Analysis of the Technical Efficiency, Malmquist Productivity Index, and TOBIT Regression of the eleven Islamic Commercial Banks in Indonesia between 2010 and 2019

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Abstract: This paper is about research on the efficiency of eleven Islamic commercial banks, data from an annual report from 2010 to 2019, the method used is DEA (data envelopment analysis) with RTS using a combination of CRS and VRS, with input-output orientation, and processed as well using Malmquist Index, DEA processing using R Programming with deaR library, the average technical efficiency or CRS is 0.95 or 95%, this indicates that the technical efficiency or CRS of Islamic commercial banks in Indonesia between 2010 and 2019 is quite efficient. The value of VRS has a value of 0.98, almost efficient. Scale Efficiency (SE), A bank with type BUKU 3 has the same value for PT. Bank Syariah Mandiri, PT. Bank BRI Syariah Tbk, has the same value, namely 0.99. And in this SE column, none of them has a value of 1 which means efficient. The Malmquist Index, indicates that in 2018 it was the highest value of MI (Malmquist index) with a value of more than 2.3, it can be concluded that 2018 was the best performance of Islamic commercial banks, note that the unemployment rate in 2018 was very small of 5.3 compared to before in 2017 and before again, and the inflation rate of 2.72 is a reasonable inflation rate for Indonesia with an ideal inflation value of around 3% as a developing country, so that the production factors can run optimally. The last results of this research are about TOBIT regression, using GRETL econometric tools, fixed assets, in this case, the natural logarithm of fixed assets, does not affect the efficiency value of Islamic commercial banks, other results are ROA influences the efficiency, CAR does not really affect the efficiency, FDR is concluded to influence the efficiency, NPF does not affect the efficiency. It is concluded that inflation rate, real GDP, unemployment rate, USD to IDR exchange, affect the efficiency of Islamic commercial banks.

Keywords : Islamic Commercial Banks, DEA, Malmquist Index, R Programming, deaR Library, TOBIT Regression, Gretl

1. Introduction

Sharia Commercial Bank has a noble task of facilitating the public to be able to transact with banks in ways that are blessed by Allah Subhanahu wa ta'ala, which has justified the sale and prohibition of usury, as stated in His Word Al Qur ' an Surah Al-Baqarah verse 275:

ٱلَّذِينَ يَأۡكُلُونَ ٱلرِّبَوٰاْ لَا يَقُومُونَ إِلَّا كَمَا يَقُومُ ٱلَّذِي يَتَخَبَّطُهُ ٱلشَّيۡطَٰنُ مِنَ ٱلۡمَسِّۚ ذَٰلِكَ بِأَنَّهُمۡ
قَالُوٓاْ إِنَّمَا ٱلۡبَيۡعُ مِثۡلُ ٱلرِّبَوٰاْۗ وَأَحَلَّ ٱللَّهُ ٱلۡبَيۡعَ وَحَرَّمَ ٱلرِّبَوٰاْۚ فَمَن جَآءَهُۥ مَوۡعِظَةٞ مِّن رَّبِّهِۦ فَٱنتَهَىٰ فَلَهُۥ مَا
سَلَفَ وَأَمۡرُهُۥٓ إِلَى ٱللَّهِۖ وَمَنۡ عَادَ فَأُوْلَٰٓئِكَ أَصۡحَٰبُ ٱلنَّارِۖ هُمۡ فِيهَا خَٰلِدُونَ ٢٧٥

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Those who consume interest cannot stand [on the Day of Resurrection] except as one stands who is being beaten by Satan into insanity. That is because they say, "Trade is [just] like interest." But Allah has permitted trade and has forbidden interest. So whoever has received an admonition from his Lord and desists may have what is past, and his affair rests with Allah . But whoever returns to [dealing in interest or usury] - those are the companions of the Fire; they will abide eternally therein.

The Sharia Commercial Bank financial statements are a very important component in realizing the proper and good governance of Sharia Commercial Banks, to realize openness to the public and the government. Allah Subhnahu wa ta'ala instructs all of us to pay attention to what is right and good for what he has done, as in his words Al-Qur'an Surah Al-Ḥasyr verse 18:

يَٰٓأَيُّهَا ٱلَّذِينَ ءَامَنُواْ ٱتَّقُواْ ٱللَّهَ وَلۡتَنظُرۡ نَفۡسٞ مَّا قَدَّمَتۡ لِغَدٖۖ وَٱتَّقُواْ ٱللَّهَۚ إِنَّ ٱللَّهَ خَبِيرُۢ بِمَا تَعۡمَلُونَ ١٨

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O you who have believed, fear Allah . And let every soul look to what it has put forth for tomorrow - and fear Allah . Indeed, Allah is Acquainted with what you do.

In this study, a comparison of Islamic Commercial Banks in Indonesia will be carried out. The increasingly tight competition between banks and the presence of foreign banks in Indonesia, has made national banking in economic theory more efficient and effective in its banking operations.

This research in the early stages will use operational data on 11 Islamic Commercial Banks, so that the comparative process of efficiency and economic performance, especially efficiency and operational performance between Islamic commercial banks is fairer, it will use the "BUKU" classification (Commercial Banks for Business Activities) issued by the Financial Services Authority (OJK) of the Republic of Indonesia, so that Islamic commercial banks that will be compared have the same classification closeness.

2. Literature review

The study examines and compares the efficiency of conventional banks and Islamic banks in Indonesia for the period 2011-2015. (Mulyany et al., 2019). Bank efficiency is an important thing in assessing the health of a bank. Data Envelopment Analysis is a bank efficiency assessment model (Mulyadi, 2015; Bae & Han, 2019).

Efficiency as one of the benchmarks for the assessment of the intermediation function and banking performance is the ratio of the ratio between the output and input values used in its operational activities. The difference in the level of achievement of the input and output variables at each bank will provide different efficiency values. Likewise, banking in Indonesia which is divided into several groups according to Law Rl N0.10 of 1998 also has various levels of achievement of input and output variables so that the level of efficiency achieved by each bank is also different. (MUHARAM, 2007).

Islamic banks can maintain their efficiency while improving their performance. Using the output-oriented DEA VRS model (Pradiknas & Faturohman, 2015).

When a bank is inefficient in using costs, there will be inputs that are used incorrectly, preventing the bank from realizing its role, function and purpose. Therefore, a bank efficiency analysis is needed (Agustina et al., 2019). Determinants of efficiency on panel data from 116 banks, including 109 conventional banks and 7 Islamic banks very important characteristics of a bank to improve bank efficiency. (Anwar, 2016).

Efficiency of banks in theory and practice in Poland. An empirical efficiency analysis was carried out for Polish banks during the period 1997-2007. The ratio analysis between commercial banks and cooperatives uses several financial ratios. Statistical analysis using parametric methods (multiple regression models). The results of the comparative analysis at the EU level show that Poland belongs to countries with relatively high levels of ROA and bank ROE. In Poland, the performance of commercial banks as measured by these indicators is currently better than cooperative banks. Overall, the findings of multiple regression analysis provide evidence that in the years covered by the study, the efficiency of Polish banks, return on assets as well as return on equity, were shaped by internal bank performance factors and the macroeconomic environment. (Siudek, 2008).

The results of the Data Envelopment Analysis (DEA), a non-parametric technique, show a general trend of decreasing technical efficiency (Gordo, 2013). The level of technical efficiency and relate it to the specific characteristics of the company and industry (Badunenko et al., 2006). Mexican banks experienced average inefficiencies, the main determinants are loan intensity, GDP growth (Garza-Garcia, 2012).

Efficiency of sample banks from 11 Central and Eastern European Countries (CEEC) during the period 2005-2008 (Pančurová & Lyócsa, 2013). Bank efficiency has become an important issue in the recovery process of Indonesian banking (Kurnia, 2004).

The technical efficiency (technical efficiency) of commercial banks in Indonesia took data for the years 2004-2009 using the intermediation approach. Research results indicate that commercial banks in Indonesia have experienced improvements in technical efficiency, an average of 10.5%. Furthermore, the study results also confirm that the national banking system experiences a scale inefficiency that is greater than that of pure technical efficiency. In terms of ownership, state banks showed perfect efficiency during the study period compared to private banks. The latest results obtained from the Tobit regression indicate that the scale of assets and liquidity risk can help increase bank efficiency, while the opposite condition occurs profitability (Soetanto & ., 2012).

The performance of banking in Indonesia is still not optimal due to the wasteful use of fees on several input variables used by banks in their economic activities. (Rubeda, Kalis et al., 2014). Efficiency in the banking industry in Indonesia during the period 2012-2014 using the Data Envelopment Analysis (DEA) method and to determine determinants using the Tobit regression model (Sari & Saraswati, 2017).

In this study the statistical tool used is the R Programming with deaR library to do DEA analysis and the version used in this statistical analysis is R Programming version 3.6 and GRETL open sources Econometric Tools 2019a Linux x86_64 version for TOBIT Regression analysis.

3. Research methodology

The research instrument, Analysis of the Technical Efficiency, Malmquist Productivity Index, and TOBIT Regression of the eleven Islamic Commercial Banks in Indonesia between 2010 and 2019, as follows:

The method used is DEA (data envelopment analysis) with RTS using a combination of CRS and VRS, with input-output orientation, and processed as well using Malmquist Index, DEA processing using R Programming with deaR library. The last results of this research are about TOBIT regression, using GRETL econometric tools.

This study uses data, eleven Islamic commercial banks, taken from the banking year report from 2010 to 2019, the total of all decision making units (DMU) is 110 DMU, the data variables used are:

Variables used in reports:
- the bank's annual report
- total capital
- Commercial Bank Business Activities (abbreviation BUKU)

Variables used for the DEA process:
The first input - Deposits, consists of:
- Wadiah's savings
- Non-profit sharing investment funds or Mudharabah Muthlaqah

Second input - Labor load or personnel costs or wages, consisting of:
- Other operational costs
- Wadiah bonus
- Impairment of financial assets
- Promotion expenses
- Other expenses for general administration

The first output, Financing, consists of:
- Receivables consist of:
* Murabaha accounts
* Murabahah receivables are deferred
* Istishna accounts
* Istishna receivables are deferred
* Qardh receivables
- Profit sharing financing consists of:
* Mudaraba financing
* Musharaka financing
* Other financing
- Ijarah lease financing consists of:
* Ijarah asset lease financing
* Accumulated depreciation lease financing

Second output - Income consists of:
- Fund distribution income
- Other operating income

Variables are used for the TOBIT Regression process:
- Natural logarithm of asset {LN (asset)}
- ROA (return on asset ratio)
- CAR (capital adequacy ratio)
- FDR (financing to deposit ratio)
- NPF (non performing financing ratio)
- Indonesia's annual inflation
- Indonesia annual Real GDP
- Indonesia annual Unemployement
- USD exchange to IDR

4. Results

In table 1.The Average Efficiency per Year of Islamic Commercial Banks in Indonesia Data for 2010-2019, concerning technical efficiency or CRS (constant return to scale), for the type of commercial bank business activity (abbreviation BUKU 3): CRS (constant return to scale) achieved by PT. Bank Syariah Mandiri, PT Bank BRI Syariah Tbk, and PT Bank BNI Syariah with a value of 0.98 or 98%. For the lowest achieved by PT Bank Jabar Banten Syariah of 0.9 or 90%. And the average technical efficiency or CRS from 2010 to 2019 is 0.95 or 95%, this indicates that the technical efficiency or CRS of Islamic commercial banks in Indonesia between 2010 and 2019 is quite efficient, it can be said that it is not efficient. And no value of 1 means efficient in the CRS column, and most values less than 1 are inefficient.

Table 1. The Average Efficiency per Year of Islamic Commercial Banks in Indonesia Data for 2010-2019

Bank	CRS	VRS	SE	Last Capital 2019	Type
PT. Bank Syariah Mandiri (PT.BSM)	0,98	0,99	0,99	IDR 9.611.534.000.000,00	BUKU 3
PT. Bank BRI Syariah Tbk (PT.BRIS)	0,98	0,98	0,99	IDR 5.812.183.000.000,00	BUKU 3
PT. Bank BNI Syariah (PT.BNIS)	0,98	1,00	0,99	IDR 4.726.908.000.000,00	BUKU 2
PT Bank Muamalat Indonesia Tbk (PT.BMI)	0,95	0,96	0,99	IDR 3.871.341.000.000,00	BUKU 2
PT. Bank BCA Syariah (PT.BCAS)	0,94	0,99	0,95	IDR 2.367.723.000.000,00	BUKU 2
PT Bank Panin Dubai Syariah Tbk (PT.BPDBS)	0,92	0,98	0,94	IDR 1.248.263.000.000,00	BUKU 2
PT BANK MEGA SYARIAH (PT.BMS)	0,96	0,99	0,97	IDR 1.228.122.000.000,00	BUKU 2
PT. Bank Syariah Bukopin (PT.BSB)	0,97	0,99	0,98	IDR 814.080.000.000,00	BUKU 1
PT. Bank Jabar Banten Syariah (PT.BJBS)	0,90	0,94	0,96	IDR 687.797.000.000,00	BUKU 1
PT Bank Net Indonesia Syariah Tbk (PT.BNetIS)	0,95	0,98	0,97	IDR 592.939.000.000,00	BUKU 1
PT. Bank Victoria Syariah (PT.BVS)	0,96	0,98	0,99	IDR 225.037.000.000,00	BUKU 1
Average	0,95	0,98	0,97		

Still in table 1, the value of VRS (variable return to scale) or BBC model (Banker, Charnes and Cooper), is related to the optimal scale of efficiency, if we look at the VRS column, it is found that PT Bank BNI Syariah has a value of 1 which means efficient, and the others have a value which is very thin, such as the value of 0.99 which is owned by PT. Bank Syariah Mandiri, PT. Bank BCA Syariah, PT. Bank Mega Syariah, and PT. Bank Syariah Bukopin, the lowest in the VRS column is owned by PT. Bank Jabar Syariah with a value of 0.94. The average VRS value for 2010 to 2019 has a value of 0.98, almost efficient, but it can be stated that it is not efficient or inefficient.

In column SE table 1 or the so-called efficiency scale, where the value is the division between CRS / VRS, each has a size and level of production, indicating that the size of the bank determines its relative efficiency or inefficiency. A bank with type BUKU 3 (BUKU means the type of commercial bank with business activities) has the same value for the 2 banks at the BUKU 3 level, namely PT. Bank Syariah Mandiri, PT. Bank BRI Syariah Tbk, has the same value, namely 0.99. With type BUKU 2 only 1 bank with a value of 0.99, namely bank PT. Bank Muamalat Indonesia Tbk, the rest is less than 0.99. At the BUKU 1 level only PT. Victoria Syariah Bank which has a value of 0.99, the rest is less than that value. And in this SE column, none of them has a value of 1 which means efficient, beyond that value, in theory from DEA, it can be said that it is not efficient.

Table2. Malmquist Index, means by DMU

DMU	MI (Malmquist Index)	EC (Efficiency Change)	TC (Technological Change)
PT.BNETIS	1,313581575	1	1,313581575
PT.BVS	1,02547074	0,980864381	1,045476581
PT.BSM	1,004117804	0,999499289	1,004620828
PT.BCAS	0,981318329	1,019000329	0,963020621
PT.BMI	0,975818784	0,973138123	1,002754656
PT.BSB	0,973395821	0,999472028	0,973910018
PT.BRIS	0,957729158	0,989181589	0,968203582
PT.BMS	0,954510223	1,013016798	0,942245207
PT.BNIS	0,952822283	1,00658051	0,946593217
PT.BJBS	0,931070739	0,997421702	0,933477522
PT.BPDBS	0,904622807	1	0,904622807

In this study, the DEA process was carried out with the Malmquist Index model as well, because it was used with 110 DMUs, consisting of 11 Islamic commercial banks, with data ranges from 2010 to 2019, a form of time series panel data, so the data processing was carried out with the Malmquist Index. which is the concept of measuring productivity.

In Table2. Malmquist Index (MI), means by DMU, is a summary of data from 2010 to 2019, which is averaged by the DMU, in this case the names of banks, we can see that the MI (Malmquist Index) value of more than 1 is held by PT Bank Net Indonesia Syariah, PT. Bank Victoria Syariah, PT. Bank Syariah Mandiri, the value of MI which is greater than one, indicates an increase in total productivity (TP). On the other hand, there are several MI values from DMU that are less than 1, such as the lowest MI value is owned by PT. Bank Muamalat Indonesia with a value of 0.97, with an MI value of less than 1, it can be stated that the DMU has decreased in total productivity (TP).

Table 3. Malmquist Index, Means by Period of 11 Islamic Banking

Period	MI (Malmquist Index)	EC (Efficiency Change)	TC (Technological Change)
2018	2,382222417	1,003834182	2,373123431
2013	1,132039534	1,058573034	1,069401447
2015	1,09103459	0,914203557	1,193426324
2014	1,071626719	0,977306118	1,096510806
2011	0,989347628	0,905144725	1,093027005
2016	0,951704373	1,097819467	0,86690426
2019	0,79580245	0,950605141	0,837153531
2017	0,772785984	1,003061267	0,7704275
2012	0,51385159	1,091169928	0,470918028

In Table 3.Malmquist Index, Means by Period of 11 Islamic Banking, indicates that in 2018 it was the highest value of MI (malmquist index) with a value of more than 2.3, it can be concluded that 2018 was the best performance of Islamic commercial banks between 2010 and With 2019, what made it the best year, when seen from Table 4. Reports of Average 11 Islamic Banking Ratio and Economic Ratio in Indonesia Data Between 2010-2019, we can note that the unemployment rate in 2018 was very small of 5.3 compared to before in 2017 and before again, and the inflation rate of 2.72 is a reasonable inflation rate for Indonesia with an ideal inflation value of around 3% as a developing country, so that the production factors can run optimally.

Table 4. Reports of Average 11 Islamic Banking Ratio and Economic Ratio in Indonesia Data Between 2010-2019

Bank	LN	ROA	CAR	FDR	NPF	In	Re	Unemp	USD

and Years	Fix Asset					flation	al GDP	loyement	Exchange
2010	10,81103974	1,064545455	52,63727273	83,48956105	2,353636364	6,96	6,224	7,1	8946
2011	11,18063762	1,949090909	31,46909091	97,1690068	1,909090909	3,79	6,17	7,48	9023
2012	11,58001684	1,811818182	23,13636364	94,05914327	2,465454545	4,3	6,03	6,13	9622
2013	11,78915587	1,341818182	20,46909091	94,64076811	2,565454545	8,38	5,557	6,17	12128
2014	12,03175878	0,678181818	21,21181818	93,39270588	4,12	8,36	5,007	5,94	12378
2015	12,1807976	-1,465454545	20,12272727	94,44181818	7,547272727	3,35	4,876	6,18	13726
2016	12,21625386	-1,063818182	22,46109364	94,54297182	8,473658182	3,02	5,033	5,61	13369
2017	12,37834446	-0,484545455	23,96363636	83,96727273	6,231818182	3,61	5,07	5,5	13480
2018	12,5036207	-0,073628182	33,31588091	121,8422018	3,490924545	3,13	5,17	5,3	14409
2019	12,52468653	1,640909091	39,71272727	123,5245455	3,244545455	2,72	5,025	5,23	13901
Average	11,9196312	0,539891727	28,84997018	98,10699951	4,240185545	4,762	5,4162	6,064	12098,2

In Table 4. Reports of Average 11 Islamic Banking Ratio and Economic Ratio in Indonesia Data, is a conclusion for all Islamic commercial banks between 2010 and 2019, this determinant data will be used in the TOBIT reggression process in this study.

Standards are set by The Indonesia Financial Services Authority (OJK) and the Indonesian central bank, such as the best ROA value at 1.5%, or the best value between 1% - 2% with a score of 100, if you pay attention to the ROA column, almost all of them are in the range 1% - 2%, except in 2014, 2017, 2018, it can be concluded that the ROA of Islamic commercial banks from 2010 to 2019 is good.

In the CAR column, the authority determines that it must have a minimum CAR of 8% with a score of 80, if 12% - 20% of the score is 90, if more than 20% of the score is 100, if you pay attention to the CAR column, the average is above 20%, It can be concluded that the CAR value of Islamic commercial banks between 2010 and 2019 is very good.

The FDR (Financing to Deposit Ratio) column is the average FDR value of Islamic commercial banks in the year concerned, if the reference is determined by the authority, the best LDR is between 78% - 100%, and a value of 85% - 110%, a score of 100 and almost all FDR values are in this range, except for 2010 with a value of 83.4 (the score for 50% - 85% is 80), and also in 2018 the average FDR value is 121.84 and in 2019 the average FDR value is 123 , 52 (more than 110% with a score of 90), it can be concluded that the FDR of Islamic commercial banks between 2010 and 2019 is very good, it can be concluded that the liquidity of Islamic commercial banks is very good.

Still in Table 4., the NPF (non performing financing) column, the standards set by the authorities, the best NPF if below 5%, almost all years below 5%, so it can be concluded that all Islamic commercial banks have the best NPF ratio, even in 2010, 2011, 2012, 2013 below 3% (the score below 3% is 100). Except in 2015, the NPF in that year was 7.54 (NPF 5% - 8% = score of 80), even in 2016 the NPF was 8.47 (NPF more than 8% = score of 0).

The average inflation rate between 2010 and 2019 is 5.41, the most reasonable value for Indonesia as a middle developing country is around 3%, but in the inflation column it can be seen that there are periods of inflation around 3% such as in 2018, 2017, 2016, 2015 and if we pay attention to Table 3. Malmquist Index,

Means by Period of 11 Islamic Banking, there is a period in 2018 that the MI (Malmquist Index) has a value of 2.38, above the value of 1 then the productivity factor (TP) is very good, where at in 2018, the inflation rate was 2.72.

Determinant factors of the bank / bank ratio (ROA, CAR, FDR, and NPF), together with the natural logarithm of fix assets (LN (fix asset)), and economic factors such as inflation, real GDP, unemployment, USD to IDR exchange will be used. as independent variables in the TOBIT regression process, the results will be seen in Table 5. Tobit, using observations 1-110, and for Dependent variables used: CRS (technical efficiency), Standard errors based on Hessian.

Table 5. Tobit, using observations 1-110
Dependent variable: CRS
Standard errors based on Hessian

	Coefficient	*Std. Error*	*z*	*p-value*	
LNTA	−0.00178118	0.00492488	−0.3617	0.7176	
ROA	0.00657934	0.00334971	1.964	0.0495	**
CAR	−0.000808978	0.000312958	−2.585	0.0097	***
FDR	0.000394302	0.000158654	2.485	0.0129	**
NPF	−5.05659e-05	0.00183294	−0.02759	0.9780	
inflation	0.000259726	0.00343499	0.07561	0.9397	
realgdp	0.0407788	0.0204198	1.997	0.0458	**
unemployment	0.0517161	0.0167422	3.089	0.0020	***
usdexchange	3.47726e-05	3.58964e-06	9.687	<0.0001	***

Log-likelihood	134.3254	Akaike criterion	−248.6508
Schwarz criterion	−221.6460	Hannan-Quinn	−237.6975

sigma = 0.0713557 (0.0048108)
Left-censored observations: 0
Right-censored observations: 0
Test for normality of residual -
Null hypothesis: error is normally distributed
Test statistic: Chi-square(2) = 76.8663
with p-value = 2.0356e-17

In Table 5.Tobit, using observations 1-110, Dependent variable: CRS, Standard errors based on Hessian, with p-value = 2.0356e-17 less than 5% significance, you can see the coefficient value:

1. LNTA with a coefficient value is −0.00178118, it can be concluded that the value of fixed assets, in this case the natural logarithm of fixed assets, has no effect on the efficiency value of Islamic commercial banks.
2. ROA with a coefficient value is 0.00657934, having a positive value, it can be concluded that ROA has an influence on the efficiency of Islamic commercial banks.
3. CAR with a coefficient value is −0.000808978, with a negative value, in this case it can be concluded that CAR does not really affect the efficiency of Islamic commercial banks.
4. FDR with a coefficient value is 0.000394302, has a positive value, and is concluded to have an influence on the efficiency of Islamic commercial banks.
5. NPF with a coefficient value is −5.05659e-05, has a negative value, it is concluded that NPF has no effect on the efficiency of Islamic commercial banks.
6. And finally, inflation with a value of 0.000259726, realgdp with a value of 0.0407788, unemployment with a value of 0.0517161, usdexchange with a value of 3.47726e-05, has a positive value, so it is concluded that inflation rate, real GDP, unemployment rate, USD to IDR exchange, have an effect on efficiency Islamic commercial banks.

Table 6. Equation Results : Tobit, using observations 1-110
Dependent variable: CRS
Standard errors based on Hessian

^CRS = - 0.00178*LNTA + 0.00658*ROA - 0.000809*CAR + 0.000394*FDR - 5.06e-05*NPF
(0.00492) (0.00335) (0.000313) (0.000159) (0.00183)
+ 0.000260*inflation + 0.0408*realgdp + 0.0517*unemployment + 3.48e-05*usdexchange
(0.00343) (0.0204) (0.0167) (3.59e-06)

n = 110, loglikelihood = 134
(standard errors in parentheses)

Table 6 shows the results of Equation: Tobit Regression, using observations 1-110 data, Dependent variable: CRS, Standard errors based on Hessian, using data from eleven Islamic commercial banks in Indonesia, between 2010 and 2019.

And in Table 7. The Average Efficiency of Islamic Commercial Banks in Indonesia Data for 2010-2019, is a complete table of the efficiency of eleven Islamic commercial banks in Indonesia, with data years between 2010 and 2019.

Table 7. The Average Efficiency of Islamic Commercial Banks in Indonesia Data for 2010-2019

Row Labels	Average of CRS	Average of VRS	Average of Scale Eff	Average of Total Capital	Average of Input 1 Saving	Average of Input 2 Fix Asset	Average of Input 3 Wages	Average of Output 1 Financing	Average of Output Earnings
2010	**0,90386636**	**1**	**0,9038663664**	**805686,3636**	**6050364,455**	**1338588,7273**	**1422188,0909**	**4693602,727**	**735160,1818**
BUKU 1	**0,86781625**	**1**	**0,8678162 5**	**437365,875**	**1767012,375**	**54236,125**	**76397,125**	**1516820,625**	**288345**
PT.BMS	0,98281	1	0,98281	378452	4040981	123910	293340	3077850	971497
PT.BNETIS	0,74954	1	0,74954	860562	355374	15976	17554	612167	110045
PT.BPDBS	0,47875	1	0,47875	141405	309763	36060	8390	216096	22629
PT.BCAS	0,82979	1	0,82979	300924	556776	20392	20076	417087	91664
PT.BRIS	0,97483	1	0,97483	995322	5762952	158778	189999	4746297	734301
PT.BJBS	1	1	1	515591	1321758	1794	34987	1439311	129006
PT.BSBB	1	1	1	185411	1621914	63754	41843	1597561	223156
PT.BVS	0,92681	1	0,92681	121260	166581	13225	4988	28196	24462

BUKU 2	**1**	**1**	**1**	**1787874,333**	**17472636,67**	**346185,6667**	**317740,6667**	**13165021,67**	**1926667,333**
PT.BMI	1	1	1	2127277	18574217	362798	253263	14673493	1885707
PT.BNIS	1	1	1	1057469	5162728	56466	77280	3341080	447913
PT.BSM	1	1	1	2178877	28680965	619293	622679	21480492	3446382
2011	**0,941023636**	**0,988979091**	**0,951384887**	**1034817,364**	**9041861,818**	**1823577,273**	**2142518,182**	**648603,727**	**1071404,364**
BUKU 1	**0,927172857**	**0,994295714**	**0,932209434**	**438341,1429**	**1648214,857**	**4561971,429**	**7075628,571**	**1334537,857**	**2719118,571**
PT.BMS	0,847669	0,96007	0,882946035	441469	4928442	132284	310735	3487401	982607
PT.BNETIS	1	1	1	894511	349848	22032	18786	998893	117474
PT.BPDBS	1	1	1	452867	419772	36680	14956	684118	74894
PT.BCAS	0,870333	1	0,87033	308458	864135	21373	32755	680837	144381
PT.BJBS	0,918355	1	0,91835	533379	2218533	9518	64417	1367990	265039
PT.BSB	0,853844	1	0,85384	301859	2291738	80837	44229	1908245	245306
PT.BVS	1	1	1	135845	465036	16614	9416	214281	73682
BUKU 2	**0,965262525**	**0,979675**	**0,984941932**	**2078650,75**	**21980744**	**421649,25**	**465369**	**15501159,75**	**2470516,25**
PT.BMI	0,971533	1	0,97153	2462443	29126650	529642	410355	20424349	2674527
PT.BNIS	1	1	1	1097119	6756261	88098	183764	4463891	1009550
PT.BRIS	0,889552	0,9187	0,968237727	1034367	9906412	224785	302475	7191071	1141770
PT.BSM	1	1	1	3720674	42133653	844072	964882	29925328	5056218
2012	**0,9434**	**0,9708**	**0,972256**	**1273497,818**	**11289513**	**255204,5455**	**247428,6364**	**9220685**	**1339323**

	61818	**69091**	**02**						
BUKU 1	**0,91933**	**0,959712857**	**0,9591217 26**	**4926 00,8571**	**24493 49**	**66854, 85714**	**80174 ,85714**	**212456 0,429**	**36106 1,2857**
PT.BMS	0,86704	1	0,86704	578863	7090422	136315	324834	5396463	1302340
PT.BNETIS	1	1	1	941844	710726	21688	23895	1377778	135607
PT.BPDBS	1	1	1	483369	1223290	39463	19907	1515420	152468
PT.BCAS	0,87469	1	0,87469	308589	1261824	20894	39039	1008279	171381
PT.BJBS	0,78413	0,79242	0,9 8953837 6	650023	3362073	143705	78073	2481554	370923
PT.BSB	1	1	1	331199	2850784	86224	51390	2615615	311220
PT.BVS	0,90945	0,92557	0,9 8258370 5	154319	646324	19695	24086	476814	83490
BUKU 2	**0,9856 925**	**0,9903 925**	**0,9 9523988 4**	**2640 067,5**	**26759 800**	**58481 6,5**	**54012 2,75**	**216389 03**	**30512 81**
PT.BMI	1	1	1	3682 215	39422 307	71084 6	54687 5	3154853 6	3382835
PT.BNIS	0,96788	0,97094	0,9 9684841 5	1198 018	8980035	153169	317073	6868979	1259539
PT.BRIS	0,97489	0,99063	0,9 8411112 1	1112 727	11948 889	267368	323383	9946886	1507472
PT.BSM	1	1	1	4567 310	46687 969	120783	973160	3819121 1	6055278
2013	**0,95444909 1**	**0,96836727 3**	**0,9 8518282**	**1660 769,545**	**13445 471,45**	**34320 1,6364**	**31591 6,5455**	**11781908,55**	**16787 06,545**
BUKU 1	**0,92182166 7**	**0,94200666 7**	**0,9 7816683 8**	**4641 06,8333**	**33824 72,333**	**89140, 33333**	**10673 5,1667**	**308174 4**	**53333 8,8333**
PT.BMS	1	1	1	746969	7730738	148900	362352	6915288	1673842
PT.BPDBS	0,88432	0,93447	0,9 4633321 6	537402	2870310	46237	35375	2594825	283759
PT.BC	0,9130	0,9472	0,9 639467	321436	1703049	29438	40683	1421389	200956

AS	6	1	49						
PT.BJBS	0,85931	0,86967	0,9880874 35	655836	3702683	1686 58	108721	3430228	528197
PT.BSB	1	1	1	358919	3272262	11897 2	62577	3268790	401503
PT.BVS	0,87424	0,90069	0,9 706336 25	164079	1015792	22637	30703	859944	111776
BUKU 2	**0,99612**	**1**	**0,99612**	**1385 406,667**	**89381 79,667**	**18687 1,3333**	**29606 9,6667**	**839924 7,333**	**12317 73,333**
PT.BNETIS	0,98836	1	0,98836	1025691	976618	19323	26430	1412776	207478
PT.BNIS	1	1	1	1365396	11488209	18376 4	46151 2	10590896	1612222
PT.BRIS	1	1	1	1765133	14349712	35752 7	40026 7	13194070	1875620
BUKU 3	**0,989825**	**1**	**0,989825**	**5663802**	**50395406,5**	**13398 81**	**97323 1**	**42956394**	**5785209,5**
PT.BMI	1	1	1	5982703	45022858	12441 90	75405 9	41336440	4794213
PT.BSM	0,97965	1	0,97965	5344901	55767955	14355 72	11924 03	44576348	6776206
2014	**0,969466364**	**0,977204545**	**0,9 919513 08**	**1837 875,636**	**15515 578,64**	**52804 7,1818**	**36517 9,9091**	**12763677,91**	**1871927**
BUKU 1	**0,95599**	**0,959998**	**0,9 954907 23**	**5673 96,4**	**37155 93,4**	**15067 9,4**	**12399 7,4**	**331399 0,8**	**61188 0,8**
PT.BMS	0,96838	0,97067	0,9 976408 05	812683	5821319	39523 2	34399 2	5364947	1380366
PT.BCAS	1	1	1	637854	2338709	33140	51596	2131454	280983
PT.BJBS	0,85842	0,87517	0,9 808608 61	681337	5237296	17574 7	12426 9	4299704	742209
PT.BSB	1	1	1	567308	3994957	12247 7	68565	3696968	502833
PT.BVS	0,95315	0,95415	0,9 989519 47	137800	1185686	26801	31565	1076881	153013
BUKU 2	**0,998205**	**1**	**0,998205**	**1470 250,25**	**98282 30,25**	**17173 1,25**	**29420 6**	**895455 4,25**	**12879 88,75**
PT.B	1	1	1	1031988	1043046	20539	30601	1571661	275672

NETIS									
PT.BPDBS	1	1	1	1077568	5076082	50765	54735	4773554	559789
PT.BNIS	1	1	1	2004358	16246405	219644	644458	14383804	2176438
PT.BRIS	0,99282	1	0,99282	1767087	16947388	395977	447030	15089198	2140056
BUKU 3	**0,94568**	**0,97463**	**0,9705953 89**	**5749324,5**	**56390238,5**	**2184098,5**	**1110084**	**44006143**	**6189919**
PT.BMI	0,95911	1	0,95911	5876558	53496985	2798346	860392	42796191	5528377
PT.BSM	0,93225	0,94926	0,9820807 79	5622091	59283492	1569851	1359776	45216095	6851461
2015	**1**	**1**	**1**	**1967497,364**	**15601449,64**	**6077073636**	**4023116364**	**13716178,82**	**2091482,909**
BUKU 1	**1**	**1**	**1**	**597491,5**	**2773256,75**	**161636**	**98460**	**2793969**	**745554,75**
PT.BMS	1	1	1	882992	4268834	441703	265509	4211474	1810150
PT.BNETIS	1	1	1	669584	938982	20509	28953	1552520	461251
PT.BSSB	1	1	1	690593	4756303	160648	73145	4336201	557957
PT.BVS	1	1	1	146797	1128908	23684	26233	1075681	152861
BUKU 2	**1**	**1**	**1**	**1578554,2**	**10666477,4**	**190943,6**	**2843 71,8**	**9620485,8**	**1548459**
PT.BPDBS	1	1	1	1176549	5928345	73100	76656	5716720	734238
PT.BCAS	1	1	1	1070282	3255154	55858	63314	2975474	551045
PT.BNIS	1	1	1	2254181	19322756	274946	646364	17765096	2573188
PT.BRIS	1	1	1	2343249	20123658	379245	509098	16660266	2567870
PT.BJBS	1	1	1	1048510	4702474	171569	126427	4984873	1315954
BUKU 3	**1**	**1**	**1**	**5679867**	**53595266**	**2541759,5**	**1304864,5**	**45799831**	**6140899**

PT.BMI	1	1	1	5172344	45077653	3090102	924521	40706151	5384026
PT.BSM	1	1	1	6187390	62112879	1993417	1685208	50893511	6897772
2016	**0,96515545**	**0,976168182**	**0,987699574**	**2167581,818**	**16963569,45**	**670586,0909**	**421057,0909**	**14625966,18**	**2144540**
BUKU 1	**0,9366875**	**0,951375**	**0,982037028**	**563611,5**	**3203848,75**	**10139**	**75617**	**30984008,75**	**8656708,5**
PT.BNETIS	0,75124	0,8055	0,932638113	510620	714716	23408	33790	962919	270701
PT.BJBS	1	1	1	742192	5453390	175751	150587	5414130	2396916
PT.BSB	0,99551	1	0,99551	838696	5442608	195970	91294	4803895	671864
PT.BVS	1	1	1	162938	1204681	10463	26797	1212691	123233
BUKU 2	**0,98057**	**0,989042**	**0,991367628**	**1885364,2**	**12382817,6**	**2690109,4**	**320732,4**	**10610659,8**	**1726673,8**
PT.BMS	1	1	1	1057437	4920733	432608	160897	4714811	1398154
PT.BPDBS	0,94202	0,95323	0,988239984	1288029	6899007	87627	100928	6346929	717682
PT.BCAS	1	1	1	1127355	3842272	68548	79112	3462826	777404
PT.BNIS	0,96083	0,99198	0,968598157	2486598	24233009	357962	724498	20493609	2960724
PT.BRIS	1	1	1	3467402	22019067	398352	538227	18035124	2779405
BUKU 3	**0,983555**	**0,99357**	**0,989854529**	**6081066,5**	**55934890,5**	**2812879**	**1362749**	**47719347**	**5746928,5**
PT.BMI	1	1	1	5220131	41919920	3576787	880812	40050448	4144222
PT.BSM	0,96711	0,98714	0,979709058	6942002	69949861	2048971	1844686	55388246	7349635
2017	**0,940146364**	**0,973521818**	**0,965918901**	**2441985,182**	**19381259,82**	**71698 5,8182**	**429932**	**15592487,82**	**2196795,909**
BUK	**0,9187**	**0,9678**	**0,995254**	**621343,4**	**4214831,8**	**14226 0,6**	**96863 ,8**	**3654559,4**	**652850**

U 1	**56**	**78**	**62**						
PT.BNETIS	1	1	1	586735	561510	23366	45474	485353	444648
PT.BPDBS	0,880255	0,924033	0,952620586	691237	7525232	105530	144316	6542901	819504
PT.BJBS	0,854622	1	0,85462	644460	5977834	280877	164996	5447525	1228212
PT.BSB	0,881155	0,915336	0,962676726	946389	5498424	290937	100073	4534091	615093
PT.BVS	0,977766	1	0,97776	237896	1511159	10593	29460	1262927	156793
BUKU 2	**0,964515**	**0,983582 5**	**0,980790347**	**2445895,75**	**1638255 3,5**	**3519388,75**	**3798977,75**	**12860286,75**	**2024199**
PT.BMS	0,9623	1	0,9623	1179097	5055436	437720	144874	4641539	1213044
PT.BCAS	0,969552	1	0,96952	1179154	4736403	103511	86068	4191101	493497
PT.BNIS	1	1	1	3814099	2937929 1	410421	673381	2359671 9	3399586
PT.BRIS	0,926244	0,934333	0,91341389	3611233	2635908 4	456103	615268	1901178 8	2990669
BUKU 3	**0,944885**	**0,96751**	**0,977159605**	**6985768,5**	**6329474 2,5**	**2883893**	**1362671**	**5090171 1**	**6401854,5**	
PT.BMI	0,935744	0,939529	0,95976669	6127412	4868634 2	3773383	802493	4133182 2	4185953
PT.BSM	0,95403	0,9955	0,95834254 1	7844125	7790314 3	1994403	1922849	6047160 0	8617756
2018	**0,955548182**	**0,966712727**	**0,9883547 3**	**2678765,545**	**2061525 9,27**	**8396304545**	**4670748182**	**1615750 1,82**	**2249937,091**
BUKU 1	**0,951**	**0,961867 5**	**0,9885120 09**	**608347,5**	**2804317,75**	**1768 71,25**	**76128**	**2552463,25**	**380568,5**
PT.BNETIS	1	1	1	529177	17	22502	33658	72237	92346
PT.BJBS	0,833688	0,84747	0,9837280 38	685267	5182147	289407	159852	4658962	708826
PT.BSB	0,97032	1	0,97032	946186	4543665	383691	80903	4244083	537896
P	1	1	1	2727	14914	11885	30099	123457	18320

T.BVS				60	42			1	6
BUKU 2	**0,947698**	**0,957274**	**0,98986279**	**2508795,4**	**1984324 2,8**	**1173592,8**	**420160,2**	**15632943,8**	**2151726**
PT.BMS	1	1	1	1174083	5672207	420986	147619	5178618	1430105
PT.BMI	0,79713	0,80901	0,9853153 85	4255006	4563557 4	4672144	845632	3356618 0	3921533
PT.BPDBS	1	1	1	1541192	6905806	105048	120059	6133980	956048
PT.BCAS	0,9773	0,97736	0,9999386 1	1285880	5506107	155609	89234	4899744	580083
PT.BNIS	0,96406	1	0,96406	4287816	3549652 0	5141 77	898257	2838619 7	3870861
BUKU 3	**0,98427**	**1**	**0,98427**	**7244527**	**5816718 3,5**	**1330243**	**1366255**	**4467897 4**	**6234202**
PT.BRIS	1	1	1	5922283	2886252 4	512551	588766	2185508 2	3648751
PT.BSM	0,96854	1	0,96854	8566771	8747184 3	2147935	2143744	6750286 6	8819653
2019	**0,968157273**	**0,985897273**	**0,98221559 9**	**2835084,273**	**2288948 0,45**	**864977**	**4945 8,7273**	**1787881 6,09**	**2517207,909**
BUKU 1	**0,97434**	**1**	**0,97434**	**579963,25**	**3101232,75**	**181500,5**	**67245 ,75**	**2851908**	**367244,75**
PT.BNETIS	1	1	1	592939	1	19737	19950	5066	56370
PT.BJBS	0,89736	1	0,89736	687797	5788150	359301	148251	5415364	716572
PT.BSB	1	1	1	814080	5087295	337332	71978	4755589	520515
PT.BVS	1	1	1	225037	1529485	9632	28804	1231613	175522
BUKU 2	**0,953014**	**0,968974**	**0,98342317**	**2688471,4**	**2108894 6**	**1203125,4**	**4266 09,4**	**1651746 6,6**	**2295842**
PT.BMS	1	1	1	1228122	6403049	421165	154841	6080453	1543950
PT.BMI	0,84221	0,84487	0,9685158 7	3871341	4035721 4	4612014	770739	2987721 7	3934585
P	0,	1	0,9	1248	87076	10003	98816	833517	82178

T.BP DBS	9967 6		9676	263	57	0		1	6
P T.BC AS	1	1	1	2367 723	62049 31	18498 1	96516	564541 9	68692 2
P T.B NIS	0, 9261	1	0,9 261	4726 908	43771 879	69743 7	10121 35	326490 73	44919 67
B UK U 3	**0, 9936 5**	**1**	**0,9 9365**	**7711 858,5**	**66967 312**	**13865 59**	**15192 23**	**513360 06**	**73705 49**
P T.BR IS	1	1	1	5812 183	34124 895	52472 8	66277 9	273830 17	37034 21
P T.BS M	0, 9873	1	0,9 873	9611 534	99809 729	22483 90	23756 67	752889 95	11037 677
A vera ge Tota l	**0, 9541 2745 5**	**0, 9807 72**	**0,9 728829 79**	**1870 356,091**	**15079 380,8**	**51425 5,6545**	**34999 5,9273**	**122916 86,16**	**17896 48,491**

5. Conclusion

This study uses data, eleven Islamic commercial banks, taken from the banking year report from 2010 to 2019, the total of all decision making units (DMU) is 110 DMU. The Average Efficiency per Year of Islamic Commercial Banks in Indonesia Data for 2010-2019, concerning technical efficiency or CRS (constant return to scale), for the type of commercial bank business activity (abbreviation BUKU 3): CRS (constant return to scale) achieved by PT. Bank Syariah Mandiri, PT Bank BRI Syariah Tbk, and PT Bank BNI Syariah with a value of 0.98 or 98%. And the average technical efficiency or CRS from 2010 to 2019 is 0.95 or 95%, this indicates that the technical efficiency or CRS of Islamic commercial banks in Indonesia between 2010 and 2019 is quite efficient, it can be said that it is not efficient. And no value of 1 means efficient in the CRS column, and most values less than 1 are inefficient.

The value of VRS (variable return to scale) or BBC model (Banker, Charnes and Cooper), is related to the optimal scale of efficiency, it is found that PT Bank BNI Syariah has a value of 1 which means efficient, and the others have a value which is very thin, such as the value of 0.99 which is owned by PT. Bank Syariah Mandiri, PT. Bank BCA Syariah, PT. Bank Mega Syariah, and PT. Bank Syariah Bukopin. The average VRS value for 2010 to 2019 has a value of 0.98, almost efficient, but it can be stated that it is not efficient or inefficient.

Scala Efficieny (SE), A bank with type BUKU 3 (BUKU means the type of commercial bank with business activities) has the same value for the 2 banks at the BUKU 3 level, namely PT. Bank Syariah Mandiri, PT. Bank BRI Syariah Tbk, has the same value, namely 0.99. With type BUKU 2 only 1 bank with a value of 0.99, namely bank PT. Bank Muamalat Indonesia Tbk, the rest is less than 0.99. At the BUKU 1 level only PT. Victoria Syariah Bank which has a value of 0.99, the rest is less than that value. And in this SE column, none of them has a value of 1 which means efficient, beyond that value, in theory from DEA, it can be said that it is not efficient.

The Malmquist Index model, used with 110 DMUs, consisting of 11 Islamic commercial banks, with data ranges from 2010 to 2019, the MI (Malmquist Index) value of more than 1 is held by PT Bank Net Indonesia Syariah, PT. Bank Victoria Syariah, PT. Bank Syariah Mandiri, the value of MI which is greater than one, indicates an increase in total productivity (TP). On the other hand, there are several MI values from DMU that are less than 1, such as the lowest MI value is owned by PT. Bank Muamalat Indonesia with a value of 0.97, with an MI value of less than 1, it can be stated that the DMU has decreased in total productivity (TP), indicates that in 2018 it was the highest value of MI (malmquist index) with a value of more than 2.3, it can be concluded that 2018 was the best performance of Islamic commercial banks between 2010 and With 2019, what made it the best year, we can note that the unemployment rate in 2018 was very small of 5.3 compared to before in 2017 and before again, and the inflation rate of 2.72 is a reasonable inflation rate for Indonesia with an ideal inflation value of around 3% as a developing country, so that the production factors can run optimally.

Determinant factors of the bank / bank ratio (ROA, CAR, FDR, and NPF), together with the natural logarithm of fix assets (LN (fix asset)), and economic factors such as inflation, real GDP, unemployment, USD to IDR exchange will be used. as independent variables in the TOBIT regression process, the results of this Tobit regression, using observations 1-110, and for Dependent variables used: CRS (technical efficiency), Standard errors based on Hessian, the coefficient value:

1. LNTA with a coefficient value is −0.00178118, it can be concluded that the value of fixed assets, in this case the natural logarithm of fixed assets, has no effect on the efficiency value of Islamic commercial banks.
2. ROA with a coefficient value is 0.00657934, having a positive value, it can be concluded that ROA has an influence on the efficiency of Islamic commercial banks.
3. CAR with a coefficient value is −0.000808978, with a negative value, in this case it can be concluded that CAR does not really affect the efficiency of Islamic commercial banks.
4. FDR with a coefficient value is 0.000394302, has a positive value, and is concluded to have an influence on the efficiency of Islamic commercial banks.
5. NPF with a coefficient value is −5.05659e-05, has a negative value, it is concluded that NPF has no effect on the efficiency of Islamic commercial banks.
6. And finally, inflation with a value of 0.000259726, realgdp with a value of 0.0407788, unemployment with a value of 0.0517161, usdexchange with a value of 3.47726e-05, has a positive value, so it is concluded that inflation rate, real GDP, unemployment rate, USD to IDR exchange, have an effect on efficiency Islamic commercial banks.

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