

# Efficiency and Productivity Growth Analysis of the Islamic Banking in Indonesia: Data Envelopment Analysis and Malmquist Productivity Index Approach

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**Keywords:** Data Envelopment Analysis (DEA), Efficiency, Islamic Bank, Indonesia, Malmquist Productivity Index (MPI), Productivity Growth.

**Abstract:** The purpose of this paper is to examine the efficiency and productivity growth of the Islamic Banking in Indonesia. The paper utilizes 11 banks for the duration of 2009 to 2015. Data envelopment Analysis (DEA) technique is applied to compute technical efficiency, pure technical efficiency and scale efficiency. Also, Malmquist Productivity Index (MPI) is used to identify the sources of productivity growth of the banks. The result suggest that Indonesian Islamic Banks are operating below optimum performance and were managerially incompetent in using their input resources effectively even though they have been operating at a reasonably optimal scale of operation. Islamic banks seem to be affected during the period of the global financial crisis from 2008 to 2009. In terms of productivity growth, all the Islamic Banks in Indonesia were experiencing a decline in productivity mainly attributed to less technological innovation in the Islamic Banking industry in Indonesia. There is less technological innovation in the Islamic Banking industry of Indonesia. There is the need for more innovative financial services in terms of improvement in banking technology. This study is pioneering effort in the application Malmquist Productivity Index (MPI) to study about the Islamic Banking sector in Indonesia.

## 1 INTRODUCTION

The development of Indonesian Islamic banking is aligned with other strategic plans such as Indonesian Banking Architecture, Indonesian Financial System Architecture, and both medium and long-term National Development Plans. Under the dual banking system, Islamic and non-Islamic banks synergise to mobilise public funds to foster the financing of the national economic sector. This role of Indonesian Islamic banking shows that it has a larger social mission, instead of being business as usual. The partnership principle of Islamic banking provides mutual benefit for both the public and the bank. The global growth of Islamic banking is extensive and that the Central Bank of Indonesia expects it to also grow in Indonesia due to a local Muslim population of 87%. However, the Indonesian Islamic Banking growth is substantially slower than expected (Faturahman, 2013). The target in 2016 which was formulated by Bank Indonesia to achieve 5% of market share was not satisfied. The growth occurs in Islamic bank was not much better than the growth of

market share it self. Market share target of Islamic bank in 2015 that was not sufficient is become a phenomenon to evaluate the performance of whole Islamic Banking efficiency and productivity in Indonesia. There are some obstacles such as competitions, conversion process from Islamic Business Unit into Islamic Banking, and then it would be so many investment values to be expended. As a result, inefficiency would be the great obstacles in head to head to conventional bank. So the results of several studies such as Jaelani (2015), Setiawan and Bagaskara (2016), Kariemah *et al.* (2016) Rodoni *et al.* (2017), Arsal and Hamid (2017) have indicated that the Indonesian Islamic banks are still operating below optimal performance due to managerial inefficiency and low level of innovation.

## 2 THEORITICAL BACKGROUND

### 2.1 The Concept of Efficiency and Productivity

The terms efficiency and productivity have been used frequently in the media over the last ten years by a variety of commentators. They are often used interchangeably, but this is unfortunate because they are not precisely the same things (Coelli, 2005).

Any producing unit is said to be technically efficient when it can produce the maximum amount of output using the given level of input, or it can produce given level of output using minimum amount of input. Efficiency in general is a technical term, it is sign of efficacy of an individual bank, and benchmarking of the industry can be evaluated by peer group (banks) efficiency. Bank's efficiency can be evaluated on the basis of two criteria: (1) technical efficiency (Farrell, 1957); and (2) Allocative or economic efficiency (Farrell, 1957; Leibenstein, 1966); allocative efficiency is further classified into two types efficiency, one is cost efficiency (CE) and other one is profit efficiency (PE) (Berger and Mester, 1997). The estimates of technical efficiency are decomposed into the product of pure technical efficiency and scale efficiency. More specifically, the estimates of technical efficiency are obtained by running an input-oriented Data Envelopment Analysis (DEA) model which constructs a grand frontier enveloping all of the input-output observations for all banks. Several studies such as Zeitun and Benjelloun (2013), Pradiknas and Faturohman (2015) Miranti and Sari (2016), Rodoni (2017), Arsal and Hamid (2017) have all utilized DEA method to study about the banking efficiency.

On the other hand, productivity can be assessed by total factor productivity change (TFPCH). Most of studies estimated TFPCH using the Malmquist Productivity Index (MPI) (Mukharjee *et al.*, 2001; Sufian, 2011). TFPCH can be further decomposed into technological change (TECHCH), efficiency change (EFFCH), pure technical efficiency change (PEFCH), scale efficiency change (SECH). Several studies such as Kirikal (2005), Kourouchi (2008), have all resulted that the productivity growth mainly due to improvement in technological change.

## 3 RESEARCH METHODOLOGY

### 3.1 Data sample selection

The data samples in this studi comprises 11 Islamic banks in Indonesia (BNI Syariah, Bank Muamalat

Indonesia, BSM, BRI Syariah, Bank Mega Syariah, BCA Syariah, BJB Syariah, Panin Syariah, Bukopin Sayariah, Victoria Syariah, dan Maybank Syariah). The other one, BTPN Syariah have been excluded from this study due to lack of data because it spin off at year 2014. The data is time series data from 2009 to 2015.

### 3.2 Specification of inputs and outputs

This Study is using the intermediation approach. This approach considers banks as financial intermediaries with the function of collecting deposits from customers and in turn provide loans to borrowers or invest the funds to generate income (Sufian *et al.*, 2008; Avkiran, 1999). In this study *the input variables* are : deposits, fixed assets, and labor, while *the output variables* are : interest income/profit and loss sharing and fee based income.

### 3.3 Model spesification

DEA was first presented by Charnes *et al.*(1978) in an input orientation model with constant returns to scale. This model is renowned as the CCR model or the CRS model. Banker *et al.* (1984) later extended the CRS model to a n alternative model known as the VRS model or the BCC model which is based on output orientation. In this study, the VRS model is used based on output orientation. The model developed by Banker *et al.* (1984) can be written as:

$$\begin{aligned} \min_{\lambda} z_0 = & \dots \\ \text{subject to } & \sum_{j=1}^n \lambda_j y_r \geq y_{r_0}, r = 1, 2, \dots, s \\ & \theta_0 x_{i_0} - \sum_{j=1}^n \lambda_j y_j \geq 0, i = 1, 2, \dots, m \\ & \lambda_j \geq 0, j = 1, 2, \dots, n. \end{aligned} \tag{1}$$

The level of efficiency obtained by applying the BCC model is also called *pure technical efficiency* and is obtained by running Equation (1) for all decisional units. The BCC model eliminates from the analysis the scale component of efficiency and, thus, the level of efficiency obtained through the BCC model is lower or equal to the level of efficiency resulted from applying the CCR model

In this study, the measurement of productivity change is based on the output-oriented MPI Caves *et al.*, 1982; Fare *et al.*, 1994), specify the output-oriented MTFPI as follows:

$$M_0(x^{t+1}, y^{t+1}, x^t, y^t) = \left( \frac{D_0^t(x^{t+1}, y^{t+1})}{D_0^t(x^t, y^t)} \times \frac{D_0^{t+1}(x^{t+1}, y^{t+1})}{D_0^{t+1}(x^t, y^t)} \right)^{1/2} \quad (2)$$

This function above, M denotes the productivity of the production point (xt+1, yt+1) comparative to the production point (xt, yt). All the Ds represent the output distance functions. Any value higher than 1 shows positive total factor productivity growth from period t to t+1. The MTFPI can be divided into two parts namely EFFCH and TECHCH, which are defined as below (Fare et al., 1994):

$$M_0(x^{t+1}, y^{t+1}, x^t, y^t) = \left( \frac{D_0^{t+1}(x^{t+1}, y^{t+1})}{D_0^t(x^t, y^t)} \times \left( \frac{D_0^t(x^{t+1}, y^{t+1})}{D_0^{t+1}(x^{t+1}, y^{t+1})} \times \frac{D_0^t(x^t, y^t)}{D_0^{t+1}(x^t, y^t)} \right) \right)^{1/2} \quad (3)$$

The ratio outside the brackets in Equation (5) above is a measure of the change in relative efficiency or the change in how far perceived production is from full potential production between period t and t+1. The part inside the brackets represents the geometric mean of the two ratios indicating the shift in production technology (TECHCH) between the two periods. That is to say:

$$\text{Technical efficiency change (EFFCH)} = \frac{D_0^{t+1}(x^{t+1}, y^{t+1})}{D_0^t(x^t, y^t)} \quad (4)$$

$$\text{Technological Change (TECHCH)} = \left( \frac{D_0^t(x^{t+1}, y^{t+1})}{D_0^{t+1}(x^{t+1}, y^{t+1})} \times \frac{D_0^t(x^t, y^t)}{D_0^{t+1}(x^t, y^t)} \right)^{1/2} \quad (5)$$

EFFCH in Equation (5) can be further divided into pure technical efficiency change (PEFFCH) and scale efficiency change (SECH) subject to a VRS distance function between period t to t+1 as below (Fare et al., 1994):

$$\text{Pure technical efficiency change (PECH)} = \frac{D_0^{t+1}(x^{t+1}, y^{t+1})}{D_0^t(x^t, y^t)} \quad (6)$$

$$\text{Scale efficiency change (SECH)} = \text{EFFCH} / \text{PECH} \quad (7)$$

Where : A value of M (MTFPI) greater than one (i.e. M > 1) denotes productivity growth, while a value less than one (M < 1) indicates productivity decline, and M = 1 corresponds to stagnation.

## 4 RESEARCH FINDINGS

### 4.1 Efficiency levels of Indonesian Islamic Banks based on the DEA approach

From the tabel 1, it is indicated that during studi period, Indonesian Islamic banks have shown an average technical efficiency of 24.8 percent of the amount of inputs employed. This suggests that by implementing best mangement practices, the Indonesian Islamic banks on average could reduce their inputs by at least 75.2 percent and yet volume of outputs produced will remain unchanged. That is, the Indonesian Islamic banks could produce identical volume of outputs by using only 24.8 percent of the amount of input. It is important to note however, that the potential reduction in inputs from implementing best management practices varies from bank to bank.

Table 1: Summary of efficiency score (Islamic banks).

Efficiency Measures	Mean
Technical efficiency (TE)	0.248
Pure technical efficiency (PTE)	0.277
Scale efficiency (SE)	0.925

The results of the scale efficiency and pure technical efficiency indicate that pure technical inefficiency surpasses scale inefficiency in the Indonesian Islamic Banking industry during the studi period. Generally, findings reveal that from the duration 2009 to 2010, the Indonesian Islamic banks were managerially incompetent in using their input resources effectively eventhough they have been operating at a reasonably optimal scale of operation.

### 4.2 Productivity growth of Indonesian Islamic Banks based on MPI

Tabel 2 below reports the summary of annual geometric mean scores of the Malmquist total factor productivity change (TFPCH) of the Indonesian Islamic banking for the duration of 2010-2015. The Malmquist TFPCH and its component are based on an initial score of 1.000 for year 2010, with year 2010 as the reference year. Therefore, any score higher (lower) than 1.000 in the following years shows a progress (decline) in the applicable measure. A positive EFFCH is considered as evidence of approaching the frontier, while a positive TECHCH is understood as innovation (Sufian and Haron, 2008). As can bee seen in the table, the Islamic banks have exhibited a decline in productivity by 6.2 percent based on geometric mean, which was attributed to

decrease in TECHCH by 7.1 percent, and attributed to decrease in PEFFCH index by 0.3 percent, it is related to managerially inefficiency. The decreasing in TECHCH indicated that low level of innovation such as online banking and the like. EFFCH index showed an increase of 0.9 percent and the main source of the increase was due to increase in SECH of 1.2 persen rather than PEFFCH.

From this analysis, it is interesting to note that declining in productivity growth was attributed to decrease in TECHCH and PEFFCH. Hence, there is the need for more innovative financial services in terms of improvement in banking technology such as telephone banking, online banking, mobile banking, and financial technology in the Indonesian Islamic banks. The decrease in PEFFCH has indicated that the Indonesian Islamic banks are managerially inefficiency. There is the need for improving in bank management performance through proper planning,

control, and implement best management practices in their operations.

### 4.3 Indonesian Islamic Banking Quadrant Analysis based on Efficiency Score and MPI

Figure 1 below describe the group of Indonesian Islamic banks based on the computation of constant return to scale (CRS) efficiency score and Malmquist Productivity Index (MPI). The quadrant 1 is Indonesian Islamic bank with High Efficiency and High Productivity, namely BNI Syariah has efficiency mean is 63.31 percent and MPI is 1.365. Therefore, BNI Syariah is the most successful Islamic bank in managing resources of the firm, and it has a high level of innovation financial services, in terms of improvement in banking technology and has the best performance in implementing management practices.

Table 2: MTFPI (Malmquist Total Factor Productivity Index) in Indonesian Islamic Banking Industry.

Banks Productivity	EFFCH	TECHCH	PEFFCH	SECH	TFPCH
2010	1.000	1.000	1.000	1.000	1.000
2011	0.871	1.178	0.953	0.914	1.026
2012	1.233	0.688	1.049	1.175	0.847
2013	0.936	1.139	0.926	1.010	1.066
2014	1.081	0.669	1.071	1.009	0.723
2015	0.962	1.124	0.992	0.969	1.081
<b>Mean</b>	<b>1.009</b>	<b>0.929</b>	<b>0.997</b>	<b>1.012</b>	<b>0.938</b>

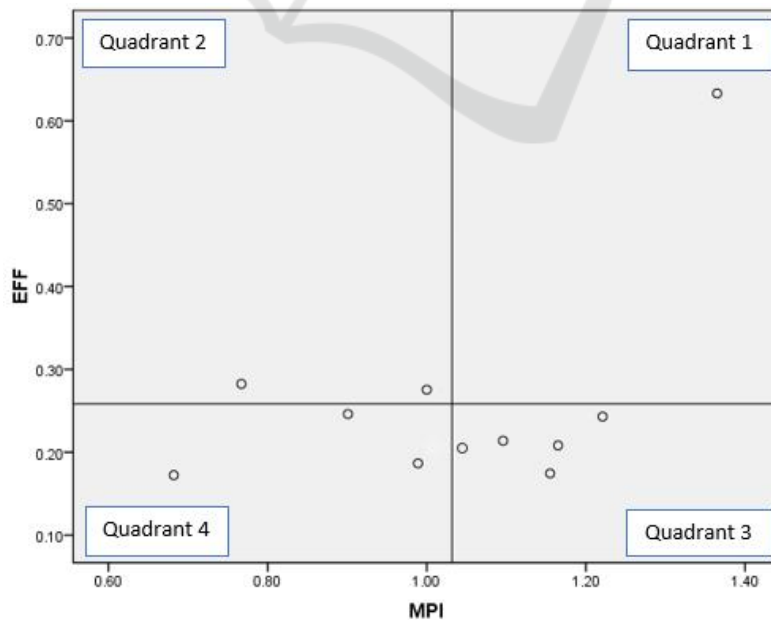


Figure 1: Four Quadrant of Indonesian Islamic Banking Based on Efficiency Score and Malmquist Productivity Index.

The quadrant 2 group is Islamic bank with high efficiency and low productivity. The Indonesian Islamic banks which is involved in this category are BJB Syariah and Maybank Syariah. BJB Syariah has efficiency mean is 28.25 percent over of the banking industry mean, namely 25.5 percent, and it has MPI is 0.767, while Maybank Syariah has efficiency mean is 27.55 percent, and it has MPI is 1.000. They are the Indonesian Islamic banks which are successful in managing resources of the firm, but in other side has a low level of innovation.

The quadrant 3 group is Islamic bank with high productivity and low efficiency. The Indonesian Islamic banks which is involved in this category are Bank Muamalat Indonesia, BSM, BRI Syariah, Bank Mega Syariah, Victoria Syariah. Bank Muamalat Indonesia has efficiency mean is 24.29 percent, and it has MPI is 1.221. BSM has efficiency mean is 21.39 percent, and its MPI is 1.096. BRI Syariah has efficiency mean is 17.44 percent, and its MPI is 1.155. Bank Mega Syariah has efficiency mean is 20.82, and its MPI is 1.165. Bank Victoria Syariah has efficiency mean is 20.66 percent, and its MPI is 1.008 over of the industry mean of productivity, namely 1.005. They are managerially inefficiency in using resouces of firm efectively, but have a high level of innovation.

The quadrant 4 group is Islamic bank with low productivity and low efficiency. The Indonesian Islamic banks which are involved in this category are BCA syariah, Panin Syariah, dan Bukopin Syariah. BCA Syariah has efficiency mean is 17.23 percent, and it has MPI is 0.682. Panin Syariah has efficiency mean is 24.61 percent, and its MPI is 0.901. Bukopin Syariah has efficiency mean is 18,66 percent, and its MPI is 0.989. They are managerially inefficiency in using resources of firm efectively, and have a low level of innovation.

## 5 DISCUSSION, CONCLUSION, AND RECOMMENDATIONS

The study disclosed that the technical efficiency of all Indonesian Islamic bank, on average were inefficiency. The Indonesian Islamic banks were managerially incompetent in using their input resources effectively eventhough they have been operating at a reasonably optimal scale of operation.

This study indicates that they are still operating below optimal performance, thus there is still room for improvement. Improvement in bank management performance through proper planning and control is therefore necessary to attain optimum performance in the Indonesian Islamic banking sector. If Indonesian

Islamic banks were to implement best management practices in their operations, on average they could be able to reduce their inputs by at least 75.2 percent and still capable of producing the same amount of outputs.

The declining in productivity growth in Indonesian Islamic banks based on average was attributed to decrease in TECHCH and PEFFCH. According to decrease in TECHCH, there is the need for more innovative financial services in terms of improvement in banking technology such as telephone banking, mobile banking, and online banking infrastrucur (Kumar and Gulati, 2008). Similar to the findings of Rodoni *et al.*, (2017), found that contribution on productivity in the Indonesian Islamic banking was not from technology aspect, but mainly from managerial aspect. All relevant with results of other studies such as Jaelani (2015), Kariemah *et al* (2016), Setiawan and Sherwin (2017). This will enable the banks to offer secure, reliable and dynamic banking services to their clients. Introducing new technologies and diversifying their products and services will help shift the production frontier positively.

The decrease in PEFFCH has indicated that the Indonesian Islamic banks are managerial inefficiency. There is the need for improving in bank management performance through proper planning, control, and implement best management practices in their operations.

## 6 RECOMMENDATION FOR FUTURE RESEARCH

This study serves as a foundation for future researchers who wish to explore more about the efficiency and productivity growth of the Indonesian Islamic banks. It is important to note that this research suffered a number of limitations with regards to the availability of data for Indonesian Islamic banks. This made it difficult to do extra analysis in the Indonesian Islamic banking sector. Nevertheless, the utilization of DEA and the MPI gave a good representation of the performance of the Indonesian Islamic banking sector during the duration of the study. Future research may use larger data sample alongside longer sample periods in order to offer more understanding into the efficiency and productivity growth of the Indonesian Islamic banks.

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