



The efficiency level of Indonesian banks in the Covid-19 pandemic era and its determinant

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Abstract

Purpose – This study aims to measure the efficiency level of Indonesian Banking in the period 2015-2020, especially in the year 2020 when the Covid-19 pandemic began to spread in Indonesia. In addition, the efficiency determinant was further analyzed to find some factors that affect banking efficiency.

Methodology – Non-parametric approach-Data Envelopment Analysis (DEA) and Tobit Regression were employed as the research methods to determine determinants that affect efficiency level.

Findings – The findings show that the efficiency level of Indonesian Banks experienced a decreasing trend in 2020. The impact of Covid-19 on banking efficiency was also confirmed by RTS, which was included in the Decreasing Return to Scale (DRS) category. Islamic banking scored a higher score of 0.66 than conventional banking, with a score of 0.59. In addition, Indonesian Banks' most crucial variable to be improved during the pandemic is total financing. This study also found that ROA and LDR/FDR significantly affects banking efficiency. Therefore, Indonesian Banks should maintain and increase their bank profitability and financing distributions to improve their efficiency.

Implication – This research can be used as guidelines for policymakers, especially bank management, to improve their weaknesses in terms of banking efficiency.

Originality – This study was the first research that focuses on measuring the efficiency of Islamic banks compared to conventional banks in Indonesia during the Covid-19 and precisely measures the bank's internal factors affecting bank efficiency.

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Introduction

The world is faced with the outbreak of the Covid-19 pandemic, which has triggered a severe crisis for global markets and has become a significant concern of economic policy (Li et al., 2021). All economic players are experiencing an unprecedented problem due to the widespread global spread of the coronavirus. The impact on economic development and financial stability is difficult to predict due to the unique character of this crisis, but it must be addressed urgently. For many countries, this will depend on their ability to restart economic activity and efficiently manage public health hazards. Exogenous shocks to financial institutions, such as banks, have prompted them to prepare for the challenges of a highly demanding and diverse future. The emergence of this crisis has had an impacted of banks in countries (Elnahass et al., 2021).

Banks must maintain profitability, cost-effective financial operations, and support requirements so that banking services can continue operating amid a pandemic. The impact of Covid-19 on the banking industry sector is triggered by the large number of business owner customers who have difficulty paying bank obligations, resulting in bad loans. One of the main consequences of Covid-19 on the banking industry is an increase in the ratio of non-performing loans (NPL) and funding freezes (Baldwin & Mauro, 2020; Park & Shin, 2021). However, unlike the 1997/1998 Asian financial crisis, the problem for the banks this time is more a loan deterioration than a tight liquidity problem.

To prevent the possibility of bad credit, banks began to channel credit very carefully. Due to the inability of customers to pay, some institutions, especially small-scale banks, have seen an increase in cases of bad loans. The occurrence of bad credit cases in several banks is a symptom that bank operations are in bad condition. This was especially felt during the second quarter of 2020 when the stock market dived. In Indonesia, during the Covid-19 pandemic, the national banking non-performing loan (NPL) rate increased from 2.77% in March 2020 to 3.22% in July 2020. This can be seen through the trend depicted in the following graph:

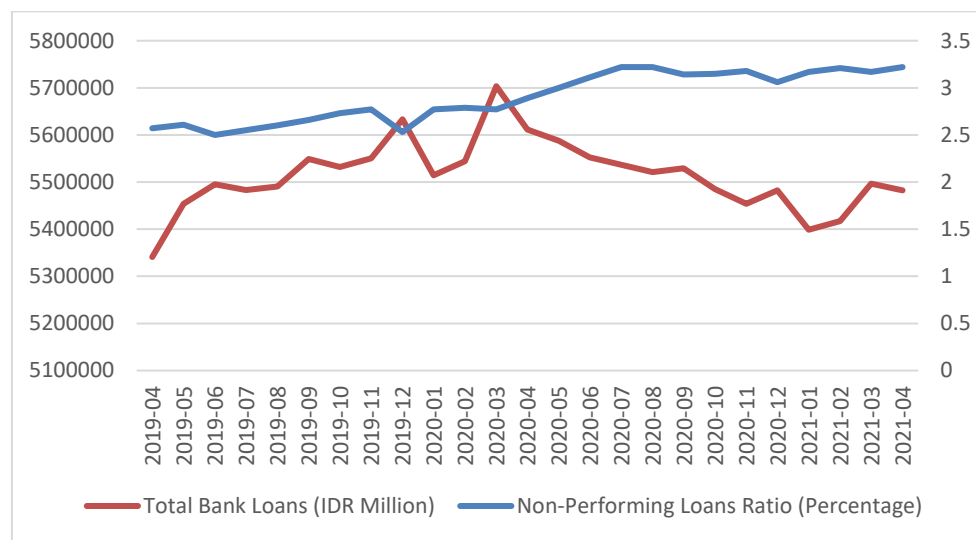


Figure 1. Total Bank Loans and Non-performing Loans Ratio

Despite these constraints, there are high expectations that banks will not only survive financial system shocks but will also become active contributors to broader economic solutions, assisting the government in mitigating the recessive factors affecting the economy caused by pandemic risks. Various government policies in multiple countries aim to maximize banking efficiency so that they can be more optimal in realizing financial prosperity and economic equity, especially in the era of the Covid-19 pandemic, where most countries in the world are affected (Jamaruddin & Markom, 2020). Either through the restructuring process for customers affected by Covid-19, by increasing the financing period, or by providing a grace period of 3-6 months in the future (Habibah, 2020).

Based on the situation mentioned earlier, evaluating a bank's efficiency will become essential, as efficiency reflects a firm's performance and has been seen as a critical factor for stakeholders in creating rational strategic decisions to minimize the risk level of banking operations. Efficiency is crucial for banks because it can measure performance (Sarifuddin et al., 2015). Efficiency is calculated to determine bank performance, particularly during the Covid-19 pandemic. Pandemic conditions can cause several consequences, including financial distress and inefficiency.

Drawn by the rapid developments even during the global financial crisis of 2008, researchers and policymakers worldwide made comparative assessments of the two types of banks using various bank performance metrics. With differences in the nature, principles, and direction of performance, their capacity to deal with the Covid-19 outbreak will also differ. Therefore, information about bank efficiency that compares and conventional banks is essential, thus enabling

policymakers to formulate appropriate and healthy policies to guide their banking industry (Zaini & Karim, 2015).

Various countries have implemented a dual banking system mechanism with a conventional and sharia banking system in the banking industry (Yunita, 2020). Indonesian Government Law No. 21 of 2008 on Islamic Banking stated that Indonesia uses a dual banking system consisting of conventional and Islamic banks. Islamic banks are entities that carry out business activities under Sharia or Islamic legal principles as regulated in the fatwas of the Indonesian Ulema Council (MUI). The study of the efficiency of the banking sector has become an essential part of the banking literature, both with parametric and non-parametric techniques. Most studies have been conducted using the DEA method to evaluate bank efficiency in various countries. Several studies examining the comparative efficiency between Islamic and conventional banks show that Islamic banking is still less effective in multiple countries than conventional banks (Bitar et al., 2020; Rozzani & Rahman, 2013). In contrast, Sakti and Mohamad (2018) show that from 2008 to 2012, Islamic banks in Indonesia were more efficient than conventional banks.

Several studies have progressed more into their research to investigate the key factors influencing the bank's efficiency. Pantas (2021) determined the adverse and significant effects on bank efficiency of the variable Non-performing Financing in Malaysian Islamic banks. The same result was found by Firdaus and Hosen (2014), even though his research shows that the CAR variable also has a negative impact similar to the NPF on bank efficiency. Other studies focused on capital adequacy ratios, operating efficiency ratios, return on assets, return on equity, incapacity to finance, and deposit funding ratios as the determinant of efficiency (Majdina et al., 2019; Hidayati et al., 2017; Sari, 2017; Suryani et al., 2019; Widiarti et al., 2015). Since Covid-19 began to spread widely in Indonesia and became one of the causes of the economic recession that affected the banking sector, the measurement of efficiency can be an essential indicator to assess the bank's survival ability. Evaluating bank efficiency is needed so that banks can act rationally to minimize risk in their operational activities, increase competitiveness, and expand their market share (Hidayati et al., 2017; Pambuko, 2016).

This study examines and compares the efficiency of conventional and Islamic banking in Indonesia during the Covid-19 outbreak. Does the presence of Covid-19 impact the efficiency level of each of these banks. Research on bank efficiency continues to develop, the research method uses a two-stage data development analysis (Firdaus & Hosen, 2013; Pambuko, 2016). In this first phase of research, efficiency measurements will be carried out using the DEA method. Meanwhile, in the second stage, the study will analyze the factors that affect the efficiency of Islamic and conventional banking in Indonesia using the Tobit regression model.

A study that measures the efficiency of Islamic banks compared to conventional banks in Indonesia during the Covid-19 outbreak has never been conducted. Furthermore, this study estimates explicitly the bank's internal factors that can affect bank efficiency. So that the results of this finding can be used as guidelines for policymakers, especially bank management, to improve each type of bank's weaknesses to compete in the global market and achieve the stated goal of increasing market share. In addition, the purpose of strengthening the banking structure during a weak economy can be achieved, and banks can accelerate recovery.

Literature Review

According to Law No. 10 of 1998 concerning Banking, a Bank is a business entity that collects funds from the public in savings and distributes them to the public in the form of credit or other conditions to improve the standard of living of the people. Indonesian banks strive to support the implementation of national development in the framework of increasing equity, economic growth, and national stability to improve the welfare of the general public by doing business based on economic democracy and the precautionary principle (Widiarti et al., 2015).

Devi and Firmansyah (2020) state that a business entity must sustain its financial performance by maintaining high efficiency to be stable in its operations. It does not show the usage of resources beneath the proportions in general, so there will be no waste. Therefore, the

need for operational costs as an input bank can be appropriate to achieve profit. In the end, the output will be completed well and show good efficiency. Efficiency at the bank will demonstrate the bank's ability to maximize production using existing resources (Firmansyah, 2018). According to Farrell (1957), efficiency is divided into two categories: technical efficiency and allocative efficiency. Technical efficiency measures a company's capacity to manage the quantity of input it has to achieve a variety of outputs. Second, allocative efficiency measures a company's ability to optimize input consumption based on price structure and manufacturing technology; these metrics are called economic efficiency. When a company uses technology and proper market pricing to reduce manufacturing costs, it is said to be efficient (Octrina & Mariam, 2021).

The efficiency of financial institutions such as banks may be evaluated through their operations, which explains the relationship between the bank's input and output. The production approach, the intermediation approach, and the asset approach are the categories of activities that are commonly classified (Ascarya & Yumanita, 2009). The production approach defines banking as providing services for depositors and borrowers using all available resources, including labor and physical capital. Under the intermediation approach, banking activities are described as intermediaries that transfer money borrowed from depositors into money lent to borrowers. The third method is a combination of the preceding two. It includes certain specifics of the bank's activities, such as risk management, information processing, and other forms of agency problems, into a modified classical theory of the firm.

Firdaus and Hosen (2014) tried to measure the efficiency of Islamic banking in Indonesia from Quarter II-2010 to Quarter IV-2012 using two stages of analysis, namely: Data Envelopment Analysis (DEA) in the first stage and the Tobit model in the second stage. The study's results found that the efficiency level of Islamic banks in Indonesia during the study period had not yet reached the optimal level of efficiency. The Tobit model reveals that variables such as branch banks, non-performing financing (NPF), and capital adequacy ratio (CAR) have a negative and significant effect on the level of bank efficiency. While the variables of Assets, Return On Assets (ROA), and Return On Equity (ROE) have a positive and significant effect on the efficiency of Islamic banking.

Anwar (2016) evaluated the technical efficiency of Islamic and conventional banks and the determinants of efficiency in Indonesian banking during the period 2002-2010. Using the two-stage method on panel data of 116 banks, consisting of 109 conventional and 7 Islamic banks. The study's results found that the average technical efficiency of commercial banks in Indonesia tended to decline from 2002 to 2010. However, Islamic banks are considered superior to conventional banks. Furthermore, it is concluded that bank size, capital adequacy, and liquidity are essential characteristics to consider when trying to improve bank efficiency.

Furthermore, Majdina et al. (2019) use the Two-Stage Data Envelopment Analysis approach to investigate the efficiency of Islamic and conventional banks in Indonesia and the factors that influence efficiency. Between the first quarter of 2014 and the fourth quarter of 2017, they discovered considerable efficiency disparities between Islamic and conventional banking. NPF and NPL results, on the other hand, had a detrimental impact on the efficiency of Islamic and conventional banks. Assets and CAR had a favorable effect on the efficiency of Islamic banks. Asset and ROA had a considerable positive impact on the efficiency of conventional banks, but CAR had a minor beneficial effect on the efficiency of conventional banks. Finally, ROA has a negligible effect on the efficiency of Islamic banks.

Research Methods

Data Envelopment Analysis

This study uses a quantitative non-parametric approach, Data Envelopment Analysis (DEA) to measure the efficiency of the Decision-Making Unit (in this case banks in Indonesia). DEA is firstly introduced by Farrell (1957), developed by Charnes et al., (1978), and later expanded by Banker et al., (1984). DEA can be used to determine the relative efficiency level of several Decision-Making Units (DMU) and can use many outputs and inputs with different units. In the efficiency literature, DEA is widely used to measure technical efficiency, including the efficiency of financial institutions

(Sharma et al., 2013). There are several methods that can be used to measure the efficiency level of institutions such as. Among others, DEA has several superiorities. First, DEA can be used to determine the relative efficiency level of several Decision-Making Units (DMU)s, and can use many outputs and inputs with different units. Second, the DEA method can also provide information about Decision Making Unit (DMU) that does not use efficient inputs and causes inefficiencies, both in input and output variables. Last, this method can generate information on how much input and output must be adjusted to have a maximum relative efficiency value.

DEA method can also provide information about Decision Making Unit (DMU) that do not use efficient inputs and causes of inefficiencies, both in input and output variables. Last, this method can generate information on how much input and output must be adjusted to have a maximum relative efficiency value. Farrell (1957) as the pioneer in efficiency measurement divided efficiency into technical efficiency and allocative efficiency. The definition of technical efficiency is based on the radial expansion of the factors of production, i.e., inputs and outputs. Technical efficiency could be achieved through either the maximization of outputs with a given number of inputs or input minimization to produce a given number of outputs. Allocative efficiency is the result of choosing the combination of inputs subject to their prices to maximize outputs. DEA Term refers more to the definition of technical efficiency, which is about the relationship between input and output in a business unit (Rusydia, 2013).

In measuring the efficiency of a Decision-Making Unit (DMU) there are two approaches that can be used (Rusydia, 2013). First, the input approach which used to answer how much input quantity can be reduced proportionally to produce the same output quantity. Then, the output approach which answered how much the output quantity can be increased in proportion to the same input quantity. The efficiency score in DEA ranges between 0 and 1 or 100%. An efficient DMU is indicated by 100% score. The lower the score, the less efficient the firm. Using a mathematical equation, the formula of DEA is drawn as follows (Ascarya & Yumanita, 2006).

$$\text{Efficiency of DMU} = \frac{\sum_{k=1}^p u_k y_{kj}}{\sum_{i=1}^m v_i x_{ij}}$$

Whereby:

DMU = decision making unit

n = number of DMU observed

m = different inputs

p = different outputs

μ_k = average output

v_i = average input

x_{ij} = number of input i consumed by DMUj

y_{kj} = number of output k produced by DMUj

There are two DEA models which are frequently employed, namely Charnes et al. (1978) (CCR) model and the Banker, Charnes, and Cooper (BCC) model, introduced in the year 1984 (Coelli, 1996). The primary distinction between the CCR model and the BCC model is the treatment over the return to scale. The CCR model assumes a constant return to scale (CRS) while the BCC model assumes that each DMU operates with the variable return to scale (VRS) (Ascarya & Yumanita, 2006). The CCR model is used with the assumption that changes in the value of output produced by DMU will always be equal to the proportion of adding a certain output value. This is in line with the Constant Return to Scale (CRS) assumption that the production function is fixed. But the CRS model is only applicable when the observed DMU has been operating on an optimal scale. Competition and other financial barriers in most of the time are key factors of firm inefficiency. To anticipate it, the BCC model was proposed. this model assumes changes in the output value generated by DMU are different for each proportion of change in the value of a particular input. This is in line with Variable Return to Scale (VRS), which means that each input does not necessarily produce the same output. VRS model assumes that the ratio between input

and output increment is different, which means that the addition of input x times will not cause the output to increase by x times, it can be smaller or larger.

A firm should be very sensitive to the issue of output scale (commonly called return to scale (RTS)) (Siswandi and Arafat (2004). In practice, a firm is experiencing one of three RTS conditions, namely increasing return to scale (IRS), constant return to scale (CRS), and decreasing return to scale (DRS). The IRS condition assumes that every increase of x times of input will produce more than y times of output. The CRS condition assumes that every increase of $1x$ input will produce $1y$ output. Meanwhile, the DRS assumes that every increase of 1 unit of input will produce less than 1 unit of output. Briefly, the DEA method can be explained by the Figure 2.

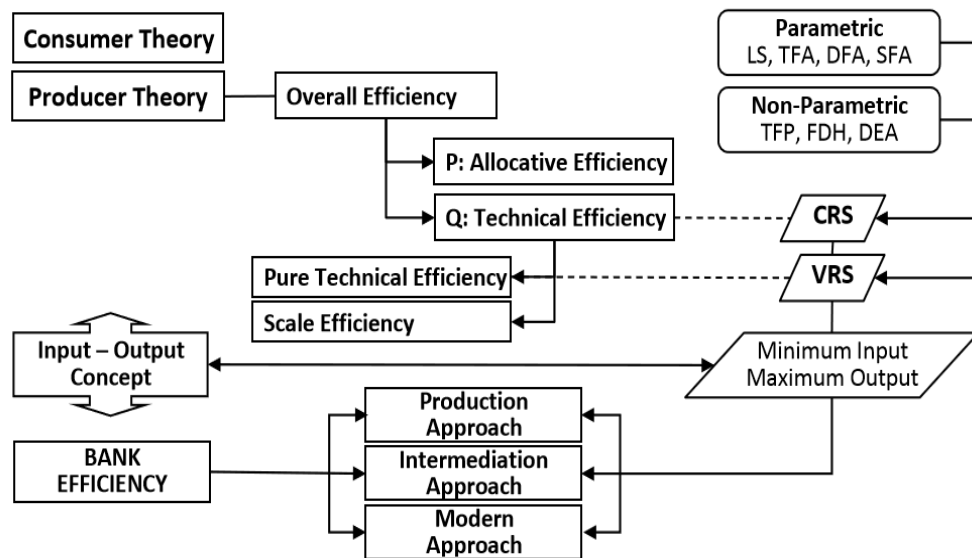


Figure 2. DEA Model (Ascarya & Yumanita, 2006)

In this study, we used DEA by using input-oriented with assuming Variable Return to Scale (VRS). This model assumes that the ratio between input and output increment is different, which means that the addition of input x times will not cause output to increase by x times, it can be smaller or larger. The VRS model is used to determine the level of efficiency in each regional expenditure. Uses of Input oriented mean that DEA results will be oriented to what percentage of inputs can be reduced by a fixed level of output. This study focuses on analyzing the efficiency of 30 banks (both conventional and Syariah) in Indonesia, in the 2015 to 2020 period. In measuring efficiency level, this study uses the VRS model based on the input approach. The input variables used in this study are fixed asset, labor cost, and third party funds, whereas output variables used are total financing and operating revenues. The selection of input-output variables is in line with Sufian (2007), Ascarya and Yumanita, (2006) and, Rusydiana and Marlina, (2019). Data related to the input and output variables used were obtained from the financial statements and annual reports of each bank The analytical tool is the MAXDea 8 software. Table 1 provides an overview of the statistical descriptive input and output variables.

Table I. Statistical Descriptive Input and Output Variables (in US Dollar)

Variable	Mean	StDev	Max	Min
Input				
Fixed Asset	5.070.671	9.426.437	46.728.153	2.21
Labor Cost	3.063.682	4.946.009	26.319.791	7.316
Third-Party Funds	134.160.295	233.546.492	1.087.555.173	40.162
Output				
Total Financing	114.440.359	203.546.492	899.458.207	5.066
Operating Revenues	13.811.832	23.952.390	111.157.163	31.277

To comprehensively analyse the internal factors that affect banking profitability, this study used three types of profitability ratios, namely ROA, ROE, NIM, as done by Menicucci and Paolucci (2016). In Table 1 is the definition of variables and measurements used in this study.

Tobit Regression

The second research stage employs Tobit regression. Hoff (2007) argued that the Tobit approach as the second stage of DEA is sufficient in most cases. The method is introduced by James Tobin in the year 1958 to evaluate the relationship between limited dependent variables and independent variables (Gujarati, 2008). Initially, he wants to evaluate the expenditure of American households to buy cars. However, this creates a problem in the OLS estimation as some households may not buy a car (zero expenditure). The estimation will tend to be zero and not significant. If it is significant, the value will be bias and not consistent Tobin (1958). In the Tobit regression model, the estimation is based on the result of Maximum Likelihood (ML). The result of parameter estimation is more accurate compared with OLS. Tobit regression is also known as a censored regression (Gujarati, 2008). The use of Tobit in this research is to evaluate determinants of efficiency value (dependent variable) as the score lies between 0 and 1. Several variables on a bank's financial ratio have been selected as the independent variables namely size/total asset, age (internal), branch/number of offices, and the type of organization. The data used in running the tobit regression are panel data, where the Tobit model of the research is as follows:

$$Y_t = \beta_0 + \beta_1 CAR + \beta_2 NPL_NPF + \beta_3 ROA + \beta_4 LDR_FDR + \beta_5 SIZE + \mu$$

Table 2. Tobit Variable Specification

Tobit Variable	Definition	References	Source of Data
Efficiency (Y)	Relative efficiency scores obtained from DEA computation		MaxDea 8
CAR	The ratio of risky capital to the risk-weighted asset	Nasution et al (2020), Devi and Firmansyah (2020), Hidayati et al. (2017)	Bank financial ratio -OJK's website
NPL/NPF	Non-performing loan/financing ratio to the total financing	Sufian (2009), Řepková (2015), Jiménez-Hernandez et al (2019), Devi and Firmansyah (2020), Rozzani and Rahman (2013)	Bank financial ratio -OJK's website
ROA	The ratio of annualized earnings before taxes to average assets	Sufian (2009), Řepková (2015), Nasution et al (2020), Devi and Firmansyah (2020)	Bank financial ratio -OJK's website
LDR/FDR	The ratio of loan/financing to the third-party funds	Otaviya and Rani (2020), Řepková (2015), Nasution et al (2020), Hidayati et al. (2017)	Bank financial ratio -OJK's website

Results and Discussion

Efficiency Level of Indonesian Banks

The results will be displayed through an efficiency score with a range of 0-1. A score of 100% describes the bank's ability to manage its input and output variable already optimal. Meanwhile, if the efficiency score is further away from 1, it can be indicated that the bank is inefficient or has not managed its input and output variable optimally. The efficiency scores of Indonesian Banks after data processing can be seen in Table 3.

BRI is the only bank that gets the maximum score, with a relative efficiency value equal to one during the study period. This result is in line with the research by Kristianto and Hendrawan (2020) and Hendrawan and Nasution (2018) where BRI is the most efficient bank compared to other banks during the study period, while BCA Syariah has the lowest efficiency score with an average

value of 0.59. Meanwhile, based on observations during the research period, the average value of banking efficiency in Indonesia fluctuates every year. The average value of banking efficiency in Indonesia decreased from 2015 to 2017. Then there was an increase in 2018 and 2019, and a decline again in 2020 when Covid-19 began to spread in Indonesia. The spread of Covid-19 has already affected banking activities in many countries, and it has triggered precautionary reactions on the part of the depositors) and counterparties of financial intermediaries (Baldwin et al., 2020).

Table 3. Efficiency Level of Indonesian Banks

DMU	VRS							RTS
	2015	2016	2017	2018	2019	2020		
Mandiri	1,00	1,00	0,96	1,00	1,00	0,93	DRS	
BRI	1,00	1,00	1,00	0,99	1,00	1,00	DRS	
BCA	0,96	0,94	0,94	0,97	0,99	1,00	DRS	
BTN	1,00	0,98	0,97	1,00	1,00	0,99	DRS	
BNI	0,94	0,91	0,89	0,96	0,97	1,00	DRS	
CIMB Niaga	0,67	0,70	0,69	0,67	0,68	0,59	DRS	
OCBC NISP	0,80	0,71	0,75	0,77	0,76	0,78	DRS	
Panin	0,76	0,86	0,81	0,88	0,84	0,96	DRS	
Danamon	0,96	1,00	0,99	1,00	1,00	0,93	DRS	
BTPN	0,93	0,81	0,86	0,90	1,00	0,95	DRS	
Permata	0,83	0,70	0,71	0,64	0,80	0,89	DRS	
Maybank Indonesia	0,90	0,85	0,85	0,84	0,81	0,70	DRS	
Mega	0,81	0,79	0,77	0,73	0,72	0,86	DRS	
HSBC	1,00	0,89	0,72	0,84	0,76	0,63	DRS	
DKI Bank	0,72	0,88	0,69	0,76	0,68	0,61	DRS	
DBS Bank	1,00	0,90	0,89	0,73	0,71	0,76	DRS	
Aceh Syariah Bank	1,00	0,57	0,69	0,70	0,65	0,57	DRS	
BPD NTB Syariah	1,00	0,91	1,00	1,00	0,76	0,76	DRS	
Muamalat	0,86	0,72	0,79	0,62	0,59	0,60	DRS	
Victoria Syariah	0,75	0,59	0,67	0,72	0,77	0,80	DRS	
BRI Syariah	0,98	0,98	0,95	1,00	0,99	1,00	DRS	
BNI Syariah	0,84	0,77	0,80	0,73	0,68	0,58	DRS	
BSM	0,95	0,98	1,00	1,00	1,00	0,92	DRS	
Jabar Banten Syariah Bank	0,86	0,77	0,70	0,70	0,72	0,70	DRS	
Mega Syariah	0,68	0,76	0,77	0,71	0,78	0,80	DRS	
Panin Dubai Syariah	1,00	0,84	0,78	0,71	1,00	1,00	DRS	
Bukopin Syariah	0,92	0,85	0,77	0,84	0,85	1,00	DRS	
BCA Syariah	0,57	0,55	0,58	0,60	0,63	0,58	DRS	
BTPN Syariah	0,92	0,89	0,60	0,66	1,00	0,94	DRS	
Maybank Syariah Indonesia	1,00	0,99	0,85	1,00	1,00	0,77	IRS	
Mean	0,89	0,84	0,81	0,82	0,84	0,82		

Table 3 also shows Return to Scale (RTS) which is used as an indicator to describe how well the bank's ability to produce its output. In the relationship between production factors or inputs with the level of production or output, RTS describes the response of output to a proportional change in input. In this case, 29 of the 30 banks studied experienced a Decreasing Return to Scale (DRS) condition, which indicates that an increase in all inputs the same amount causes a disproportionate increase in total output, this occurs when the increase in output is smaller than the added input. This result also indirectly confirms the results of the first finding which shows a decrease in the efficiency level of all banks in 2020 or during the Covid-19 pandemic.

Efficiency Comparison of Conventional and Islamic Banking

Furthermore, a comparison will be made on banking efficiency based on the classification of conventional banks and Islamic banks. The comparison is made by looking at the average efficiency value of conventional and Islamic banking each year during the five-year study period.

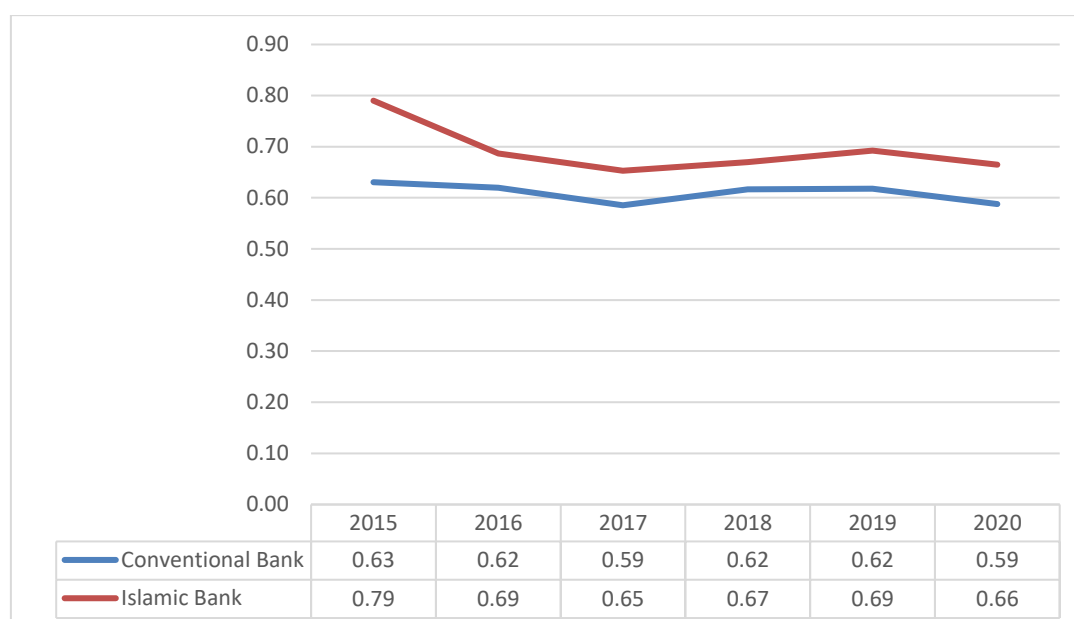


Figure 3. Comparison of the Efficiency of Islamic and Conventional Banks

Table 4. Potential Improvement Analysis

Bank	Input Variable			Output Variable	
	Fixed Asset	Labor Cost	Third-Party Funds	Total Financing	Operating Revenues
Aceh Syariah Bank	-39,24	-39,24	-39,24	0,00	0,00
BNI Syariah	-41,13	-41,13	-41,13	0,00	0,00
BPD NTB Syariah	-16,27	-16,27	-16,27	12,35	0,00
BRI Syariah	0,00	0,00	0,00	0,00	0,00
BTPN	0,00	0,00	0,00	0,00	0,00
BCA Syariah	-41,62	-16,99	-16,99	40,71	0,00
CIMB Niaga	-62,11	-46,26	-46,26	4292,53	0,00
Danamon Bank	-3,68	-32,61	-3,68	318,83	0,00
DBS Bank	-27,12	-27,12	-27,12	14,97	0,00
DKI Bank	-34,49	-34,49	-34,49	0,00	0,00
HSBC	-7,63	-36,74	-7,63	0,00	42,75
Jabar Banten Syariah Bank	-35,15	-24,94	-24,94	12,88	0,00
Mandiri Bank	-49,12	-21,12	-21,12	0,00	0,00
Maybank Indonesia	-33,97	-33,97	-33,97	0,00	0,00
Mega Bank	-82,15	-19,65	-19,65	39,24	0,00
Mega Syariah Bank	-59,43	-9,00	-9,00	62,10	0,00
Muamalat Syariah Bank	-60,43	-45,53	-45,53	0,00	0,00
BNI	-65,70	-18,43	-18,43	0,00	0,00
OCBC NISP	-34,85	-34,85	-37,69	0,00	13,77
Panin Bank	-75,30	-16,00	-16,00	1655,31	0,00
Panin Dubai Syariah Bank	0,00	0,00	0,00	0,00	0,00
Permata Bank	-11,31	-11,31	-11,31	0,00	48,79
BRI	-28,87	-28,87	-28,87	2,90	0,00
Syariah Bukopin Bank	0,00	0,00	0,00	0,00	0,00
BSM (BSI)	0,00	0,00	0,00	0,00	0,00
BTN	0,00	0,00	0,00	0,00	0,00
BTPN Syariah	0,00	0,00	0,00	0,00	0,00
Victoria Syariah Bank	0,00	0,00	0,00	0,00	0,00
BCA Syariah	-37,71	-37,71	-37,71	0,00	0,00
Maybank Syariah Indonesia	0,00	0,00	0,00	0,00	0,00
Mean	-28,24	-19,74	-17,90	215,06	3,51

Based on Figure 3, the efficiency value of Islamic banking is higher than conventional banking. The results of this analysis are in line with (Musa et al., 2020; Nafla & Hammas, 2016; Parsa, 2020), where Islamic banks are considered more efficient than conventional banks. However, several other research results contradict the results of this study (Wafik & Tharwat, 2015; Khalil & Siddiqui, 2019; Matar, 2017; Khan et al., 2018). Interestingly, Islamic and conventional banks showed a similar pattern during the research period. There was a decrease in the average efficiency value in 2015-2017, then slightly improved until 2019, and decreased again in 2020. In Indonesia, overall banking performance declined when Covid-19 began to spread (Nugroho et al., 2020).

Besides producing efficiency values, the DEA method can also make potential improvements or the level of improvement needed to achieve optimal efficiency values. So, it can be known which variables need to be optimized. Analysis of potential improvement is carried out using the last year of observation and is carried out separately from previous years, to describe the real value that must be achieved. The results of the measurement of potential improvement can be seen in Table 4.

The table shows the potential improvement that each bank should make to achieve maximum efficiency level. The percentage on the input variable means that the banks did not optimize the uses of their inputs yet to generate more output. At the same time, the rate on output variables means that the banks must increase and improve their output variable by the value above to achieve maximum efficiency.

Based on input variables, Mega Bank has the highest value to be optimized, which is a fixed asset (82,15%). CIMB Niaga needs to optimize its Labor cost and Third-Party funds by 46,26% to achieve efficiency. Total financing is the highest value that needs to be increased on output variables. CIMB Niaga has the highest potential improvement in total financing (4292, 53), followed by Panin Bank (1655,31%). On the other hand, the highest percentage to be increasing in operating revenue need to be achieved by Permata Bank and HSBC by 48,79% and 42,75%, respectively. On average, the problem in outputs is higher than inputs, especially on total financing. The total financing includes total credit in conventional banks, and total financing in Islamic banks. Banks need to find a better strategy to increase their total financing in this Covid-19 pandemic. In addition, Banks also should pay attention to their use on input variables. The table above shows that the potential improvement should be made on inputs to be more evenly distributed in each bank. In this Covid-19 pandemic, where most of the banking industry is affected, the bank needs to optimize every use of their input to keep their balance sheet balanced.

Tobit Regression Analysis

The Tobit model will be used to analyze the elements that affect the efficiency level of Islamic and conventional banks in the following research stage, resulting in the "Two-Stage Data Envelopment Analysis" for the entire approach in this study. The Eviews 11 software program was used to analyze the Tobit model. The results are used to conclude the factors influencing the efficiency of Islamic and conventional banks. The following are the findings of the Tobit regression analysis:

Table 5. Tobit Regression Result

Variable	Coefficient	Prob
CAR	-0.001431	0.063
NPL_NPF	0.008525	0.346
ROA	0.007336	0.05
LDR_FDR	0.001163	0

Based on the result analysis in Table 5, it could be seen that some variables gave positive and negative impacts. However, not all variables gave significant influence, or it could be said that some variables did not provide real influence. Thus, by using this Tobit model, we could see that the CAR variable has a coefficient value of -0.001431, which shows a negative effect, but it's not significant to the banking efficiency due to its significant value of $0.063 > 0.05$. Because banks are

regulated entities, the capital adequacy ratio cannot be used alone to determine bank efficiency. Capital adequacy is the starting point for business activity; it creates effective bank operations. By integrating numerous additional variables under management's control, capital adequacy becomes the basis for constructing an efficiency strategy (Pantas, 2021).

This study also found that NPL/NPF variable has a coefficient value of 0.008525, showing a positive effect but not significant to the banking efficiency due to its significant value of $0.346 > 0.05$. This means that the credit risk faced by banks does not affect the level of banking efficiency. This could happen because banks that channel more financing to the public will face greater risks. However, banks can maintain their profitability and efficiency, supported by sufficient capital. This result is in line with Rozzani & Rahman (2013), Anwar (2016), and Majdina et al., (2019).

Furthermore, ROA has a coefficient value of 0.007336, shows a positive effect, and its significance in influencing banking efficiency due to its significant value of 0.05. This was because a bank that could generate more profit could be considered efficient. According to Anwar (2016), the positive relationship between ROA and banking efficiency suggests that as a bank's profitability rises, its efficiency also increases. Then, the LDR_FDR variable has a significant positive effect on banking efficiency. This suggests that the bank will become more efficient as financing distribution increases. The LDR value is a ratio used to assess bank liquidity quality and intermediation performance. The better the bank's intermediation function, the higher the LDR. The result supported the study conducted by Suryani et al., (2019). At the same time, this result contradicts Hidayati et al. (2017).

The results generally show that Indonesian Banks face a high probability of default and have high asset risk during this outbreak. However, our results also show that banks have reduced their operational risk, as confirmed by the significant positive relationship between the ROA and efficiency variables. In addition, the liquidity ratio indicated by the LDR_FDR variable shows a significant positive coefficient on efficiency related to the intermediation function, which is a factor that causes banks to be efficient. This means that banks can maintain asset quality and lower credit risk levels through effective credit restructuring policies and loan default plans when facing crises such as the Covid-19 outbreak.

Conclusion

This study measured and compared the efficiency level of 30 Indonesian banks (both conventional and Sharia banks) in the 2015 to 2020 period. The efficiency determinant was then further analyzed to find the bank's internal factors affecting efficiency achievement. The result shows that the average efficiency score of Indonesian Banks fluctuated throughout the study period. BRI is the only bank with the highest efficiency value of 1 during the study period. Furthermore, comparing efficiency scores shows that Islamic banks achieve a higher score than conventional banks. However, both Islamic and conventional banks showed similar patterns: a decrease in average efficiency during the Covid-19 pandemic.

This study also provides potential improvement recommendations for each inefficient input and output variable. The potential improvement analysis shows that Indonesian Banks need to improve the output variable of the total financing to achieve optimal efficiency scores. The total financing includes total credit in conventional banks and total financing in Islamic banks. Banks must find a better strategy to increase their total financing, especially in this Covid-19 pandemic.

Further analysis is shown by Tobit regression, whereby ROA and LDR/FDR had a significant positive impact on banking efficiency. It means that Indonesian banking will become more efficient as the bank's profitability and financing distributions increase. However, CAR has a negative, not significant effect on banking efficiency. Banks are regulated entities; the capital adequacy ratio cannot be used alone to determine bank efficiency. Lastly, the result of Tobit regression showed that NPL/NPF had no significant effect on efficiency. This can be explained by the banks that channel more financing to the public and will face greater risk.

Indonesian banking (both Islamic and conventional) needs to optimize its resources and improve the total financing and revenue to increase efficiency, especially in cases like this Covid-

19 pandemic. The management of Indonesian banking must also evaluate existing regulations to improve efficiency, maintain performance and upgrade service quality. Also needed support from the policymakers to strengthen supervision and guidance to enhance the bank's efficiency level. Improving the quality of human resources and providing innovation in banking products are needed to provide more varied choices for customers so that the financing can be more optimal.

This study has a limitation related to the data of the study period, which was only analyzed on 6 years. Further study could use more extended data to produce more robust results. Further research is also suggested to be conducted by updating the related data, especially in 2021, because the pandemic period is still not over. This study also only uses the internal variable (bank's financial ratio) as the independent variable. The uses of other external variables such as GDP, inflation, and economic growth also suggested to the next research to see more comprehensive determinants that affects the efficiency achievement of Indonesian Banks.

Author Contributions

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