

EFFICIENCY OF ISLAMIC RURAL BANKS USING TWO-STAGE DATA ENVELOPMENT ANALYSIS APPROACH

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Abstract: *Islamic Rural Bank is required to operate effectively and efficiently to achieve maximum profit levels by minimizing costs incurred. West Java as one of the provinces with the highest number of rural banks must pay more attention to the level of efficiency to continue developing and competing with other banking institutions. This study aims to determine the level of efficiency and the factors that affect it. The samples were 27 Islamic rural banks in West Java. The results showed that from 2018 to 2021, the efficiency level of Islamic rural banks in West Java was included in the category of still very likely to be optimized to be efficient. Inefficiency is caused by the lack of optimal utilization of third-party funds so that the level of output obtained is also less than optimal. Then the NPF ratio and KPMM have a negative and significant effect on the level of Islamic rural bank efficiency, while the ROA ratio has a significant effect in the positive direction and the FDR ratio does not have a significant effect on the level of Islamic rural bank efficiency in West Java. The implications of this study show that the efficiency of Islamic rural banks is closely related to the management and allocation of funds, especially third-party funds and other assets as owned resources to operate.*

Keywords: *Efficiency, Islamic Rural Bank, Data Envelopment Analysis (DEA), Tobit regression.*

1. INTRODUCTION

The importance of the Micro, Small, and Medium Enterprises (MSMEs) sector can be reflected in its contribution to the national economy. 99% of existing business units belong to the MSME category which contributes around 61% to Indonesia's GDP and provides 97% of jobs. In addition to its large contribution to the economy, the MSME sector faces important problems including access to finance and financing. This problem is related to the function of financial institutions as intermediary institutions, especially banking institutions which bridge the needs of the owners of funds and those who need funds. Departing from this, the role of financial institutions with a microeconomic basis is needed to become supporting institutions that help the development of MSMEs in the economy. One of the developing microfinance institutions in Indonesia is the Rural Bank (BPR).

Along with developments in the banking world and the need for Muslim communities for financial services based on Islamic Sharia principles, the government through Law Number 21 of 2008 has opened opportunities for banking business activities that have an operational basis for profit sharing, providing great opportunities for conventional banking in providing sharia services as a form of management of the dual banking system by establishing a locus in the form of a Sharia Business Unit (UUS), in addition to this, Islamic Rural Banks (BPRS) were also established (Ramadhan P., 2017).

Based on the development of assets, BPRS is still far behind when compared to BUS and UUS in Indonesia. BPRS only contributed 2.46% or around 17.06 trillion of the total assets of Islamic banking in Indonesia, which reached approximately 693.8 trillion in December 2021 (OJK, 2021). In addition, BPRS experienced a slowdown in growth (year on year/yoy), especially in the 2017-2020 period, both in terms of assets, Third Party Funds (DPK), and financing provided (PYD) (OJK, 2021).

In December 2012, Bank Indonesia through Bank Indonesia Regulation (PBI) No.14/22/PBI/2012 stated that commercial banks are required to provide credit or financing to MSMEs at least 20% and be given in stages. With the expansion of commercial banks, banking competition in the micro market is certainly getting higher, so BPRS are required to operate as effectively and efficiently as possible to achieve maximum profit levels by minimizing costs incurred.

On the other hand, Muhari and Hosen (2014) state that if BPRS increases profits by increasing margin values, then BPRS will lose competitiveness with MFIs and other commercial banks which do not make profits by increasing margins, therefore various efforts are needed to develop and increasing the competitiveness of sharia banking, especially BPRS. Ramadhan, et al (2017) stated that one of the things that need to be considered in developing Islamic banking is the operational efficiency of Islamic banking which is not yet optimal.

Measurement of efficiency in the world of banking is one of the most popular parameters of financial performance. The ratio of Operating Costs to Operating Income (BOPO) is a ratio that is often used as a reference in measuring efficiency. BOPO is a ratio used to measure the ability of bank management to carry out its operational activities by controlling operational costs and operating income. Naufal and Firdaus (2017) state that banking performance can be said to be efficient if the BOPO ratio has decreased.

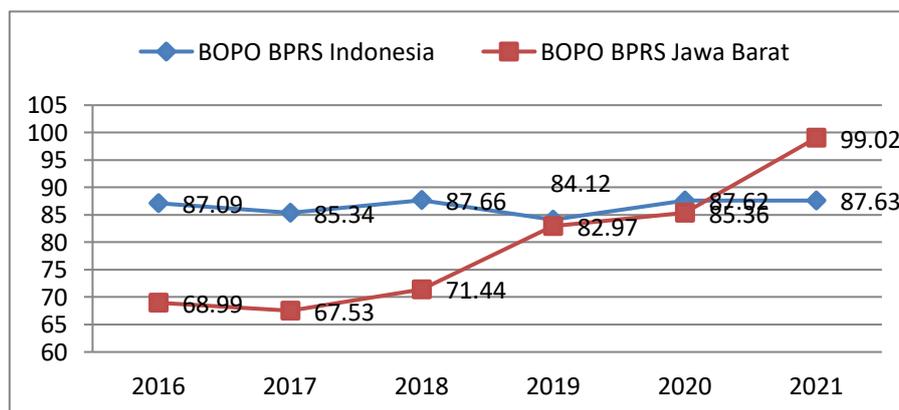


Figure 1. Development of the BOPO Ratio in BPRS

Figure 1 also shows an increase in the BOPO ratio at BPRS in West Java over the past three years, and it has increased rapidly from 2019 to 2021. This was also revealed by Hasbi and Apriyana (2021), that there has been a decrease in efficiency in both BPR and BPRS in West Java in 2019 and 2020. If this continues to happen, then it is feared that the increase in the BOPO ratio will disrupt the operations of the BPRS, or even further affect the ability of the BPRS to generate profits. The less efficient the BPR is in managing BOPO's financial performance, it will slowly reduce the ability to earn profits so that the profit generated is not optimal (Supeno, 2019).

The theory of efficiency is closely related to the theory of consumption and the theory of production in microeconomics. As is the case with consumers who always want to satisfy their needs most efficiently, producers also try to satisfy their needs by producing goods at the lowest cost (Muhammad, 2004).

In production theory, the relationship between input and output is explained using the production function, namely the technical relationship between factors of production (input) and production results (output). In production with one variable, the law of diminishing returns applies, that is, if the input variable continues to be added, the longer the output will decrease on average and in total (Muhammad, 2004).

When efficiency measurements are carried out, banks are faced with the condition of how to obtain optimal output levels with existing input levels or obtain minimum input levels with certain output levels. By identifying input and output allocations, it can be further analyzed to see the causes of inefficiencies (Hadad & et al, 2003).

Departing from the shortcomings in measuring financial performance and efficiency using financial ratios, a method for measuring efficiency using the frontier approach was developed. One method that is often used to measure banking efficiency is to use the Data Envelopment Analysis (DEA) method. After that, research on the level of efficiency of economic activity units continued to develop and then came the Two-Stage Data Envelopment Analysis research procedure which was a development from DEA. The first stage is a measurement of the level of efficiency of the economic unit using DEA, then at the second stage, an analysis is carried out to determine the factors that affect the level of efficiency using the Tobit regression model.

Terlepas dari penelitian mengenai tingkat efisiensi, penilaian kinerja keuangan khususnya institusi perbankan berpedoman pada Peraturan Bank Indonesia No.13/1/PBI/2011 tentang sistem penilaian tingkat kesehatan bank umum, yang mencakup penilaian terhadap faktor profil risiko (*risk profile*), *Good Corporate Governance* (GCG), rentabilitas (*earnings*), permodalan (*capital*), atau yang biasa dikenal dengan istilah RGEK.

Based on PBI No.13/1/PBI/2011 as well as several previous studies, one of the factors that are thought to influence the level of efficiency is the credit/financing risk profile factor as measured using the NPF (Non-Performing Financing) ratio to determine the quality of the suspected earning assets. effect on efficiency. Wasiaturrehman, et al (2020) stated that NPF has a positive effect on production efficiency. The same thing was also expressed by Fatmawati and Aji (2018) and Pambuko (2016), it is assumed that with bank credit restrictions it becomes more efficient, but the possibility of a high level of bad loans. Meanwhile, it is different from the research conducted by Firdaus and Hosen (2013) and Nugrohowati (2019) which stated that NPF caused by problem financing had an effect on bank efficiency and hurt the level of efficiency.

Then the liquidity risk profile factor using FDR (Financing to Deposit Ratio) as an indicator is thought to have a positive effect on the level of efficiency by Pambuko (2016) and Khairunnisa and Khasanah (2018). The ability of banks to fulfill their obligations to third parties allocated for financing makes BUS run more efficiently in managing resources. Meanwhile, Naufal and Firdaus (2017) and Halim and Oswari (2020) state that FDR hurts efficiency. This indicates that the available funds are not productive and

require adjustments so that the funds can be used optimally and increase the level of liquidity.

The next factor is the aspect of profitability or profitability as measured using the ROA (Return on Assets) ratio. Firdaus and Hosen (2013) state that ROA has a positive and significant effect on efficiency. Banks that generate greater profits are indicated as banks that have been running efficiently. This is in line with research conducted by Pambuko (2016), Sofia (2016), and Halim and Oswari (2020).

However, it is different from the research conducted by Nugrohowati (2019) and Suwignyo and Musdholifah (2019) which stated that the ROA ratio hurts the level of efficiency. Then Soetanto and Ricky's research (2011) explains that the negative effect of the ROA ratio is due to the returns obtained by banks in Indonesia do not come from their role as intermediary institutions, but come from other activities such as placements with Indonesian banks, investments in financial markets, and credit for consumption.

Furthermore, the capital factor uses CAR (Capital Adequacy Ratio) as an indicator to determine the level of capital adequacy. In their research, Wasiaturrehman, et al (2020) stated that the CAR ratio consistently has a significant effect on efficiency. When CAR increases, either because of higher capital or because of lower-risk assets, the potential for achieving efficiency will also be higher. Similar results regarding the CAR ratio which has a positive effect on efficiency are also revealed in the research of Nugrohowati (2019), Pambuko (2016), Devi and Firmansyah (2020), and Halim and Oswari (2020).

Meanwhile, the research conducted by Naufal and Firdaus (2017) and Firdaus and Hosen (2013) showed that the CAR ratio hurts efficiency. The same thing was also expressed by Suwignyo and Musdholifah that a high CAR ratio is not always followed by a high level of efficiency, because it depends on how the capital is managed.

Based on the background of the problem and the existence of research gaps from previous research, this research was conducted by focusing on assessing the efficiency level of BPRS in West Java using the Data Envelopment Analysis (DEA) method and analyzing the factors that influence it, and the author is interested in raising this issue. into a thesis, with the title "Efficiency of Islamic Rural Banks with a Two-Stage Data Envelopment Analysis Approach: Studies on Islamic Rural Banks in West Java".

2. LITERATURE REVIEW

Efficiency in production theory is where a company can generate maximum profit for the production carried out (Tuffahati, Mardian, & Suprpto, 2016). As with consumers, producers also try to satisfy their needs by producing goods using the most efficient way and at the lowest cost (Muhammad, 2004).

To produce output, production can be done with only one variable or by using more than one variable. In production with one variable, the law of diminishing returns applies, that is, if the variable is added continuously, the longer the output will decrease on average and in total (Muhammad, 2004). Production by using two variables means combining two or more factors of production as inputs to produce (the same) output. In this case, producers are trying to find combinations and use the two factors of production efficiently to obtain optimum results (Muhammad, 2004).

Producer balance occurs when the combination of the use of two factors of production gives the maximum output. In achieving balance, producers are always based on the principles of efficiency: (Rahardja & Manurung, 2008).

- The principle of output maximization states that with a predetermined budget, maximum output is achieved.
- The principle of cost minimization states that the output target that has been set must be achieved with minimum cost.

The producer's decision regarding which efficiency principle to use depends on the company's goals/mission. In general, the principle of maximizing output is applied to companies that aim to maximize profits. Meanwhile, the principle of cost minimization is generally used by institutions that are not profit-oriented (non-profit or non-profit) (Rahardja & Manurung, 2008).

To achieve efficiency as a financial institution, BPRS applies the principle of maximizing output to obtain maximum profit. BPRS will use funds from the public as well as other income as production inputs and at a certain cost level to produce a proportional ratio to generate income.

Efficiency

Efficiency can be translated as the ability of an organization to get the job done right by calculating the ratio between input and output (Nugraha, 2013). Based on the Big Indonesian Dictionary (KBBI), efficiency is defined as the accuracy of how to do something or means efficiency. This is in line with Syamsi's opinion in Naufal and Firdaus (2017) that apart from emphasizing results, efficiency also emphasizes the power or effort used to obtain these results without any waste.

Firdaus and Hosen (2013) state that the urgency of measuring efficiency in the Islamic banking industry is an important indicator to see the ability of Islamic banks to face competition between national banking industries. Overall, banking efficiency can be decomposed as follows: (Firdaus & Hosen, 2013).

1. Scale efficiency (scale efficiency). Banks are said to achieve efficiency on a scale when the bank concerned can operate on a constant return to scale.
2. Efficiency in scope (scope efficiency) is the efficiency that will be achieved when a bank can operate on diversified allocations.
3. Technical efficiency states the relationship between input and output in a production process.
4. Allocative efficiency occurs when a bank can determine various outputs that maximize profits.

According to Muharam and Pusvitasari (2007), efficiency measurement can be carried out using three approaches, namely the ratio approach, the regression approach, and the frontier approach. The ratio approach is an approach that calculates the comparison between the output and the input used. Silkman in Muharam and Pusvitasari (2007) states that the weakness of measuring efficiency using the ratio approach is when there are many inputs and outputs which then lead to many calculation results, causing the results of assumptions that are not firm.

The regression approach measures efficiency using a model of a given output level as a function of a given input level. Silkman in Muharam and Pusvitasari (2007) explain that

an Economic Activity Unit (UKE) is said to be efficient if it can produce more output than the estimated results. However, this approach cannot overcome output conditions because only one output indicator can be used in a regression equation.

According to Silkman in Muharam and Pusvitasari (2007), the frontier approach used to measure efficiency is divided into two types, namely the parametric and non-parametric approaches. The purpose of measuring efficiency is to obtain an accurate frontier (production limit), but the parametric approach produces the Stochastic Cost Frontier while the non-parametric approach produces the Production Frontier (Wardana, 2012). Berger and Humphrey in Muhari and Hosen (2014) classify those included in the parametric approach as the Stochastic Frontier Approach (SFA) and Distribution Free Approach (DFA), while non-parametric approaches are divided into Free Disposable Hull (FDH) and Data Envelopment Analysis (DEA).

Third-Party Funds (DPK)

Law of the Republic of Indonesia Number 21 of 2008 concerning Sharia Banking Article 21 states that the collection of public funds carried out by BPRS consists of deposits in the form of savings with contracts or other contracts that do not conflict with Sharia principles and investments in the form of deposits and savings with mudharabah contracts or another contract by sharia. Based on this, the input variable for DPK in this study is the amount of savings and time deposits in the BPRS.

Operating costs

Operational costs consist of two words, namely "cost" and "operational". According to the Big Indonesian Dictionary, cost means money spent to establish (establish, do, and so on) something. While operational means operationally, related to operations. Operational costs are the overall costs incurred to support or support the activities or activities of the company to achieve predetermined targets,

Operating Income

Kusnadi in Fauzi (2018) defines operating income as income derived from the sale of merchandise, products, or services within a certain period as an activity or general purpose of the company and this income is normal and recurring as long as the company is still carrying out its activities. Then according to Iskandar in Manurung and Marwansyah (2017), operating income is income derived from bank business activities.

Funding provided

According Law No. 21 of 2008 concerning Islamic Banking states that financing is funds or equivalent claims in the form of:

- a. Profit-sharing transactions in the form of mudharabah and musyarakah,
- b. leasing transactions in the form of ijarah or leasing purchases in the form of ijarah Muntamlik,
- c. Sale and purchase transactions in the form of murabahah, salam, and istishna' receivables,
- d. Lending and borrowing transactions in the form of qardh receivables, and
- e. Service leasing transactions in the form of ijarah for multi-service transactions.

Based on agreements or agreements between Islamic Banks and/or UUS and other parties that require parties who are financed and/or given funding facilities to return the

funds after a certain period in exchange for ujah, without compensation, or profit sharing.

The type of financing used as the output variable in this study is the sum of all types of financing provided by the BPRS, consisting of murabahah financing, istishna financing, multiservice financing, qardh financing, mudharabah financing, musyarakah financing, leasing financing, and other financing.

Earning Asset Quality

Assessment of the quality of earning assets is an assessment related to the risk of financing due to the provision of financing and investment of bank funds (Festani, 2016). One of the indicators used to assess the financial performance of Islamic banking in terms of productive asset quality is to use the Non-Performing Financing (NPF) ratio.

Non-Performing Financing (NPF) is the amount of problem financing (loss) managed by Islamic banks and reflects credit risk (Pambuko, 2016). This ratio is formulated as follows:

$$\text{NPF} = \frac{\text{Number of problematic financing}}{\text{Total of Financing}} \times 100\%$$

Liquidity

Liquidity is the company's ability to fulfill its obligations or pay its short-term debt (Prabowo & Sutanto, 2019). The Finance to Deposit Ratio (FDR) is a ratio that shows the ability of a bank to provide funds to its debtors with capital owned by the bank and funds that can be collected from the public (Sarasyanti & Shofawati, 2018). Then Rivai and Arifin in Iqbal and Budiyanto (2020) state that the Financing to Deposit Ratio (FDR) is a comparison between financing provided by banks and third-party funds. This ratio is formulated as follows:

$$\text{FDR} = \frac{\text{Funding provided}}{\text{Total of Third Party Fund}} \times 100\%$$

Profitability

Bank profitability is the bank's ability to generate profits from the results of bank business performance (Mauliza & Daud, 2016). One indicator that can be used to measure a bank's ability to generate profits is to use Return On Assets (ROA).

The Return On Assets (ROA) ratio shows the company's ability to generate profits by using all of its assets. Then an increase in this ratio means an increase in net profit obtained (Iqbal & Budiyanto, 2020). This ratio is formulated as follows:

$$\text{ROA} = \frac{\text{Net Profit}}{\text{Total of Assets}} \times 100\%$$

Capital Adequacy

One of the indicators used to measure banking capital adequacy is to use the Capital Adequacy Ratio (CAR). According to POJK No.5/POJK.03/2015 Concerning minimum capital adequacy requirements and fulfillment of minimum core capital for Rural Banks, the Minimum Capital Adequacy Requirement (KPMM) is the ratio of capital to Risk-Weighted Assets (RWA) that must be provided by BPRs. Meanwhile, according to Dendawijaya in Iqbal and Budiyanto (2020), KPMM or Capital Adequacy Ratio (CAR) is a ratio that reflects how much capital the bank itself finances bank assets that contain risks (loans, investments, securities, claims on other banks). This ratio can be formulated as follows:

$$\text{KPMM} = \frac{\text{Equity}}{\text{ATMR}} \times 100\%$$

THEORETICAL FRAMEWORK

a. The Linkage of Earning Asset Quality to Efficiency

NPF is a ratio that reflects the level of problem financing in banks. Based on research conducted by Firdaus and Hosen (2013) and Halim and Oswari (2020), the NPF ratio has a negative and significant effect on the level of banking efficiency. Furthermore, Firdaus and Hosen (2013) explained that the negative effect is that if the ratio of non-performing financing gets bigger, bank operations will be disrupted, especially from a liquidity perspective, and this disruption will cause inefficiencies in the use of available resources. Wasiaturrahma, et al (2020) also explained the same thing that the NPF ratio negatively affects the efficiency of collection and distribution of financing.

In a similar study conducted by Nugrohowati (2019) and Khairunnisa and Khasanah (2018), the NPF ratio hurts the level of efficiency but does not have a significant effect. The high NPF is due to two things, namely the increasing problem financing or the decreasing total financing. The high NPF ratio, which was triggered by an increase in non-performing financing, will affect the level of bank efficiency. A high NPF ratio will threaten bank capital, because of its function as a risk absorber. However, if the high NPF is caused by low total financing due to reduced credit demand and reduced credit disbursement, the NPF is considered to have no significant effect on efficiency (Nugrohowati, 2019).

b. The linkage of Likuidity to Efficiency

Tingkat likuiditas berkaitan dengan pengelolaan dana, *Financing to Deposit Ratio* (FDR) yang merupakan salah satu indikator dari tingkat likuiditas adalah rasio yang menggambarkan kemampuan bank dalam memberikan pembiayaan yang berasal dari dana yang telah dihimpun dari masyarakat. Hasil penelitian dari Pambuko (2016), Suwigno dan Musdholifah (2019), Miftahurrohman (2019) serta Khairunnisa dan Khasanah (2018) menunjukkan bahwa FDR berpengaruh secara positif dan signifikan terhadap tingkat efisiensi.

Suwigno dan Musdholifah (2019) menjelaskan bahwa semakin tinggi pembiayaan yang disalurkan sejalan dengan peningkatan pada laba yang diterima. Dari perolehan laba tersebut bank akan mampu mengelola sumberdaya hingga mencapai titik optimalnya sehingga kinerja bank syariah menjadi semakin baik dan akibatnya tingkat efisiensi bank syariah akan meningkat pula. Hasil penelitian tersebut sejalan dengan penelitian Puspita dan Shofawati (2018) yang juga menunjukkan bahwa FDR berpengaruh secara positif terhadap tingkat efisiensi UUS Bank Pembangunan Daerah.

c. Profitability Level Linkage to Efficiency

The level of profitability shows the bank's ability to make a profit. Return On Assets (ROA) is a type of ratio that assesses a bank's ability to generate profits by using all of its assets. Firdaus and Hosen (2013), Devi and Firmansyah (2020), and Sofia (2016) state that the ROA ratio has a positive and significant effect on the level of efficiency. This is because banks that generate greater profits can be indicated as efficient banks. This statement is also in line with Pambuko's research (2016) which states that if the profits derived from assets are greater, it will make BUS more efficient in managing its resources.

With a large asset value, companies can carry out their operational activities in a wider and more varied manner so that they will generate large profits (profits) (Khairunnisa & Khasanah, 2018). Whereas in Naufal and Firdaus' research (2017) the ROA ratio has a positive effect on the level of efficiency but not significantly.

d. The Linkage of Capital Adequacy Level to Efficiency

One of the ratios that reflects the strength of BPRS capital is the capital adequacy ratio, which is commonly called the Capital Adequacy Ratio (CAR) or Minimum Capital Adequacy Requirement (KPMM). CAR is the ratio between capital and risk-weighted assets used to measure a bank's ability to absorb risk. When the KPMM ratio is high, the ability of capital to absorb risk will be greater so that the bank is considered more efficient.

In their research, Nugrohowati (2019), Devi and Firmansyah (2020), Wasiaturrahma, et al (2020), and Halim and Oswari (2020) state that CAR consistently has a significant effect on efficiency. The greater the capital owned, the greater the level of production and intermediation efficiency. When CAR increases, either because of higher capital or because of lower-risk assets, the potential for achieving efficiency will also be higher.

Then, Nugrohowati (2019) also explained that limited capital will result in a lack of ability to recruit quality human resources, an inability to provide reliable IT facilities, and a lack of ability to realize good corporate governance and to develop competitive products and services. These things can trigger potential risks, mismanagement, or even cause economic losses which will lead to inefficiencies for BPRS.

RESEARCH HYPOTHESIS

1. The quality of earning assets hurts the efficiency level of the BPRS.
2. The level of liquidity has a positive effect on the efficiency level of the BPRS.
3. The level of profitability has a positive effect on the level of efficiency of the BPRS.
4. The level of capital adequacy has a positive effect on the efficiency level of the BPRS.

3. RESEARCH METHODS

Research Methods

This study uses a descriptive analysis method with a qualitative approach. Kurniawan and Puspaningtyas (2016) state that descriptive research is research that is directed to determine the value of the independent variable (either one variable or more) without making comparisons or linking one variable to another. Then Yusuf (2017) states that quantitative research is a type of research in which the data collected is in the form of quantitative data or other types of data that can be quantified and processed using statistical techniques.

Research design

The design of this research is an explanatory research design. The object of explanatory research is to examine the hypothesized relationship or influence between variables. therefore, the purpose of explanatory research is to explain the relationship, difference, or effect of a variable on other variables or also aims to explain the generalization of the sample to the population (Mulyadi, 2012).

Research Objects and Subjects

The objects in this study consist of the level of efficiency as the dependent (bound) variable and the quality of productive assets, the level of liquidity, the level of profitability,

and capital adequacy as the object of research. Then the subjects of this study were BPRS in West Java which published financial reports and was registered by the Financial Services Authority (OJK) from 2018 to 2021.

Population and Research Sample

The population in this study were all BPRS in West Java, namely 30 BPRS. The sample taken was determined by the purposive sampling method. Purposive sampling is choosing subjectively targeted samples that can provide information and meet the criteria determined by the researcher (Ferdinand, 2014). The criteria for taking samples in this study are as follows:

1. BPRS in West Java registered with the Financial Services Authority.
2. BPRS published complete financial reports for the 2018-2021 period on the Financial Services Authority website.

Based on the criteria for taking the sample above, the sample that meets the requirements and will be used in this study consists of 27 BPRS in West Java, namely as follows:

Table 1
List of Research Samples

No.	Nama BPRS
1	BPRS Amanah Insani
2	BPRS Artha Madani
3	BPRS Patriot Bekasi
4	BPRS Amanah Ummah
5	BPRS Bina Rahmah
6	BPRS Rifatul Ummah
7	BPRS Insan Cita Arta Jaya
8	BPRS Bogor Tegar Beriman
9	BPRS Artha Fisabilillah
10	BPRS Amanah Rabbaniah
11	BPRS Al Masoem
12	BPRS Al Ihsan
13	BPRS Harta Insan Karimah Parahyangan
14	BPRS Mentari
15	BPRS Harum Hikmahnugraha
16	BPRS Baiturridha Pustaka
17	BPRS Mitra Harmoni Kota Bandung
18	BPRS Al Wadiah
19	BPRS Al Madinah Tasikmalaya Perseroda
20	BPRS Daarut Tauhiid
21	BPRS Bina Amwalul Hasanah
22	BPRS Al Barokah
23	BPRS Al Hijrah Amanah
24	BPRS Al Salaam Amal Salman
25	BPRS Riyal Irsyadi
26	BPRS Harta Insan Karimah Bekasi
27	BPRS Harta Insan Karimah Cibitung

Data analysis technique

This study will use a non-parametric Data Envelopment Analysis (DEA) model which is analyzed using MaxDEA 8 software to determine the level of efficiency and the Tobit regression model analyzed with EVIEWS 10 software to analyze factors that affect the efficiency level of the BPRS.

Data Envelopment Analysis (DEA)

Pambuko (2016) states that Data Envelopment Analysis (DEA) is a non-parametric method used to measure the level of efficiency of an Economic Activity Unit (UKE) or Decision Making Unit (DMU). The Data Envelopment Analysis (DEA) testing method is a method that specifically uses many inputs and many outputs to measure the level of efficiency (Primatami & Primadhita, 2020).

DEA is used to calculate the technical efficiency of all units. Each unit of analysis is considered to have no negative efficiency level, and the value only ranges from 0 to 1 which indicates perfect efficiency. Units that have perfect efficiency values will create an envelope for the efficiency frontier (Hadad & et al, 2003).

The efficiency value from the results of calculations using the Data Envelopment Analysis (DEA) method will be classified using an assessment scale and a numerical scale modified from the assessment framework of the Analytic Network Process method (Saaty & Vargas, 2006).

Two DEA models are often used to measure efficiency, namely CCR, and BCC. Pioneered by Charnes, Cooper, and Rhodes in 1978, the CCR model assumes that there is a Constant Return to Scale (CRS) which states that a proportional change in the input level will cause a similar proportional change in the output level (Muharam & Pusvitasari, 2007). Under the CRS assumption, each UKE will be compared with all UKE in the sample with the assumption that UKE has the same internal and external conditions. This CCR model can show overall technical efficiency or the value of profit efficiency for each UKE.

The CCR model was later expanded in 1984 by Bankers, Charoes, and Cooper and became known as the BCC model which assumes a Variable Return to Scale (VRS) which means that each unit measured will produce changes at various levels of output and there is an assumption that production scale can affect on efficiency (Muharam & Pusvitasari, 2007).

The BCC model assumes that the conditions for each UKE are not the same or that not all UKEs operate optimally, and this suboptimal can be caused by imperfect competition, financial constraints, and so on (Firdaus & Hosen, 2013).

When performing the analysis, the optimization method used can be input minimization or output maximization. The input minimization approach aims to minimize or reduce inputs without changing the amount of output produced. Meanwhile, the output maximization approach aims to increase or maximize the amount of output produced without changing the number of predetermined inputs (Primatami & Primadhita, 2020).

This study will use the BCC model with the assumption that there is a Variable Return to Scale (VRS). The Return to Scale variable assumes that the DMU is not yet in an optimal state so each addition of input is not the same as the addition of output. The

results of calculations with the VRS model are also called technical efficiency (Puspita & Shofawati, 2018).

This research also uses an output-oriented approach, because with this approach we can see how much output is produced with the same amount of input between UKE (Muharam & Pusvitasari, 2007), besides optimizing the resources owned to get optimal profit is the goal. from a UKE (Firdaus & Hosen, 2013).

Tobit regression

The first stage in the Two-Stage Data Envelopment Analysis (DEA) is an analysis to determine the level of efficiency of a UKE and the second stage is carried out to analyze the factors that affect the efficiency of a company or UKE. This method is the development of the DEA non-parametric method to determine environmental variables that affect the level of efficiency (Naufal & Firdaus, 2017).

Delis and Papanikalou in Sari (2018) state that the efficiency level of banking performance is influenced by internal and external determinants. Internal determinants can be in the form of bank accounts such as performance in financial statements, while external determinants have no relationship with bank management but can reflect economic conditions and can affect financial performance.

James Tobin developed a tobit regression in 1958 which was then used to analyze the factors that affect the efficiency of UKE. Tobit regression was developed when he analyzed household expenses whose value was zero because the household did not have a car, and this affected the results of the regression analysis. Tobin argues that if you keep using OLS, parameter calculations will tend to be close to zero and not significant, or if significant, the values will be biased and inconsistent (Naufal & Firdaus, 2017).

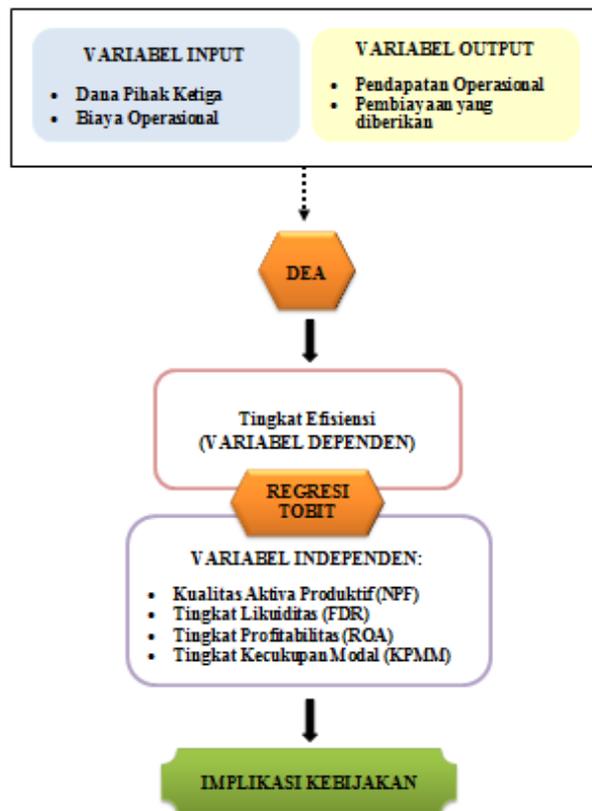


Figure 2 Research Framework

4. RESULTS AND DISCUSSIONS

In the process of analysis to determine the level of efficiency, this study uses the BCC model with the Variable Return to Scale (VRS) which assumes that each Economic Activity Unit (UKE) has not operated optimally so that each additional input does not necessarily result in the same additional output. In addition, this study will analyze the output-oriented approach to see how much output can be produced with the amount of input available. The efficiency value from the results of calculations using the Data Envelopment Analysis (DEA) method will be classified using an assessment scale and a numerical scale modified from the assessment framework of the Analytic Network Process method (Saaty & Vargas, 2006). The results of the analysis of input variables and output variables using the Data Envelopment Analysis (DEA) method in the MaxDEA 8 software are as follows.

Table 2 Average Level of Efficiency of BPRS in West Java

NO	BPRS	2018	2019	2020	2021	AVERAGE
1	BPRS Amanah Insani	0,43	0,34	0,55	0,63	0,49
2	BPRS Artha Madani	0,69	0,73	0,64	0,77	0,71
3	BPRS Patriot Bekasi	0,74	0,84	0,85	0,87	0,82
4	BPRS Amanah Ummah	0,80	0,75	0,86	0,94	0,84
5	BPRS Bina Rahmah	0,54	0,70	0,61	0,70	0,64
6	BPRS Rifatul Ummah	0,90	0,98	0,71	0,75	0,83
7	BPRS Insan Cita Arta Jaya	0,90	0,81	0,79	0,80	0,83
8	BPRS Bogor Tegar Beriman	0,66	0,71	1,00	1,00	0,84
9	BPRS Artha Fisabilillah	0,35	0,56	0,38	0,52	0,45
10	BPRS Amanah Rabbaniyah	0,79	0,85	0,91	0,83	0,84
11	BPRS Al Masoem	0,69	0,79	0,83	0,87	0,80
12	BPRS Al Ihsan	0,82	0,66	0,65	0,68	0,70
13	BPRS HIK Parahyangan	1,00	1,00	1,00	0,99	1,00
14	BPRS Mentari	0,77	0,75	0,79	0,70	0,75
15	BPRS Harum Hikmah Nugraha	0,75	0,70	0,73	0,63	0,70
16	BPRS Baiturridha Pustaka	0,72	0,81	0,93	0,92	0,85
17	BPRS Mitra Harmoni	0,72	0,61	0,36	0,52	0,55
18	BPRS Al Wadiah Tasik	0,58	0,77	0,63	0,65	0,66
19	BPRS Al Madinah	0,64	0,73	0,62	0,57	0,64
20	BPRS Daarut Tauhiid	0,70	0,56	0,65	0,45	0,59
21	BPRS Bina Amwalul Hasanah	0,88	0,91	0,74	0,74	0,82
22	BPRS Al Barokah	0,88	0,64	0,55	0,63	0,67
23	BPRS Al Hijrah Amanah	0,78	0,78	0,67	0,67	0,72
24	BPRS Al Salaam Amal Salman	0,71	0,75	1,00	0,80	0,82
25	BPRS Riyal Irsyadi	0,61	0,39	0,47	0,40	0,47
26	BPRS HIK Bekasi	0,77	0,72	0,75	0,55	0,70
27	BPRS HIK Cibitung	1,00	1,00	0,97	0,98	0,99
	AVERAGE	0,73	0,73	0,73	0,73	0,73

NO	BPRS	2018	2019	2020	2021	AVERAGE
	MINIMUM VALUE			0,34		
	MAXIMUM VALUE			1,00		

Overall, the average BPRS efficiency score in West Java from 2018 to 2021 is 0.73 and is in the strong expected category, where even though there are inefficiencies it is still very possible to achieve a maximum level of efficiency.

Causes of SRB Inefficiency

Based on the results of research on third-party funds (DPK) and operational costs as input variables as well as operating income and financing provided as output variables using the Data Envelopment Analysis (DEA) method, it is known that in the period 2018 to 2021, the majority of BPRS in West Java has not yet reached the maximum level of efficiency and there are only two BPRS whose average efficiency value is very good and did not experience significant movement during the study period.

One of the factors causing inefficiency in BPRS in West Java is the excess of third-party funds whose amounts are not by the target, this can also mean that the role of third-party funds as input is not optimal to produce output. In 2018 11 BPRS had to reduce the number of DPK to achieve maximum efficiency. A significant increase in third-party funds (DPK) is related to the Covid-19 phenomenon. During a pandemic, people tend to do more fund-saving activities because the risks are smaller when compared to investing.

Efforts that can be made to reduce the number of third-party funds are to allocate them into productive assets, one of which can be allocated as a source of funds for financing that will be given to the community. In addition, third-party funds can be reduced by increasing administrative costs for both deposits and deposits, which will indirectly increase the level of operating income. This is in line with the opinion of Naufal and Firdaus (2017), but this increase in administrative costs must be followed by an increase in the services provided to remain competitive with other BPRS.

The next factor that causes inefficiency in BPRS is the high amount of operational costs incurred. One of the causes of the high operational costs is the large number of workers used. Sutawijaya and Lestari (2009) state that one of the problems faced by BPRS is an increase in a workforce that is not matched by adequate skills. This condition is by the principle of the law of diminishing returns where the continuous addition of labor can cause a marginal decrease in labor productivity.

To avoid this, the effort that can be done is to recruit workers with good abilities. Another effort that can be done is to reduce the number of unnecessary expenses, such as promotion costs or other unnecessary costs.

The output-oriented approach used in the analysis process assumes that every BPRS that has not reached the maximum efficiency level must increase the amount of output to achieve the maximum profit level.

Efforts to increase operating income and financing provided as output variables in this study are interconnected. When the amount of financing provided increases simultaneously operating income will also increase because the BPRS will receive a profit ratio when providing financing to the public. Therefore one way that can be used to increase operating income is to increase the amount of financing provided, then to increase the amount of financing provided can be done by increasing the number of

financing customers or by increasing the funds that will be channeled for financing, either from additional capital or from the allocation of third-party funds that have been collected.

In addition, Naufal and Firdaus (2017) added that operating income can be increased by innovating products and service costs related to input deposits, such as providing safe deposit box services, increasing administrative costs, and others.

The second stage is the next step which analyzes the effect of the research-independent variables on the efficiency level of the BPRS as the dependent variable. The following are the results of the Tobit regression from research data that was processed using the help of the Eviews 10 software.

Table 3 Tobit Regression Results

Variable	Coefficient	Std. Error	z-Statistic	Prob.
NPF	-0.007504	0.000808	-9.283281	0.0000
FDR	0.000159	0.000197	0.805577	0.4205
ROA	0.001076	0.000510	2.110749	0.0348
KPMM	-0.001074	0.000487	-2.207160	0.0273
C	0.819305	0.025418	32.23375	0.0000

The Effect of Earning Assets Quality on Efficiency Levels

One of the indicators used to assess the quality of earning assets is the NPF (Non-Performing Financing) ratio which shows the level of problem financing. The results of the analysis show that the NPF variable has a negative and significant relationship with the level of BPRS efficiency.

Nugrohowati (2019) stated that the high NPF ratio caused by an increase in non-performing financing would affect efficiency, Firdaus and Hosen (2013) also explained that an increasingly high non-performing financing ratio would disrupt bank operations, especially in terms of liquidity. Then other studies that show similar results include research conducted by Wasiaturrahma, et al (2020) and research by Halim and Oswari (2020) which explains that the NPF ratio is a ratio that must be continuously suppressed because it can drain funds intended for other operational activities.

As a ratio that reflects the level of non-performing financing, one of the efforts that can be made to reduce the NPF ratio is by taking preventive measures in the form of applying stricter precautionary principles when disbursing financing. Then to improve the condition of existing problem financing as an effort by banks to assist customers in settling their obligations, this can be done using financing restructuring by Bank Indonesia Regulation No. 10/18/PBI/2008 regarding financing restructuring.

Effect of Liquidity Level on Efficiency Level

The Financing to Deposit Ratio (FDR) is an indicator of the level of liquidity that describes a bank's ability to provide financing from funds that have been collected from the public. Based on the results of the analysis that has been done, it can be concluded that the FDR variable has no significant effect on the efficiency level of the BPRS.

The results of the analysis in this study are in line with research conducted by Naufal and Firdaus (2017), Rahma and Mayasari (2021), and Khairunnisa and Khasanah (2018)

which also show that the FDR ratio does not significantly affect the level of efficiency. Rahma and Mayasari (2021) explain that to achieve a good level of liquidity, banks need to fulfill cash reserves, increase the number of deposits, and have a low level of bad loans. If the opportunity cost increases due to the high amount of maintenance for deposits and the cost of handling bad loans, then the bank will lose its opportunity to invest and make a profit.

Even though the FDR ratio does not significantly affect the level of efficiency, this ratio needs to be maintained and cared for. This is because the higher level of the FDR ratio will cause a decrease in the bank's liquidity level, and if the level of the FDR ratio is very low, it can be identified that there are a lot of third-party funds that are not used as productive sources of funds to channel funds through financing so that the level of income originating from the disbursement of funds is getting lower.

Furthermore, this is also in line with the results of the analysis using the Data Envelopment Analysis (DEA) method where it was identified that one of the causes of inefficiency in BPRS is the lack of the amount of financing provided.

Effect of Profitability Level on Efficiency Level

The level of profitability can be assessed using the ROA (Return On Assets) ratio which shows the bank's ability to generate profits from all assets owned. The results of the analysis show that the ROA variable has a positive and significant effect on the efficiency level of the BPRS.

This research is in line with research conducted by Pambuko (2016) and research by Firdaus and Hosen (2013) which states that the greater the profit a bank gets from the results of asset management is indicated as a more efficient bank. Similar research results were also put forward by Naufal and Firdaus (2017) and Devi and Firmansyah (2020) which showed that the ROA ratio has a positive relationship with the level of efficiency, it's just that the effect is not significant.

Then Khairunnisa and Khasanah (2018) explain that if the asset value is greater, the bank can carry out its operations more broadly and varied so that it will generate greater profits. Sofia (2016) further explains that the income earned by banks can be used to add technology such as ATM networks or other technology services that make it easier for customers to make transactions to encourage operational activities to become more efficient.

The explanation above is also in line with the results of the DEA analysis that the potential for improvement to achieve the maximum level of efficiency, BPRS needs to increase the amount of operating income.

Effect of Capital Adequacy Level on Efficiency Level

One of the ratios that can be used to assess the level of capital adequacy is the Capital Adequacy Ratio (CAR) or Minimum Capital Adequacy Ratio (KPMM), this ratio shows a bank's ability to absorb risk. Based on the results of the analysis, it was concluded that the KPMM ratio has a negative and significant relationship to the efficiency level of the BPRS.

The results of the study show that there is a negative and significant relationship between the CAR and the level of efficiency in between, namely research conducted by Naufal and Firdaus (2017), Suwignyo and Musdholifah (2019), and Firdaus and Hosen

(2013). Suwignyo and Musdholifah (2019) explain that an increase in the CAR ratio is not necessarily in line with an increase in the level of efficiency, this depends on how the bank's ability to manage capital to deal with possible risks while carrying out its operational activities.

Then Firdaus and Hosen (2013) explained that the negative relationship between the CAR ratio and the level of efficiency can reflect a risk-return trade-off or a condition where the higher the risk, the higher the return received. This can happen because most people tend to choose banks that have a lower level of risk compared to banks that have a high level of risk but are more productive.

The practical implication of this research on the development of studies regarding the level of efficiency of BPRS is that the efficiency of BPRS is very closely related to the management and allocation of funds, especially third-party funds, and assets as resources owned to carry out operations. Supposedly with the resources that are already owned, BPRS can provide greater income and can be used as a source of funds for channeling financing to the public.

This study also shows that inefficiency in BPRS occurs due to excess third-party funds and high levels of operational costs and this is to the principle of the law of diminishing returns where continuous additions to production inputs can cause a marginal decrease in output.

5. CONCLUSION

The average BPRS efficiency score in West Java from 2018 to 2021 is included in the Strong Expected category which is still very likely to be optimized to achieve maximum efficiency levels. The ratio of NPF (Non-Performing Financing) which is an indicator of the quality of productive assets and the ratio of KPMM (Minimum Capital Adequacy Ratio) or also known as CAR (Capital Adequacy Ratio) as an indicator of the level of capital adequacy has a negative and significant effect on the efficiency level of BPRS in West Java. The FDR (Financing to Deposit Ratio) ratio as an indicator of the level of liquidity does not significantly affect the efficiency level of BPRS in West Java. The ratio of ROA (Return On Assets) as an indicator of the level of profitability has a positive and significant effect on the efficiency level of BPRS in West Java.

For future researchers, it is hoped that they can examine using more diverse variables beyond the variables used in this study and are not limited to internal variables but also examine external factors, such as inflation rates, interest rates, and Gross Domestic Product (GDP). In addition, future research is also expected to broaden the range of subjects and extend the research period in order to obtain more varied and more accurate research results.

REFERENCES

- Devi, A., & Firmansyah, I. (2020). Efficiency Determinant Analysis in Islamic Bank in Indonesia. *Muqtasih: Jurnal Ekonomi dan Perbankan Syariah*, 104-116.
- Fatmawati, R., & Aji, T. S. (2018). Analisis Pengaruh Faktor Internal dan Eksternal Terhadap Efisiensi Bank Umum Konvensional di Indonesia Periode 2012-2016 Dengan Menggunakan Two Stage Data Envelopment Analysis. *Jurnal Ilmu Manajemen*, 367-375.

- Fauzi, A. (2018). Perhitungan PSAK 23 (Pendapatan Operasional, Non Operasional) dan Pelaporan Keuangan Perusahaan pada PT. Jasa Marga (Persero) Tbk. *Cakrawala Management Business Journal*, 102-118.
- Ferdinand, A. (2014). *Metode Penelitian: Pedoman untuk Penulisan Skripsi, Tesis, dan Disertasi Ilmu Manajemen*. Semarang: Badan Penerbit Universitas Diponegoro.
- Festiani, E. R. (2016). Analisis Pengaruh Rasio CAR, NPF, BOPO, ROA, dan FDR terhadap Tingkat Kesehatan Bank Umum Syariah di Indonesia. *El-Dinar: Jurnal Keuangan dan Perbankan Syariah*, 196-211.
- Firdaus, M. F., & Hosen, M. N. (2013). Efisiensi Bank Umum Syariah Menggunakan Pendekatan Two-Stage Data Envelopment Analysis. *Buletin Ekonomi Moneter dan Perbankan*, 167-188.
- Hadad, M. D., & dkk. (2003). Analisis Efisiensi Industri Perbankan Indonesia: Penggunaan Metode Non Parametrik Data Envelopmen Anlysis (DEA). Retrieved Juni 6, 2020, from <https://www.bi.go.id>
- Hadad, M., & dkk. (2003). Pendekatan Parametrik untuk Efisiensi Pebankan Indoesia. Retrieved Juni 6, 2021, from <https://www.bi.go.id>
- Halim, A., & Oswari, T. (2020). The Level of Efficiency of Islamic Rural Banks in Java 2014-2017 Using Slacks-Based Data Envelopment Analysis. *Falah: Jurnal Ekonomi Syariah*, 45-57.
- Hasbi, S., & Apriyana, M. (2021). Tingkat Efisiensi BPR dan BPRS di Jawa Barat pada Masa Pandemi Covid-19. *Jurnal Nisbah*, 1-7.
- Iqbal, M. H., & Budiyanto, I. (2020). Analisis Pengaruh Kewajiban Penyediaan Modal Minimum (KPM), Beban Operasional Pendapatan Operasional (BOPO), Financing To Deposit Ratio (FDR), Dan Inflasi Terhadap Return On Asset (ROA) Pada Bank Umum Syariah di Indonesia Periode 2016-2019. *MALIA: Journal of Islamic Banking and Finance*, 1-11.
- Khairunnisa, S., & Khasanah, M. (2018). Tingkat Efisiensi Perbankan Syariah Pasca Spin Off dengan Metode Two-Stage Data Envelopment Analysis. *Al-Tijary: Jurnal Ekonomi dan Bisnis Islam*, 11-24.
- Kurniawan, A. W., & Puspitaningtyas, Z. (2016). *Metode Penelitian Kuantitatif*. Yogyakarta: Pandiva Buku.
- Manurung, Y. M., & Marwansyah, S. (2017). Analisis Pemberian Kredit terhadap Pendapatan Bunga Bersih Pada PT Bank DKI. *Jurnal Moneter*, 176-182.
- Mauliza, D., & Daud, R. (2016). Pengaruh Kecukupan Modal dan Kompetensi terhadap Profitabilitas Bank Syariah di Indonesia. *Jurnal Ilmiah Mahasiswa Ekonomi Akuntansi (JIMEKA)*, 13-19.
- Miftahurrohman. (2019). Analisis Faktor-Faktor yang Mempengaruhi Tingkat Efisiensi Perbankan Syariah dengan Pendekatan Data Envelopment Analysis (Studi Pada Bank Syariah Negara-Negara ASEAN). *Jurnal Lentera Akuntansi*, 71-91.
- Muhammad. (2004). *Ekonomi Mikro dalam Perspektif Islam*. Yogyakarta: BPFE-Yogyakarta.
- Muharam, H., & Pusvitasari, R. (2007). Analisis Perbandingan Efisiensi Bank Syariah di Indonesia Dengan Metode Data Envelopment Analysis (periode Tahun 2005). *Jurnal Ekonomi dan Bisnis Islam*, 80-166.
- Muhari, S., & Hosen, M. N. (2014). Tingkat Efisiensi BPRS di Indonesia: Perbandingan Metode SFA dengan DEA dan hubungannya dengan CAMEL. *Jurnal Keuangan dan Perbankan*, 307-328.
- Mulyadi, M. (2012). Riset Desain dalam Metodologi Penelitian. *Jurnal Studi Komunikasi dan Media*, 71-80.

- Naufal, F. M., & Firdaus, A. (2017). Analisis Efisiensi Islamic Rural Bank (BPRS) Wilayah Jabodetabek Dengan Pendekatan Two Stage Data Envelopment Analysis (DEA). *Equilibrium: Jurnal Ekonomi Syariah*, 196 - 220.
- Nugraha, B. W. (2013). Analisis Efisiensi Perbankan Menggunakan Metode Non Parametrik Data Envelopment Anlysis (DEA). *Jurnal Ilmu Manajemen*, 272-284.
- Nugrohowati, R. N. (2019). Measuring The Efficiency of Indonesian Sharia Rural Banks: Two Stage Approach. *Jurnal Ekonomi Pembangunan: Kajian Masalah Ekonomi dan Pembangunan*, 28-49.
- OJK. (2021). Laporan Perkembangan Keuangan Syariah Indonesia. Jakarta: Otoritas Jasa Keuangan.
- OJK. (2021). Statistik Perbankan Syariah. Jakarta: Otoritas Jasa Keuangan.
- Pambuko, Z. B. (2016). Determinan Tingkat Efisiensi Perbankan Syariah di Indonesia: Two Stages Data Envelopment Analysis. *Cakrawala*, 178-194.
- Prabowo, R., & Sutanto, A. (2019). Analisis Pengaruh Struktur Modal dan Likuiditas terhadap Profitabilitas pada Perusahaan Sektor Otomotif di Indonesia. *Jurnal Samudra EKonomi dan Bisnis*, 1-11.
- Primatami, A., & Primadhita, Y. (2020). Efisiensi UMKM Makanan dengan Pendekatan Data Envelopment Analysis. *Jurnal Pengembangan Wiraswasta*, 1-10.
- Puspita, H. S., & Shofawati, A. (2018). Determinan Tingkat Efisiensi Bank Pembangunan Daerah (BPD) Syariah di Indonesia: Two-Stage Data Envelopment Analysis. *Jurnal Ekonomi Syariah Teori dan Terapan*, 804-819.
- Rahardja, P., & Manurung, M. (2008). Pengantar Ilmu Ekonomi (Mikroekonomi & Makroekonomi). Jakarta: Lembaga Penerbit Fakultas Ekonomi Universitas Indonesia.
- Rahma, N. A., & Mayasari, I. (2021). Pengaruh Total Aset, Profitabilitas, dan Likuiditas Terhadap Efisiensi Bank Umum Syariah Di Indonesia dengan Pendekatan Stochastic Frontier Analysis. *Industrial Research Workshop and National Seminar* (pp. 1562-1567). Bandung: Politeknik Negeri Bandung.
- Ramadhan, A., & dkk. (2017). Mengukur Tingkat Efisiensi Islamic Rural Bank dengan Menggunakan Data Envelopment Analysis (DEA). *Cakrawala: Jurnal Studi Islam*, 113-120.
- Ramadhan, P. (2017). Determinan Pembiayaan Bermasalah Sektor Pertambangan Pada Perbankan Syariah. *Akuntabilitas: Jurnal Ilmu Akuntansi*, 369-390.
- Saaty, T. L., & Vargas, L. G. (2006). *Decision Making with the Analytic Network Process. Economic, Political, Social and Technological Applications with Benefits, Opportunities, Costs and Risks*. Pittsburgh: Springer.
- Sarasyanti, N., & Shofawati, A. (2018). Perbandingan Kinerja Keuangan BPRS dan BPR Konvensional di Surabaya. *Jurnal Ekonomi Syariah Teori dan Terapan*, 290-304.
- Sari, P. Z., Harianto, R., & Andini, B. N. (2018). Determinan Efisiensi Perbankan (Bank Umum Konvensional dan Bank Syariah) Tahun 2015-2017. *Media Mahardhika*, 110-131.
- Soetanto, T. V., & Ricky. (2011). Technical Efficiency of Indonesian Commercial Banks: An Application of Two-Stage DEA. *Jurnal Manajemen dan Kewirausahaan*, 107-116.
- Sofia, G. N. (2016). Analisis Faktor Penentu Tingkat Efisiensi Perbankan di Indonesia Pada Tahun 2012-2014 Dengan Menggunakan Pendekatan Two Stage Data Envelopment Analysis. *Jurnal Ilmu Manajemen*, 449-457.
- Supeno, W. (2019). Analisis Efisiensi BOPO Terhadap Laba Bersih Pada BPR . *Jurnal Kajian Ilmiah Universitas Bhayangkara Jakarta Raya*, 182-194.

- Sutawijaya, A., & Lestari, E. P. (2009). Efisiensi Teknis Perbankan Indonesia Pasca Krisis Ekonomi: Sebuah Studi Empiris Penerapan Model DEA. *Jurnal Ekonomi Pembangunan*, 49-67.
- Suwignyo, A. O., & Musdholifah. (2019). Analisis Faktor Penentu Efisiensi Bank Syariah di Indonesia Dengan Pendekatan Two Stage Data Envelopment Analysis (DEA). *Jurnal Ilmu Manajemen*, 172-183.
- Tuffahati, H., Mardian, S., & Suprpto, E. (2016). Pengukuran Efisiensi Asuransi Syariah dengan Data Envelopment Analysis (DEA). *Jurnal Akuntansi dan Keuangan Islam*, 1-24.
- Wardana, S. K. (2012). Analisis Tingkat Efisiensi Perbankan Dengan Pendekatan Non Parametrik Data Envelopment Analysis (DEA) (Studi Pada Bank Umum di Indonesia Tahun 2005-2011). *Jurnal Ilmiah Mahasiswa FEB Universitas Brawijaya*, 1-10.
- Wasiaturrahma, & dkk. (2020). Financial performance of rural banks in Indonesia: A two-stage DEA approach. *Heliyon*, 1-9.
- Yusuf, M. (2017). *Metode Penelitian: Kuantitatif, Kualitatif, dan Penelitian Gabungan*. Jakarta: Kencana.