

# BI Rate as Moderator: Internal Bank Factors and Profitability in Indonesian Banks

Original Article

**Alfius Sonandi<sup>1\*</sup>, Anggraeni Anggraeni<sup>2</sup>**

<sup>1,2</sup>Management Study Program, Faculty of Economics and Business, Universitas Hayam Wuruk Perbanas, Surabaya, Indonesia

Email: <sup>1)</sup> [aubertpangeran@yahoo.co.id](mailto:aubertpangeran@yahoo.co.id), <sup>2)</sup> [anggi@perbanas.ac.id](mailto:anggi@perbanas.ac.id)

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## Abstract

The banking sector drives Indonesia's economic stability, but profitability depends on internal management and external conditions, especially monetary policy shifts. During 2019–2023, Indonesia's BI Rate fluctuated dramatically. This study examines profitability drivers in publicly listed Indonesian banks under these changing conditions. Using Return on Assets (ROA) as the performance measure, it analyzes how Net Interest Margin (NIM), Operational Expense Ratio (BOPO), Non-Performing Loans (NPL), Loan to Deposit Ratio (LDR), and Loan to Asset Ratio (LAR) affect profitability. Panel data from seven banks were analyzed using multiple linear regression models, with one incorporating the BI Rate as a moderating variable. Results show NIM and LDR significantly boost ROA, while BOPO significantly reduces it, emphasizing the importance of interest income efficiency and cost control. NPL and LAR show no significant effect, indicating effective risk and asset management. The BI Rate's moderating effect on the NIM–ROA relationship is statistically insignificant, suggesting monetary policy changes don't substantially alter this relationship. These findings guide banks in optimizing income and costs while showing policymakers the limited role of monetary policy in moderating bank-level performance.

**Keywords:** Bank Profitability, BI Rate Moderation, Credit Risk Management, Indonesian Banking, Operational Efficiency.

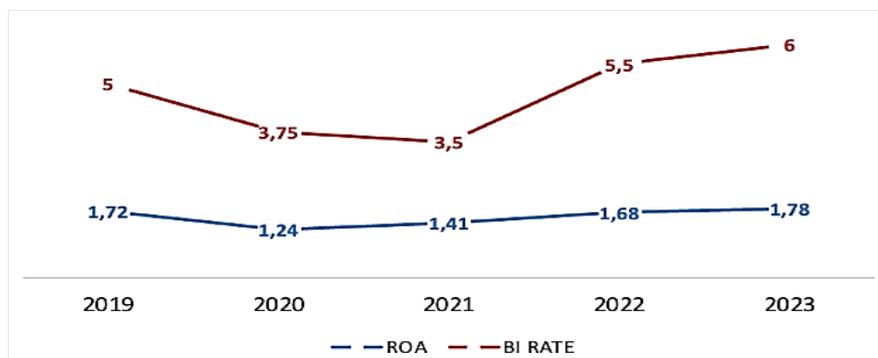
## 1. Introduction

Modern banking plays a central role in the economic expansion of Indonesia. The stability of this sector is closely related to the ability of banks to maintain credit flows and investments that support various economic sectors. In Indonesia, the banking industry is considered the driving force of economic stability, where the progress of this sector directly impacts national economic advancement (Komarudin, 2018). In a global context, the role of banks in maintaining financial stability is increasingly important, especially in the face of rapidly changing economic dynamics (Wardani, 2022). Profitability, measured by Return on Assets (ROA), serves as a key indicator of how effectively a bank operates and reflects how well its assets are managed. A high ROA indicates good operational efficiency, while a low ROA suggests problems in asset or cost management (Hartanto & Syarif, 2022). ROA is influenced by internal factors such as financial ratios and external factors like the Bank Indonesia Rate (BI Rate).

Figure 1 illustrates a comparative trend between the BI Rate and ROA of commercial banks in Indonesia from 2019 to 2023. The data is sourced from the Indonesian Banking Statistics (Financial Services Authority, 2024), with the BI Rate obtained from Bank Indonesia and published by the Central Statistics Agency (BPS). The graph shows that the BI Rate declined from 5% in 2019 to 3.5% in 2021, then increased significantly to 6% in 2023. These



BI Rate fluctuations reflect the monetary policy measures implemented by Bank Indonesia in response to both domestic and global economic dynamics, including efforts to curb inflation and maintain rupiah stability. Meanwhile, the ROA of commercial banks also experienced significant changes, dropping from 1.72% in 2019 to its lowest point of 1.24% in 2020.



**Figure 1. Comparison of the BI Rate and Banking ROA in Indonesia**

Source: Financial Services Authority (2024)

However, since 2021, ROA has shown a positive recovery trend, rising to 1.78% in 2023, indicating improved efficiency and asset management by national banks. Overall, Figure 1 illustrates a dynamic relationship between the BI Rate and ROA, where changes in the benchmark interest rate can affect interest margins and asset management strategies, ultimately impacting bank profitability in Indonesia. Bank profitability is influenced by various interrelated internal factors.

One of the key indicators reflecting how well a bank manages its interest income is Net Interest Margin (NIM). Previous studies have shown that a high NIM is positively correlated with ROA, highlighting the importance of efficient interest income management in improving bank profitability. Lestari et al. (2021) emphasize that a high NIM not only enhances profits but also ensures long-term financial stability. This finding is supported by the study of Widyakto et al. (2021) which shows that efficient NIM management is crucial for public banks in Indonesia, especially between 2015 and 2019. However, research by Mandala et al. (2023) indicates that the effect of high NIM on profitability becomes insignificant when banks face macroeconomic pressure, as rising operational costs may hinder NIM management efficiency.

In addition to NIM, operational efficiency, as indicated by Operating Cost to Operating Income Ratio (BOPO), plays a crucial role in influencing profitability. BOPO measures how well a bank manages its operational costs relative to its operating income. A high BOPO indicates lower efficiency, which can negatively affect profitability. According to Manurung et al. (2020), effective management of BOPO can lead to an increase in NIM, thereby improving overall profitability. Maintaining operational efficiency is vital, especially when dealing with liquidity risks and macroeconomic pressures. Credit quality, reflected in (Non-Performing Loan) NPL, negatively affects ROA (Prasetyowatie & Hariadi, 2022), while LDR and LAR play important roles in determining the risk and profitability of banks (K. Puspitasari & Muflih, 2024; Tazriah & Pratiwi, 2023; Wijaya, 2025).

These studies show that although there are significant relationships between internal factors and profitability. However, limited attention has been given to the integration of external macroeconomic factors, particularly the Bank Indonesia Rate (BI Rate), as a moderating variable in these relationships. Research by Widodo et al. (2022) examined the relationship between the BI Rate and profitability independently, without assessing its interaction with NIM. Similarly, Hasyim et al. (2023) focused their analysis on Islamic banks,

thereby limiting the generalizability of their findings to the broader commercial banking sector. Meanwhile, Mulyati & Widhiastuti (2024), although exploring the BI Rate as a moderating variable on NIM, did not include other important internal indicators such as LAR. This situation highlights a clear research gap.

Understanding this interaction is crucial for banks in navigating profitability under fluctuating economic conditions. Theoretically, the BI Rate as the central bank's policy benchmark shapes a bank's cost of funds and the interest rates applied to its loans. This makes it a relevant moderating variable. When the BI Rate increases, funding costs may rise more quickly than lending returns, narrowing bank margins and weakening the positive influence of NIM on ROA. In contrast, when the BI Rate is lower, funding pressures ease, allowing the NIM-ROA relationship to become stronger. In light of this gap, the present study primarily aims to examine the influence of Net Interest Margin (NIM) on the profitability of publicly listed banks in Indonesia and to test the moderating role of the Bank Indonesia (BI) Rate in this relationship. In addition, the study incorporates the Loan to Asset Ratio (LAR) to address its omission in prior research. Other internal factors such as BOPO, NPL, and LDR are included as control variables to provide a more comprehensive analysis. By sharpening the focus on the BI Rate as a moderating factor and the inclusion of LAR, this study seeks to enrich the academic literature, provide practical insights for banking practitioners, and contribute to policy strategies aimed at enhancing financial performance in Indonesia's banking sector.

## 2. Literature Review

### 2.1. Financial Intermediation

The financial intermediation theory outlines the critical role banks play in linking surplus fund holders with those in need of capital. Banks exist to address key market imperfections such as transaction costs, asymmetric information, and agency risks (Carli et al., 2024). Within this theoretical framework, banks serve a specialized function by managing information and mitigating risks, thereby promoting efficient capital allocation and contributing to economic stability (Scannella, 2010). Further, research highlights that the success of financial intermediation is influenced by factors such as operational efficiency, capital structure, and asset quality, all of which significantly impact bank profitability (Idowu & Asaolu, 2017).

Empirical findings indicate that intermediation indicators like the Liquidity, Efficiency, and credit risk have a significant impact on Return on Assets (ROA), which serves as a core measure of bank performance (Buchory & Kusmaryadi, 2023). Achieving a balance between proactive lending and prudent risk management is essential for enhancing profitability while safeguarding financial stability (Buchory & Kusmaryadi, 2023). Additional studies also point out that efficient intermediation can actively drive profitability, and in some cases, ROA itself may feedback as a determinant of intermediation efficiency (Idowu & Asaolu, 2017).

### 2.2. Profitability (ROA)

Banks are financial institutions that serve as intermediaries, playing a critical role in collecting funds from individuals and businesses and channeling them into loans or financing to support various economic activities (Felle & Santioso, 2024). Through these functions, banks influence economic growth by facilitating credit distribution and efficient fund management (Komarudin, 2018). Profitability, commonly measured by ROA, is a key indicator of a bank performance in generating profit from its assets (Sunaryo, 2020). An effective utilization of assets to generate net income is suggested by a high ROA. A low ROA

could signal inefficiencies in asset management or high operational costs, which may point to potential financial struggles (Sianturi & Rahadian, 2020). To perform their roles effectively, banks must focus on maintaining operational efficiency, managing credit quality, and ensuring profitability. A substantial body of literature has examined the factors affecting bank profitability. NIM, BOPO, NPL, LDR and LAR have been identified as key determinants of profitability. A high NIM is positively correlated with ROA, while high BOPO and NPL generally lead to a decrease in profitability (Lestari et al., 2021; Prasetyowatie & Hariadi, 2022). Optimal LDR and LAR ratios can improve profitability, but they also pose liquidity risks if not managed properly (E. Puspitasari et al., 2021; Tazriah & Pratiwi, 2023).

Hartanto & Syarif (2022) emphasize that ROA is an essential measure for assessing how effectively a bank performs relative to its size and resources. It offers a clear picture of the profitability achieved by a bank in relation to the assets it controls. As the net income from total assets increases, the level of profitability for the bank rises, signaling a successful and efficient management strategy. This shows that as net income generated from total assets increases, so does the level of profitability achieved by the bank.

### 2.3. Net Interest Margin (NIM)

NIM is an important indicator for banks to evaluate how efficiently they generate interest income from their assets. A high NIM reflects strong management of interest income, which contributes positively to the bank's overall profitability. Recent studies by Andhikatama & Daulay (2020) have analyzed factors influencing bank profitability, confirming the significant effects of NIM, BOPO, and NPL on ROA. Lestari et al. (2021) emphasized the importance of managing NIM and operational efficiency to enhance bank profitability. Research by Widyakto et al. (2021) suggests that efficient management of NIM correlates with higher profitability, particularly in periods of economic stability. However, macroeconomic pressures, such as rising operational costs, can reduce the positive effect of NIM on profitability, as noted by Mandala et al. (2023).

This underscores the significance of managing NIM in a dynamic economic environment, where effective interest income management is essential for sustaining profitability, especially when banks are exposed to increased operational challenges (Lestari et al., 2021). Considering the supporting theories and prior studies, the following hypothesis is developed:

**H1:** NIM positively impacts bank profitability.

### 2.4. Operational Expense to Operating Income Ratio (BOPO)

The BOPO ratio measures how effectively a bank controls its operating expenses in relation to its operating income (Alam et al., 2022). A high BOPO indicates inefficiency, as it shows that operational costs consume a significant portion of income, thereby reducing profitability (Darmawan, et al., 2023). Mulyati & Widhiastuti (2024) state that a high BOPO ratio negatively affects profitability, as it indicates that a bank is not managing its costs effectively. Efficient BOPO management allows banks to maintain a higher margin between operating income and expenses, thereby improving overall profitability. In contrast, a high BOPO can directly limit the ability of bank to maximize its earnings, stressing the importance of cost control in achieving financial stability. Based on this understanding, the following hypothesis is formulated:

**H2:** BOPO negatively influences bank profitability.

## 2.5. Non-Performing Loans (NPL)

NPL are a crucial indicator of a bank credit risk. An increased NPL ratio reflects a substantial amount of loans that are no longer contributing to income generation, which can decrease profitability due to the need for loan loss provisions (Abdat et al., 2024). Research by Prawira & Wiryono (2020) shows that increasing NPL negatively affects profitability, as banks must set aside provisions for bad loans, which diminishes net income. However, Tarigan & Tandeas (2022) highlight that well-managed banks with effective risk management strategies can minimize the impact of NPL on profitability, especially when supported by strong net interest income. Thus, although NPLs typically reduce profitability, banks with robust risk management practices can mitigate these effects by maintaining a balanced approach to credit risk and provisioning (Karim et al., 2023; Sewanyina et al., 2025). Drawing from the evidence, the hypothesis is stated as follows:

**H3:** NPL negatively affects bank profitability.

## 2.6. Loan to Deposit Ratio (LDR)

For larger banks, LDR illustrates how efficiently deposits are managed to support lending activities, where a higher ratio suggests more aggressive loan disbursement that may enhance interest income and profitability (Hasbi et al., 2024). E. Puspitasari et al. (2021) show that an optimal LDR has a positive relationship with profitability, as it helps banks generate more revenue from loans. However, Tarigan & Tandeas (2022) caution that an excessively high LDR can create liquidity risks, as the bank may struggle to meet its obligations if deposit growth slows or loan repayments are delayed. Therefore, while a high LDR can improve profitability, it must be managed carefully to avoid potential liquidity issues. Balancing credit expansion with prudent liquidity management is essential for maintaining stable profitability in banks (Olofin et al., 2024). From this rationale, the following hypothesis is developed:

**H4:** LDR positively contributes to bank profitability.

## 2.7. Loan to Asset Ratio (LAR)

LAR represents the proportion of overall bank assets is allocated toward providing loans to customers. An optimal LAR can enhance profitability by ensuring that a significant portion of assets is generating interest income (Anto et al., 2021). However, if the LAR is too high, the bank may face increased liquidity risks and financial instability (Lohven & Adamu, 2023). Manurung et al. (2020) explain that effective LAR management can contribute positively to profitability, especially if the loans issued are of high quality and risk is well-managed. Tazriah & Pratiwi (2023) argue that while LAR enhances profitability by utilizing assets for lending, an excessively high ratio can strain liquidity and impair the bank ability to meet short-term obligations. Thus, maintaining a balanced LAR is crucial for ensuring that the bank can both generate income and manage liquidity risk effectively. E. Puspitasari et al. (2021) and Tarigan & Tandeas (2022) have further underscored the role of LDR and LAR in maintaining a balance between credit distribution and liquidity risk. Accordingly, the following hypothesis is formulated:

**H5:** LAR positively influences bank profitability.

## 2.8. Bank Indonesia Rate (BI Rate)

The Bank Indonesia Rate (BI Rate) serves as a key benchmark interest rate established to support rupiah stability and influences banks funding costs as well as their asset and liability management. Adjustments to the BI Rate can have significant effects on a bank interest margin and, consequently, its profitability (Wasita et al., 2022). A decrease in the BI Rate tends to lower loan interest rates, stimulating credit demand, but can also compress interest

margins for banks (Hidayat et al., 2024; Mubarok & Fatimah, 2022). Conversely, an increase in the BI Rate raises interest income for banks but may reduce credit demand (Siwi et al., 2019). Although many studies have explored the direct relationship between NIM and profitability, the moderating role of the BI Rate has not been extensively examined. Research by Widodo et al. (2022) has focused on the BI Rate and NIM separately but has not integrated them into a single model. A more recent study by Mulyati & Widhiastuti (2024) explored the role of the BI Rate as a moderating variable, though it did not integrate the LAR variable, presenting an opportunity for future research. This gap in the literature presents an opportunity for further exploration, offering valuable insights into how banks can optimize profitability amid changes in monetary policy (Siwi et al., 2019). In line with this research gap, the final hypothesis proposed is:

**H6:** The BI Rate moderates the relationship between NIM and bank profitability.

### 3. Methods

This study employs a quantitative research method to examine the influence of internal bank variables on profitability and the moderating role of the BI Rate in publicly listed banks in Indonesia during the 2019–2023 period. The sample period was selected to capture the effects of the COVID-19 pandemic on bank performance, ensuring that the analysis reflects both normal and crisis conditions. The population consists of all banks listed on the Indonesia Stock Exchange (IDX). The sample was selected through purposive sampling using the following criteria: (1) banks that remained consistently listed on the IDX throughout the 2019–2023 observation period; (2) banks that published complete and audited annual financial reports during the study period; (3) banks that disclosed the financial ratios required for this research, namely NIM, BOPO, NPL, LDR, LAR, and ROA; and (4) banks classified under *Kelompok Bank Berdasarkan Modal Inti* (KBMI) with core capital between IDR 14 trillion and IDR 70 trillion, as defined by the Financial Services Authority (OJK). The final sample consisted of seven banks that met all these requirements. Secondary data were obtained from official publications of the IDX and Bank Indonesia.

Secondary data for this study were obtained from official public sources. Bank-specific financial data for the 2019–2023 period were manually extracted from the annual financial reports published on the Indonesia Stock Exchange (IDX) and the individual banks' websites. The monthly BI Rate data were sourced directly from Bank Indonesia's official publications, and the annual average was calculated to align with the financial data frequency. This process ensured the reliability and transparency of the dataset.

In this study, the variables and their measurements are as follows:

- 1) Profitability (ROA): Measures how effectively a bank generates profit from its assets.  

$$ROA = \left( \frac{\text{Net Income}}{\text{Total Assets}} \right) \times 100$$
- 2) Net Interest Margin (NIM): Indicates efficiency in generating interest income.  

$$NIM = \left( \frac{\text{Net Interest Income}}{\text{Earning Assets}} \right) \times 100$$
- 3) Operational Expense to Operating Income (BOPO): Reflects operational efficiency.  

$$BOPO = \left( \frac{\text{Operational Expenses}}{\text{Operational Income}} \right) \times 100$$
- 4) Non-Performing Loans (NPL): Measures credit risk.  

$$NPL = \left( \frac{\text{Non-Performing Loans}}{\text{Total Loans}} \right) \times 100$$
- 5) Loan to Deposit Ratio (LDR): Shows how efficiently deposits are used for lending.

$$LDR = \frac{\text{Total Loans}}{\text{Third-Party Funds}} \times 100$$

6) Loan to Asset Ratio (LAR): Indicates the proportion of assets allocated to loans.

$$LAR = \frac{\text{Total Loans}}{\text{Total Assets}} \times 100$$

Data analysis includes descriptive statistics and multiple linear regression using SPSS. The moderation effect of the BI Rate is tested through an interaction term in the extended regression model. The regression model used is as follows:

1) Without moderation:

$$ROA = \alpha + \beta_1 \cdot NIM + \beta_2 \cdot BOPO + \beta_3 \cdot NPL + \beta_4 \cdot LDR + \beta_5 \cdot LAR + \epsilon$$

2) With moderation:

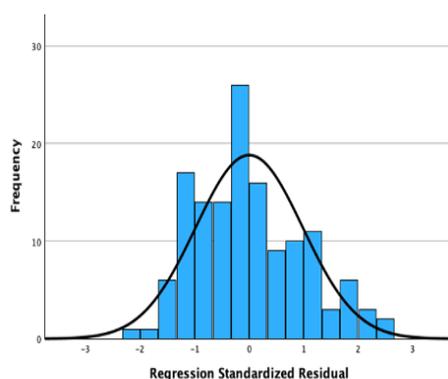
$$ROA = \alpha + \beta_1 \cdot NIM + \beta_2 \cdot BOPO + \beta_3 \cdot NPL + \beta_4 \cdot LDR + \beta_5 \cdot LAR + \beta_6 \cdot (NIM \times BI \text{ Rate}) + \epsilon$$

In this model,  $\alpha$  denotes the constant or intercept, while  $\beta_1$  through  $\beta_6$  are the regression coefficients associated with each independent variable and  $\epsilon$  accounts for the model's error term. F-test evaluates the overall significance of the model. The coefficient of determination ( $R^2$ ) measures the extent to which variations in ROA can be explained by the explanatory variables. In addition, classical assumption tests to ensure the validity and reliability.

## 4. Results and Discussion

### 4.1. Research Results

One crucial assumption in regression analysis is the normality of residuals. This assumption ensures that the errors (residuals) are normally distributed, making the estimates and statistical inferences valid. To test the normality of residuals, both visual and statistical methods were employed, including a histogram, Normal P-P Plot, and the Kolmogorov-Smirnov statistical test. Figure 2 displays the histogram of the standardized residuals for the dependent variable, ROA, with an overlay of the normal distribution curve. The residual distribution appears symmetric and closely follows a normal distribution, with frequencies centered around zero. This observation is further supported by a mean residual close to zero (Mean = -1.82E-16) and a standard deviation of 0.982.

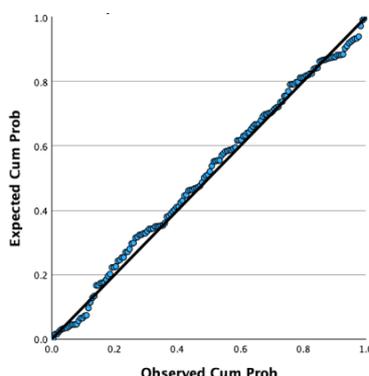


**Figure 2. Normality Test Using Histogram Method**

Source: Processed Data, 2025

Figure 3 presents the Normal P-P Plot, where the residual points align closely with the diagonal line. This close adherence to the diagonal line suggests a high degree of conformity between the observed residuals and the theoretical normal distribution, reinforcing the conclusion that the residuals follow a normal distribution, consistent with the assumption of

normality. The One-Sample Kolmogorov-Smirnov test for the regression residuals yielded a test statistic of 0.079, with an Asymp. Sig. (2-tailed) value of 0.034. Based on the histogram, Normal P-P Plot, and the Kolmogorov-Smirnov test with a significance value close to 0.05, the residuals can be reasonably assumed to follow a normal distribution.



**Figure 3. Normality Test Using P-Plot Method**

Source: Processed Data, 2025

Multicollinearity was assessed using Tolerance and Variance Inflation Factor (VIF), with Tolerance values ranging from 0.213 to 0.512 and VIF values between 1.953 and 4.685, as presented in Table 2. Since the VIF values are all below the threshold of 10 and the Tolerance values do not approach zero, there is no significant multicollinearity (NIM, BOPO, NPL, LDR, and LAR). Therefore, these variables can be used simultaneously in the regression analysis without concern that multicollinearity will distort the accuracy of the results.

#### 4.1.1. Multicollinearity and Heteroscedasticity Test

**Table 1. Multicollinearity and Heteroscedasticity Test Results**

Variable	Tolerance	VIF	Sig.
NIM	0.232	4.314	0.804
BOPO	0.232	4.318	0.205
NPL	0.352	2.838	0.051
LDR	0.213	4.685	0.425
LAR	0.512	1.953	0.122

Source: Processed Data, 2025

The Durbin-Watson statistic for this study was 1.990. The bounds  $d_L$  and  $d_U$  were set at 1.6491 and 1.7979, respectively. Since the Durbin-Watson value is above the upper bound ( $d_U$ ) and also below the critical value of  $4 - d_U$  (i.e., 2.2021), it indicates no significant positive or negative autocorrelation in the residuals. Therefore, it can be concluded that the regression model is free from autocorrelation issues, and the parameter estimates are valid and reliable.

To detect heteroscedasticity, the Glejser test was conducted by regressing the absolute squared residuals on each independent variable, as presented in Table 2. Additionally, the results of the Glejser test indicated that all independent variables: NIM (0.804), BOPO (0.205), NPL (0.051), LDR (0.425), and LAR (0.122) had significance values greater than 0.05. While the significance of NPL is marginally close to 0.05, none of the variables exerted a significant influence on the variance of the residuals, suggesting that heteroscedasticity is not a concern for this model.

### 4.1.2. Multiple Linear Regression Analysis

Table 2 presents the regression results for the first model (without moderation). The results include the unstandardized coefficients (B), standardized coefficients (Beta), t-statistics, and p-values (Sig.), along with the F-statistic, its significance level, and the R-Square value, which indicates the proportion of variance in the dependent variable explained by the model.

**Table 2. Multiple Linear Regression Without Moderation Test Results**

Variable	Unstandardized Coefficients (B)	Standardized Coefficients (Beta)	t	Sig.
Constant	0.473		1.515	0.132
NIM	0.583	0.864	8.312	<0.001
BOPO	-0.035	-0.867	-8.336	<0.001
NPL	-0.044	-0.053	-0.629	0.530
LDR	0.016	0.473	4.363	<0.001
LAR	-0.068	-0.011	-0.153	0.879
F-Statistics	53.164			
Sig. (F)	0.001			
R-Square	0.667			

Source: Processed Data, 2025

The equation for the model without moderation is as follows:

$$ROA = 0.473 + 0.583 \cdot NIM - 0.035 \cdot BOPO - 0.044 \cdot NPL + 0.016 \cdot LDR - 0.068 \cdot LAR$$

The second model tests whether and how the BI Rate influences the relationship between NIM and bank profitability. Table 3 shows the results of the multiple regression linier model with moderation, which includes the interaction term between NIM and the BI Rate.

**Table 3. Multiple Linear Regression with Moderation Test Results**

Variable	Unstandardized Coefficients (B)	Std. Error	Standardized Coefficients (Beta)	T
Constant	0.473		1.515	0.132
NIM	0.583	0.864	8.312	<0.001
BOPO	-0.035	-0.867	-8.336	<0.001
NPL	-0.044	-0.053	-0.629	0.530
LDR	0.016	0.473	4.363	<0.001
LAR	-0.068	-0.011	-0.153	0.879
F-Statistics	45.334			
Sig. (F)	0.001			
R-Square	0.658			

Source: Processed Data, 2025

In this model, the NIM × BI Rate interaction term is positive, suggesting that the relationship between NIM and ROA may be strengthened by changes in the BI Rate. However, this interaction effect is not statistically significant, indicating that while the BI Rate may influence the relationship between NIM and ROA, the effect is not conclusive. The equation for the model with moderation is as follows:

$$ROA = 0.560 + 0.513 \cdot NIM - 0.032 \cdot BOPO - 0.052 \cdot NPL + 0.014 \cdot LDR - 0.216 \cdot LAR + 0.014 \cdot (NIM \times BIRate)$$

### 4.1.3. F-Test (Simultaneous Test)

The results from the first model reveal an F-statistic of 53.164, with a significance level below 0.001. This suggests that the independent variables NIM, BOPO, NPL, LDR, and LAR together have a statistically significant impact on explaining the variation in ROA. These findings support the model's relevance and the inclusion of the independent variables as meaningful predictors of profitability. In the second model, which integrates the BI Rate interaction term to assess its moderating role, the F-statistic is 45.334 and the p-values show a significant result.

Despite the slightly lower F-statistic in the second model compared to the first model, the result remains highly significant, reaffirming that the independent variables, including the interaction term, together account for a substantial proportion of the variability in ROA. This indicates that the inclusion of the BI Rate does not diminish the explanatory power of the model. Instead, it further demonstrates the relevance of considering external economic factors, like the BI Rate, in understanding the factors influencing bank profitability. The slightly reduced F-statistic in the second model suggests that while the addition of the BI Rate as a moderating variable slightly alters the model's fit, it still provides valuable insight into how external factors interact with internal bank variables.

### 4.1.4. Coefficient of Determination ( $R^2$ )

In the first model, the  $R^2$  value is 0.667, with an Adjusted  $R^2$  of 0.654. This implies that approximately 66.7% of the variability in ROA can be accounted for by the independent variables, NIM, BOPO, NPL, LDR, and LAR. The Adjusted  $R^2$ , which accounts for the number of predictors in the model, confirms that the first model fits the data well, explaining a significant portion of the variation in bank profitability. In the second model, which incorporates the interaction term of the BI Rate, the  $R^2$  value increases slightly to 0.673, with an Adjusted  $R^2$  of 0.658. This small increase suggests that the addition of the BI Rate enhances the model's explanatory power, improving the ability to explain variations in ROA. The slight increase in  $R^2$  further supports the idea that the BI Rate plays a meaningful role in moderating the relationship between internal bank variables and profitability.

## 4.2. Discussion

### 4.2.1. The Effect of NIM on Probability

In the first model, Net Interest Margin (NIM), which reflects how efficiently a bank generates net interest income from its assets, has a positive and statistically significant effect on Return on Assets (ROA), a measure of profitability. This relationship remains robust in the second model, even with the inclusion of the BI Rate as a moderating variable, suggesting that efficient interest margin management consistently enhances bank performance. A higher NIM indicates that banks generate more income from core assets such as loans and securities, directly contributing to profitability.

This positive effect can be linked to the characteristics of Bank KBMI 3, whose strong financial and operational capacity allows for effective management of interest margins. Their ability to optimize loan and investment portfolios, combined with prudent risk management, strengthens the impact of NIM on profitability. Beyond confirming prior studies Mulyati & Widhiastuti (2024) and Rochmah & Purnamasari (2023), this positive effect can be attributed to specific characteristics of the Indonesian banking sector. Indonesian banks rely heavily on interest income due to limited diversification of fee-based services, making efficient asset utilization crucial. Additionally, prevailing regulatory frameworks, competitive lending rates, and the structure of domestic deposits amplify the impact of NIM on profitability. Therefore,

managing interest margins effectively is particularly critical in Indonesia, where banks' ability to generate stable net interest income largely determines overall financial performance. This supports the hypothesis (H1) that NIM positively impacts bank profitability.

#### 4.2.2. The Effect of BOPO on Probability

For the first model, the Operating Expenses to Operating Income Ratio (BOPO), which measures a bank's operational efficiency, shows a significant negative relationship with ROA. This indicates that banks with higher operational costs relative to income tend to have lower profitability. In the second model, which includes the BI Rate, the negative effect of BOPO on profitability remains statistically significant, reinforcing the importance of controlling operational costs to maintain strong financial performance. These results support Hypothesis 2 (H2), which posits that a higher BOPO ratio negatively affects bank profitability.

These findings are consistent with prior studies, including those by Andhikatama & Daulay (2020) and Mulyati & Widhiastuti (2024), which found that banks with lower BOPO ratios tend to exhibit superior financial performance due to more efficient management of operational costs. The negative relationship between BOPO and ROA underscores the crucial role of operational efficiency in enhancing profitability. A lower BOPO ratio allows banks to keep a larger portion of their income, directly boosting their profitability. In this study, both models affirm that improved management of operational costs significantly contributes to higher ROA. These conclusions are in line with the broader literature, including the work of Mulyati & Widhiastuti (2024), which also observed a negative correlation between BOPO and ROA, as well as the findings by Manurung et al. (2020), which highlight the significant impact of cost efficiency on overall financial performance in Indonesian banks. Furthermore, the study by Hartanto & Syarif (2022) supports these results by emphasizing the importance of operational efficiency in driving profitability, particularly in the context of banks listed on the Indonesia Stock Exchange (IDX).

#### 4.2.3. The Effect of NPL on Profitability

In the case of Non-Performing Loans (NPL), which measures the proportion of loans that are not performing, the results show an insignificant negative relationship with ROA in both models. This suggests that, although higher NPL levels may indicate potential credit risk, they do not significantly affect bank profitability in the sample. The negative impact of NPL on ROA is not strong enough to be considered statistically meaningful, leading to the rejection of Hypothesis 3 (H3). This result suggests that while NPL theoretically decreases profitability, the effective credit risk management practices at publicly listed banks in Indonesia, including strict loan approval procedures, proactive monitoring systems, and prudent provisioning policies, may mitigate its impact.

Studies, such as Andhikatama & Daulay (2020), show that large banks in Indonesia with strong risk management systems can effectively manage NPLs, reducing their negative effects on profitability. Similarly, Tarigan & Tandean (2022) found that the negative effect of NPL on profitability was less evident in banks with strong management practices. Additionally, regulatory oversight by Bank Indonesia ensures that banks maintain healthy loan portfolios, which further minimizes the impact of non-performing loans on profitability. Therefore, NPL does not significantly impact the profitability of publicly listed banks in Indonesia, as banks with robust risk management frameworks can offset potential losses from non-performing loans. Moreover, regulatory oversight by Bank Indonesia ensures that banks sustain healthy loan portfolios, further minimizing the influence of non-performing loans on profitability. As a result, NPL does not significantly affect profitability, reflecting the operational and financial strength of Bank KBMI 3.

#### 4.2.4. The Effect of LDR on Profitability

Regarding the Loan to Deposit Ratio (LDR), which indicates how effectively a bank uses its deposits to extend loans, both models reveal a positive and significant relationship with ROA. This indicates that banks that utilize their deposits more efficiently for lending tend to achieve higher profitability. The positive relationship remains significant even when considering the BI Rate as a moderating factor, demonstrating that effective deposit utilization supports bank performance regardless of external economic conditions. These findings support Hypothesis 4 (H4) that LDR positively affects bank profitability.

Bank KBMI 3, in particular, demonstrates strong deposit management capabilities, allowing them to optimize lending while maintaining financial stability. The findings align with research by Andhikatama & Daulay (2020), which found a significant positive relationship between LDR and profitability. A higher LDR reflects better utilization of collected deposits to generate loans, which in turn generates more interest income and increases profitability. However, it is important to note that while a higher LDR can boost profitability, an excessively high LDR can lead to liquidity risks if not properly managed. Hence, effective management of LDR is vital to balancing profitability and financial stability. Further, Mulyati & Widhiastuti (2024) found that LDR positively influenced ROA in their study of Indonesian banks, aligning with the idea that a higher LDR can lead to greater profitability. E. Puspitasari et al. (2021) also noted that a higher LDR, in combination with a favorable Net Interest Margin (NIM), can enhance ROA, consistent with the current results.

#### 4.2.5. The Effect of LAR on Profitability

Regarding the Loan to Asset Ratio (LAR), which measures the proportion of loans relative to total bank assets, the results in both models suggest a negative but statistically insignificant relationship with ROA. This indicates that while higher LAR may be associated with lower profitability, the effect is not strong enough to be considered significant. Consequently, Hypothesis 5 (H5) is not supported. This outcome may reflect the potential risks of increasing loan volumes relative to assets, which could raise credit risk and financial instability if not carefully managed.

Study by Andhikatama & Daulay (2020) support the view that a high LAR may not contribute positively to profitability and could pose risks if not accompanied by strong risk management. In line with this, Hadi (2024) found that a high LAR significantly reduced both ROA and ROE in Indonesian commercial banks, underscoring the importance of credit quality and prudent asset allocation. Additionally, Indrayani et al. (2022) demonstrated that rising credit risk, often a byproduct of aggressive lending, has a significant negative effect on profitability. Maintaining an optimal LAR and managing credit risk effectively are therefore essential for ensuring sustainable profitability.

This phenomenon occurs because Bank KBMI 3 has strong internal controls and risk management systems that prevent high loan volumes from negatively impacting profitability. Even when the Loan to Asset Ratio increases, the banks' careful loan appraisal, diversification of assets, and proactive monitoring ensure that credit risk remains manageable. Consequently, fluctuations in LAR do not significantly affect ROA, reflecting the banks' capacity to balance lending growth with financial stability. This highlights the importance of robust risk management and prudent asset allocation in maintaining sustainable profitability.

#### 4.2.6. The Moderating Effect of BI Rate

In this study, the BI Rate was used as a moderating variable to examine its impact on the relationship between NIM and ROA. The results suggest a positive moderating effect, indicating that changes in the BI Rate could potentially enhance the positive relationship

between NIM and profitability. However, this effect is not statistically significant, implying that the BI Rate does not meaningfully alter the influence of NIM on ROA in the sample banks. Consequently, while macroeconomic interest rates may have some influence, internal bank factors like interest margin management remain the dominant drivers of profitability.

These findings partially support Hypothesis 6 (H6), as the moderating effect of BI Rate is not statistically significant at the 5% level. The literature on the moderating effect of BI Rate shows mixed results. Andhikata & Daulay (2020) found that the BI Rate does not significantly influence the NIM-ROA relationship, while Rochmah & Purnamasari (2023) reported that BI Rate negatively affects profitability. The inconsistent results may be due to different macroeconomic conditions and varying risk management strategies across banks. Thus, while the BI Rate may play a role in moderating the NIM-ROA relationship, its effect should be interpreted with caution.

The limited impact of the BI Rate can be attributed to the characteristics of Bank KBMI 3, which maintain strong internal controls and conservative risk management practices. These banks rely heavily on core interest income and adjust lending rates, manage liquidity, and diversify income sources to mitigate the effect of short-term BI Rate fluctuations. As a result, internal management of interest margins plays a more decisive role in profitability than external macroeconomic changes, rendering the moderating effect of the BI Rate less pronounced.

## 5. Conclusion

This study provides a comprehensive analysis of the factors affecting the profitability of publicly listed banks in Indonesia, specifically focusing on the roles of Net Interest Margin (NIM), Operational Expense to Operating Income Ratio (BOPO), Non-Performing Loans (NPL), Loan to Deposit Ratio (LDR), Loan to Asset Ratio (LAR), and the moderating effect of the Bank Indonesia (BI) Rate on profitability as measured by Return on Assets (ROA). The results show that NIM, BOPO, and LDR significantly impact ROA. A higher NIM enhances profitability by efficiently generating interest income, while lower BOPO ratios, indicative of better cost management, also boost profitability.

The LDR positively influences ROA by effectively utilizing deposits for lending, thus increasing interest income. On the other hand, NPL and LAR were found to have an insignificant effect on profitability, suggesting that credit risk management and asset management strategies employed by the banks may mitigate potential losses associated with non-performing loans and high loan volumes. Regarding the BI Rate, its moderating effect on the relationship between NIM and profitability was found to be positive but statistically insignificant. This suggests that while macroeconomic factors such as the BI Rate may influence profitability, bank-specific factors like interest margin management and operational efficiency remain more pivotal in driving profitability.

Overall, the findings emphasize the importance of effective management of interest income, operational efficiency, and liquidity for improving bank profitability in Indonesia. While macroeconomic factors such as the BI Rate play a role, their influence may not be as significant as the internal management strategies of the banks. Future research could expand the sample to include more banks or cover a longer period to better understand how internal and external factors affect profitability over time. Comparative studies between different types of banks, such as conventional versus Islamic banks or large versus medium-sized banks, are also recommended to examine whether these factors impact profitability differently across bank types. Additionally, alternative methodological approaches, such as panel data with

dynamic modeling or structural equation modeling, could provide deeper insights into the interactions between macroeconomic conditions and internal performance metrics.

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