercial Bank in Indonesia

Based on these results, in general Islamic banking technology changes are in line with changes in productivity, but technological changes are not in line with efficiency changes.

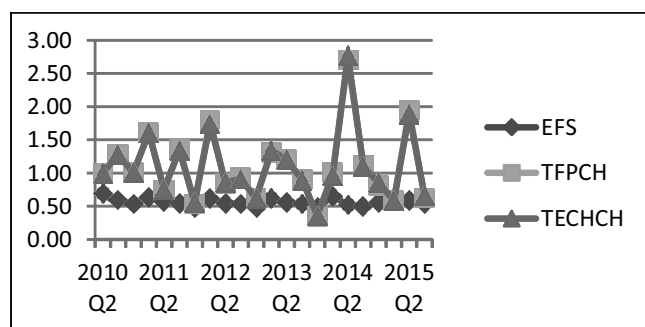


Figure 1. Comparison scores of Productivity, Efficiency, and Technology Change

### DISCUSSION

According to annual report 2016, factors influence growth of deposits (DPK) and the growth of Islamic banking assets namely increased business expansion in the form of office network expansion and the development of ATM followed by additional bank capital, thus factors are contributing to the productivity of Islamic banking. However, the results of this study is not in line with the factors. This is partly due to the decline in the financing to deposit ratio (FDR) from 96.51 percent to 88.03 percent in the second half of 2015. The decline in FDR ratio is due to improve performance, particularly in NPF and arising operational cost caused by business expansion in the form of office network expansion (Bank Indonesia, 2016).

PECH, SECH, EFFCH, and TECHCH which affect the level of productivity of Islamic banking, both industrially and individually. PECH and SECH are the main components affecting productivity levels which means the increase in bank capital greatly

affects the increase in EFFCH and TECHCH and will further affect TFPCH.

According to Saepullah (2013), increased DPK can illustrate that Islamic bank funding products of Islamic bank are increasingly is demanded by the public. But if the excess funds are not immediately offset by financing products, total financing as well as total other productive assets, it will only be idle funds that will burden Islamic banks. So the financing products must be more competitive than conventional products, in addition to marketing techniques should be more innovative in order to absorb various circles of society. On the other hand, Bank Indonesia's policy on Islamic bank financing products can be minimized in order to be more competitive with conventional bank products (Saepullah, 2013).

Annual Report No.26 (2016) show that personnel expenses are increasing due to the expansion of Islamic commercial banks. Increase in bank capital that encourages the improvement of public education, as well as the ease of opening the network in Islamic banking which will certainly increase the fixed assets of banks, such as operational vehicles, ATM machines, and others. Expansion of Islamic banking will also increase the number of human resources that will increase the cost of personnel. Therefore, regulators and management must jointly create policies to make human resources more efficient, resulting in insufficient operational revenue targets (Bank Indonesia, 2016).

Table 4 shows that the variable of TA has a positive and significant effect. The results is in line with Endri (2011) study which shows that banks with larger assets will result in better efficiency performance compared to banks with small assets.

However, in individually, TA variable can negatively affect the efficiency of Islamic bank cause by impetus to increase market share in Islamic banking industry in Indonesia. This result is in line with Mu'izzuddin & Isnurhadi (2013) and data of Annual Report No.26 (2016) was recorded at the end



## Total Factor Productivity and Efficiency Analysis on Islamic Banks in Indonesia

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of second semester of 2015 total assets of Islamic banking amounted to 296 trillion or grew by 9 percent compared to first semester of 2015. While efficiency of Islamic banking experience downward trend, one of them caused by increase of operational cost arising from business expansion (Bank Indonesia, 2016; Mu'izzuddin & Isnurhadi, 2013)

In industrially and individually, operational expenses variable has a negative and significant influence. This results is in line with data from Annual Report No.26 (2016) about the efficiency of Islamic banking showed a declining trend at semester II in 2015 due to BOPO ratio which increased from 96.98 percent at semester I in 2015 to 97.01 percent (Bank Indonesia, 2016).

In industry, CAR variable has positive and significant influence. This result is in line with Endri (2011) study which states that the CAR owned by a bank can establish a market perception of the security level of the bank concerned, thus affecting the market's acceptance of the bank. The CAR variable can also illustrate the relationship between the level of efficiency and the level of risk to be taken by the bank (Endri, 2011).

But individually, several banks show that CAR variable can negatively affect efficiency, namely, Syariah Mandiri, Bukopin Syariah, Maybank Syariah, and Panin Syariah because the greater the CAR level of a BUS will be to limit the BUS in channeling the financing. The results is in line with Firdaus & Hosen (2013) study and data of Annual Report No.26 (2016) which shows that the CAR of Islamic banking increased from 14.02 percent to 15.02 percent, while the efficiency of Islamic banking has decreased (Firdaus & Hosen, 2013; Bank Indonesia, 2016).

While on ROE, variable has positive and significant effect to bank efficiency. This result is in line with Firdaus & Hosen (2013) study which show that banks that can generate greater profits can be indicated as efficient banks. Data from Annual Report number 26 (2016) show that ROE ratio also decreased from 5.97 percent to 3.93 percent in line

with the decline in the efficiency of Islamic banking (Firdaus & Hosen, 2013; Indonesia, 2016).

But individually, several bank show that ROE variable can negatively affect efficiency, namely BCA Syariah, BJB Syariah, Bukopin Syariah, and Muamalat. This result is in line with Mu'izzuddin & Isnurhadi (2013) study which shows that the market share of a relatively small bank will make it difficult for the bank to generate a higher return rate, resulting in a large ROE ratio without increasing market share.

Meanwhile, the NOM variable has a positive effect on bank efficiency. However, this study show that NOM variable has a negative and insignificant effect on bank efficiency, either industrially or individually. This is consistent with previous research conducted by Mu'izzuddin & Isnurhadi (2013) which found that more efficient banks tend to have lower NOM. This can happen because the average BOPO rate of the bank has increased exceeding the maximum value of 90 percent, so that the NOM will be eroded by the high ratio of BOPO (Mu'izzuddin & Isnurhadi, 2013).

**Table 5.** Quadrant Relationship Level Productivity and Efficiency

		Efficiency	
		High	Low
Productivity	High	<b>Quadrant I</b>	<b>Quadrant II</b>
		Syariah Mandiri Panin Syariah Victoria Syariah	BCA Syariah BRI Syariah Muamalat
	Low	<b>Quadrant III</b>	<b>Quadrant VI</b>
		BJB Syariah BNI Syariah Maybank Syariah	Mega Syariah Bukopin Syariah

Based on these results, technology changes in line with changes in productivity, but fluctuate to changes in efficiency. Referring to research of Surjaningsih & Permono (2014), the result is grouped into 4 quadrants based on category of productivity and efficiency level that is high and low. With high

efficiency (51-100 percent), low efficiency (0-50 percent), while high productivity ( $\geq 1.00$ ), and low productivity ( $< 1.00$ ) are as shown in Table 5 (Surjaningsih & Permono, 2014).

Productivity and efficiency are interconnected based on the relationship of input and output. In productivity, the use of the same input can be said to be productive when the amount of output produced is greater than other output. While on efficiency, the use of minimal input can be said to be efficient when the output produced can be greater than other output. Based on the theory, relation between productivity and efficiency will only occur in the first and fourth quarters.

However, Table 5 shows that not automatically high productivity levels are followed by high efficiency, and otherwise. The result can occur because there are other factors which has affected to the levels of productivity and efficiency.

The decreased of the level of productivity has not impact to efficiency directly and otherwise. This result can occur because there are time lag which can affect input factors. Therefore, in the quadrant II and III should be done further research to determine the factors that influence to productivity and efficiency.

## CONCLUSION AND SUGGESTIONS

### Conclusion

The level of productivity and efficiency of Islamic banking in Indonesia during the study period was low, because Islamic banking is still not able to optimize its performance well. This result occur in Mega Syariah and Bukopin Syariah. The level of productivity and efficiency was low will have an impact on competition in the banking industry. The Islamic banking sector needs to improve its perfor-

mance in terms of optimizing the channeling of funds while maintaining the risk management, as well as controlling the operational cost that becomes one of the factors of inefficiency. In addition, the development of human resources and technology to improve productivity is also needed in an effort to increase productivity and efficiency in the Islamic banking sector.

This study examines the relationship between productivity and efficiency levels that are categorized into 4 quadrants. In quadrant I, there are only 3 banks that have high productivity and efficiency namely Syariah Mandiri, Panin Syariah, and Victoria Syariah, and quadrant IV which describes 2 banks in low level of productivity and efficiency namely Mega Syariah and Bukopin Syariah. While the quadrant II namely BCA Syariah, BRI syariah, and Muamalat and quadrant III namely BJB Syariah, BNI Syariah, and Maybank Syariah required further research to determine the factors that affect the productivity and efficiency relationships that occur.

### Suggestions

Limitations in this study is only to analyze the factors that affect the level of efficiency with the Tobit model. Further research is expected to analyze also the factors that affect the level of productivity in Islamic banking in Indonesia and can analyze with different study period, so it can be a comparative study. In addition, on the fading mapping of productivity and efficiency relations required further research on the factors affecting quadrant II and III.

For the banks that become the object of research is expected this research can be a consideration to maintain and improve its performance, so that the Islamic banking industry can continue to expand its market share.

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