

Analysis of Determinants of Return on Assets at DKI Jakarta Regional Development Bank Using the Partial Adjustment Model

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ABSTRACT

This study aims to analyze the factors that affect the Return on Assets (ROA) at the Jakarta Regional Development Bank (BPD) using the *Partial Adjustment Model* (PAM) approach during the 2017–2024 period. The independent variables used include Operating Expenses to Operating Income (BOPO), Non-Performing Loans (NPL), Loan to Deposit Ratio (LDR), Minimum Mandatory Current Account (GWM), and ROA for the previous period (ROA (-1) as a form of partial adjustment. The estimated results showed that BOPO had a significant negative effect on ROA, while NPL, LDR, and ROA (-1) had a significant positive effect. The reserve requirement does not have a significant influence on ROA. The model passed the test of classical assumptions, including normality, multicollinearity, heteroscedasticity, and autocorrelation, which strengthened the reliability of the results. These findings indicate that operational efficiency and credit risk management strategies are the main keys in increasing the profitability of BPD DKI Jakarta. This research provides important implications for bank management and banking authorities in formulating more effective and sustainable data-based policies.

Keywords: ROA, BOPO, NPL, LDR, GWM, Partial Adjustment Model, BPD DKI Jakarta

INTRODUCTION

Banking has a very vital role in a country's economy, especially in supporting investment and financing activities for productive sectors. As an intermediary institution, the bank functions to collect public funds and distribute them in the form of credit to sectors in need, as well as maintain financial system stability. Regional Development Banks (BPD), including the Jakarta Regional Development Bank (BPD DKI Jakarta), have a special role in supporting regional development and strengthening the local economy. BPD DKI Jakarta, as one of the local government-owned banks, has the task of facilitating financing for the public sector and the community in the DKI Jakarta area, while maintaining its financial health and operational performance.

In this context, a bank's profitability, which is often measured by Return on Assets (ROA), is the main indicator of a bank's success and health. ROA describes the extent to which a bank can generate profits relative to the total assets owned (Saputra & Lina, 2020). The higher the ROA, the more efficient the bank will be in managing its assets to generate profits. Therefore, for BPD DKI Jakarta, it is important to understand the factors that affect the performance of ROA, in order to formulate the right policies to increase profitability and reduce the risk of loss.

Various factors can affect ROA, both internal (such as operational costs, credit quality, and liquidity) and external (such as macroeconomic conditions and government policies). In this case, several variables that are commonly used to measure bank performance (Harun, 2016) include Operating Costs to Operating Income (BOPO), Non-Performing Loans (NPL), Loan to Deposit Ratio (LDR), and Minimum Mandatory Current Account (GWM).

BOPO describes the operational efficiency of a bank, which is an important indicator in reflecting how much it costs a bank to generate revenue. The higher the BOPO, the lower the bank's operational efficiency, which in turn can lower the ROA (Maulana, et al., 2021). NPLs reflect the quality of a bank's assets, where the higher the NPL, the greater the credit risk the bank has to face, which can reduce net profit and affect ROA.

LDR describes a bank's level of liquidity, which is directly related to its ability to meet short-term obligations and disburse credit. An LDR that is too high can indicate a bank's dependence on loans (Ambaroita, 2015), while an LDR that is too low can indicate an imbalance in financing.

The reserve requirement, as a monetary policy set by Bank Indonesia, influences the bank's liquidity. High reserve requirements can reduce banks' ability to disburse credit, potentially hindering profit growth and ROA.

Additionally, it is important to consider partial adjustments in the ROA. In economic theory, banks cannot always adapt directly to changes in market conditions or new policies. Therefore, the Partial Adjustment model is used to describe the bank's gradual adjustment to the changes that occur, so that the ROA does not immediately respond to policy changes or economic variables in a period. This approach is relevant, especially for banks that face market dynamics and regulations that change frequently, such as BPD DKI Jakarta which must adjust to government policies and regional economic conditions.

Although several studies have discussed the factors that affect ROA in the banking sector in general, there is still limited research that specifically examines the influence of these factors on the profitability of BPDs, especially BPD DKI Jakarta, which has unique characteristics and policies. Therefore, it is important to conduct a more in-depth analysis of the factors that affect the ROA of the DKI Jakarta BPD, using the Partial Adjustment Model approach that can describe the dynamics of ROA adjustment more realistically.

This study aims to identify and analyse the factors that affect ROA in BPD DKI Jakarta using the Partial Adjustment model. This research is expected to provide deeper insights into how BPD DKI Jakarta can manage resources and policies to increase profitability and face operational and regulatory challenges faced by regionally owned banks. These findings are also expected to make an important contribution to regional banking policies, especially in asset management, operational efficiency, credit risk management, and effective liquidity policies. Thus, this research is not only important for academics and banking practitioners but also provides guidance for the management of the Jakarta BPD and related authorities in formulating better strategies in increasing the bank's profitability, while supporting regional economic growth.

Theoretical Framework

This theoretical framework will explain the basics of the concepts used in this study, which include the theory of bank profitability, the Partial Adjustment Model, and the relationship between factors that affect the bank's Return on Assets (ROA), with a focus on the Jakarta Regional Development Bank (BPD). This explanation will also discuss the variables used in regression models and how these theories underlie research.

Profitability is an important measure that reflects the success of a bank's operations in generating profits from its assets. Return on Assets (ROA) is a ratio commonly used to measure a bank's profitability, which is calculated by comparing the net profit after tax to the bank's total assets. ROA measures the efficiency of a bank in using its assets to generate profits.

In the context of banking, a high ROA indicates that the bank can generate significant profits relative to the number of assets it owns, while a low ROA indicates inefficiencies in

asset management. The profitability of banks is greatly influenced by various internal and external factors, which will be discussed further in this study. Several factors that have the potential to affect ROA in banks, especially in BPD DKI Jakarta, include BOPO, NPL, LDR, GWM, and ROA lag.

Operating Costs to Operating Income (BOPO): BOPO measures the operational efficiency of a bank by comparing operating costs with the operating income obtained. Banks with high BOPO show inefficiencies in their operations, which can reduce profitability (ROA). The theory of operational efficiency states that banks that are efficient in managing their operating costs tend to have higher ROAs (Susila, et al., 2021).

Non-Performing Loan (NPL): NPL describes the ratio of non-performing loans provided by a bank. The higher the NPL, the greater the credit risk that the bank must face. Non-performing loans not only reduce interest income but can also increase the cost of credit loss reserves, which will ultimately lower ROA (Al-Sharkas & Al-Sharkas, 2022; Singh, et al., 2021; Do, et al., 2020). Credit risk management theory explains that banks must maintain credit quality so as not to harm their financial performance.

Loan to Deposit Ratio (LDR): LDR shows the ratio between the total loans disbursed and the total deposits accumulated by the bank. An LDR that is too high can indicate a bank's reliance on credit, which increases liquidity risk. Conversely, a low LDR can indicate that the bank is not maximizing the revenue potential from credit distribution (Yudha, et al., 2017; Bella, 2022). The bank's liquidity theory states that there is a balance that must be maintained between credit distribution and deposit management to maximize profitability.

Minimum Mandatory Reserve Requirement (GWM): Reserve requirement is an obligation set by the central bank that must be fulfilled by the bank by depositing a certain amount of funds in Bank Indonesia. This policy affects bank liquidity, where a high reserve requirement policy can reduce the bank's ability to disburse credit, thereby reducing potential profits and suppressing ROA (Jatmiko, 2025; Jackson & Tamuke, 2022). ROA (-1): As a lag variable, the previous period ROA (ROA (-1)) reflects a partial adjustment in the bank's profitability. Banks cannot directly change the ROA simply by changing policies or internal variables. Therefore, there is an adjustment effect that occurs gradually. The partial adjustment theory explains that changes in a bank's performance take time to be fully reflected in the bank's financial results.

The partial adjustment model (PAM) is an approach used to describe the dynamics of gradual adjustment in a variable, in this case ROA. This model assumes that changes in dependent variables do not occur directly over a period, but occur gradually, influenced by independent variables. In other words, the ROA in a current period is not fully adjusted to the factors that affect in a period, but rather there is a delay or *lag* in the adjustment. PAM is particularly relevant for this analysis, as banks are not always able to respond immediately to changes in market conditions or government policies. Adjustments to internal (such as BOPO, NPLs, and LDRs) and external factors (such as changes in monetary policy or reserve requirements) will affect ROA, but the effect may not be seen until after a certain period. Therefore, this model provides a more realistic picture of the adjustment process in the bank's performance.

This theoretical framework compiles the basic concepts used in this study to analyse the factors that affect ROA in the DKI Jakarta BPD using the Partial Adjustment Model (Basuki & Prawoto, 2019). Considering the theories of operational efficiency, credit risk management, and bank liquidity, as well as partial adjustment models, this study aims to provide a more accurate picture of the dynamics of bank profitability performance. This study also tests classical assumptions in regression to ensure the validity of the analysis results.

RESEARCH METHODOLOGY

This study aims to analyse the factors that affect the Return on Assets (ROA) in the Jakarta Regional Development Bank (BPD) using the Partial Adjustment Model (PAM). To achieve this goal, the methodology used includes a quantitative approach with time series regression analysis that examines secondary data during the period 2017 to 2024.

1. Data Types and Sources

The type of data used in this study is quantitative data obtained from the annual and quarterly financial statements of BPD DKI Jakarta during the period 2017 to 2024. The data collected included the following variables:

- a. ROA (Return on Assets) as a dependent variable that indicates the bank's profitability.
- b. BOPO (Operating Costs to Operating Income), which describes the operational efficiency of banks.
- c. NPL (Non-Performing Loan), which shows the level of credit quality of the bank.
- d. LDR (Loan to Deposit Ratio), which describes the bank's liquidity level.
- e. Reserve Requirement (Minimum Mandatory Current Account), which reflects the liquidity policy set by Bank Indonesia.
- f. ROA (-1), which is the lag value of the ROA, which is used to capture the effect of partial adjustments on the bank's profitability.

Data sources are obtained from bank annual reports, Bank Indonesia data, Financial Services Authority, and reliable secondary data sources.

2. Regression Models and Analytical Approaches

To analyze the influence of factors on ROA, this study uses a dynamic regression model with a Partial Adjustment Model (PAM) approach (Saraswati, et al., 2022). This model was chosen because it can describe a gradual adjustment to changes in variables that affect ROA, where full adjustment to change does not occur in a single period. The regression model used in this study can be written as follows:

$$ROA_t = \alpha + \beta_1 BOPO_t + \beta_2 NPL_t + \beta_3 LDR_t + \beta_4 GWM_t + \beta_5 ROA_{t-1} + \epsilon_t$$

Information:

- a. ROAt: Return on Assets pada periode t
- b. BOPOt: Operating Costs to Operating Income in the period t
- c. NPLt: Non-Performing Loan in the period t
- d. LDRt: Loan to Deposit Ratio in the period t
- e. Reserve Requirement: Minimum Mandatory Current Account in the t period
- f. ROAt-1: Return on Assets of the previous period (lag)
- g. ϵ_t : Term error or interruption in period t

3. Classic Assumption Test

Before conducting regression analysis, a classical assumption test needs to be carried out to ensure that the regression model used is valid and does not contain bias (Damodar, 2021). Some of the tests performed include:

- a. Normality Test: Uses the Jarque-Bera test to test whether the residue of the regression model follows the normal distribution. If the residual is abnormal, then the regression model estimation may be inefficient.

- b. Multicollinearity test: Uses the Variance Inflation Factor (VIF) to identify the presence of high linear relationships between independent variables in the model. If the VIF shows a high value, this can lead to an unstable estimate.
- c. Heteroscedasticity Test: Using the Breusch-Pagan-Godfrey test to test whether there is a residual variance inconsistency throughout the observation period. If there is heteroscedasticity, then model estimation can become inefficient.
- d. Autocorrelation Test: Uses the Breusch-Godfrey Serial Correlation LM Test to test whether there is autocorrelation in the residual model. Autocorrelation can lead to bias in the estimation of regression parameters.

4. Hypothesis Estimation and Testing Techniques

After performing the classical assumption test, the regression model estimation was carried out using the Ordinary Least Squares (OLS) method (Wooditch, et al., 2021). To test the significance of the influence of each independent variable on the ROA, a hypothesis test was carried out with a t-test for each coefficient, as well as an F-statistical test to test the shared significance of all independent variables in the model.

- a. Null hypothesis (H₀): The coefficients of independent variables have no significant effect on ROA.
- b. Alternative hypothesis (H₁): The coefficients of independent variables have a significant effect on ROA.

Furthermore, R-squared and Adjusted R-squared values are used to measure how well the model can explain variations in ROA, with higher values indicating a better model.

RESULTS OF ANALYSIS AND DISCUSSION

Based on descriptive statistical data for five bank financial indicators (ROA, BOPO, LDR, NPL, and GWM) from 32 observations, the following analysis can be carried out:

ROA (Return on Assets) has an average of 1.85%, which reflects the bank's ability to generate a profit from its total assets. The maximum ROA value of 2.47% and the minimum of 1.11% indicate a variation in performance between banks or between periods. The low standard deviation (0.4084) indicates a relatively small variation in the data. Skewness of negative value (-0.1444) indicates a slight right-skewed distribution. A kurtosis value below 3 (1.8636) indicates a smoother distribution than normal. The Jarque-Bera test yields a probability of 0.3999 (>0.05), which means that the ROA data is normally distributed.

Table 1. Descriptive Statistics of Research Variables

| Information | ROA | BOPO | LDR | NPL | GWM |
|-------------|---------|----------|----------|---------|---------|
| Mean | 1.8534 | 78.8591 | 82.8659 | 2.8172 | 6.4625 |
| Median | 1.8050 | 77.9000 | 81.9450 | 2.9900 | 6.2900 |
| Maximum | 2.4700 | 87.0200 | 100.3300 | 3.7600 | 11.5900 |
| Minimum | 1.1100 | 75.2000 | 66.2900 | 1.7500 | 3.2300 |
| Std. Dev. | 0.4084 | 3.5411 | 8.2181 | 0.6722 | 2.4144 |
| Skewness | -0.1444 | 1.1528 | 0.1500 | -0.3156 | 0.4076 |
| Kurtosis | 1.8636 | 3.0036 | 2.3576 | 1.6738 | 1.9673 |
| Jarque-Bera | 1.8330 | 7.0882 | 0.6702 | 2.8763 | 2.3081 |
| Probability | 0.3999 | 0.0289 | 0.7153 | 0.2374 | 0.3154 |
| Sum | 59.3100 | 2523.490 | 2651.710 | 90.1500 | 206.800 |
| | | 0 | 0 | | 0 |

| | | | | | |
|--------------|--------|----------|----------|---------|---------|
| | | | 2093.659 | | 180.712 |
| Sum Sq. Dev. | 5.1707 | 388.7161 | 0 | 14.0069 | 8 |
| Observations | 32 | 32 | 32 | 32 | 32 |

Source: Data processed 2025

BOPO (Operating Costs to Operating Income) has a high average of 78.86%, indicating that operational efficiency is still low. A high positive skewness (1.1528) indicates an outward deviation to the right. The probability of the Jarque-Bera test of 0.0289 (<0.05) indicates an abnormal distribution.

The LDR (Loan to Deposit Ratio) shows an average of 82.87%, meaning that most third-party funds are disbursed in the form of credit. A maximum value of 100.33% indicates that there is a bank that distributes credit more than the funds collected. Skewness close to zero (0.1500) and kurtosis close to 3 indicates a near-normal distribution, supported by a probability value of 0.7153 (>0.05).

NPLs (Non-Performing Loans) have an average of 2.82% with a slight left-leaning distribution (skewness -0.3156) and low kurtosis (1.6738). This shows that most of the data gathers at high values yet there are no extreme deviations. The Jarque-Bera probability value of 0.2374 indicates normal distributed data.

The reserve requirement (Minimum Required Current Account) has an average of 6.46% and a large spread (standard deviation of 2.41). Positive skewness (0.4076) and low kurtosis (1.9673) indicate that the data is not too aberrant, although it is not yet completely normal (probability 0.3154).

Table 2. PAM Model Regression Results

| Dependent Variable: ROA | | | | |
|-------------------------|-------------|-----------------------|-------------|---------|
| Sample: 2017Q1 2024Q4 | | | | |
| Variable | Coefficient | Std. Error | t-Statistic | Prob. |
| BOPO | -0.0646 | 0.007585 | -8.511624 | 0.0000 |
| NPL | 0.1479 | 0.057106 | 2.589314 | 0.0158 |
| LDR | 0.0117 | 0.003265 | 3.592473 | 0.0014 |
| GWM | 0.0151 | 0.013091 | 1.155957 | 0.2586 |
| ROA (-1) | 0.2690 | 0.094928 | 2.833274 | 0.0090 |
| C | 4.9485 | 0.596709 | 8.293042 | 0.0000 |
| R-squared | 0.9542 | Mean dependent var | | 1.8335 |
| Adjusted R-squared | 0.9451 | S.D. dependent var | | 0.3991 |
| S.E. of regression | 0.0935 | Akaike info criterion | | -1.7290 |
| Sum squared resid | 0.2187 | Schwarz criterion | | -1.4514 |
| F-statistic | 104.2309 | Hannan-Quinn criter | | -1.6385 |

| | | | |
|-------------------|--------|--------------------|--------|
| Prob(F-statistic) | 0.0000 | Durbin-Watson stat | 2.5034 |
|-------------------|--------|--------------------|--------|

Source: Data processed 2025

The regression model in Table 1 above is often referred to as *the Partial Adjustment Model* (PAM) with dependent variables ROA (Return on Assets) and a sample period from the first quarter of 2017 to the fourth quarter of 2024. This model includes ROA (-1), which is the value of the ROA in the previous period, as an independent variable, reflecting the dynamics of the adjustment of the ROA to changes in other explanatory variables.

BOPO had a significant negative effect on ROA with a coefficient of -0.0646 and a p value = 0.0000. This is consistent in theory, as increased operating costs (BOPO) suppress profitability.

NPL had a significant positive effect on ROA (coefficient 0.1479, p = 0.0158). This can be considered unusual, as in general an increase in NPLs indicates a high credit risk and should suppress ROA. However, it can happen if the bank is still able to maintain profitability even if the non-performing loan ratio increases, or if the short-term correlation is temporary.

LDR also had a significant positive effect (coefficient of 0.0117, p = 0.0014), indicating that the greater the proportion of credit given to the funds raised, the greater the profit generated.

The reserve requirement is not statistically significant (p = 0.2586), so it cannot be concluded that there is a direct effect of the minimum mandatory reserve on ROA in the short term.

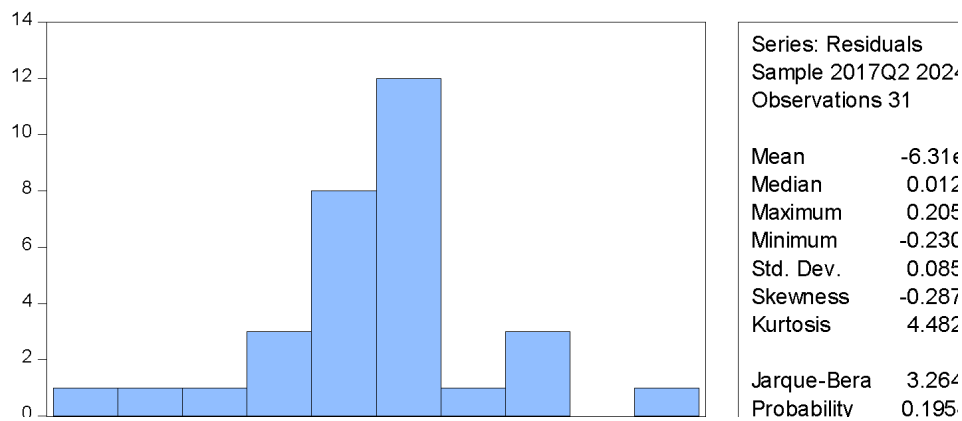
The ROA (-1) was significant (coefficient 0.2690, p = 0.0090), confirming that the PAM model was valid and that there was a partial adjustment process to the previous value. This coefficient shows that about 26.9% of the current ROA changes are still affected by the previous period's ROA, indicating an *inertia* in the bank's profitability.

R-squared = 0.9542 and Adjusted R-squared = 0.9451, indicate that the model can explain more than 94% of the variation in ROA. This is an excellent achievement for the economic time series model.

The F-statistic value = 104.23 and the probability of 0.0000 indicates that the model is very significant.

Durbin-Watson = 2.5034; This value is close to 2, even slightly above it, which indicates that there is no autocorrelation in the residual model. This is important in time series models because autocorrelation can cause the estimated results to be biased.

Overall, the regression results show that operational efficiency (BOPO), asset quality (NPL), and credit disbursement liquidity (LDR) have a significant role in the bank's profitability. This model can be used by bank management and financial authorities to formulate policies that maintain a balance between credit growth and operational risks. The insignificance of the reserve requirement suggests that the effect of the minimum reserve is not directly reflected in the short-term ROA, perhaps due to its more macroprudential nature.



Source: Data processed 2025

Figure 1. Normality Test

The Jarque-Bera test is used to evaluate whether the residual distribution (error) of the regression model follows the normal distribution (Thadewald & Büning, 2007; Cardoso, et al., 2025). This is important because one of the classic assumptions of linear regression is that the residuals must be normally distributed, specifically if we want to perform inferential statistical tests (such as the t and F tests) validly. Since the probability value is $0.195 > 0.05$, it accepts the null hypothesis (H_0). That is, there is not enough evidence to state that the residual is abnormal. In other words, this residual regression model can be normally distributed. The normal residual distribution strengthens the reliability of regression models in terms of statistical validity, particularly for coefficient interpretation and significance tests. Thus, the residual normality assumption is fulfilled, and the model can be used for prediction and decision-making with a decent level of confidence.

Table 3. Multicollinearity Test

| Variable | Variance Inflation Factors | | |
|----------|----------------------------|----------------|--------------|
| | Coefficient Variance | Uncentered VIF | Centered VIF |
| BOPO | 5.75E-05 | 1273.842 | 2.46502 |
| NPL | 3.26E-03 | 94.6163 | 4.878921 |
| LDR | 1.07E-05 | 260.2703 | 2.474926 |
| GWM | 1.71E-04 | 29.38727 | 3.427908 |
| ROA (-1) | 0.009011 | 116.8886 | 4.963872 |
| C | 0.356061 | 1261.618 | NA |

Source: Data processed 2025

Variance Inflation Factor (VIF) is used to detect the presence of multicollinearity between independent variables in the regression model (Oke, et al., 2019). VIF measures how much the variance of the regression coefficient increases due to the correlation between independent variables.

- VIF = 1 indicates No multicollinearity.
- $1 < \text{VIF} < 5$ indicate mild/non-worrying multicollinearity.
- $\text{VIF} > 5$ indicates a strong indication of multicollinearity.
- $\text{VIF} > 10$ indicates serious multicollinearity, the model needs to be reviewed.

All Cantered VIF values are below the critical number of 5, although NPL (4.88) and ROA (-1) (4.96) are close to the threshold. This means that there is no serious multicollinearity between independent variables in the model. Uncentered VIF is used for analysis without considering intercepts, and can be very high; in this context, the relevant is Cantered VIF. This model does not experience significant multicollinearity issues. All independent variables are still quite independent of each other, and the results of regression estimation can be considered stable. Although some variables such as NPL and ROA (-1) indicate a VIF close to 5, this does not indicate a serious threat to the validity of the model.

Table 4. Heteroscedasticity Test

| Heteroskedasticity Test: Breusch-Pagan-Godfrey | | | |
|--|----------|----------------------|--------|
| F-statistic | 1.808073 | Prob. F(5,25) | 0.1478 |
| Obs*R-squared | 8.232912 | Prob. Chi-Square (5) | 0.1439 |
| Scaled explained SS | 9.322226 | Prob. Chi-Square (5) | 0.0969 |

Source: Data processed 2025

The Breusch-Pagan-Godfrey heteroscedasticity test aims to detect whether heteroscedasticity occurs (Ilori & Tanimowo, 2022), which is a condition in which the variance of error/residual is not constant across observations. Heteroscedasticity can cause the regression coefficient to remain unbiased, but the standard error becomes invalid, so the t and F tests can be misleading. The results of Table 5 show all probability values > 0.05 , both from F-statistic, Obs*R-squared, and Scaled Explained SS. Thus, we fail to reject the null (H_0) hypothesis. This means that no evidence of heteroscedasticity was found in the regression model. The regression model passed the heteroscedasticity test, which means that the classical assumption that the error has a constant variance (homoscedastic) is met. This strengthens the reliability of the estimated regression coefficients, and the validity of the statistical tests (t and F) used in the model.

Table 5. Autocorrelation Test

| Breusch-Godfrey Serial Correlation LM Test: | | | |
|---|----------|----------------------|--------|
| F-statistic | 1.601273 | Prob. F (2,23) | 0.2233 |
| Obs*R-squared | 3.788905 | Prob. Chi-Square (2) | 0.1504 |

Source: Data processed 2025

The Breusch-Godfrey test is used to detect residual autocorrelations in regression models (Rois, et al., 2012), especially autocorrelations of more than one order, which often occur in *time series data*. Autocorrelation can cause the estimation results to be inefficient, as well as the t-test and F-test to be invalid. The results of Table 5 show both probability values > 0.05 , both for F-statistic (0.2233) and for Obs*R-squared (0.1504). That is, there is not enough evidence to reject H_0 . In other words, no significant autocorrelation was found in the residual model. The regression model is free of autocorrelation issues, at least up to the 2nd lag as per this test specification. This is especially important for time series data, as autocorrelation can lead to underestimation of standard errors, resulting in errors in decision-making.

Operating Costs to Operating Income (BOPO) is a ratio that describes how efficient a bank is in managing its operating costs to generate operating income. The higher the BOPO value, the more inefficient the bank will be in managing costs. In this context, BOPO is negatively related to Return on Assets (ROA). This means that when BOPO increases, ROA tends to decrease (Putri, et al., 2023). In theory, in the Theory of Operational Efficiency, a

bank that has a high BOPO rate indicates that the bank incurs high costs to generate revenue. This causes the bank's profits to decrease, as much of the revenue is used to cover operating costs. In other words, banks that are efficient in managing operational costs will have a higher ROA. Conversely, if the bank is not able to manage costs properly, then the net profit margin will decrease, so the ROA will also decrease. Therefore, the relationship between BOPO and ROA is a significant negative relationship in this analysis.

Non-Performing Loan (NPL) is a ratio that shows the proportion of non-performing loans to the total credit provided by banks. NPLs are positively related to ROA, because the higher the NPL, the greater the credit risk faced by the bank. In theory, in Credit Risk Management Theory, banks with high NPLs are at risk of a decrease in income from interest, because non-performing loans do not provide the interest payments they should. In addition, banks must also provide allowance for loan losses, which will reduce the bank's net profit. Therefore, high NPLs tend to lower ROA. However, in this analysis, NPLs are positively correlated with ROA (Socol & Danuletiu, 2013), which suggests that even if NPLs increase, banks may have the capacity to manage those losses well through adequate provision policies or diversification of other sources of revenue. This can be explained by Financial Management Theory, which states that banks with good management can balance risk and return even if NPLs increase.

Loan to Deposit Ratio (LDR) is a ratio that shows the extent to which banks distribute funds collected from the public (deposits) in the form of credit. A high LDR can indicate that banks are being too aggressive in disbursing credit, which can increase liquidity risk. Conversely, a low LDR could indicate that banks are not maximizing the use of their funds to generate income from credit.

In theory, in Bank Liquidity Theory, there is a balance between liquidity and profitability. If the LDR is too high, the bank can face high liquidity risks, which can disrupt the bank's financial stability and profitability in the long run. On the other hand, an LDR that is too low indicates that the bank is not channelling enough credit, which can lead to low bank revenues and potentially lower ROA. Therefore, LDR is positively related to ROA (Beni, et al., 2023), but with good management. Banks that have an optimal LDR will be able to distribute credit carefully while maintaining liquidity, thus increasing ROA. In other words, a healthy LDR has the potential to increase bank profits through the provision of favourable credit.

The Minimum Mandatory Current Account (GWM) is an obligation for banks to keep a certain amount of funds in Bank Indonesia that cannot be used for operational activities. The reserve requirement policy serves as a monetary instrument to control the amount of money in circulation and affect the bank's liquidity. An increase in the reserve requirement will reduce the funds that can be used for credit disbursement, which in turn can affect the bank's revenue.

In theory, in Monetary Policy Theory, high reserve requirements can reduce banks' ability to disburse credit and increase income from interest (Birhanu, et al., 2021). This can lower the ROA, as the bank will have fewer funds to channel to the debtor, which reduces potential revenue. However, a reserve requirement that is too low can increase the bank's liquidity risk, so even if the reserve requirement is negatively related to the ROA in the short term, in the long term, the bank still needs to maintain sufficient liquidity so that its operations are not disrupted. Therefore, the relationship between the reserve requirement and the ROA may vary depending on the policy level set by Bank Indonesia.

ROA lag (ROA (-1)) indicates that the bank's profitability in the previous period affects the profitability of the next period. In the Partial Adjustment Model (PAM), the presence of a

partial adjustment effect means that the ROA in the previous period (lag) will have an impact on the current ROA, even if the effect is indirect.

In theory, in the Partial Adjustment Theory, banks cannot adjust all the factors that affect their performance in a single period. Adjustments to changing market conditions, internal and external policies take time to be reflected in the bank's performance. Therefore, lag ROA has a positive relationship with ROA because bank profitability tends to be inertial or follow existing patterns from previous periods. Banks that show good performance in the previous period are likely to maintain their good performance in the following period, despite changing external factors.

Overall, BOPO, NPL, LDR, GWM, and ROA (-1) affect ROA in different ways. BOPO shows a negative relationship with ROA because operational efficiency plays an important role in increasing profitability. NPLs and LDRs have a more complex relationship, where high NPLs typically reduce ROAs, while a balanced LDR can support a bank's profitability. The reserve requirement, although it reduces credit disbursement capacity, is important in maintaining the bank's liquidity and stability. Finally, ROA (-1) is positively correlated with ROA, reflecting the effect of a gradual adjustment in the bank's profitability. All of these factors must be carefully managed to ensure the bank's financial health and achieve optimal ROA levels.

CONCLUSION

The regression model constructed showed excellent performance statistically and econometrically. The regression results showed that the variables BOPO, NPL, LDR, and ROA (-1) had a significant effect on ROA. BOPO has a significant negative influence, indicating that the higher the operating costs on operating income, the bank's profitability (ROA) will decrease. In contrast, the LDR and NPL variables exert a significant positive influence on ROA, although the positive influence of NPLs needs to be examined further because theoretically an increase in non-performing loans should suppress profitability. The reserve requirement variable has no significant effect on ROA, which shows that the minimum mandatory current account policy does not have a direct impact on the bank's profitability performance in the short term.

The ROA lag coefficient (ROA (-1)) of 0.269 indicates a partial adjustment pattern, where the current ROA is still influenced by past values, indicating the existence of rigidity or stability in changes in the bank's profitability performance. An R-squared value of 0.9542 indicates that the variation in ROA can be explained by 95% of the independent variables in the model, indicating excellent goodness-of-fit.

Based on these findings, several recommendations can be given. First, banks need to focus on suppressing BOPO as the main strategy to increase profitability. Operational efficiency must be improved through digitalization, labour cost efficiency, and business process optimization. Second, although NPLs have a positive effect in the short term, credit risk management must still be strengthened because high NPLs in the long term still risk lowering asset quality. Third, a high LDR needs to be maintained so as not to cross the safe limit, to avoid liquidity risks. Finally, monetary authorities can review the effectiveness of reserve instruments in influencing bank profitability, as their impact on ROA does not appear significant in this observation period.

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