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Evaluation of the Profitability Performance of Regional Development Banks Using Panel Regression: A Study on Four Provinces in Indonesia

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ABSTRACT

This study aims to analyse the influence of ROE, BOPO, NPL, LDR, NIM, and reserve requirement on profitability as measured by Return on Assets (ROA) in four Regional Development Banks (BPD) in Indonesia, namely BPD DKI Jakarta, BPD Central Java, BPD DIY, and BPD East Java during the period 2017Q1 to 2024Q4. The method used is panel data regression using the Common Effect Model (CEM), Fixed Effect Model (FEM), and Random Effect Model (REM) approaches. The results of the Chow test showed that FEM was better than CEM, while Hausman's test showed that FEM was also more accurate than REM. Thus, the best model used is the Fixed Effect Model. The results of the analysis showed that the variables ROE, NPL, LDR, NIM, and GWM had a positive and significant effect on ROA, while BOPO had a negative and significant effect. The NIM variable is the most dominant factor in increasing profitability, while BOPO is the main obstacle. These findings confirm the importance of operational efficiency and interest margin management in improving BPD's financial performance. This research provides implications for BPD management to focus more on cost control strategies and interest income optimization to increase profitability in a sustainable manner.

Keywords: Panel Data, ROA, ROE, BOPO, GWM

1. INTRODUCTION

Regional Development Banks (BPD) have a strategic role in the Indonesian economy, especially in supporting regional development through real sector financing, MSMEs, and local infrastructure. As a financial institution owned by local governments, BPD is expected to contribute significantly to regional and national economic growth. However, despite its great potential, BPD's financial performance often fluctuates influenced by various internal and external factors.

Profitability is the main indicator in assessing BPD performance. Return on Assets (ROA) is used to measure the efficiency of banks in generating profits from their assets (Supriyono & Herdhayinta, 2019). Various studies show that factors such as Non-Performing Loan (NPL), Loan to Deposit Ratio (LDR), Operating Costs to Operating Income (BOPO), Net Interest Margin (NIM), and Minimum Required Current Account (GWM) have an influence on ROA. However, the results of previous studies show findings that vary, both in significance and direction of influence.

For example, research by Beni, et al (2023) shows that NPLs have a negative effect on ROA, while LDR has a positive effect. On the other hand, research by Tangngisalu, et al (2020) found that NPL does not have a significant effect on ROA, but LDR has a significant positive effect (Dewi & Badjra, 2020). These differences in results indicate the need for further research to comprehensively understand the factors that affect BPD profitability.

In addition, the challenges faced by BPDs, such as limited human resources, information technology, and competition with national banks, also affect their financial performance. Therefore, it is important to conduct an in-depth analysis of the factors that affect the profitability of BPD to provide strategic recommendations for the management and development of BPD in the future.

The theory of bank intermediation explains the role of banks as intermediaries between parties who have surplus funds and those who need funds. In the context of BPD, banks function to collect funds from the community and distribute them to productive sectors in the regions. Efficiency in this intermediation process will affect the bank's profitability. Factors such as BOPO, LDR, and NIM are the main indicators in assessing the operational efficiency and intermediation of banks (Buchory, 2015).

The Risk and Return Theory states that there is a positive relationship between risk and return (Fifield, e al.,2020). In the context of BPD, credit risk measured by NPLs can affect the rate of return generated. The higher the NPL, the greater the potential for losses that can reduce net profit and, in turn, ROA. Therefore, effective risk management is essential to maintain the bank's profitability.

Capital structure theory focuses on how banks determine the composition between their own capital and debt in financing their operations (DeAngelo & Stulz, 2015). CAR (Capital Adequacy Ratio) is an important indicator in this theory, as it reflects how much the bank can bear the risk of loss with the capital it has. Although not always significant, CAR can affect the stability and profitability of a bank.

The Theory of Operational Efficiency emphasizes the importance of efficiency in bank operations to achieve optimal profitability (Elmahdy, et al., 2025). BOPO is the main indicator in this theory, which measures the extent to which a bank can generate operating income compared to the operating costs incurred. The lower the BOPO, the more efficient the bank's operations, which can increase ROA.

Liquidity theory focuses on the ability of banks to meet their short-term obligations without sacrificing profitability (Calomiris, et al., 2015). LDR and reserve requirement are important liquidity indicators. An optimal LDR indicates that banks can disburse credit efficiently without sacrificing liquidity, while reserve requirements reflect adequate liquidity reserves to meet urgent needs.

Efficient market theory states that the price of an asset reflects all available information (Hodnett & Hsieh, 2012). In the context of BPD, this theory can explain how information regarding a bank's financial performance, including ROA, can affect market perception and investment decisions. Therefore, transparency and accurate disclosure of financial information are essential to build trust and increase profitability.

Institutional Economic Theory emphasizes the role of institutions and institutional structures in influencing economic performance (North, 2025). In the context of BPD, factors such as local government policies, OJK regulations, and the bank's organizational structure can affect decision-making and financial performance. Understanding this theory is important for designing policies that support the sustainable development of BPDs.

This study aims to analyse the influence of ROE, BOPO, NPL, LDR, NIM, and GWM on ROA in Regional Development Banks (BPD) in Indonesia using the panel data regression method. The contribution of this research is to provide empirical evidence on the financial factors that affect the profitability of BPD, as well as to become a reference for bank management and policymakers in formulating more efficient and sustainable strategies to improve financial performance in the sector

2. RESEARCH METHODOLOGY

This study uses a quantitative approach with a panel data analysis method to determine the influence of independent variables on the profitability of Regional Development Banks (BPD) in Indonesia. The research objects include four BPDs, namely Bank DKI Jakarta, Bank Jateng, Bank DIY, and Bank Jatim during the period from the first quarter of 2017 to the fourth quarter of 2024. The data used is secondary data obtained from the financial statements of each bank, publications of the Financial Services Authority (OJK), and Bank Indonesia. The dependent variables in this study are Return on Assets (ROA), while the independent variables include Return on Equity (ROE), Operating Costs to Operating Income (BOPO), Non-Performing Loans (NPL), Loan to Deposit Ratio (LDR), Net Interest Margin (NIM), and Minimum Required Current Account (GWM).

The estimation model used includes three panel data regression approaches, namely Common Effect Model (CEM), Fixed Effect Model (FEM), and (REM) Random Effect Model (Basuki & Prawoto, 2019). To determine the best model, the Chow test (comparing CEM and FEM) and the Hausman test (comparing FEM and REM) were performed. The classical assumption test (Gujarati, 2021) carried out included a multicollinearity test with a correlation matrix, a heteroscedasticity test using a quadratic residual regression (Breusch-Pagan test), and an autocorrelation test by entering residual lag (Breusch-Godfrey test).

Data processing and analysis is carried out using the statistical software EViews (Thomsen, et al., 2013). The best model is selected based on the results of statistical tests and the highest R-squared value. With this methodological approach, the research is expected to be able to provide valid and reliable results on the factors affecting the profitability of BPD, as well as provide strategic recommendations for sustainable financial management of regional banks.

Econometric equations for the panel regression model with the variables used in this study:

$$ROA_{it} = \alpha_i + \beta_1 ROE_{it} + \beta_2 BOPO_{it} + \beta_3 NPL_{it} + \beta_4 LDR_{it} + \beta_5 NIM_{it} + \beta_6 GWM_{it} + \varepsilon_{it}$$

Information:

ROAit	= Return on Assets bank iii at ttt time (dependent variable)
αi	= intercept which can be different for each bank (fixed effect)
β1, β2, ..., β6	= the regression coefficient of each independent variable
ROEit	= Return on Equity bank iii at ttt time
BOPOit	= Operating Expenses to Operating Income of the bank iii at the time of ttt
NPLit	= Non-Performing Loan bank iii at ttt time
LDRit	= Loan to Deposit Ratio of bank iii at ttt time
NIMit	= Net Interest Margin of bank iii at ttt time
GWMit	= Minimum bank Mandatory Current Account iii at ttt time

Error Term = Error Term

This equation represents a Fixed Effect model that accommodates the differences in the characteristics of each bank specifically through αi.

3. RESULTS AND ANALYSIS

Data analysis in this study was carried out to understand the influence of key financial variables on the profitability of Regional Development Banks (BPD) using Return on Assets (ROA) as a performance indicator. Using the panel data regression method, this analysis aims to identify the relationship and significance of the influence of independent variables such as Return on Equity (ROE), Operating Costs to Operating Income (BOPO), Non-Performing Loan (NPL), Loan to Deposit Ratio (LDR), Net Interest Margin (NIM), and Minimum Required Current Account (GWM) on ROA. Through this approach, it is hoped that a comprehensive understanding of the factors that determine the profitability of BPD will be obtained so that it can provide strategic recommendations for the management of regional banks.

Based on descriptive statistics from the seven banking financial indicators (ROA, ROE, BOPO, NPL, LDR, NIM, and GWM), in general the data has a relatively symmetrical distribution (skewness close to zero) and not too far from the normal distribution (kurtosis close to 3). ROE has a large spread (Std. Dev. = 6.5130), indicating a high variation in interbank performance in generating returns to equity. BOPO and LDR also have relatively high standard deviations, indicating operational efficiency and diversified credit disbursement. The LDR has a negative skewness (-0.9027), indicating its distribution is skewed to the right (many high values). Meanwhile, the NPL indicator showed a maximum value of 5.29% with an average of 3.28%, reflecting credit quality that is still within reasonable limits. The reserve requirement has the second-highest variation (Std. Dev. = 1.9917) and positive skewness (0.6265), suggesting some banks have much higher-than-average liquidity reserves. In general, the data showed significant differences in performance between banks, but there were no glaring extreme outliers.

Table 1. Descriptive Statistics of Research Data

	ROA	ROE	BOPO	NPL	LDR	NIM	GWM
Mean	2.3237	15.2853	73.0382	3.2839	73.6920	5.6991	5.5081
Median	2.2500	14.2400	73.0700	3.1400	77.3050	5.6450	5.2050
aximum	3.3600	30.3300	87.0200	5.2900	100.3300	7.4400	11.5900
inimum	1.1100	6.3800	63.8700	1.7500	37.7400	4.0200	2.8000
Std. Dev.	0.5430	6.5130	5.5307	0.7979	14.3634	0.8182	1.9917
skewness	0.0456	0.6106	0.3239	0.3887	-0.9027	0.0202	0.6265
Kurtosis	2.3053	2.2002	2.3878	2.9190	3.0357	2.3040	2.6867

Source: Data processed 2025

Based on the results of the regression of panel data on four Regional Development Banks (BPD DKI Jakarta, BPD Central Java, BPD DIY, and BPD East Java) with ROA dependent variables during the period 2017Q1 to 2024Q4, three models were analysed: Common Effect Model (CEM), Fixed Effect Model (FEM), and Random Effect Model (REM). To determine the best model, two statistical tests are used, namely the Chow Test and the Hausman Test. The results of the Chow Test showed an F value of 10.0982 with a probability of 0.0000, which means that the Fixed Effect model is better than the Common Effect because there are significant differences between entities. Furthermore, the Hausman Test yields a chi-square value of 130.7483 with a probability of 0.0000, indicating that the Fixed Effect model is also more accurate than the Random Effect because the individual effects between banks are not random, but specific.

The Fixed Effect model has an R-squared value of 0.989, which indicates that it can explain 98.9% of the ROA variation, higher than Common Effect (0.9656) and Random Effect (0.9442).

All independent variables are significant in this model. ROE has a positive effect on ROA (coefficient of 0.0273), indicating that increased equity returns also increase profitability. BOPO has a negative coefficient (-0.0391), which means that the more efficient the bank's operations, the higher the ROA. NPLs had a positive but relatively small effect (0.0276), indicating that in the context of BPD, the non-performing loan ratio is still within tolerable limits and does not directly reduce profitability. LDR also shows a positive influence (0.0054), meaning that the greater the proportion of third-party funds channelled to credit, the higher the ROA. NIM is the variable with the strongest influence on ROA (0.2178), confirming the importance of interest margin in creating profits. Meanwhile, the GWM in the Fixed Effect model shows a positive coefficient (0.0233), in contrast to the other two models that show a negative influence; This can be interpreted that efficient management of minimum mandatory reserves can support profitability in some banks.

Overall, the Fixed Effect model is the best model because it can capture significant interbank specific variations and has the highest predictive capabilities. The NIM and BOPO variables proved to be the main factors influencing ROA, demonstrating the importance of efficiency and interest setting strategies in improving BPD's financial performance.

Based on the Fixed Effect (FEM) model which was chosen as the best model in the panel regression analysis of the four Regional Development Banks (DKI Jakarta, Central Java, DIY, and East Java), the relationship between each independent variable to ROA can be explained in more depth. This model considers the differences in the characteristics of each bank that are fixed, so that the estimation results are more accurate to analyse the determinants of banking profitability.

First, the ROE (Return on Equity) variable has a positive and significant relationship with ROA with a coefficient of 0.0273. This shows that the higher the bank's ability to generate profits from its equity, the profitability in the form of ROA also increases. ROE reflects the efficiency of its own capital use, so strong financial performance in this aspect directly impacts an increase in return on assets.

Table 2. Panel Data Regression Results

Dependent Variable: ROA Method: Panel EGLS (Period weights) Sample: 2017Q1 2024Q4			
Variable	Common Effect Model	Fixed Effect Model	Random Effect Model
ROE	0.0296	0.0273	0.0274
	14.1769	17.5367	13.3247
BOPO	-0.0463	-0.0391	-0.0507
	-14.1546	-12.4530	-16.3498
NPL	0.0501	0.0276	0.0534
	3.9509	2.4146	3.9194
LDR	0.0081	0.0054	0.0093
	8.6382	6.1732	9.9389
NIM	0.1958	0.2178	0.1729
	10.5317	12.6123	10.1814
GWM	-0.0152	0.0233	-0.0166
	-3.5857	3.7837	-3.3005
C	3.4592	2.9023	3.8545
	11.1450	9.7861	12.7477
R-squared	0.965582	0.989	0.944185
F-statistic	565.7645	218.6959	341.1471
Jarque-Bera	4.6242	5.5499	1.269

Dependent Variable: ROA			
Probability	0.0990	0.0623	0.5302
Chow Test (F Statistic)		10.0982	
Probability		0.0000	
Hausman Test (Chi-Sq. Statistic)			130.7483
Probability			0.0000

Source: Data processed 2025

Second, BOPO (Operating Costs to Operating Income) has a negative influence on ROA, with a coefficient of -0.0391. The higher the BOPO value, the greater the cost incurred by the bank to generate income, which has an impact on declining profitability. BOPO is an indicator of operational efficiency, and these results confirm that efficiency is a key factor in maintaining BPD's financial performance.

Third, the NPL (Non-Performing Loan) variable in the FEM model showed a positive influence on ROA (coefficient of 0.0276). Although high NPLs are generally considered detrimental because they indicate poor credit quality, these results may reflect that BPD is able to manage credit risk well and still maintain profit margins despite the presence of non-performing loans. However, the relatively small coefficient suggests that its effect on ROA is not dominant.

Fourth, LDR (Loan to Deposit Ratio) also has a positive effect on ROA with a coefficient of 0.0054. This means that the greater the proportion of third-party funds channelled to credit, the higher the return on assets. This illustrates that banking intermediation activities are effective, where aggressive and healthy credit disbursement encourages increased profitability.

Fifth, NIM (Net Interest Margin) is the variable with the strongest influence on ROA, shown by a coefficient of 0.2178. This indicates that the difference in interest earned from financing activities compared to interest expense is the main component that forms a bank's profit. The larger the interest margin, the greater the profit potential, making NIM the most crucial factor in increasing ROA.

Sixth, the GWM (Minimum Mandatory Current Account) variable in the FEM model shows a positive influence on ROA with a coefficient of 0.0233. Although theoretically an increase in reserve requirements could reduce the bank's liquidity and flexibility, these results suggest that BPDs may be able to manage their reserve requirements optimally or that high reserves increase confidence and stability, which ultimately has a positive impact on profitability.

Thus, all independent variables in the FEM model have a significant influence on ROA. Positive relationships were seen in ROE, NPL, LDR, NIM, and GWM, while BOPO was the only one that showed a negative influence. These results illustrate that operational efficiency, ability to manage interest margins, and appropriate intermediation strategies are the main factors influencing the financial performance of Regional Development Banks in Indonesia. Before further analysis is carried out, it is necessary to carry out multicollinearity tests, heteroscedasticity tests and autocorrelation tests so that the panel data regression model has the Best Linear Unbiased Estimator (BLUE) criteria.

The multicollinearity test aims to find out if there is a strong linear relationship between independent variables in the regression model, which can disrupt the stability of the coefficient estimation. One commonly used method is to look at the correlation values between variables. If the correlation coefficient between two variables is more than 0.80 or less than -0.80, then it is suspected that high multicollinearity occurs.

Table 3. Multicollinearity Test

	ROE	BOPO	LDR	NIM	NPL	GWM
ROE	1.0000	-0.7568	-0.2933	0.2052	0.3513	-0.3236
BOPO	-0.7568	1.0000	0.2599	-0.5056	-0.3717	0.3714
LDR	-0.2933	0.2599	1.0000	0.4233	-0.5501	0.3557
NIM	0.2052	-0.5056	0.4233	1.0000	-0.0088	-0.1760

NPL	0.3513	-0.3717	-0.5501	-0.0088	1.0000	-0.4897
GWM	-0.3236	0.3714	0.3557	-0.1760	-0.4897	1.0000

Source: Data processed 2025

Based on the presented correlation matrix, no pair of variables has an absolute correlation greater than 0.80. The highest correlation was between ROE and BOPO of -0.7568, which is still below the general threshold of multicollinearity. Another high correlation is between LDR and NPL of -0.5501 and BOPO with NIM of -0.5056, but both are also still within safe limits.

Thus, no strong indication of multicollinearity between independent variables was found in this ROA regression model. Although there were some moderate correlations, the value was still tolerable in regression analysis. Therefore, all independent variables can still be included in the model without the need to exclude or perform special transformations to address multicollinearity.

Heteroscedasticity test was performed to determine whether there was an unevenness of variance from the residual in the regression model. Based on the first table, the regression model uses the dependent variable RESID² (residual squared), which is a common approach in heteroscedasticity tests such as the Breusch-Pagan test or the White Test.

The results of the estimation show that none of the independent variables have a probability value below 0.05. The highest *p-value is* indicated by the NPL variable (0.8193), and the lowest is NIM (0.0819). Since all probability values > 0.05, there is no significant evidence of heteroscedasticity in the model. This means that the error variance is homogeneous (homoscedastic), and the regression model meets classical assumptions regarding the stability of residual variance.

Table 4. Heteroscedasticity and Autocorrelation Test

Dependent Variable: $RESID^2$				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
ROE	0.000142	0.000225	0.631919	0.5290
BOPO	0.000659	0.000396	1.662677	0.0999
NPL	0.000371	0.001620	0.229124	0.8193
LDR	4.35E-05	0.000112	0.387426	0.6994
NIM	0.003563	0.002026	1.759303	0.0819
GWM	-0.000879	0.000823	-1.067385	0.2887
C	-0.064031	0.038575	-1.659895	0.1004
Dependent Variable: $RESID^2$				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
ROE	9.50E-05	0.000240	0.395761	0.6933
BOPO	0.000692	0.000426	1.623960	0.1082
NPL	0.000808	0.001739	0.464855	0.6433
LDR	6.94E-05	0.000120	0.578108	0.5648
NIM	0.003672	0.002217	1.656559	0.1014
GWM	-0.000936	0.000879	-1.064446	0.2903
RESID (-1)	0.002731	0.012597	0.216780	0.8289
RESID (-2)	0.002109	0.012966	0.162643	0.8712
C	-0.069262	0.041482	-1.669668	0.0988

Source: Data processed 2025

The autocorrelation test aims to test whether there is a correlation between the residual in one period and the previous period. The second table shows the regression of the quadratic residual to lag of the residuals, namely RESID (-1) and RESID (-2), which is the approach of the Breusch-Godfrey test or LM test.

The results showed that the coefficients of RESID (-1) and RESID (-2) had *p-values* of 0.8289 and 0.8712, respectively, well above the significance threshold of 0.05. This indicates that there is no significant autocorrelation in the residual Fixed Effect model.

Conclusion: The Fixed Effect model passed the heteroscedasticity and autocorrelation tests. Thus, the model can be said to meet Gauss-Markov assumptions, so the resulting estimate is BLUE (Best Linear Unbiased Estimator). This model can be used for the drawing of valid and reliable conclusions regarding the factors affecting BPD ROA.

Return on Equity (ROE) and Return on Assets (ROA) are two important indicators in measuring the profitability of a bank, including Regional Development Banks (BPD). ROE measures a bank's ability to generate net profit from its own invested capital, while ROA measures the effectiveness of using bank assets to generate profits. Theoretically, the positive relationship between ROE and ROA is very logical because increased efficiency in asset use (ROA) will usually increase net profit which ultimately magnifies the return on capital to shareholders (ROE).

Accounting and financial management theory explains that ROE is influenced by two main factors, namely asset profitability (ROA) and financial leverage. If banks can increase ROA through efficient asset management and improved credit quality, net profit will rise so that ROE will also increase, especially if the capital structure is relatively stable. In other words, an increase in ROA will strengthen ROE if the debt-to-capital ratio does not change drastically.

Previous research has also supported these findings. For example, a study by Pointer & Khoi (2019) and Rauf, et al (2014) shows that ROE and ROA have a positive and significant correlation in the banking industry, indicating that good asset performance will have a positive impact on return on capital. Similarly, research by Ichsani & Suhardi (2015) confirms that ROE is significantly influenced by ROA as both reflect the bank's operational efficiency and profitability. Thus, the focus on increasing ROA, for example through sound credit risk management and operational efficiency, will directly support increased ROE, increasing shareholder value and the bank's overall financial stability.

Operating Costs to Operating Income (BOPO) is a ratio that measures the operational efficiency of a bank by comparing total operating costs to the operating income obtained. The relationship between BOPO and Return on Assets (ROA) is usually negative because the higher the operational costs that must be borne by the bank without being offset by an increase in revenue, the profitability of the asset will decrease (Swandewi & Purnawati, 2021). In theory, BOPO reflects the effectiveness of management in controlling operational costs. The lower the BOPO, the more efficient the bank is in using its resources to generate revenue. This efficiency directly increases the net profit and improves the ROA as smaller costs reduce the burden and increase profit margins. On the other hand, high BOPO indicates large operating costs that erode net profit, and ultimately lower ROA. Therefore, BOPO is often considered an important indicator to measure the efficiency of bank management.

Previous research has also reinforced this negative relationship. According to research by Sitompul & Nasution (2019), there is a significant negative correlation between BOPO and ROA in banks in Indonesia, which shows that increased operational cost efficiency contributes to increased profitability. Another study by Jatmiko (2025) also found that low BOPO is associated with higher ROA, indicating that strict operational cost control is a key factor in improving a bank's financial performance. Thus, banks that can keep BOPO within optimal limits will tend to have better ROAs, which reflects higher profitability and competitiveness in the banking industry.

Non-Performing Loan (NPL) or non-performing loans is one of the credit risk indicators that shows the percentage of loans that are in default or non-performing in the bank's credit portfolio. The relationship between NPLs and Return on Assets (ROA) is theoretically usually negative, as rising NPLs reflect a decline in the quality of assets owned by banks, which has an impact on declining profitability.

In theory, high NPLs indicate a high risk of bad loans, which causes banks to have to make larger credit loss reserves. This directly reduces the bank's revenue and increases the cost burden, resulting in a decrease in net profit and a negative impact on ROA. In addition, high NPLs can also reduce banks' ability to expand credit and affect customer reputation and confidence, ultimately hindering the bank's asset growth and profitability.

However, in some cases and studies, this relationship could show variation depending on how the bank manages its credit risk. For example, a study by Singh, Set al (2021) showed that banks that have good credit risk management can mitigate the negative impact of NPLs on profitability. Another study by Kartikasary, et al (2020) on banks in Indonesia found that although

NPLs have a negative effect on ROA, they are not necessarily significant if banks have adequate loss reserves and effective risk management.

In conclusion, NPLs generally have a negative relationship with ROA because they reflect poor asset quality and a high risk of credit loss. Therefore, strict management of NPLs and improvement of credit quality are important aspects for banks to maintain and increase the profitability of their assets.

Loan to Deposit Ratio (LDR) is a ratio that measures how much of the proportion of credit provided by a bank is compared to the third-party funds (deposits) raised. The relationship between LDR and Return on Assets (ROA) is very important because LDR describes the level of utilization of funds that banks must disburse credit, which is the bank's main source of interest income. In theory, the relationship between LDR and ROA tends to be positive to some extent, but if the LDR is too high or too low, the effect on ROA can be reversed.

Theoretically, an optimal LDR indicates that banks can distribute credit efficiently without sacrificing liquidity. An LDR that is too low means that banks are less aggressive in disbursing credit so that potential interest income is reduced, which has a negative impact on ROA. Conversely, an excessively high LDR indicates that banks are risking large liquidity by lending most of their deposits, which can increase the risk of default and increase the cost burden, thus ultimately lowering ROA. Therefore, there is a trade-off between profitability and liquidity risk that banks must manage.

Previous research supports this relationship. According to Fitriani and Suhartini (2019), LDR has a significant positive influence on ROA in banks in Indonesia over a certain period, noting that LDR is in the optimal range (around 80%-90%). Another study by Paleni, et al (2017) also showed that a moderate LDR can increase profitability, but if the LDR crosses a certain limit, the risk increases and profitability decreases. Thus, proper LDR management is essential for banks to maintain a balance between liquidity and profitability, so that ROA can be maximized without sacrificing financial stability.

Net Interest Margin (NIM) is the difference between the interest income earned by a bank from its productive assets, such as credit, and the interest costs that must be paid on third-party fund obligations, such as customer deposits, expressed as a percentage of total productive assets. NIM is an important indicator in assessing the efficiency of banks in generating profits from funding activities and credit disbursement. Theoretically, the relationship between NIM and Return on Assets (ROA) is generally positive, as a high NIM reflects a bank's ability to obtain a larger profit margin from its assets.

From the perspective of banking financial theory, a high NIM means that banks can manage interest spreads efficiently, i.e. obtain interest income greater than the interest costs incurred. This contributes directly to an increase in net profit which then increases ROA. In contrast, a low NIM indicates a narrow profit margin, which can depress the bank's profitability despite the large volume of assets it owns.

Various empirical studies support the positive relationship between NIM and ROA. For example, research by Rahman, et al (2015) shows that NIM is one of the main determinants of bank profitability. Another study by Yuan, et al (2022) on Asian banks also confirmed that an increase in NIM significantly increases ROA. In Indonesia, research by Matuszak & Różańska (2017) found a significant positive relationship between NIM and ROA in national commercial banks, suggesting that effective interest margin management strategies can strengthen banks' financial performance.

Thus, increasing NIM through efficient asset and liability management is essential to increase the profitability of bank assets. Banks should focus on increasing interest income while keeping interest costs low, so that optimal interest margins can be obtained and contribute positively to ROA.

The Minimum Reserve Requirement (GWM) is the percentage of funds that banks must keep in Bank Indonesia as liquidity reserves, which cannot be used for productive activities such as credit disbursement. Therefore, the reserve requirement acts as an instrument to control the liquidity and stability of the banking system, but it can directly affect the bank's profitability, especially the Return on Assets (ROA).

In theory, the relationship between the GWM and ROA is usually negative. When banks are required to keep a large amount of funds as reserve requirements, the funds cannot be used to generate interest income through lending or other investments. As a result, the bank loses revenue potential, which ultimately lowers net profit and ROA. The higher the reserve requirement, the larger the unproductive funds, thus suppressing the bank's financial performance. However, the positive side of the reserve requirement is to maintain liquidity and stability of the banking system which in the long term can support the bank's business continuity.

Previous research has also shown a negative relationship between GWM and ROA. For example, research by Haryanto, et al (2020) on Indonesian banks found that an increase in reserve requirements had a significant negative impact on bank profitability. Another study by Isanzu, J. S. (2017) also supports these findings, emphasizing that high reserve requirements reduce the funds that can be used to disburse credit, thus hindering the increase in ROA. However, some literature warns of the importance of a balance between controlling liquidity and optimizing profitability to keep banks healthy and competitive.

In conclusion, although the reserve requirement is an important instrument in maintaining banking stability, banks need to manage the reserve requirement efficiently so that the negative impact on profitability, especially ROA, can be minimized. A strategic approach in liquidity management and credit planning is key to overcoming these challenges.

4. CONCLUSION

This study succeeded in identifying the factors that affect the profitability of Regional Development Banks (BPD) in Indonesia using a panel data regression approach with the Fixed Effect model. The results of the analysis show that the variables Return on Equity (ROE), Non-Performing Loan (NPL), Loan to Deposit Ratio (LDR), Net Interest Margin (NIM), and Minimum Required Reserve Requirement (GWM) have a positive and significant influence on Return on Assets (ROA). On the other hand, Operating Costs to Operating Income (BOPO) has a significant negative effect on profitability. This indicates that operational efficiency is a crucial factor that must be considered to improve BPD's financial performance. In addition, the Fixed Effect model proved to be better than Common Effect and Random Effect, and it met classical assumptions without finding problems of heteroscedasticity and autocorrelation.

Based on these findings, BPD management is advised to focus more on optimizing operational cost efficiency and improving asset quality with strict credit management to reduce NPL levels. In addition, the increase in net interest margin (NIM) needs to be maintained through competitive interest rate setting strategies and selective credit disbursement. Adjustments to the Minimum Mandatory Current Account must also be considered so that liquidity is maintained without sacrificing profitability. Local governments and regulators can support by providing conducive regulations and risk management training for BPDs to encourage continuous performance improvement.

This research has several limitations that need to be considered. First, the data used is limited to four BPDs in the Java and DKI Jakarta regions, so the results of the study cannot be generalized to all BPDs in Indonesia. Second, macroeconomic variables and other external factors such as national economic conditions, BI interest rates, and fiscal policy have not been included in the model, even though they can affect the bank's profitability. Third, the analysis period, which is still limited from 2017 to 2024, does not fully capture the long-term dynamics in the regional banking sector. Further research is suggested to expand the scope of the data, add external variables, and use other methodical approaches such as dynamic panels for more comprehensive results.

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