

## The Efficiency of Local and International Banks in Indonesia

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### ABSTRACT

This study uses two stages, first measure the technical effectiveness of banking using the data envelopment analysis (DEA), and the second stage to estimate the influence of macroeconomic variables, namely interest rate, inflation rate, and exchange rate against the efficiency of local and international banks using Tobit's regression model. Based on the results of the measurement of the effectiveness of local and international banks using the DEA method, it was found that on average the level of efficiency of local and international banks have not yet reached the level of effectiveness of optimal 100% and the level of ability of local banks has the higher efficiency level than foreign banks.



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## INTRODUCTION

The aspect of efficiency for the national banking industry is one of the essential elements that must be considered by the management of the bank to be able to produce the financial performance of healthy and sustainable production. According to efficiency is an essential measure of the bank's operational conditions and became one of the critical indicators of a successful bank (Wheelock and Wilson, 1995). While considers the importance of efficiency for banks can be reviewed from the perspective of the micro and the macro. Based on the view of the micro, in the conditions of increasingly sharp competition, then a bank that can survive and thrive must be efficient in its operations. From a macro perspective, the banking industry can efficiently affect the financial intermediation cost and the financial system's overall stability (Berger and Mester, 1997). This is due to the strategic role of the banking industry as an intermediary and producer services-financial services. With a higher efficiency level, the performance of banking will increasingly be better in allocating financial resources, and in the end, it can increase investment activity and economic growth (Weill, 2003).

The level of efficiency of a bank is primarily determined by factors that can be controlled by the company's management and factors outside the control of management. Internal factor is a determinant which describes the policy and management decisions of the bank itself, such as the raising and use of fund management, capital management, liquidity management and cost management (Bararuallo and Aba, 2019). Meanwhile, the determinant of external influences is influenced by many macroeconomic variables, among others, the level of inflation and interest rates. Increase as the indicator of macroeconomic stability, and is directly related to the level of interest rates, and further costs and interest income. Macroeconomic instability, in general, will cause an impact on the performance of the banking sector (Domikowsky et al., 2017).. Banks' ability to manage interest rates under conditions of high inflation may affect the cost structure of the bank and further affect the efficiency level.

Also, with a high level of inflation, it causes the power of the rich people who are resembled with a reduced ability to save their funds in the bank. The decrease in the number of funds deposited in banks due to high inflation rates has an impact on the banks' performance that is burdened with high operational costs (Suhartoko and Aba, 2019). In contrast, the income from them has reduced interest rates so that the operational costs are low. While, with high-interest rates, on one side of the bank, it becomes attractive for customers to deposit their funds to get certain benefits, while, on the other hand, the distribution of credit makes the bank operate at a higher cost and on an operational

basis. On the other hand, the delivery of a loan makes the bank work functionally and does not have high operational costs.

The turmoil in changing the macroeconomic conditions has proven to be able to destabilize the national sacrifice system. The financial crisis that occurred in the middle of 1997, which was marked by the Indonesia Rupiah (IDR) exchange rate appreciation, double-digit inflation rates, and high-interest rates, has provided valuable lessons for the sacrificial industry in Indonesia. The crisis has caused Indonesian victims to suffer inferior performance, especially financial distress. Besides that, many banks have experienced competitive rates in their operational activities, namely the interest income from credit is smaller than the obligation to pay interest in advance (McCullough et al., 2006). This condition has been exacerbated due to the government's actions to liquidate 54 banks during the 1997-1999 period so that the trust of the public has led to the sharp decline of victims. The reason for all this is that national sacrifice has not been able to meditate in any way.

The spread of illiteracy that stimulates the influence of macroeconomic variables on the performance of bank efficiency is still relatively limited. Many large-scale empirical studies again focus on measuring the performance of the institutions, both using the parametric and non-parametric bonding study both in the developed gates and in the gates of the development, for example; It has been investigating the influence of macroeconomic factors on the efficiency of the banking sector, among others, the results of which show that the impact of macroeconomic factors on the ability of the banking sector, among others, in the year of 1997/1998, the results of the crisis 2006 (Krichene, 2017). Has a significant impact on the sacrifice of sacrifice. This research aims to find out the effect of. Macroeconomic variables include interest rates, inflation, and exchange rates in Indonesia's local and international banks.

## LITERATURE REVIEW

Evaluation is a basic word that means judgment. This assessment is not easy because we are not obtained to be objective. Everything must be by the existing assessment criteria (Zingales, 2015). Therefore, in implementing policy, and evaluation phase must be carried out from the activities that have been carried out by seeing whether it is appropriate or has achieved the objectives of the policy (Burton et al, 2017). Some of the criteria used as the basis for evaluating public policies are effectiveness, efficiency, adequacy, leveling, responsiveness, and accuracy. One of the most popular evaluation methods for measuring efficiency criteria is DEA or data envelopment analysis (Cooper et al., 2007). Efficiency is a measure of success that is assessed in terms of the number of resources/costs to achieve the activities carried revealed that efficiency is the best Comparison between input and output (the results between profits and sources used), as well as optimal results achieved with limited resources. In other words, the relationship between what has been resolved. From this statement, it can be concluded that the DEA method will later compare input and output to measure the level of success of an activity (Radam et al., 2002).

Charles, Cooper, and Rhodes introduced DEA. This method is one of the evaluation assistance tools to examine the performance of an activity in an entity unit. Eriņa and Eriņš (2013), suggested that DEA is a mathematical programming technique used to evaluate the relative efficiency of a collection of decision-making units (DMUs) in managing resources (inputs) with the same type so that it becomes the result (output) ) of the same kind, where the relationship of the form of the function from input to output is known. According to Cooper et al., (2011), DEA is an evaluation tool for the process activities in a system or work unit. The evaluation is a comparative evaluation or relative between one group with another unit in one organization with another organization. This relative measurement results in two or more work units with 100% efficiency, which are used as benchmarks for other work units to determine corrective measures. From these statements, it can be concluded that the DEA method is used to evaluate the performance of a group, which by using this analysis, can know which units and what factors should be improved in that unit. In principle, the DEA method follows a non-parametric approach based on Linear Programming. Each method of analysis must have advantages and disadvantages as well as this DEA method (Cooper et al., 2007). The benefits of this evaluation technique are: (i). Can handle multiple inputs and multiple outputs; (ii). No need to know the relationship between inputs and outputs; (iii). Can be used with different input and output data units; (iv). Comparison can be seen directly from the output of the resulting processing. While the weaknesses of the DEA analysis are: (i). To measure the error rate is

influenced by the level of significance; (ii). In DEA it does not measure absolute efficiency; (iii). The statistical test used must be manual not applicable.

The working principle of DEA is to compare input and output data from a data organization, or what is called a decision-making unit (DMU), with other input and output data in a similar DMU. This Comparison is made to get a value of efficiency. The efficiency determined by the DEA method is a relative value, so it is not an absolute value that can be achieved by a unit. The DMU with the best performance will have the level of efficiency expressed in the amount of 100%, while other DMUs below it will have varying efficiency values, between 0% to 100%. The steps in measuring the efficiency value in the DEA (Cooper et al., 2007). method are as follows: (i). Perform DMU determination (decision-making unit); (ii). Determine the input variables and output variables; (iii). Analyze to obtain the value of relative efficiency. Two models are often used, namely constant return to scale (CRS) and charnes-cooper-rhodes (CCR) Super Efficiency.

There are several definitions of efficiency proposed by several authors, among others: (Yang et al., 2015) define efficiency is the ratio between actual cost and budget. Efficiency is always measured by using a flexible budget, not the static budget. Diebold and Yilmaz (2009), defines efficiency as the ratio between output to input or the amount of the production per unit compared with the input. For example, responsibility center A is more efficient than responsibility center B; if the responsibility centered A using, fewer inputs than responsibility center B but produces the same output or to obtain more significant results while the input is the same. According to Da Silva Filho et al (2012), the efficiency is: the ratio between output to input or the amount of output produced from one unit is used. Central accountability is said to be efficient if the center of the liability that (i). Using a cost resource or input to produce output in the same amount; (ii). Use the source or input cost the same to produce the output larger. From the above notions, in essence, understanding the efficiency is the same, namely a comparison between the results output with the resources inputs.

Conduct research on the effect of macroeconomic variables on banking efficiency in Indonesia. Macro-economic factors affect the estimation results using the Tobit regression model showed that the variable interest rate affects the technical ability of banks is negative, while the rate of inflation and exchange rate positive effect. The empirical findings of the research in these journals had implications for national banks, especially banks that are listed on the Stock Exchange (Aba et al., 2019; Acharya and Ryan, 2016): (i) the bank should improve technical efficiency in its operations to achieve a score of efficiency of optimal 100 percent, and (ii) with better technical efficiency. The bank may face changes in turbulence that occur in macroeconomic factors, especially interest rates, inflation rates, and exchange rates.

It conducted a study on the determinants of efficiency in the banking industry in Latin America. The results of the research of the international journal showed that the level of capitalization, profitability ratios, interest rate differential, and gross domestic product (GDP) growth positively affect the efficiency of larger banks. Meanwhile, loan loss reserve, the value of shares traded, and the inflation rate negatively affect the banks' ability (Hassan and Sanchez, 2007).

It conducted a study on the determinants of the efficiency of banks in ten European countries. Research in the international journal of this model using two-stage semi-parametric to test the influence of specific banks, industry-specific, and macroeconomic variables on bank efficiency. An essential finding of this study is that foreign ownership, market interest rates, and GDP growth positively affect the bank's ability. While credit risk and concentration of the industry affect the efficiency of banks negatively (Pasiouras et al., 2009).

Evaluating the efficiency of banks in countries that use the outline Meta, which is calculated with the DEA. Further, using a Tobit regression to investigate the influence of the institutions, specific financial, and the bank is a determinant of the bank's efficiency. The findings of the international journal indicate that the efficiency score of banks in countries using the line of Meta by 67 percent. For the determinants of efficiency, suggesting that banks with large capitalization, liquidity, and the development of the stock market increase the ability of the bank while lending to sectors private and market concentration, the great cause of the efficiency of banks is low (Naceur et al., 2009).

Using the DEA methodology to measure the scores of technical efficiency between groups of banks in Jamaica during the period 1998-2007. To estimate the factors affecting technical ability utilizing the technique of panel data, the results of the international empirical journal of this suggested

that the income and the size of the banks affect the efficiency of the bank in the opposite direction. In contrast, the GDP growth positively influences the effectiveness of the bank (Daley and Matthews, 2009).

To test the determinants of cost efficiency of commercial banks in India during the period 1992-2006. To calculate the efficiency score, the journal of the international used the parametric stochastic frontier approach (SFA) and estimate the determinants of efficiency score applying the Tobit regression. The results of measurements of the cost efficiency of commercial banks in India showed a decline during the study period (Kalluru and Bhat, 2009). They also found that bank earnings' capacity is the determinant of the bank's main efficiency. The new factor is the diversification and activity of non-interest.

## RESEARCH METHODOLOGY

In this research, I use quantitative analysis by looking for information about symptoms, defined with clear objectives to be achieved, planning how to approach, and collecting data as a material for making the report. In this study, the authors want to determine the effect of macroeconomic variables on the efficiency of local and international banks in Indonesia.

### Operational definition of variables

This research evaluated the influence of macroeconomic factors on the efficiency of banks that have total assets of Indonesia's most significant. The population in this research is bank Indonesia which amounted to a total of 134 banks. The sample of this research is local and international banks that have total assets of the largest of 10 banks, five local banks, and five foreign banks. While the selection of the sample in this research using a purposive sampling method, namely by using specific criteria in making the selection of the sample. Criteria for selection of sample in this research is (Al-Harbi, 2019): (i) Bank has data financial statements complete and available to the public; (ii) The Bank does not face big problems that can interfere with the performance of the commercial; (iii) The Bank enters in the ranking of the total assets of the largest in Indonesia as of the first quarter of 2019. Based on the criteria of sample selection, then the selected ten banks in the study sample is to be analyzed further, namely the five local banks and five international banks.

Performance measurement of technical efficiency against the ten banks that became a research sample is measured by using Data Envelopment Analysis (DEA) with the approach of intermediation where the output variable consists of Total Financing (Y1), and the Total Operating Income (Y2). In contrast, the input variables include Total Third Party Fund (X1), labor Cost (X2), and Fixed Assets (X3). Then to estimate the influence of macroeconomic variables on the performance of banking efficiency using the Tobit regression model.

### The research variables

The variables used in this study are the efficiency (Independent Variable) derived from the Total Financing, Total Operating Revenue, Total Third-Party Funds, Cost of Labor, and Fixed Assets. While macroeconomic variables (Dependent Variable) used is the Interest Rate, Inflation, and Exchange rates.

**Efficiency:** According to (Bonin et al., 2005; Anayiotos et al., 2010), efficiency is: The comparison between the output with the input or the amount of output produced from one unit of used. A responsibility center is said to be efficient if the center of that accountability (Charnes et al., 1978): (i). Using a cost resource or input to produce output in the same amount; (ii). Using the source or the cost or put them together to produce output. From the above notions, in essence, understanding the efficiency is the same, namely a comparison between the results (output) with the resources (inputs) or the amount of output produced from the one input used.

The Total Financing is the provision of money or bills equivalent, based on approval or agreement between Banks with another party that requires the financed party to return the funds or bill after a certain period with a reward or for the results by (Broni et al, 2019). Without operating income, the Bank will not run properly. Operating income will be used to finance some operational costs, improve the performance of the Bank, and also for the capital. The Bank should not be forever dependent on third parties. Though a lot of credit applications, the banks continue to be selective, especially if the funds owned by the Bank is not how big (Bushman et al, 2015). Operating income

obtained by the Bank consists of all the income from operating activities direct a been accepted. Operating income in the form of the interest, commissions, fees, income on foreign exchange transactions, and other income. Revenue from interest earned is the primary income obtained from the distribution of funds from the Bank to the customer, the income of the investment bank to the customer.

The definition of third-party funds according to (Granja, 2018) is as follows: third-party funding (TPF) is a fund sourced from the public that is shaped demand deposits, time deposits, certificates of deposit, savings or equivalent, the largest funding source that is most relied upon by the Bank. Banks can utilize these funds to be income, namely by distributing the funds. The Bank can disburse the funds to the community in the form of financing. The higher the revenue generated by the Bank, means the greater the chance the Bank in making profits so that the Bank will be more interested in increasing the number of distribution of funds to the community.

Labor cost is named the number of wages and salaries paid to the workers. Fixed assets are tangible assets used in operating the company and not intended for sale in the framework of the company's normal activities (Charnes et al.,1978). Assets usually have a period of prolonged usage and expected member benefits in the company for many years. The benefits given fixed assets is generally increasingly decreasing, except for the benefits provided by the land. Assets used in the operation of the company, there are two types, namely tangible assets and intangible assets.

**The Interest rate** is dependent on the loan money, which is usually expressed by a percentage of the money lent (Rossetti et al, 2017). One the interest Rate is the interest rate shown in percent, a specified period (monthly or annually). Rates are distinguished into two, namely : (i). Nominal interest rates are the rate that can be observed in the market; (ii). Real interest rates are a concept that measures the interest rate. The actual real interest rates equal nominal interest rates reduced by the percentage of expected inflation.

**Inflation** according to Chen et al., (2015), inflation is the tendency of prices to an ascending thoroughly and continuously. The rise in the amount of one or two goods alone is not called inflation, except when the increase is widespread or results in an increase in most of the price of other products, namely the amount of food, cost of food, beverages, cigarettes, and tobacco, the price of clothing, the price of the health, education, recreation, and sports, the price of transportation, communication, and financial services.

**Exchange Rate;** The value of the currency exchange rate or what is commonly called the exchange rate is the price of one unit foreign currency in domestic currency or can also be said the cost of the local currency against the foreign money (Aba;2018). For example exchange rate of the Rupiah against us Dollar (USD) is the price of one American Dollar (USD) in Indonesian Rupiah (IDR) or can otherwise also be interpreted the price of one of the Indonesian Rupiah against the US Dollar.

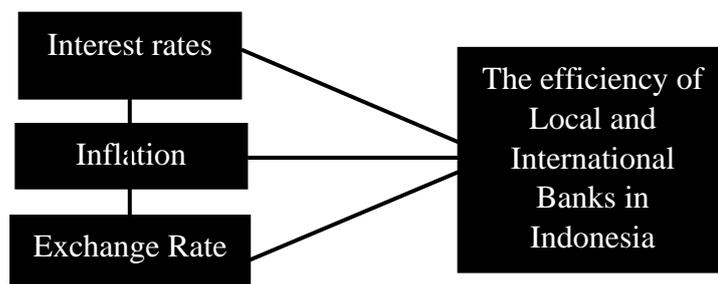


Figure 1. Research model macroeconomic variables  
 Note: Author development

**Data collection methods**

The Data used in this research is secondary data. Secondary Data is the research data obtained by researchers indirectly but rather on the data collected through the processing result of the second party or data published to explain the symptoms of a phenomenon. This research data obtained from the publication of the Central Bureau of Statistics, Bank Indonesia, Financial Services Authority, and

the official website of Bank BCA, Mandiri, BRI, BNI, CIMB Niaga, Citibank, HSBC Indonesia, DBS Indonesia, KEB Hana, and Standard Chartered Bank.

### The method of data envelopment analysis (DEA)

DEA is an approach of non-parametric, which is a technique based on linear programming. DEA was first introduced by charnes, cooper, and rhodes (CCR) in 1978. DEA is the method used to measure the relative efficiency of a work unit economic (WUE) that can be compared with WUE others in the sample. The WUE in question can be in the form of a company, division, department, and bank. In research with DEA, every WUE in the sample used the data type of the input and output are the same. In DEA, the relative efficiency is defined as the ratio of the total output weighted divided by total input. The core of DEA is to determine the weights or scales for each input and output WUE. These weights have the properties, namely: the Weights should not be harmful (Banker et al,1984). The masses must be universal, meaning that every WUE in the sample have to use a set of equal weights to evaluate the ratio and the ratio should not be more than 1 (<1)

DEA has some value managerial. First, the DEA produces efficiency for each WUE, relative to WUE, the others in the sample. Efficiency numbers this allows an analyst to recognize the WUE most in need of attention and plan remedial action to WUE less. Second, if a WUE is less efficient (efficiency<100%), DEA indicates a WUE that has the ability of stay (efficiency=100%) and a set number of multipliers that can be used by managers to draw up improvement strategies (Liu et al., 2009). Such information allows an analyst to make WUE the hypothesis that handles input and generate output at least equal or more than the WUE that is not efficient, so the WUE such a theory would have an efficiency which is perfect if using weights input and the output of the WUE active (Baležentis et al, 2013).

The formulation of the DEA method is a frontier non-parametric models using linear programming to calculate the ratio of output and inputs for all units are compared in a population (Hadad et al., 2003). The purpose of the DEA method is to measure the level of the relative efficiency of the bank against the bank similar when all units are on or below the “curve” efficient frontier his. So this method is used to evaluate the relative efficiency of several objects (Benchmarking Performance). Model DEA or CCR allows each bank to adopt a set of its weight (set of importance), i.e., to maximize the possibility of the efficiency of the best if compared with another bank (Cooper et al., 2007). Under these conditions, the ability of a bank is determined by the ratio of output against the weight of the input. Algebra Model for the shape of the rate of the CCR (information-based) as follows:

Model CCR

$$\begin{aligned} \text{Max } h_c &= \frac{\sum_{r=1}^s U_r Y_{rj}}{\sum_{i=1}^m V_i X_{ij}} \\ \text{Subject to } &\frac{\sum_{r=1}^s U_r Y_{re}}{\sum_{i=1}^m V_i X_{ij}} & (1) \\ r &= 1, \dots, s; \quad I = 1, \dots, m \text{ dan } j = 1, \dots, n \end{aligned}$$

Where :

- C = Commercial Bank that is Evaluated
- Y<sub>rj</sub> = Amount of output r from Bank General j
- X<sub>ij</sub> = Amount of input I for Bank Common j
- U<sub>r</sub> = Weight Selected for Output r
- V<sub>i</sub> = The Weight Chosen for the Input i
- n = The Number of Commercial Banks
- s = Amount of Output
- m = Number of Input

The objective function is defined with a **hc** that aims to maximize the ratio of output-weighted to the input-weighted of the bank are observed. Another bank in the sample constrains this function cannot exceed unit efficiency by using the same weight. It is important to note that its weight is assumed to be unknown, but are obtained through optimization. The optimization is done separately

for each unit to be able to calculate weights and measures of efficiency (Filho and Hong, 2016). The issue of determination in equation (1) is fractional. This can be converted into the form of a linear programming (LP) with restrictions denominator of the objective function  $h_c$  to unity, and adding this as a constraint to the problem. The version of the LP from the determination of the fraction shown in the model.

$$\begin{aligned}
 & \text{Primal} \\
 & \text{Max } h_c = \sum_{r=1}^s U_r Y_{re} \\
 & \text{Subject to } \sum_{i=1}^m V_i X_{ie} = 1 \\
 & \quad \quad \quad \sum_{r=1}^s U_r Y_{rj} - \sum_{i=1}^m V_i X_{ij} \leq 0 \\
 & \quad \quad \quad U_r, V_i \geq 0
 \end{aligned} \tag{2}$$

$r = 1, \dots, s; i = 1, \dots, m \text{ dan } j = 1, \dots, n$

Maximize the LP setting in (2) assumes constant returns to scale technologies. When we formulate the constraints of the sum of the weights of the input to unity in (2) and maximize the output, this being a measurement of efficiency based on data (input-based efficiency measurement). Which means, with a specific output, bank water input use.

One possibility is the completion of LP (the primal) in (2), namely, formulate a dual companion. With marking weights of the input bank  $c$  with  $\theta_c$  and the weights of the input and output of another bank in the sample  $\lambda_j$  form of the dual problem of the maximum formalized as follows:

$$\begin{aligned}
 & \text{Dual} \\
 & \text{Min } h_c = \Theta_c \\
 & \text{Subject to } \sum_{j=1}^m \lambda_j Y_{rj} - S_i^+ = Y_{rc} \\
 & \quad \quad \quad \sum_{j=1}^m \lambda_j X_{ij} - S_i^- = O_c X_{ic} \\
 & \quad \quad \quad \lambda_j, \dots, S_i^-, \dots, S_i^+ \geq 0
 \end{aligned} \tag{3}$$

$j = 1, \dots, n$

Bank  $c$  is considered efficient if  $\Theta_c$  equal to one and the slack ( $S_i^-$  and  $S_i^+$ ) is zero. That is, if and only if  $h_c = 1$  with  $S_i^-$  and  $S_i^+ = 0$ , for all  $c = j$ .

Where the asterisk indicates the optimal value of the variable in the dual, it is essential to note that these same conditions with the efficiency conditions Pareto. When the Bank is fully efficient, it is not possible to fix the value of the input or output that is observed without affecting the value of the input or output of the other. The Bank is not considered efficient (inefficient) if  $\theta_c$  is less than one, and the variable slack is positive (Resti, 1997). For banks that are not efficient, the optimal value of  $\lambda_j$  form a hypothetical bank, which was formed by a group of banks efficient. Consider variable returns to scale (VRS) in production (Cooper et al., 2011). Score efficiency DEA is used as performance indicators to determine banks operate inefficient technical.

### Tobit regression model

James Tobin first introduced Tobit regression in 1958. Tobit regression is a regression analysis used for the variable bound to that portion of the data that has a scale of measurement discrete and some other continuous scale. States that the dependent variable that is a mixture has a data structure with the size of a discrete for the value zero, and a continuous scale for which is not zero. Such Data are called censored data. Censored yourself in this can mean the value of the dependent variable is concentrated or clustered in one value (Cooper et al., 2007). The distribution of censored data is a normal distribution censored and the following assumptions.

The regression model is censored as one of the statistical methods used to determine the model if there is a restriction on the dependent variable. In the regression model, edited some of the value of the sample is recorded as the limit value of the actual costs. Observational Data on the variables of this type are clumped due to the lower limit, the upper limit, or both. Such restrictions can be naturally-occurring such as some value that is close to a specific amount, depending on the purpose of the research (Cooper et al., 2011).

The use of the Tobit regression model due to the value of the dependent variable, i.e., technical efficiency lies between 0 and 1. In other words, the dependent variable's value is censored or limited, while the independent variables are not limited in amount. The Tobit regression model is one of the models regress variable is categorically using the method of maximum likelihood (ML) to

estimate the model with maximizing the value of the likelihood function by finding the parameters of a regression that gives the highest value for the likelihood function of the. Model standard Tobit can be defined for the bank to-i as follows:

$$Y_i^* = \beta x_i + \sigma \varepsilon_i \quad (4)$$

Where :

$$Y_i = Y_i^* \text{ jika } Y_i^* > 0$$

$$Y_i = 0 \text{ jika } Y_i^* \leq 0$$

In the Tobit model, an additional information scale coefficient (SCALE) is the scale factor that will be estimated  $\sigma$ . The scale factor can be used to determine the standard deviation of the residuals. The maximum likelihood (L) to determine the parameters  $\beta$  and  $\sigma$  based on the observations (banks) of  $y_i$  and  $x_i$ :

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

$$\text{Where : } F_i = \int_{-\infty}^{\beta x_i / \sigma} \frac{1}{(2\pi)^2} e^{-t^2/2} dt \quad (6)$$

The first product is the success of its observation; in this case, the bank is 100% efficient ( $y = 0$ ), and the other product is the failure of the banks that are not efficient ( $y > 0$ ).  $F_i$  is the normal standard distribution function at  $= \beta x_i / \sigma$ . Modification Test for Tobit References Bank Performance:

$$EFT_i = \beta_0 + \beta_1 IR_i + \beta_2 INF_i + \beta_3 COURSE + \varepsilon_i \quad (7)$$

Where :

EFT = DEA score between 0 and 1

IR = Interest Rates

INF = Inflation Rate

EXCHANGE = IDR/Rupiah Exchange Rate Against US Dollar

## EMPIRICAL RESULTS AND DISCUSSION

The object of this study uses local and international banks in Indonesia. The Bank used is Bank that has been registered in Bank Indonesia and regulated by the Financial Services Authority. This study uses the top ten banks, namely Bank BRI, Mandiri, BCA, BNI, Cimb Niaga, HSBC, DBS, Standard Chartered, Citibank, and Keb Hana. The fourth Bank this selected based on the ranking of total assets of the largest in Indonesia.

### Efficiency of local and international banks

The results of the calculation of the level of efficiency of local banks and international banks in Indonesia, which consists of 10 banks, can be seen in table 1. The level of ability of banks is calculated using the method of DEA CCR treated with the data envelopment analysis program (DEAP). On average the level of efficiency of local and international banks in Indonesia have not yet reached the level of maximum efficiency, seen from the 2008 level of efficiency of local and international banks in Indonesia at the moment it is far from the maximum efficiency at which time the average ability of the Bank only 0.7903 or 79%.

The efficiency level of the average low is caused by the turmoil of changes in macroeconomic conditions in the United States. The Subprime Mortgage Crisis in America at the time made the inflation in 2008 peak at 12,55%, and at the end of 2008, Indonesia's increase was 11.06%. High inflation affects the level of banking efficiency in Indonesia at that time.

No	Bank	Total Assets
1	PT. Bank Rakyat Indonesia	IDR 1,216,323,558,000,000.00
2	PT. Bank Mandiri	IDR 1,035,916,523,000,000.00
3	PT. Bank Central Asia	IDR 814,559,087,000,000.00
4	PT. Bank Negara Indonesia	IDR 744,421,643,000,000.00
5	PT. Bank Cimb Niaga	IDR 261,262,096,000,000.00
6	PT. Bank HSBC Indonesia	IDR 111,902,941,000,000.00

No	Bank	Total Assets	
7	PT. Bank Cimb Niaga	IDR	94,857,465,000,000.00
8	Citibank	IDR	84,954,281,000,000.00
9	Standard Chartered Bank	IDR	59,946,229,000,000.00
10	PT. Bank Keb Hana Indonesia	IDR	47,406,659,000,000.00

Table 1. The ranking of total assets of local and international banks per quarter 1 2019

Based on the experience of the global financial crisis of 2008/2009, one of the valuable lessons that emerged was the need for sufficient flexibility for the Central Bank to respond to economic development that is increasingly complex and the role of the financial sector, which is increasingly powerful in influencing macroeconomic stability. Based on these developments, Bank Indonesia will strengthen the framework of the inflation targeting framework (ITF) to be Flexible ITF.

Flexible ITF-built with the remains grounded in the essential elements of the ITF that have been awakened. Fundamental aspects of the ITF, including the announcement of the inflation target to the public, the monetary policy pursued by forward-looking, and policy accountability to the public remains to be part of a Flexible ITF.

The analysis shows that such banks own the inefficiency of local and international banks in the outline caused by the inputs (Resources) that have not been used optimally. This is evident from the many idle resources. Resources unemployed or have not been widely used is in the outline is a savings and burden of labor. Customer deposits are a source of funds essential for the Bank's operations and are a measure of the Bank's success if it can finance its operations from this funding source. For that, if the amount of the deposit from the customer can be optimally used for the distribution of credit, the Bank will bring significant benefits of loan interest income. On the contrary, if the unemployed will be a burden because the banks have to pay interest expense on customer deposits.

The burden of labor costs in the Bank to pay the salary of the employee. The bank employee in charge of providing satisfactory services for the community to raise funds from them. However, the results of the analysis show that the burden of high labor does not have an impact on the increase in output if this situation continues where a high load can affect earnings from the Bank itself.

### The efficiency of local and international banks

The results of the calculation of the efficiency score of local banks and international banks period 2008-2017 are further estimated using a Tobit regression model to determine whether macroeconomic variables, namely interest rates, inflation rates, and exchange rates affect the level of efficiency of local and international banks own. The level of interest rates, inflation, and the exchange rate itself can be seen in the table (2).

Table 2. Macroeconomic variables

Years	Interest Rate	Inflation	Exchange Rate
2008	9.25%	11.06%	10950
2009	6.50%	2.78%	9400
2010	6.50%	6.96%	8991
2011	6%	3.79%	9068
2012	5.75%	4.30%	9670
2013	7.50%	8.38%	12189
2014	7.75%	8.36%	12440
2015	7.50%	3.35%	13795
2016	4.75%	3.02%	13436
2017	4.25%	3.61%	13548

Estimation results of testing the Tobit regression model are shown in table (3), which shows that all the macroeconomic variables, namely interest rate, inflation rate, and exchange rate affect the efficiency of local and international banks are significant with 99% confidence level ( $\alpha = 5\%$ ).

Table 3. Estimation of the influence of macroeconomic variables on the efficiency of local and international banks in Indonesia. Note: Author calculations

Dependent Variabel: EFFICIENCY				
Method: ML – Censored Normal (TOBIT) (Newton-Raphson / Marquardt steps)				
Variabel	Coefficient	Std. Error	z-Statistic	Prob.
INTEREST RATE	-0.015300	0.014371	-1.064615	0.2871
INFLATION	0.002028	0.007373	0.275107	0.7832
EXCHANGE	2.01E-05	7.00E-06	2.867054	0.0041
C	0.771420	0.110397	6.987713	0.0000
Error Distribution				
SCALE:C(5)	0.129624	0.009166	14.14214	0.0000
Mean dependent var	0.909990	S.D. dependent var	0.137239	
S.E. of regression	0.132992	Akaike info criterion	-1.148354	
Sum squared resid	1.680244	Schwarz criterion	-1.018096	
Log likelihood	62.41771	Hannan-Quinn criter.	-1.095636	
Avg. log likelihood	0.624177			
Left censored obs	0	Right censored obs	0	
Uncensored obs	100	Total obs	100	

This study's findings prove that the three macroeconomic variables, namely, interest rate, inflation rate, and exchange rate, significantly affect the efficiency of local and international banks in Indonesia. The results of this study are in line with the findings of the Experiencing (2015), Cooper et al., (2007) which proved that the variation inefficiency could be explained by the macroeconomic variables where the results of the estimation can be seen through Tobit regression model :

$$EFT_i = 0.771420 - 0.015300 IR_i + 0.002028 INF_i + 0.0000201 \text{ Exchange Rate}_i$$

### Interest rates on the efficiency of local and international banks

The level of interest rates affects the performance of the efficiency of local and international banks in the negative with a regression coefficient of -0,015300 that has meaning if there is an increase in interest rates. The ability of local and international banks will decline. Variable interest rates affect the efficiency of local and international banks in Indonesia negatively. This means that if interest rates rise, then the ability of local and international banks in Indonesia will tend to go down. This condition is based on the characteristics of the national banking system that bases its earnings from the high-interest credit rates with the deposit rates low. This causes the difference in interest rates. The credit with interest rates of deposits, known as net interest margin (NIM), tends to become more significant. With NIM, high banks feel they do not need to operate at a lower cost, so it tends not efficient. Empirical evidence of this study differs from the survey (Hassan and Sanchez, 2007) and (Pasiouras et al., 2009), who found that the difference in interest rates positively affects the efficiency of the bank.

### Inflation on the efficiency of local and international banks

The inflation rate affects the efficiency of local and international banks positively with a coefficient of 0,002028, which means that in the period 2008-2017, the inflation rate that moves by the target affects the level of efficiency of local and international banks in a positive way. These findings contrast with studies (Hassan and Sanchez, 2007), who found instead that the inflation rate

negatively affects the efficiency of banks in Latin American countries. Stated that high inflation would reduce the source of financing in the private sector so that the impact negatively affects the banks. Indonesia itself during the study period 2008-2017 only once has a high level of efficiency that by the time it reaches two digits, namely 12,55 % in 2008, while the following years, the level of efficiency in Indonesia by the target set by Bank Indonesia, which includes lower inflation. Therefore, the results obtained in the table (3) above show that increase affects positively. According to Bank Indonesia, low and stable inflation is a requirement for sustainable economic growth and ultimately provides benefits for the community's welfare.

### The exchange rate against the efficiency of local and international banks

The exchange rate also affects the efficiency of local and international banks positively with a coefficient of 0,0000201 that has meaning if the value of the Indonesian rupiah or the U.S. dollar changes, then the efficiency of local and international banks will be increased. The amount of Indonesia Rupiah (IDR) against the U.S. Dollar positively affects the efficiency of local and international banks in Indonesia. Currency exchange rates also became one of the factors of banking profitability. It is because, in its activities, the bank provides services to buy and sell foreign exchange. In a normal situation, international trade exchange is primarily advantageous because such transactions generate profit in the form of foreign exchange. In the event of such transactions, the exchange rate will be the currency of the international concern to the bank because it can affect the profitability of the bank. With the onset of fluctuations in the value of foreign currency exchange rate, the bank will earn income in the form of fees and foreign exchange.

### Comparison of local and international banks

The level of efficiency of local and international banks experienced fluctuations from the year 2008 to the year 2017, the difference in the level of ability of local and international banks can be seen, the estimation results obtained by calculating the level of efficiency of local and international banks with the data envelopment analysis (DEA) is the level of efficiency of local banks consisting of bank BRI, Mandiri, BCA, BNI, and CIMB Niaga has a higher efficiency level of international banks consisting of HSBC bank, DBS Bank, Standard Chartered Bank, Citibank, and the KEB Hana Bank. It can be seen from the fluctuations in the level of efficiency in the image where the local bank outline has a level of efficiency which is stabilized near one or 100% and only seen a considerable fluctuation occurred in the years 2008 and 2009, while the international bank seen from the chart image above has a level of efficiency which fluctuates quite a lot of that change can be seen from the years 2008 until 2012.

Table 4. Estimation of the influence of macroeconomic variables on the efficiency of local banks

Dependent Variabel: EFFICIENCY  
 Method: ML - Censored Normal (TOBIT) (Newton-Raphson / Marquardt steps)

Variabel	Coefficient	Std. Error	z-Statistic	Prob.
INTEREST	-0.009024	0.010945	-0.824513	0.4096
INFLATION	0.004979	0.005615	-0.886665	0.3753
EXCHANGE	1.19E-05	5.33E-06	2.225494	0.0260
C	0.907465	0.084075	10.79356	0.0000
Error Distribution				
SCALE:C(5)	0.069804	0.006980	10.00000	0.0000
Mean dependent var	0.955160	S.D. dependent var		0.078748
S.E. of regression	0.073580	Akaike info criterion		-2.286251
Sum squared resid	0.243630	Schwarz criterion		-2.095048
Log likelihood	62.15627	Hannan-Quinn criter.		-2.213440
Avg. log likelihood	1.243125			

Left censored obs	0	Right censored obs	0
Uncensored obs	50	Total obs	50

Note: Author calculations

Bank BRI is the bank with the total assets of the largest in Indonesia during the ten year study period only reached the level of maximum efficiency of 100 percent only three times in 2009, 2012, and 2013. While the Keb Hana bank has the total assets of the smallest among the 10 sample research reached a level of efficiency, the maximum the same with the bank BRI as many as three times in 2015, 2016, and 2017. From this, it can be concluded that the total assets or can be the rounded size of the banks does not affect the efficiency of local and international banks in Indonesia.

Table 5. Estimation of the influence of macroeconomic variables on bank efficiency international

Dependent Variabel: EFFICIENCY  
 Method: ML - Censored Normal (TOBIT) (Newton-Raphson / Marquardt Steps)

Variabel	Coefficient	Std. Error	z-Statistic	Prob.
SUKU_BUNGA	-0.021576	0.024208	-0.891282	0.3728
INFLASI	0.009036	0.012420	0.727527	0.4669
NILAI_TUKAR	2.83E-05	1.18E-05	2.397981	0.0165
C	0.635376	0.185956	3.416808	0.0006
Error Distribution				
SCALE:C(5)	0.154392	0.015439	10.00000	0.0000
Mean dependent var	0.864820	S.D. dependent var		0.166397
S.E. of regression	0.162744	Akaike info criterion		-0.698642
Sum squared resid	1.191846	Schwarz criterion		-0.507440
Log likelihood	22.46605	Hannan-Quinn criter.		-0.625831
Avg. log likelihood	0.449321			
Left censored obs	0	Right censored obs		0
Uncensored obs	50	Total obs		50

Note: Author calculations

It can be seen from the two tables (4) and (5), the estimated influence of macroeconomic variables on the efficiency of local and international banks if the estimation is done separately. The results obtained if the estimation is separate to compare the two is the same results with the estimates made overall that the three macroeconomic variables, namely interest rate, inflation rate, and exchange rate significantly affect the efficiency of local and international banks in Indonesia with a Tobit regression model :

$$\text{Bank Locale: } EFT_i = 0.907465 - 0.009024 \text{ IR}_i + 0.004979 \text{ INF}_i + 0.0000119 \text{ Exchange Rate}$$

$$\text{International Banking: } EFT_i = 0.635376 - 0.021576 \text{ IR}_i + 0.009036 \text{ INF}_i + 0.0000283 \text{ Exchange Rate}$$

The level of interest rates negatively influences the efficiency of which is located in the coefficient of -0.009024 on the estimation of local banks and -0.021576 on the estimate of international banks means that if there is an increase in the level of interest rates, then the efficiency of local and international banks will decrease. The estimation of the influence of interest rates on the

efficiency of local and international banks is estimated separately and showed the same results with the estimates carried out simultaneously.

The rate of inflation affects positively to the efficiency of which is located in the coefficient of 0.004979 on the estimation of local banks and 0.009036 on the estimate of international banks which means that in the period 2008-2017 the inflation rate that moves by the target affect the level of efficiency of local and international banks for positive Results of the estimation of the effect of inflation on the efficiency of local and international banks are estimated separately also showed the same results with the estimates carried out simultaneously.

The value of the exchange rate affect positively to the efficiency of which is located in the coefficient of 0,0000119 on the estimation of local banks and 0,0000283 on the estimate of international banks means that if there is a change in the exchange rate, then the efficiency of local and international banks will be increased. The results of the estimation of the influence of the exchange rate against the efficiency of local and international banks are estimated separately also showed the same results with the estimates carried out simultaneously.

## CONCLUSION AND SUGGESTIONS

On average, during the period 2008 - 2017, the level of efficiency of local and international banks in Indonesia have not yet reached the level of efficiency of the optimal 100%. The efficiency of local banks consisting of Bank BRI, Mandiri, BCA, BNI, and CIMB Niaga has a higher efficiency level of international banks consisting of HSBC bank, DBS Bank, Standard Chartered Bank, Citibank, and the KEB Hana bank. Macroeconomic variables (Interest Rates) affect the efficiency of local and international banks in Indonesia in the negative. Macroeconomic variables (Inflation) affects the efficiency of local and international banks in Indonesia positively. Macroeconomic variables (The Exchange Rate) change the efficiency of local and international banks in Indonesia positively. The comparison is made between local and international banks to do the estimation separately also find that macroeconomic variables such as interest rates affect the efficiency negatively, inflation is positive, and the value of the exchange rate positively.

The empirical findings of this study provide implications for the national banking, mainly local and international banks in this study that local and international Banks to increase and maintain efficiency in managing the input he had, in this case, is the total party funds when and also the burden of labor surplus so that local and international banks in Indonesia can reach the score of efficiency of optimal 100%.

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