Technical Efficiency Analysis at BUKU 1 Banks in Indonesia Using the Data Envelopment Analysis (DEA) Method Period 2016 – 2017

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Abstract
This study began with an observation of the financial performance of banks in assessing the efficiency of commercial banks in Indonesia in the 2016 period and found inefficiency problems in BUKU I banks based on efficiency values (BOPO) as an indicator of bank efficiency. This study is an analysis of the measurement of bank efficiency values using quantitative analysis with secondary data obtained from the balance sheet and income statement for each bank sample (DMU) for the period 2016 - 2017 using a mathematical model (linear program) with the Non-Parametric Data Envelopment Analysis (DEA) measurement method oriented to Input and assume Variable Return to Scale (VRS) with a sample of 17 Bank sample data during the period 2016-2017. In each DMU there are two variables namely input and output, where the input variable consists of Price of Labor (X1), Price of Fund (X2) and Price of Physical Capital (X3) while the output variable consists of Credit (Y1), Interest Income (Y2) and other Operating Income (Y3). From the results of the measurement of efficiency using the DEA method of the 17 bank samples there are 6 efficient banks while 11 other banks are inefficient. The DEA method measurement results also get an inefficient output variable projection value, from 34 inefficiencies of output variables found there are 4 inefficiencies in the given credit variable, 15 inefficiencies in the Interest Income variable and finally 15 inefficiencies in other Operating Income variables. From the measurement of the efficiency value using the DEA method, the Bank's efficiency and inefficiency values are obtained and the factors causing the Bank's inefficiency so that these factors can be used as material for the Bank's evaluation in improving the Bank's strategic planning .
Keywords: Frontier, DEA, VRS, BUKU Bank, Input, Output and Projected Values**.**

Abstrak
Penelitian ini berawal dari pengamatan kinerja keuangan bank dalam menilai efisiensi Bank Umum di Indonesia periode tahun 2016 dan menemukan permasalahan inefisiensi pada Bank BUKU I berdasarkan nilai efisiensi (BOPO) sebagai salah satu indikator efisiensi bank. Penelitian ini merupakan analisa pengukuran nilai efisiensi bank menggunakan analisis kuantitatif dengan data sekunder yang diperoleh dari laporan Neraca dan Laba Rugi tiap sampel bank (DMU) periode 2016 – 2017 menggunakan model matematis (program linier) dengan metode pengukuran Non – Parametrik Data Envelopment Analysis (DEA) berorientasi Input dan berasumsi Variable Return to Scale (VRS) dengan jumlah data sampel 17 Bank selama periode 2016 – 2017. Pada setiap DMU terdapat dua variabel yaitu input dan output, dimana pada variabel input terdiri dari Price of Labor (X1), Price of Fund (X2) dan Price of Physical Capital (X3) sedangkan variabel output terdiri dari Kredit (Y1), Pendapatan Bunga (Y2) dan Pendapatan Operasional lainnya (Y3). Dari hasil pengukuran efisiensi menggunakan metode DEA dari 17 sampel bank tersebut terdapat 6 bank efisien sedangkan 11 bank lainnya tidak efisien. Hasil pengukuran metode DEA juga mendapatkan nilai proyeksi variabel output yang inefisien, dari 34 inefisiensi variabel output yang ditemukan terdapat 4 inefsiensi pada variabel kredit yang diberikan, 15 inefisiensi pada variabel Pendapatan Bunga dan terakhir 15 inefisiensi pada variabel Pendapatan Operasional lainnya. Dari pengukuran nilai efisiensi menggunakan metode DEA, didapatkan nilai efisiensi dan inefisiensi Bank dan faktor – faktor penyebab inefisiensi Bank sehingga faktor – faktor tersebut dapat menjadi bahan evaluasi Bank dalam pembenahan perencanaan strategi Bank.
Kata Kunci: *Frontier, DEA, VRS, Bank BUKU, Input, Output and Projected Values.*

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1. Introduction

A bank is faced with the condition of how to get the optimal level of output with the existing level of input or find the minimum level of input with the achievement of a certain level of output (Muazaroh et.al.2012). According to Hadad et al. (2003) efficiency is one of the performance parameters that theoretically will underlie the entire performance of an organization. The ability to produce maximum output with existing inputs is a measure of expected performance. The beginning of the assessment of a company's financial performance is to separate production units with standardized performance that separates good and bad performance (Berger and Humprey, 1997). According to Ramanathan (2003), efficiency is the ratio between the output produced and the input used. A production plan can be called efficient if it produces more output with the same number of inputs or vice versa reduces the use of inputs to produce the same level of output. These two things in the Pareto optimum approach are known as dual programming, namely two approaches with the same goal, namely increasing efficiency (Ramanathan, 2003).

Inefficiency problems were found in BUKU 1 Bank in 2016 and efficiency values were still low in 2017 based on efficiency with the BOPO ratio indicator according to the Indonesian Banking Statistics Publication Report (SPI) for the period 2016 – 2017 which can be explained on Table 1.

From the table above, the Bank's efficiency performance with the BOPO ratio at BUKU Banks for the period 2015 – 2017 is presented with the results as follows. in 2015 the efficiency of BUKU 1 Bank was 85.86%, decreased by 2.23% in 2016 to 88.09% and then increased by 0.78% to 87.31% in 2017. In 2015 the efficiency of BUKU 2 Bank was 85.48% then increased by 0.10% in 2016 to 85.38% and then decreased by 0.95% to 86.33% in 2017. In 2015 the efficiency of BUKU 3 Bank was 90, 71% then increased by 1.38% in 2016 to 89.33% then rose again by 4.74% to 86.08% in 2017. In 2015 the efficiency of BUKU 4 Bank was 70.46%, decreased by 4.59% in 2016 to 75.05% then increased by 4.74% to 70.31% in 2017. Even though the efficiency value of BUKU 4 Bank was decreased in 2016, it still remained at the best efficiency value performance, while in the efficiency value of BUKU 1 Bank, although there was increased in 2017, the efficiency value was still low and became a group of Commercial Banks with the slowest increase in efficiency value.

According to Subandi and Ghozali (2014), banks with maximum efficiency performance can be taken into account in carrying out optimal intermediation activities so as to increase firm value. Meanwhile, according to Hidayati (2005) in Sulistyono (2014), if you only pay attention to the size of financial ratios, the results obtained will only describe the financial position and are not able to show how much the bank's resources are used in order to get useful work results. The need for the quality of efficiency measurement results requires a deeper and more detailed methodology for measuring efficiency values considering the efficiency value is not only limited to numbers in the report but has a frontier value in determining whether a bank is efficient or not. Therefore, a more accurate measurement is needed to measure, assess, and project the efficiency. This study was conducted to see the efficiency value of several banks in BUKU 1 Banks from 2016 to 2017 to see the efficiency level of each bank and to see what inefficiency factors are burdening the bank and becomes inefficient so that it can be input into strategic policies future bank.

The other reason for choosing a sample of BUKU 1 Banks in this study is also based on previous research where differences can be found between BUKU 1 Banks and other BUKU Banks from several factors such as Bank Size (SIZE), Bank Ownership, and Bank Risk with the following explanation:

1. Bank Size (SIZE)

According to Delis and Papanikolau (2009) Bank Size (SIZE) has a positive economic and statistical effect and has a significant effect on bank efficiency. Bank Size is a comparison scale to classify the size of a bank in terms of assets. The

Table 1. Commercial Bank Efficiency Value (BOPO)

BANK	2015	Δ	2016	Δ	2017
BUKU I	85,86	2,23	88,09	-0,78	87,31
BUKU II	85,48	-0,10	85,38	0,95	86,33
BUKU III	90,71	-1,38	89,33	-3,25	86,08
BUKU IV	70,46	4,59	75,05	-4,74	70,31

Source: Indonesian Banking Statistics Report (SPI) for the period 2016 – 2017 (Value in Percentage)

size of the bank is measured by looking at the total value of the bank's assets, where there is an assumption that each level of BUKU grouping is equal to the grouping of total bank assets, that the higher the bank's assets the effect on the amount of core capital. BUKU 1 Bank is a Commercial Bank with the smallest core capital (under Rp.1 Trillion). Is a bank with the smallest Bank Size (SIZE) compared to other BUKU Banks. BUKU 1 banks are assumed to be inefficient because the interest income margin is not maximal to cover the interest expense and cost of funds that must be paid by the bank due to the limited amount of credit expansion. Another impact of Bank Size (SIZE) is the grouping of Banks in the Bank's Business Plan (RBB). The difference in the business grouping of Banks makes BUKU 1 have limitations in doing business, so it is assumed that it will not be more efficient than other BUKU banks with a larger Bank Size (SIZE).

2. Bank Ownership

Bank ownership that is more private (owned by a group of a family or certain peoples) will have more impact on Moral Hazard risk. According to Fiordelisi et al. (2010) the risk of Moral Hazard decreases as bank capital increases, indicating that better bank capital will be able to further reduce their cost burden compared to other banks. The more efficient the bank, the better the capital and the higher the capital also has a positive impact on the level of efficiency. Several banks in BUKU 1 have a Regional Owned Enterprise (BUMD) ownership structure and several other banks are in the form of private companies whose quality in bank management, corporate governance and performance monitoring and financial transparency are different from the banks that have gone public (public companies). This assumes that BUKU 1 Bank has a higher Moral Hazard rating.

3. Bank Risk

Deteriorating bank balance sheets and unfavorable business conditions cause some banks to find it difficult to pay depositors and creditors' fees, plus if the value of bank assets becomes negative which will lead to bank bankruptcy. Bankruptcy of a bank will have an impact on systemic risk that starts from a bank panic situation which is a situation where panic from a bank will cause several other banks to go bankrupt at the same time, due to the impact of asymmetric information (Mishkin, 2013). The risk of bank bankruptcy that occurs brings systemic risks that overall impact on the economy needs to be mitigated by implementing efficient bank operations. BUKU 3 and BUKU 4 banks have criteria as banks with the highest systemic risk impact. Those situation has an impact on the level of supervision of bank financial performance and good corporate governance (GCG) as well as several other bank bankruptcy risk indicators carried out by bank regulators. The tight level of bank supervision by the regulator has an effect on banks operation so that BUKU 3 and BUKU 4 banks can be more efficient. That assumes that BUKU 1 Bank has a higher impact on bank risk.

2. Theoretical Framework

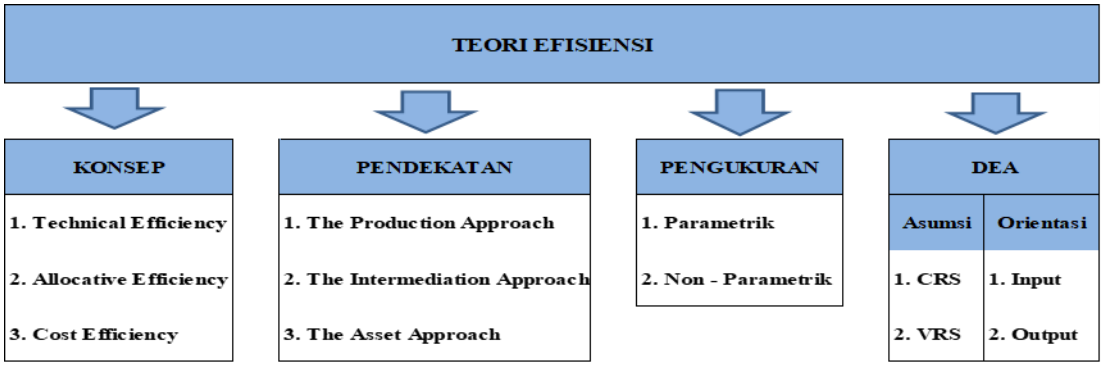
The framework is an operational description of the variables of the research model. The theoretical framework departs from several main theories that support the research model. The structure must describe the variables, sub-variables and whose theory, which can be explained with the following picture on figure 1.

DEA Optimization Approach

In the DEA optimization approach, there are two approach models based on the relationship between input variables and their outputs, namely the CRS (Constant Returns to Scale) model proposed by Charnes, Cooper and Rhodes (1978) and the VRS (Variable Returns to Scale) model known as the CCR model which was developed from its predecessor model as the Banker, Charnes, Cooper (1984) model known as the BCC Model.

The model with Constant Return to Scale (CRS) condition indicates that the addition of production factors (inputs) will not be able to have an impact on additional production (output). Meanwhile, the Variable Returns to Scale (VRS) optimization mod-

Figure 1. Theoritical Framework



Source : Farrell et al. (1957), Charnes and Coopers (1985), Hadad et al. (2003), Muljawan et al.

el will show that the addition of a number of production factors (inputs) will provide more variation, it could be increasing or decreasing production capacity (output).

The technical efficiency (TE) calculated with the VRS assumption is referred to as pure technical efficiency, abbreviated as PTE. By estimating the frontier using the CRS and VRS assumptions, we can decompose the technical efficiency on the CRS assumption (CRSTE) into pure technical efficiency (VRSTE) and Scale Efficiency (SE), mathematically = CRSTE = VRSTE x SE. The value of the efficiency is always less than or equal to 1 (≤ 1). DMU whose efficiency value is less than 1 means inefficiency, while DMU whose value is equal to 1 means that DMU is efficient (Fathony, 2012), with the following explanation.

Constant Return to Scale (CRS)

The Constant Return to Scale (CRS) optimization approach or the CCR Model (Charnes, Cooper and Rhodes) was first discovered by Charnes, Cooper and Rhodes in 1978. This model describes an efficiency measure for each Decision Making Unit (DMU) which is a ratio maximum between the weighted output and the weighted input. Each weight value used in the ratio is determined with the limitation that the same ratio for each DMU must have a value less than or equal to one (Sulistyono, 2014).

This will reduce multiple inputs and multiple outputs into one virtual input and virtual output without the need to pre-determine the weight values. Therefore, the efficiency measure is a function of the weighted value of the combination of virtual input and virtual output and can be calculated by solving the following mathematical programming problems:

$$Max\ Z_0 = \frac{\sum_{r=1}^{s} vy_{r0}}{\sum_{i=1}^{s} u_i x_{i0}} \quad \text{.....(2.1)}$$

Subject to

$$\frac{\sum_{r=1}^{s} v_r y_{rj}}{\sum_{r=1}^{s} u_i x_{ij}} \leq 1, \quad j = 1, 2, 3, \ldots, n \quad \text{.....(2.2)}$$

$$u_r \geq 0,\ r = 1, 2, \ldots, s;\ \ v_i \geq 0,\ i = 1, 2, \quad \text{.....(2.3)}$$

Where xij is the observed input value with type i of the jth DMU and xij > 0 for i = 1, 2, 3, …, m and j = 1, 2, …, n. Likewise, yrj is the observed output value with the i-th type of the j-th DMU and yrj > 0 for i = 1, 2, …, m and j = 1, 2, …,n. The variables ur and vi are weight values to determine the programming problems above. However, this problem has an infinite solution because if (u* and v*) are optimal, then for each > 0, (αu* and v*) are also optimal. By following the Charnes-Cooper transformation, the solution we can choose is a representative (u,v) solution with the following conditions:

$$u_i x_{i0} = 1 \quad \text{.....(2.4)}$$

Thus obtained linear programming which is equivalent to the linear fractional programming problem. The divisor in the efficiency measure above is made equal to one and the transformed linear problem can be written as:

$$max\ z_0 = \quad v_r y_{r0} \quad \text{.....2.5}$$

$$Subject\ to \quad \sum_{r=1}^{s} v_r y_{r_j} - \sum_{i=1}^{m} u_i x_{i_j} \ \forall\ t \quad \text{.....(2.6)}$$

$$\sum_{i=1}^{m} u_i x_{i_0} = 1 \quad \text{.....(2.7)}$$

$$v_r \geq 0,\ r = 1, 2, \ldots, s\ ;\ u_i \geq 0,\ i = 1, 2, \ldots, m \quad \text{.....(2.8)}$$

Where:

Z0 = Efficiency of the decision making unit (DMU).
ui = Weight of input i.
xij = Number of inputs i generated by DMU to j.
vr = Weight of output r.
yrj = Number of outputs r produced by DMU to j.

The linear programming problem above is often called the CCR model with input-output oriented. Maximization is done by selecting a virtual multiple (ie weighted values) u and v which produces the largest rate of virtual output per virtual input. This model assumes that the ratio between the addition of inputs and outputs is the same, meaning that if there is an additional 1 time of input, the output will increase by 1 time (constant). According to Hidayati (2005) in Sulistyono (2014) the assumption of Constant Return to Scale (CRS) can be applied if each company or Decision Making Unit (DMU) operates at an optimal scale.

Variable Return to Scale (VRS)

Variable Return to Scale (VRS) optimization approach or Banker, Charnes, Cooper (BCC) used if there is an assumption of comparison to both input and output affect the productivity achieved, namely Variable Return to Scale (VRS) by including it in the model above with the following limitations:

$$\sum_{j=1}^{n} \lambda_j = 1 \quad \text{.....(2.9)}$$

The results of the DEA model provide a scalable return variable called the BCC or Banker, Charmes and Cooper (1984) model. The model formulation is as follows:

Minimization $W_0 = w_0$ ..... (2.10)

Subject to

$$w_0 v_{i0} \geq \sum_{j=1}^{m} \lambda_j v_{ij}, \quad i = 1,2,\dots,m \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (2.11)$$

$$\sum_{j=1}^{n} \lambda_j = 1 \quad \geq 0, j = 1,\dots,n \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (2.12)$$

Based on the above formula, w0 is a value which, when multiplied by the input v, will result in the maximum value of subtracting the input in producing the same output value. Meanwhile, it is a variable that focuses on how likely it is to create a new DMU (virtual DMU) from a DMU whose relative productivity is being calculated as a combination of other DMUs. In this case, in addition to setting an efficient frontier line, the DEA method also sets a target according to the efficient frontier line for each inefficient DMU and sets one or more units that can be used as a reference for the inefficient unit, which in this case is referred to as peer units.

According to Hidayati (2005) in Sulistyono (2014), the Variable Return to Scale (VRS) model is used if we assume that a comparison of the input and output of a company will affect the productivity that may be achieved. The change in productivity can be less than the proportion of input values or more than the proportion of input values. Variable Return to Scale (VRS) is also used if it is assumed that not all Decision Making Units (DMUs) operate at an optimal scale.

3. Research Method

Research Framework

The research framework sequences the steps in the research with the following explanation:

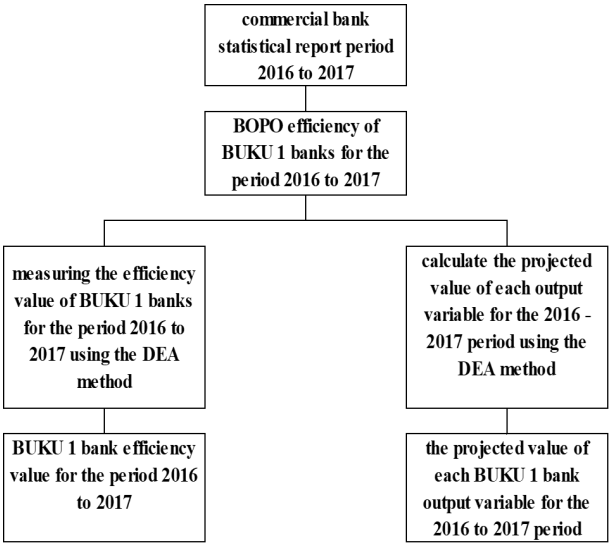
1. Research based on the presentation of commercial bank performance data (conventional) for the period 2016 – 2017 based on Indonesian Banking Statistics (SPI) and Financial Stability Studies (KSK) data.
2. Based on the statistical exposure, it was found that the efficiency value of the Bank based on the BOPO ratio as an indicator of bank efficiency decreased in the 2016 period and became the lowest efficiency value in the 2017 period when compared to BUKU 2, BUKU 3 and BUKU 4 banks in the same period. Based on the efficiency problems in BUKU 1, a deeper efficiency measurement was then carried out using the Data Envelopment Analysis (DEA) method in BUKU 1 for the 2016 – 2017 period.
3. The DEA efficiency score is obtained with an Efficiency Scale score indicator (SE) = 1,000 for each efficient bank and (SE) < 1,000 for each inefficient bank.
4. The results of the DEA measurement then produce a projected value (projected value) for each inefficiency of the BUKU 1 output variable as a projection of the efficient value.

From a total of 23 BUKU 1 Bank data for the 2016 period collected based on the Judgment Sampling method, 17 banks that passed as samples in this study were validated as follows.

This research uses quantitative analysis, which is a scientific approach that is used in deciding a certain decision where the desire, emotions, assumptions, are not part of the quantitative analysis. The quantitative analysis approach begins with data that is processed and manipulated into meaningful and valuable information for decision makers (Render et al., 2012).

This study measures the efficiency value of BUKU 1 Bank for the period 2016 – 2017 with the concept of Intermediary Technical Efficiency (TE) approach with the Non-Parametric Data Envelopment Analysis (DEA) method assuming the optimi-

Figure 2. Research Framework



Source: Self-processing using MS-Excel

Table 2. Bank Sample List

NO.	BANK NAME
1	Bank Sulawesi Tenggara
2	Bank Maluku Malut
3	Bank Lampung
4	Bank Bengkulu
5	Bank Sulawesi Tengah
6	Bank Yudha Bhakti
7	Bank Fama Internasional
8	Bank Kesejahteraan Ekonomi
9	Prima Master
10	Agris
11	Harda Internasional
12	Bank Bisnis Internasional
13	Dinar Indonesia
14	Mitra Niaga
15	Amar Indonesia
16	Artos Indonesia
17	Royal Indonesia

Source: Indonesian Banking Statistics Report (SPI) for the period 2016

zation of Variable Return to Scale (VRS) input-oriented, with the following stages of analysis.

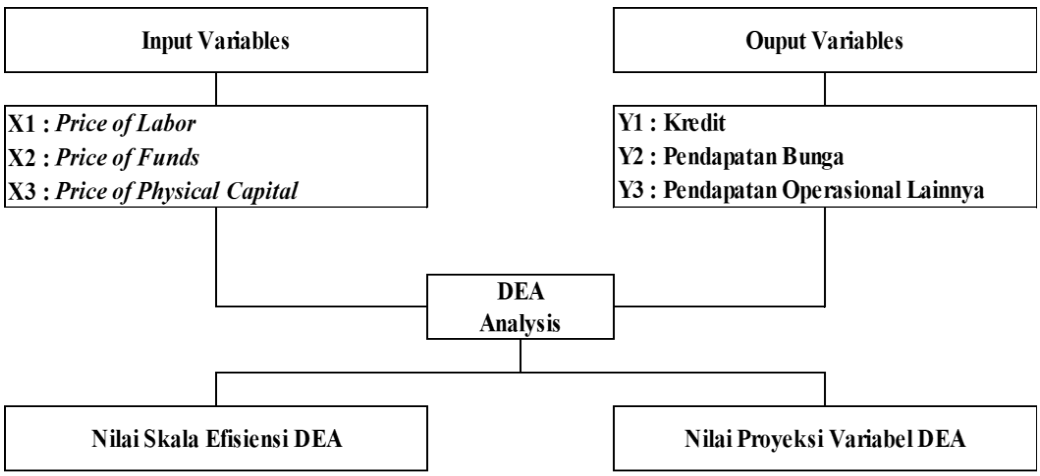
Definition of Variable Operationalization

The definition of operationalization of this research variable comes from 2 (two) previous studies, namely the research of Hadad et. al (2003) and Colline (2010). The reason for adopting the two studies is because there are similarities and conformity with the measurement methods and data used in this study, namely using the Data Envelopment Analysis (DEA) method with data from the Balance Sheet and Profit and Loss report. The research of Hadad et al. (2003) contributed to the adoption of input variables. Meanwhile, Colline's research (2010) contributed to the adoption of output variables that matched with bank financial publication data.

The definition of operationalization of this research variable can be distinguished into Variable Dimensions, Operational Definitions, Indicators, Size and Scale which consists of 3 input variables (X), namely price of labor (X1), price of funds (X2) and price of physical capital (X3). while the 3 output variables (Y) include credit (Y1), interest income (Y2) and other operating income (Y3) which can be explained as follows:

The table is a definition of operationalization of

Figure 3. Stages of Quantitative Analysis



Source: Muljawan (2013) reprocessed with variable adjustment

Table 3. Operationalization of Research Variables

	Operational definition	Indicator	Size	Statistical Scale
Efficiency Level (E)	A measure that compares the output value with the input value.	It is more efficient when the amount of output increases is greater than the number of inputs.	The maximization of (number of outputs x weights / number of inputs x weights).	Ratio
Input (X)	The resources used to produce the output.	The smaller the input the better.	*Price of labor (X1), Price of funds (X2), Price of physical capital (X3).*	Ratio
Ouput (Y)	The results that arise because of the process of an input.	The bigger the output the better.	Credit, Interest Income, Other Operating Income.	Ratio
Price of labor (X1)	Costs incurred to pay workers' salaries.	The higher the personnel load, the less efficient it is.	Personnel expenses divided by total assets.	Ratio
Price of funds (X2)	Costs incurred to pay a non perform loan interest.	The higher the interest expense, the less efficient it is.	Interest expense divided by total liabilities	Ratio
Price of physical capital (X3)	Other costs incurred in addition to interest costs.	The higher the other loads the less efficient it is.	Other expenses are divided by fixed assets.	Ratio
Credit (Y1)	Funds lent by banks to the public	The bigger the credit, the more efficient	Amount of credit granted	Ratio
Interest income (Y2)	The results obtained by the bank on funds lent to the public	The greater the interest income, the more efficient	Interest income, commissions and fees on credit	Ratio
Other Operating Income (Y3)	The results obtained by the bank excluding interest income.	The greater the other operating income, the more efficient	Other fees and commissions, return on foreign exchange	Ratio

Source: Hadad et al. (2003) and Colline (2010)

research variables from 2 (two) previous studies, namely Hadad et al. (2003) and Colline (2010), which were adopted into this study with the following explanation:

1. Efficiency Level (E)

Is a measure that compares the output value with the input value. With an indication that a bank is more efficient if the amount of output increases is greater than the number of inputs. Efficiency level has a maximization measurement model of (amount of output x weight / number of inputs x weight).

2. Input (X)

Represents the resources used to produce output. The indication is that the smaller the input, the better. Inputs in this study include; Price of labor (X1), Price of funds (X2), Price of physical capital (X3) adapted from research conducted by Hadad et. al (2003).

3. Output (Y)

Is the result that arises because of the process of an input. The indication is that the bigger the output the better. Outputs in this study include; Credit, Interest Income, Other Operating Income adapted from research conducted by Colline (2010).

4. Price of labor (X1)

Represents costs incurred to pay workers' salaries. The indicator is that the higher the personnel load, the more inefficient it is considered. The measurement is Personnel Expenses divided by Total Assets (Hadad et al., 2003). In this study, Personnel Expenses were taken from Labor Expenses contained in the Income Statement, while Total Assets were taken from Total Assets contained in the Balance Sheet report.

5. Price of funds (X2)

Represents costs incurred to pay TPF interest. The indicator is that the higher the interest expense, the more inefficient it is considered. The measurement is Interest Expense divided by Total Liabilities, (Hadad et al., 2003). In this study, interest expense is taken from the income statement, while total liabilities are total liabilities contained in the balance sheet report.

6. Price of physical capital (X3)

Represents other costs incurred in addition to interest costs. Where the indication is that the higher the other loads, the more inefficient it is considered. The measurement is other expenses divided by Fixed Assets (Hadad et al., 2003). In this study, other expenses are taken from the income statement, while fixed assets are fixed asset values contained in the balance sheet report.

7. Credit (Y1)

Represents funds that are lent by banks to the public. The indicator is that the bigger the credit, the more efficient it is considered. Measurement is carried out by taking the amount of credit provided in the Income Statement (Colline, 2010). In this

study, the amount of credit given was taken from the balance sheet report.

8. Interest Income (Y2)

Is the result obtained by the bank on the funds lent to the public. With this indicator, the greater the interest income, the more efficient it is. Measurement is done by taking the amount of interest income, commissions, and provisions on credit on the bank's balance sheet (Colline, 2010). In this study, interest income is taken from the income statement.

9. Other Operating Income (Y3)

Is the result obtained by the bank excluding interest income. Where the indicator is the greater the other operating income, the more efficient it is considered. The measurement is carried out by taking the amount of other fees and commissions, the return on foreign exchange differences in the income statement (Colline, 2010). In this study, other operating income is taken from the income statement.

4. Results and Discussion

Descriptive Statistical

The results of descriptive statistical measurements of 34 samples (17 banks multiplied by 2 years) entered can be explained in the following table.

1. Price of Labor (X1)

Based on the results of BUKU 1 Descriptive Statistics in the 2016 – 2017 period, there are results for the Price of Labor (X1) variable with a minimum value = 0.0119 or 1.18% which is the smallest value of the Price of Labor (X1) variable input data found at Bank Mitra Niaga in the period 2016, while the Maximum value = 0.0377 or 3.76% is the largest value of the input data sample of the Price of Labor (X1) variable found at Bank Amar Indonesia in the 2016 period. The Mean value = 0.0223 or 2.23% is the average value of the sample Price of Labor (X1) variable input data.

2. Price of Funds (X2)

Based on the results of BUKU 1 Descriptive Statistics in the 2016 – 2017 period, there are the results of the Price of Funds (X2) variable with a minimum value = 0.0351 or 3.51% which is the smallest value of the Price of Funds (X2) variable input data sample found at Bank Amar Indonesia for the period 2017 then the Maximum value = 0.1054 or 10.54% is the largest value of the input data sample of the Price of Funds (X2) variable contained in the Indonesian Dinar Bank for the 2016 period. The Mean value = 0.0660 or 6.60% is the average value of the data sample input variable Price of Funds (X2).

3. Price of Physical Capital (X3)

Based on the results of BUKU 1 Descriptive Statistics in the 2016 – 2017 period, there are results of Price of Physical Capital with a Minimum value = 0.0029 or 0.029% which is the smallest value of the input data sample of the Price of Physical Capital (X3) variable contained in Bank Bengkulu in the 2016 period then the Maximum value = 0.8869 or 88.69% is the largest value of the input data sample of the Price of Physical Capital (X3) variable found at Bank Mitra Niaga for the 2017 period. The Mean value = 0.1891 or 1.89% is the average value of the Price of Physical Capital variable data sample (X3).

4. Credit (Y1)

Based on the results of descriptive statistics for BUKU 1 in the 2016 – 2017 period, there are results for the Credit variable (Y1) with a Minimum value = 304,584,449,403 which is the smallest value for Credit variable data (Y1) contained at Bank Amar Indonesia in the 2016 period then the Maximum value = 4,611,044,290 .848 is the largest value of Credit

Table 4. Descriptive Statistics Results

Variabel	N	Minimum	Maximum	Mean	Std. Deviation
Price of labor	34	0.0119	0.0377	0.0223	0.0071
Price of funds	34	0.0351	0.1054	0.0660	0.0159
Price of physical capital	34	0.0029	0.8869	0.1891	0.2369
Kredit	34	304.584.449.403	4.611.044.290.848	2.088.295.688.985.670	1.392.694.457.745.830
Pendapatan Bunga	34	67.410.241.021	752.695.000.000	3.411.636.843.153.520	2.396.264.895.240.830
Pendapatan Ops. Lainnya	34	1.442.778.387	69.013.305.099	1.945.001.490.873.520	1.807.798.219.463.170

Source: Descriptive Statistics calculation results using Eviews V.9 Software

Table 5. Efficient Bank Measurement Results

NO.	BANK NAME	EFFICIENCY SCALE		Δ
		2016	2017	
1	Bank Bisnis Internasional	1.000	1.000	-
2	Dinar Indonesia	1.000	1.000	-
3	Mitra Niaga	1.000	1.000	-
4	Amar Indonesia	1.000	1.000	-
5	Artos Indonesia	1.000	1.000	-
6	Royal Indonesia	1.000	1.000	-

Source: DEA Efficiency Score using DEAP 2.1 reprocessed with MS-Excel 2010 (SE Value in Percentage (%))

variable data (Y1) contained in Southeast Sulawesi Bank in the 2017 period. Meanwhile, Mean = 2,088,295,688,985,670 is the average value of Credit variable data (Y1).

5. Interest Income (Y2)
   Based on the results of descriptive statistics for BUKU 1 in the 2016 – 2017 period, there is a variable Interest Income (Y2) with a Minimum value = 67,410,241,021 which is the smallest value of Interest Income variable data (Y2) in International Business Banks in the 2016 period, while the Maximum value = 752,695. 000000 is the largest value of Interest Income variable data (Y2) contained at Bank MalukuMalut in the 2017 period. The Mean value = 3,411,636,843,153,520 is the average value of Interest Income output variable data (Y2).
6. Other Operating Income (Y3)
   Based on the results of descriptive statistics for BUKU 1 in the 2016 – 2017 period, there is a variable Other Operating Income (Y3) with a Minimum value = 1,442,778,387 which is the smallest value for Other Operating Income (Y3) variable data contained in International Business Banks in the 2017 period, while Maximum = 69,013,305,099 is the largest value of Other Operating Income (Y3) variable data found at Central Sulawesi Bank in 2017. The Mean value = 1,945,0001,490,873,520 is the average value of Other Operating Income variable data (Y3).

Efficient Bank

Determination of Efficient Banks according to the measurement of the DEA method is a bank that has a value of SE = 1,000 which is obtained from the calculation of SE = CRSTE / VRSTE where in this study found 6 (six) banks with a value of SE = 1,000 which means these banks are at the optimal level of efficiency. These banks have a projected value that is also maximum in accordance with the original value equal to projected value and the same as radial movement equal to slack movement = 1,000. The results of the efficiency measures at an efficient BUKU 1 Bank can be illustrated on the table 5.

The table describes the results of measuring the efficiency of BUKU 1 Banks for the period 2016 – 2017 using the DEA Method with the result that in the 2016 – 2017 period of 17 banks there were only 6 banks that operated efficiently (SE = 1,000) with the value of radial movement and slack movement equal to 1,000. means that there is no difference in the projected value from the original value with the projected value.

Efficient banks are banks with an Efficiency Scale (SE) equal to 1,000 as follows; Bank Bisnis Internasional, Bank Dinar Indonesia, Bank Mitra Niaga, Bank Amar Indonesia, Bank Artos Indonesia and Bank Royal Indonesia.

Inefficient Bank

The results of the measurement of the DEA efficiency score in BUKU 1 for the period of 2016 – 2017 resulted in a measure of DEA inefficiency (SE < 1,000) where from 17 banks there were 11 inefficient banks. The inefficiency value with a range of Efficiency Scale (SE) values between 0.712 to 0.999 and an average value of 0.928 consists of the Bank Sultra with SE = 0.905 in the 2016 period, have an increase of 0.048 points in the 2017 period to SE = 0.953, Bank MalukuMalut with SE = 0.747 in the 2016 period decreased by 0.274 points in the 2017 period to SE = 0.473, Bank Lampung with SE = 0.966 in the 2016 period decreased by 0.046 points in the 2017 period to SE = 0.920, Bank Bengkulu with SE = 0.712 in the

Table 6. Inefficient Bank Measurement Results

NO.	BANK NAME	EFFICIENCY SCALE		Δ
		2016	2017	
1	Bank Sulawesi Tenggara	0.905	0.953	↑
2	Bank Maluku Malut	0.747	0.473	↓
3	Bank Lampung	0.966	0.920	↓
4	Bank Bengkulu	0.712	0.456	↓
5	Bank Sulawesi Tengah	0.962	0.865	↓
6	Bank Yudha Bhakti	0.929	0.993	↑
7	Bank Fama Internasional	0.999	0.692	↓
8	Bank Kesejahteraan Ekonomi	0.970	0.974	↑
9	Prima Master	0.842	0.966	↑
10	Agris	0.889	0.609	↓
11	Harda Internasional	0.857	0.927	↑

Source: DEA Efficiency Score using DEAP 2.1 reprocessed with MS-Excel 2010 (SE Value in Percentage (%))

2016 period decreased 0.256 points in the 2017 period to SE = 0.456, Bank Sulteng with SE = 0.962 in the 2016 period decreased by 0.0897 points in the 2017 period to SE = 0.865, Bank Yudha Bhakti with SE = 0.929 in the 2016 period have an increase of 0.064 points in the 2017 period to SE = 0.993, Bank Fama Internasional with SE = 0.999 in the 2016 period decreased by 0.307 points in the 2017 period to SE = 0.692, Bank Kesejahteraan Ekonomi with SE = 0.970 in the 2016 period increased by 0.004 points in the 2017 period to 0.974, Bank Prima Master with SE = 0.842 have an increase of 0.124 points in the 2017 period to SE = 0.966, Bank Agris with SE = 0.889 in the 2016 period decreased 0.280 points in the 2017 period to SE = 0.609 and Bank Harda Internasional with SE = 0.857 in the 2016 period increased by 0.070 points in the 2017 period to SE = 0.927.

At Bank Sultra inefficiency was found in 2016 and 2017 with output variables are Interest Income (Y2) and other Operating Income (Y3). At Bank MalukuMalut inefficiency occurred in 2016 and 2017, with Interest Income (Y2) and Other Operating Income (Y3). At Bank Lampung, inefficiency was found in 2016 at Credit (Y1) and Interest Income (Y2) variables, while in 2017 there were Interest Income (Y2) and other Operating Income (Y3). At Bank Bengkulu inefficiency was found in 2016 and 2017 with Interest Income (Y2) and other operating income (Y2). At Bank Sulteng, inefficiency was found in 2016 in the loan variable (Y1), the interest income variable (Y2) and other operating income (Y3) and the interest income variable (Y1) and other operating income (Y2) in 2017. Yudha Bhakti's inefficiency was found in the Credit variable (Y1) in 2016, while in 2017 it was found in the Credit variable (Y1) and Interest Income (Y2). At Bank Fama Internasional the inefficiency is found in the output variable, namely the Credit variable (Y1) in 2016.

Meanwhile, at Bank Kesejahteraan Ekonomi there were inefficiencies in 2016 with Credit variables (Y1) and Interest Income (Y2) and in loans (Y1), Interest Income (Y2) and other Operating Income (Y3) in 2017. Bank Prima Master in inefficiency was found in 2016 with other Operating Income (Y3) and Interest Income (Y2) and while in 2017 there were other Operating Income (Y3). At Bank Agris, inefficiency was found in 2016 with Credit (Y1) and Interest Income (Y2), while in 2017 there were other Operating Income (Y3). At Bank Harda Internasional inefficiency was found in 2016 with Other Operating Income (Y3) and Credit (Y1) while in 2017 there was Interest Income (Y2).

The table 6 is a presentation of the results of the BUKU 1 Bank's inefficiency measures for the period 2016 – 2017 using the DEA Method with efficiency movements towards better or worse.

5. Conclusion, Suggestion, and Limitation

Conclusion

The deteriorating global economic conditions did not have an impact on several banks in Indonesia, which continued to grow. This is due to several

things, among others; the impact of the tax amnesty policy that brought in bank funds from foreign sources, stable interest rates and pro-investment government policies, thus affecting several BUKU 1 banks in Indonesia, one of which was the increase and stability of efficiency values in 2016 and 2017.

Efficient Bank

An efficient bank in the 2016 – 2017 period is a bank that in terms of technical efficiency measurement of DEA has a relative efficiency value equal to a value of 1 (SE = 1,000). Efficient banks based on the results of DEA measurements in the 2016 and 2017 periods include; Bank Bisnis Internasional, Bank Dinar Indonesia, Bank Mitra Niaga, Bank Amar Indonesia, Bank Artos Indonesia and Bank Royal Indonesia From these results it can be concluded that BUKU 1 Bank has been operating efficiently in the previous period.

These banks are banks that have been able to overcome several obstacles in the field of credit, interest income and other operating income so that the production process (input and output) can run efficiently

Inefficient Bank

Based on the Financial Stability Study (KSK) for the 2016 period, the global economy experienced a decline, with indicators such as the United States, China and European Union countries experiencing a decline in the level of the economy and having an impact on the Indonesian economy which directly resulted in a decline in national banking performance. One of the consequences of the decline in bank performance was in several BUKU 1 banks.

BUKU 1 banks that are inefficient in the 2016 – 2017 period are banks that in terms of technical efficiency measurements of DEA have a relative efficiency value below the value of 1 (SE = 1,000), namely Bank MalukuMalut, Bank Bengkulu, Bank Prima Master, Bank Agris, Bank Harda Internasional, Southeast Sulawesi Bank, Lampung Bank, Central Sulawesi Bank, Yudha Bhakti Bank, Fama International Bank and Economic Welfare Bank.

The DEA measurement calculates the projected value of each inefficiency output variable where there are a total of 39 inefficiencies of output variables which can be detailed on inefficiency problems, namely; 8 inefficiencies are found in the loan variable, 16 inefficiencies are found in the interest income variable and the last 15 inefficiencies are found in other operating income variables. From the output variable inefficiency data, it can be concluded that the inefficiency problem in BUKU 1 is not much related to the amount of credit exposure, but rather to the inefficiency in the amount of interest profit (percentage of Net Interest Margin) which is the bank intermediation profit. The management of other operating income that is less than optimal has an impact on the decline in the efficiency value of BUKU 1 Bank.

Output Variables of Inefficiency

Based on the results of the study, it is proven that the input variables (price of labor, price of funds and price of physical capital) have been operationalized optimally and are not variables that reduce the value of efficiency while inefficiency can be proven in the output variables including credit, interest income and other operating income. These output variables affect or have an impact on the inefficiency of BUKU 1 Bank with the following explanation:

1. Interest Income Variable

Is the result obtained by the bank on the funds lent to the public. With this indicator, the greater the interest income, the more efficient it is. Measurement is done by taking the amount of interest income, commissions, and provisions on credit on the bank's balance sheet (Colline, 2010). Variable inefficiency of Interest Income can occur due to the condition of the amount of credit provided is not optimal, the value of the thin interest margin is due to high operating costs and the high number of bad loans which have an impact on decreasing bank income.

2. Operating Income Variable

Is the result obtained by the bank excluding interest income with indicators the greater the other operating income, the more efficient it is considered. The measurement is carried out by taking the amount of other fees and commissions, the return on foreign exchange differences in the income statement (Colline, 2010). Variable inefficiency of Operating Income can occur due to the difference between the amount of proceeds obtained from the sale of assets compared to the cost of acquisition and maintenance, for example an official vehicle that was purchased 10 years ago with all its maintenance costs, when it is no longer operational, it will be sold at auction at a price below the price. market leading to cost inefficiency. This is often found in banks in BUKU 1 because the costs incurred for the maintenance of non-productive fixed assets are too large.

3. Credit

Represents funds that are lent by banks to the public. The indicator is that the bigger the credit, the more efficient it is considered. Measurement is carried out by taking the amount of credit provided in the Income Statement (Colline, 2010). Credit Variable Inefficiency can occur due to the level of loan exposure that is not maximal, while the amount of bank capital can still absorb more credit. The maximum number of credits given is not due to several things, including; the level of public confidence that BUKU 1 is vulnerable to various risks, high bank interest rates due to high cost of funds,

low efficiency levels and finally the large number of uncollected loans so that banks hold back on lending.

Suggestion

Based on the measurement process and the results obtained from this study, the author can provide suggestions to several parties that may be related to the issue of bank efficiency as follows:

1. For regulators, it is hoped that this research can be used as input for measuring efficiency values using the DEA method in making rules, regulations and national banking policies that are more targeted.
2. For bank officials, this research is expected to be an additional input in implementing bank efficiency policies in realizing business sustainability and bank growth (sustainable and growth).
3. For academics and other writers, this research is expected to be an additional input in the study of measuring bank efficiency so that for further research it can be added the number of variables in terms of input and output, increasing the range of measurement periods, testing variables and the influence between variables (Two Stage Analysis) and can be done (Three Stage Analysis) by testing and comparing other efficiency measurement methods, for example, comparison of measurements using the DEA method with the SFA (Stochastic Frontier Analysis) method.
4. For investors, this research is expected to be an additional input in making investment decisions in the banking industry, especially in banks with the most efficient efficiency scores.

Research Limitations

In conducting a research, it is necessary to have limitations related to the analysis carried out, the research period, the number of research samples, research variables, research methods and tools used so that the research can be studied properly and in a straight line between the research boundary conditions and the research process and results. The limitations of this research can be explained as follows:

1. This research is a quantitative research that uses secondary data, namely bank financial statements contained in the Indonesian Banking Statistics (SPI) report and the official report of Bank BUKU 1 in the 2016 – 2017 period.
2. This study measures efficiency scores at BUKU 1 Banks with a sample of 17 banks (based on the Purposive Sampling method) for a 2 year measurement period (2016 – 2017).
3. This research is an analysis of the results of measuring the efficiency score (SE) and the projection value of the efficient bank using the Data Envelopment Analysis (DEA) method with the Intermediary approach assuming Variable Return to Scale (VRS) and input-oriented.
4. This study measures the efficiency of BUKU 1 Bank with the DEA method on input variables, including; Price of Labor (X1), Price of Funds (X2), Price of Physical Capital (X3) and output variables, among others; Loans (Y1), Interest Income (Y2) and Other Operating Income (Y3).
5. This study calculates the projected value of each inefficient output variable so that the efficient value projection of each inefficient variable is obtained.
6. This research uses software such as Microsoft Word V.2010, Microsoft Excel V.2010, Microsoft Power Point V.2010, DEA Program 2.1, Notepad and E-Views V.9 .

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