

# Efficiency of Conventional Versus Islamic Commercial Banks in Indonesia 2014-2016 Using Data Envelopment Analysis

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**Abstract:** This study focuses on efficiency of Islamic versus Conventional Commercial Banks. The study uses Data Envelopment Analysis (DEA) to determine efficiency of productivity growth in banks registered by applying input output orientation Constant Return to Scale (CRS) and Variable Return to Scale (VRS) during 2014-2016. Input variables that used to measure this relative efficiency are Current Account, Deposits and Savings. While output variables used in this research are Financing and Total Assets. In the DEA technique, efficiency is measured by CRS and VRS indexes. The results of the study using CRS show that on average, Islamic Commercial Banks are more efficient than Conventional Commercial Banks. As well as using VRS, Islamic Commercial Banks are more efficient than Conventional Commercial Banks.

**Index terms:** Data Envelopment Analysis (DEA), Islamic Commercial Bank (BUS), Conventional Commercial Bank (BUK), Constant Return to Scale, Variable Return to Scale, Efficiency.

## I. INTRODUCTION

Efficiency in using input to produce output is an important indicator in measuring the overall performance of a company's activities. Efficiency is often interpreted as how a company can produce at the lowest possible cost, but not only that efficiency also involves managing the input and output relationship, which is how to efficiently allocate available production factors to obtain optimal output. A company is said to have a higher level of efficiency if certain inputs can produce more output or a certain amount of output can use fewer inputs [3].

The development of Islamic Commercial Banks and Conventional Commercial Banks has opened branches in all regions. Islamic Commercial Banks have shown their superiority to survive even though Indonesia experienced an economic crisis in 1998 and the global crisis in 2008. Sharia banking profit sharing system applied to Muamalat bank

**Revised Manuscript Received on December 22, 2018.**

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products caused the bank to maintain its performance relatively Ema rindawati (2007)[2]. Conventional Commercial Banks and Islamic Commercial Banks operating in Indonesia are increasing in number with various forms of products and services provided to the public. In operating financial services, banking services are always measured by the quality of bank performance and health. Health or financial and non-financial conditions of the bank are in the interest of all related parties, both owners, communities, bank service users and financial service authorities.

The definition of a Sharia bank is a financial institution whose main business is to provide credit or financing and other services in payment traffic as well as the circulation of money in operation, in accordance with Sharia principles. Whereas conventional banks whose main activities are collecting funds from the community and redistributing the funds to the community and providing other bank services[5].

Research on the efficiency of Islamic bank versus conventional bank has been carried out by Ghadeer at all 2018, Muhammad and Helal 2017. While studying efficiency of Islamic commercial bank versus conventional commercial bank have been conducted by Shinta and Chandra 2015, Tiyo and Taufiq 2015. Of several previous research provides a different research focus from the use of different input and output. This study gives the same focus on the difference in efficiency of Islamic commercial bank versus conventional commercial bank using DEA with a constant return to scale and VRS from 2014-2016[8].

## II. RESEARCH DATA AND METHODS

This study uses 11 Islamic Commercial Banks and 11 Conventional Commercial Banks published at all annual report. The data used is panel data from 2014-2016. This study uses Data Envelopment Analysis (DEA) is a non-parametric methodology based on linear programming. It was originally developed to measure performance, DEA has been developed and used in various scientific disciplines and various operational activities. This methodology was successfully applied to measure the relative performance of a group of

companies that use a variety of identical inputs to produce a variety of identical outputs

Two models that are often used in this approach, namely:

**A.Constant Return to Scale (CRS) approach**

This CRS approach was developed by Charnes, Cooper and Rhodes (CCR Model) in 1978. This model assumes that the ratio between adding inputs and outputs is Equal. That is, if there is an additional input of x times, then the output will also increase by x times. Another assumption used in this model is that each company (bank) operates at an optimal scale. The purpose of the DEA method is to measure the level of efficiency of a bank’s decision making unit (DMU) relative to a similar bank when all of these units are at or below the frontier’s efficient “curve”. So this method is used to evaluate the relative efficiency of several objects (benchmarking performance) (Charnes at all, 1978).

Max  $\theta$  (Efisiensi DMU Model CRS)  
Subject to:

$$\sum_{j=1}^n x_{ij} \lambda_{ij} \geq \theta i_o \quad i = 1, 2, \dots, m \quad (3)$$

$$\sum_{j=1}^n y_{rj} \lambda_{ij} \geq y_{r o} \quad r = 1, 2, \dots, s \quad (4)$$

$$\sum_{j=1}^n \lambda_{ij} \geq 0 \quad j = 1, 2, \dots, n \quad (5)$$

Di mana:

- $\theta$  = Efisiensi DMU Model CRS
- $n$  = jumlah DMU
- $m$  = jumlah input
- $s$  = jumlah output
- $x_{ij}$  = jumlah input ke-i DMU j
- $y_{rj}$  = jumlah output ke-r DMU j
- $\lambda_{ij}$  = bobot DMU j untuk DMU yang dihitung

**B.VRS (VRS) Approach**

The VRS approach was developed by Banker, Charnes and Choooper in 1984. This model is a development of the CCR model which is often called the BCC model. This model assumes that the company not or does not operate at an optimal scale. Competition and financial constraints can cause a company not to operate on its optimal scale. The assumption of this model is that the ratio between the addition of input and output is not equal . This means that the addition of an input x times will not cause the output to increase x times, can be smaller or greater than x times.

**III.RESULTS AND DISCUSSION**

**A.Results of Envelopment Analysis Data from**

**B.Islamic Banks with a Constant Return to Scale Approach**

Efficiency measurement for 11 Islamic Commercial Banks and 11 Conventional Commercial Banks has been carried out using the Deap-XP1 application. In this study the CRS calculation uses the calculation of output orientation and the average value is a geometric average. To see the results of the calculation can be seen in the table below:

Subject to:

$$\sum_{j=1}^n x_{ij} \lambda_{ij} \geq \pi i_o \quad i = 1, 2, \dots, m$$

$$(6) \sum_{j=1}^n y_{rj} \lambda_{ij} \geq y_{r o} \quad r = 1, 2, \dots, s$$

$$(7) \sum_{j=1}^n \lambda_{ij} \geq 1 \quad (VRS)$$

$$\sum_{j=1}^n \lambda_{ij} \geq 0 \quad j = 1, 2, \dots, n \quad (8)$$

Dimana:

- $\theta$  = Efisiensi DMU Model VRS
- $n$  = jumlah DMU
- $m$  = jumlah input
- $s$  = jumlah output
- $x_{ij}$  = jumlah input ke-i DMU j
- $y_{rj}$  = jumlah output ke-r DMU j
- $\lambda_{ij}$  = bobot DMU j untuk DMU yang dihitung

**Table 3.1**  
**Efficiency of Islamic Commercial Banks, 2014-2016 (CRS-Output oriented)**

No	Bank Name	2014	2015	2016	Average
1	B Bni Syariah	0.742	0.159	1.000	0.634
2	BCA Syariah	1.000	0.073	0.579	0.314
3	B Mandiri Syariah	0.640	0.121	0.995	0.505
4	Bank Muamalat Ind	0.821	0.185	1.000	0.668
5	Bank Aceh	1.000	1.000	1.000	1.000
6	B Panin Syariah	0.023	0.010	0.952	0.328
7	B S Bukopin	0.008	0.008	1.000	0.339
8	B Mega Syariah	0.168	0.011	0.966	0.382
9	BJB Syariah	1.000	0.088	1.000	0.696
1	B Victoria Syariah	0.017	1.000	1.000	0.672
1	B Bri Syariah	1.000	1.000	1.000	1.000
	<b>A</b>	<b>0,405</b>	<b>0,322</b>	<b>0,419</b>	<b>0,954</b>

Source: CRS Data Envelopment Analysis (processed data 2018)

From table 3.1 above it can be seen that Islamic Banks operating efficiently are Bank Aceh and Bank Syariah Syariah from 2014 to 2016. Where we can see the score 1,000 in the table above shows that the bank is at the frontier line. The achievement of 1,000 means efficient, in the other word 9 Islamic Commercial Bank do not Operate Efficiently.

To see the development of the efficiency of Islamic Commercial banking performance every year. We can see that the achievement of efficiency is fluctuating. Whereas,

here are Islamic banks reaching an efficient level in 2014 but not efficient in 2015-2016 such as BCA Syarah and BJB



Syariah. Furthermore, Bank Victoria Syariah was inefficient in 2014 but was efficient in 2015-2016. From the results of Table 3.1 above, it can be seen that Bank Mandiri Syariah,

Bank Panin Syariah, and Bank Mega Syariah have no efficiency.

**C.Results Of Envelopment Analysis Data From Konvensional Bank Using a Constant Return to Scale Approach**

The results of CRS for 11 Conventional Banks which are used as objects in this study can be seen in table 3.2 below.

Table 3.2

Conventional Commercial Bank Efficiency, 2014-2016 (CRS-Output oriented)

No	Bank Name	2014	2015	2016	AverageF lat
1	B Artha Graha Internasional Tbk	1.000	0.482	0.690	0.724
2	Bank BCA	1.000	0.092	0.095	0.396
3	B BNI	1.000	0.139	0.156	0.432
4	Bank ICBC Indonesia	0.991	1.000	1.000	0.997
5	Bank Mandiri	1.000	0.126	0.132	0.419
6	Bank Mayora	0.939	0.340	0.314	0.531
7	Bank HCBC Indonesia	1.000	0.166	0.206	0.457
8	Bank MNC	1.000	0.573	0.598	0.724
9	Bank Nusantara parahyangan Tbk	0.875	0.342	0.314	0.510
10	Bank Sinarmas Tbk	0.981	1.000	1.000	0.994
11	Bank UOB Indonesia	1.000	0.255	0.221	0.493
<b>Average</b>		0.981	0.410	0.430	<b>0.607</b>

Source: CRS Data Envelopment Analysis (processed data 2018)

From table 3.2 above, it can be seen that the results of the measurement of the efficiency level of Conventional Banks are none of the 11 conventional commercial bank is efficient from 2014-2016. Nevertheless Sinarmas Bank Tbk, Bank ICBC Indonesia was inefficient in 2014 but was efficient in 2015-2016. Meanwhile, Bank Artha Grah International Tbk, BCA Bank, Bni Bank, Bank Mandiri, HCBC Indonesia Bank, Mnc Bank and UOB Indonesia Bank were efficient in 2014 but inefficient in 2015-2016. Whereas Bank Mayora did not achieve efficiency from 2014-2016.

**D.Efficiency Differences of Islamic Commercial Banks versus Conventional Commercial Banks Using the Constant Return to Scale Approach**

Having seen that from table 3.1 and 3.2 above the study can prove the only two islamic commercial banks but none of any conventional commercial banks are operating efficiently. It means the islamic commercial banks are more prominent than conventional commercial banks.

**E.Results of Envelopment Analysis Data from Sharia Commercial Banks Approach VRS**

Processed data using the VRS approach for 11 Islamic commercial banks can be seen from the table below.

Table 3.3

Efficiency of Islamic Commercial Banks, 2014-2016 (VRS-Output oriented)

No	Bank Name	2014	2015	2016	Average
1	B Bni Syariah	1.000 0.629 1 0.629	1	1	1
2	BCA Syariah	1	1	1	1
3	B Mandiri Syariah	0.595	0.33	1	0.642
4	Bank Muamalat Ind	0.586	0.514	1	0.7
5	Bank Aceh	1	1	1	1
6	B Panin Syariah	0.044	0.501	1	0.515
7	B S Bukopin	0.04	0.206	1	0.145
8	B Mega Syariah	1	0.297	1	0.766
9	BJB Syariah	1	1	1	1
10	B Victoria Syariah	1	1	1	1
11	B Bri Syariah	1	1	1	1
<b>Average</b>		0.751	1	1	0.797

Source: Data Envelopment Analysis VRS Processed data 2018

From table 3.3 above we can see that there are 6 Islamic commercial banks which have reached an efficient level, namely Bank Bni Syariah, BCA Syariah, Bank Aceh, BJB Syariah, Bank Victoria Syariah and Bank Bri Syariah. Furthermore, Bank Mandiri Syariah and Bank Muamalat Indonesia were not efficient in 2014-2015 but later became efficient in 2016.

**F.Results of Envelopment Analysis Data from Conventional Commercial Banks with variable the Return to Scale approach**

The results of the calculation of VRS for 11 conventional commercial banks can be seen in table 3.4 below. In this study the calculation of VRS uses the calculation of output orientation and the average value is a geometric average.

Table 3.4

Conventional General Bank Efficiency, 2014-2016 (VRS-Output oriented)

No	Bank Name	2014	2015	2016	Average
1	B Artha Graha Internasional Tbk	1.000	0.735	0.738	0.824
2	Bank BCA	1.000	1.000	0.373	0.791
3	B BNI	1.000	0.216	0.329	0.515
4	Bank ICBC Indonesia	1.000	1.000	1.000	1.000
5	Bank Mandiri	1.000	1.000	1.000	1.000
6	Bank Mayora	0.945	0.409	0.364	0.573
7	Bank HCBC Indonesia	1.000	0.356	0.457	0.604
8	Bank MNC	1.000	0.787	0.774	0.854
9	Bank Nusantara parahyangan Tbk	0.876	0.390	0.352	0.539
10	Bank Sinarmas Tbk	0.994	1.000	1.000	0.998
11	Bank UOB Indonesia	1.000	1.000	1.000	1.000
	<b>Average</b>	<b>0.983</b>	<b>0.718</b>	<b>0.672</b>	<b>0.791</b>

Source: Data Envelopment Analysis VRS (processed data 2018)

From table 3.4 above we can find that 3 conventional commercial banks reached an efficient level, namely Bank ICBC Indonesia, Bank Mandiri and Bank UOB Indonesia from 2014-2016. While other banks did not reach efficiently.

### G.Comparison of Efficiency Levels of Sharia Commercial Banks and Conventional Commercial Banks:

From the results of the study that the comparison of the efficiency level between Islamic Commercial Banks and conventional Commercial Banks using the VRS approach clearly seen more Islamic Commercial Banks dominant in operating as compared to Conventional Commercial Banks. From table 3.4 can be seen that there are 6 Sharia Banks reaching 1,000 frontier values, while there are only 3 Conventional Commercial Banks achieving frontier values.

### H.Differences in the Results of Data Envelopment Analysis Using the Consta Back To Scale Approach and Return To Scale Variables

From the results that have been described previously both in Table 3.1 and 3.2 for the CRS calculation approach as well as in Table 3.3 and 3.4 for the efficiency calculation approach using VRS can be seen clearly. They show clearly that by using CRS fewer banks have operated efficiently as compared to VRS Result Both CRS and VRS Approach so that Islamic Commercial bank are better than Conventional Commercial Banks in term of operating efficiently. This can be understood because these two calculation approaches use two different assumptions.

## IV.CONCLUSION

There are differences in the level of efficiency between Islamic Commercial Banks and Conventional Commercial Banks. This conclusion is obtained by applying Data Envelopment Analysis using CRS and Return To Scale Variables. The Result Show that Islamic Commercial Banks are more efficient than Conventional Commercial Banks.

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