

WORKSHEET : Jurnal Akuntansi

Faculty of Economics and Business, Dharmawangsa University
ISSN (Print): 2808 – 8557 ISSN (Online): 2808 – 8573
Volume. 5 Nomor. 3, Agustus 2026

THE EFFECT OF NPL, LDR, AND BOPO ON PROFITABILITY WITH NIM AS A MODERATING VARIABLE IN PRIVATE BANKS LISTED ON THE IDX

Aimmatul Qoyyimah 1*); Nanik Wahyuni 2)

1). Faculty of Economics, UIN Maulana Malik Ibrahim Malang
e-mail:220502110013@student.uin-malang.ac.id

2). Faculty of Economics, UIN Maulana Malik Ibrahim Malang
e-mail:nanik@akuntansi.uin-malang.ac.id

*Corresponding email:220502110013@student.uin-malang.ac.id

Abstract

This study is designed to examine the extent to which Non-Performing Loans (NPLs), the Loan to Deposit Ratio (LDR), and the Operating Expense to Operating Income Ratio (BOPO) influence profitability as proxied by Return on Assets (ROA) with the Net Interest Margin (NIM) serving as a moderating variable, among conventional national private commercial banks listed on the Indonesia Stock Exchange (IDX) during the period from 2020 to 2024. The data used in this study are secondary, sourced from the annual financial reports of each bank. The sample was selected using purposive sampling, resulting in 34 banks with a total of 170 observations. The approach applied is a quantitative method combining panel data regression analysis and Moderated Regression Analysis (MRA), with the entire process executed using EViews 13 software. Testing via the Chow test and the Hausman test led to the conclusion that the Fixed Effects Model is the most appropriate model specification to use. The estimation results indicate that NPL and LDR do not have a significant effect on ROA, whereas BOPO was found to have a substantial negative effect on ROA. Furthermore, NIM, as a moderating variable, was found to strengthen the effect of NPL on ROA, but conversely to weaken the relationship between LDR and ROA as well as the relationship between BOPO and ROA. These overall results reaffirm the central role of profitability as the primary benchmark for banking financial health, thereby requiring banks to consistently maintain credit quality, manage liquidity carefully, and sustain operational efficiency. Moreover, effective management of the net interest margin has been shown to have the potential to boost a bank's financial performance while mitigating the negative impacts caused by credit risk and operational inefficiencies.

Keywords:

Non-Performing Loans, Loan to Deposit Ratio, Operating Expenses to Operating Income, Net Interest Margin, Profitability

INTRODUCTION

The banking industry serves as a fundamental component of the economy, acting as a financial intermediary that is key to fostering national growth. Banks, which gather money from the public and provide loans or financing, must ensure stability, financial robustness, and operational effectiveness to carry out these responsibilities efficiently. This function is becoming more vital due to developments in the Indonesian banking landscape, including the effects of the COVID-19 crisis, rapid digital advancement, and shifts in monetary policies both globally and domestically (Abdurrohman., 2020; Faneshia, C., Rachmawati, R., & Putri, 2021).

Private banks are essential to the financial ecosystem as they encourage spending, investment, and economic expansion through their mediation processes. Vulnerabilities in the worldwide economy, mainly driven by fluctuations in global financial markets and currency rates, compel banks to enhance risk management and boost efficiency to maintain a secure financial standing. Nonetheless, the relatively steady domestic economic growth still presents banks with chances to optimize asset use and enhance their profitability (Otoritas Jasa Keuangan, 2025).

Profitability is viewed as a vital measurement for evaluating the condition and effectiveness of banks. This metric reveals how well a bank can produce profits and indicates how effectively management uses its resources (Handayani et al., 2024). In studies related to banking, return on assets (ROA) is commonly employed as a profitability indicator since it shows a bank's capacity to earn profits based on its overall assets and offers a more unbiased evaluation of asset management efficiency compared to other profitability measures (Idhiah Nurdianti et al., 2023).

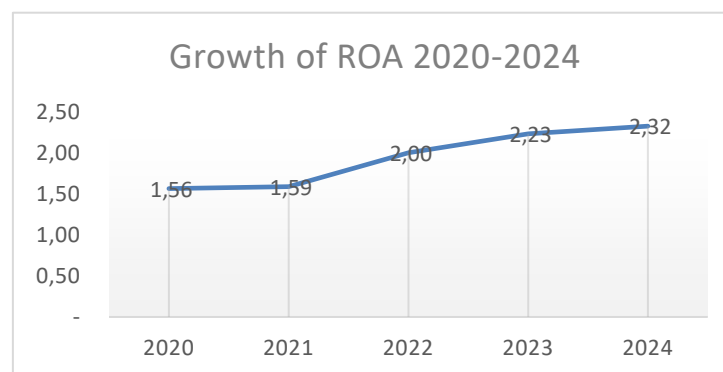


Figure 1 Growth of ROA Ratio of Conventional National Private Banks

Based on the return on assets (ROA) data from traditional domestic banks listed on the Indonesia Stock Exchange (IDX), there was a consistent yearly rise noted between 2020 and 2024. In 2020, the ROA was recorded at 1.56%, with a slight increase to 1.59% in 2021. A more noticeable jump occurred in 2022, reaching 2.00%, followed by an increase to 2.23% in 2023 and 2.32% in 2024. This upward trend indicates advancements made by bank management in effectively utilizing productive assets to yield profits. The variations and increases suggest enhanced profitability within the banking sector, although this trend does not entirely clarify all the factors at play. This implies that the changes in return on assets (ROA) are influenced not just by asset growth but also by the intricacies of risk management and the efficiency of the bank's operations.

One of the factors that determines a bank's ability to generate profits is credit risk, which is typically represented by the non-performing loan (NPL) ratio. This ratio reflects the proportion of loans that borrowers have failed to repay relative to the total amount of loans disbursed. The higher the NPL ratio, the greater the potential losses the bank must bear, as this condition directly impacts the reduction of interest income while hindering the achievement of profitability targets. In this context, Sinta et al., (2023) empirically demonstrate that the NPL ratio has a significant impact on return on assets (ROA), leading to the conclusion that deteriorating credit quality is directly proportional to the weakening of profit levels achieved by banking institutions.

In addition to credit risk, the effectiveness of liquidity management is another factor that influences a bank's profitability, and this is generally measured by the loan to deposit ratio (LDR). This ratio illustrates the extent to which a bank is able to utilize third-party funds it has mobilized to channel them into productive loans. Conceptually, credit expansion has the

potential to drive interest income growth, which ultimately has a positive impact on profitability. However, existing empirical studies have not shown consistency. Rosandy, N., & Thio, (2022) found no significant relationship between the LDR and ROA, while on the other hand, Zakirah & Hasanuh, (2024) identified a clear positive effect of the LDR on ROA. This inconsistency among findings indicates that the relationship between the LDR and profitability still requires more in-depth and comprehensive research.

Another element that affects a bank's ability to earn money is its operational efficiency, often assessed by the relationship between operating costs and operating income, known as the BOPO ratio. This metric shows the disparity between what a bank spends on operations and its earnings from those operations. A higher BOPO ratio signals that the costs are a larger share of revenue, resulting in lower profits for the bank. Research conducted by Chairunisa & Isyanto, (2025), along with Hasanudin et al., (2023), has demonstrated that the BOPO ratio negatively influences return on assets (ROA), indicating that rising operational expenses usually lead to decreased profitability for banks.

The influence of non performing loans (NPLs), the loan to deposit ratio (LDR), and BOPO on the profitability of banks is not always straightforward. This is because how interest income is managed can either enhance or diminish this connection. The net interest margin (NIM) serves as an important indicator, showing how well a bank can produce net income from its assets (Regina Arthamevia & Husin, 2023). Banks that achieve a high net interest margin (NIM) tend to optimize their interest income more effectively, which increases the benefits of lending while also reducing the adverse effects of credit risks and operational problems. Consequently, the NIM plays a moderating role in the relationship among non performing loans (NPLs), loan to deposit ratio (LDR), bank to operations ratio (BOPO), and the profitability of banks (Haryanto et al., 2021).

The connection between financial ratios and profitability is also shaped by the differences in information available to internal and external stakeholders. As a result, external evaluations rely on the data provided in financial statements. This data indicates the company's present condition and potential future developments. The signaling theory proposed by Spence, (1973) suggests that the information shared by a company with external entities serves as an indicator that affects market views. In the banking sector, ratios like NPL, LDR, BOPO, and NIM act as significant indicators that represent asset quality, liquidity, efficiency of operations, and the bank's capacity to earn profits. Elevated NPL and BOPO numbers generate unfavorable signals concerning the bank's performance, whereas ideal LDR and NIM figures create affirming signals for investors and regulatory bodies, as noted by (Brigham, E. F., & Houston, 2019).

A number of previous studies have yielded mixed findings regarding the effects of NPL, LDR, and BOPO on ROA, particularly in relation to the role of NIM as a moderating variable. The inconsistency of these results suggests that the relationships among these variables have not yet been fully and comprehensively mapped, indicating that further research is still needed. Given this context, this study focuses on conventional national private commercial banks listed on the Indonesia Stock Exchange during the 2020–2024 period to gain a deeper understanding of the factors influencing profitability in the banking sector.

Based on the above description, a conceptual research framework can be developed that illustrates the relationship between the independent variables namely NPL, LDR, and BOPO and profitability (ROA), with NIM as the moderating variable, as follows:

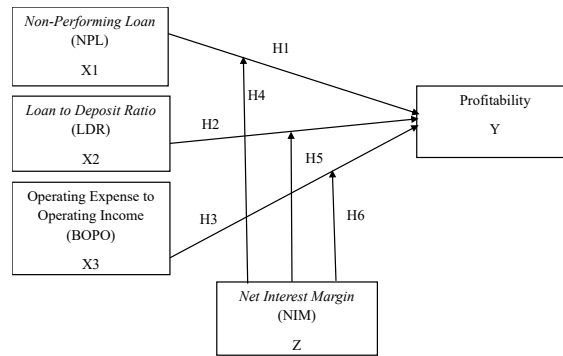


Figure 2 Conceptual Framework

The hypotheses that can be formulated in this research are as follows:

- H1:** Non-Performing Loans have a negative impact on Profitability
- H2:** Loan to Deposit Ratio has a positive impact on Profitability
- H3:** Operating Expense to Operating Income have a negative impact on Profitability
- H4:** Net Interest Margin is able to moderate the influence of Non-Performing Loans on Profitability
- H5:** Net Interest Margin is able to moderate the influence of Loan to Deposit Ratio on Profitability
- H6:** Net Interest Margin is able to moderate the influence of Operating Expense to Operating Income on Profitability

RESEARCH METHODS

This study employs a quantitative approach using secondary data sourced from financial statements and annual reports of banks published through the Indonesia Stock Exchange (IDX) and the official websites of the respective banks. The population of this study comprises all national private commercial banks that operate conventionally and are listed on the IDX from 2020 to 2024. Sampling was conducted using purposive sampling, based on a set of criteria explicitly defined prior to the selection process. Through this process, 34 banks were found to meet all required criteria, resulting in a total of 170 observations over the five-year study period. Details regarding the sample selection criteria and the results obtained are presented in full in the following section:

Table 1 Purposive Sampling Criteria

No.	Criteria	Amount
1.	Conventional national private banks listed on the IDX in 2020-2024	57
2.	Conventional national private banks that did not publish financial reports consistently during 2020-2024	(23)
Number of banks that meet the criteria		34
Number of years of research for the period 2020-2024		5
The amount of final data used in the study		170

Source: Data processed by researchers, 2025

Data analysis was conducted using panel data regression techniques performed using EViews 13 software. The most appropriate estimation model was determined through a series of tests, including the Chow test, the Hausman test, and the Lagrange multiplier test, to obtain the optimal model specification. Hypothesis testing was conducted using the t-test to evaluate the significance level of each coefficient individually. In addition, the overall model fit was

assessed using the coefficient of determination in the form of (Adjusted R²). As part of the further analysis, this study also applied moderated regression analysis (MRA) to examine the role of NIM in its capacity as a moderator variable.

Profitability

Profitability can be understood as a bank's capacity to generate profits through the optimal utilization of resources and efficient asset management. The level of profitability reflects the success of managerial activities in generating profits and simultaneously serves as a benchmark for financial performance over a specific period (Farhan, G. Z., & Zulfikar, 2024). In this study, profitability is operationalized through return on assets (ROA), as this ratio is considered the most appropriate for illustrating the extent to which a bank can generate profits from its total assets, and is deemed more objective than other profitability ratios in evaluating the financial condition of the banking sector (Susilawati & Nurulrahmatiah, 2021). The measurement of profitability in this study thus refers to return on assets (ROA) Susilawati & Nurulrahmatiah, (2021), which is formulated as follows:

$$ROA = \frac{\text{Net Income}}{\text{Total Assets}}$$

Non-Performing Loan

Non-performing loans (NPLs) are an indicator that reflects the proportion of non-performing loans or financing held by a bank. This ratio is calculated by comparing the amount of non-performing loans to the total amount of loans disbursed (Saputra & Angriani, 2023). As a reflection of the quality of credit disbursement, an increase in the NPL ratio indicates an increase in credit risk exposure, which in turn has the potential to put pressure on the bank's profit (Aura Salsabila, Eko Sujadi, 2024). In this study, the measurement of the NPL ratio follows the approach developed by Saputra & Angriani, (2023) using the following formula:

$$NPL = \frac{\text{Total Non-performing Loan}}{\text{Total Loans}} \times 100\%$$

Loan to Deposit Ratio

The Loan to Deposit Ratio (LDR) is a key performance indicator used to assess a bank's ability to meet its obligations to disburse customer funds from third-party sources through loans. In addition to a bank's liquidity, this ratio also reflects the effectiveness of its intermediary function in channeling public funds into loans (Farhan, G. Z., & Zulfikar, 2024). In this study, the LDR measurement is based on a proxy used by (Rahmani, 2022):

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

Operating Expenses to Operating Income

The BOPO (Business Operating Percentage) ratio reflects a bank's operational efficiency by comparing total operating costs to revenue. A low BOPO ratio indicates good operational efficiency, while a high BOPO ratio indicates significant operating costs (Farhanditya & Mawardi, 2021). In this study, the BOPO was calculated using a proxy based on VMS et al., (2020), which is formulated as follows:

$$BOPO = \frac{\text{Operating Expense}}{\text{Operating Income}} \times 100\%$$

Net Interest Margin

The Net Interest Margin (NIM) is a financial ratio used to measure a bank's ability to generate net interest income through the utilization of its earning assets. This ratio reflects the bank's effectiveness in performing its intermediary function, namely the process of mobilizing funds from the public and channeling them back to those in need (Saputra & Angriani, 2023). Within the analytical framework of this study, NIM is positioned as a moderating variable, the value

of which is obtained by comparing net interest income with total assets capable of generating income, as formulated in the following equation (Farhan, G. Z., & Zulfikar, 2024):

$$NIM = \frac{\text{Net Interest Income}}{\text{Earning Assets}} \times 100\%$$

RESULTS AND DISCUSSION

Descriptive Statistical Analysis

Table 2 Descriptive Statistical Analysis Results

	NPL	LDR	BOPO	ROA	NIM
Mean	3.435989	88.94818	103.3529	0.335567	4.031417
Median	2.278392	82.41888	79.41610	0.530026	3.670745
Maximum	34.14930	413.2915	1300.423	4.416733	23.84864
Minimum	0.000000	3.957684	4.788227	-18.05767	-2.309853
Std. Dev.	4.398273	49.06188	124.5005	2.518784	3.209145
Skewness	4.116407	2.547888	6.287448	-3.502686	2.999183
Kurtosis	24.42428	15.48957	54.11827	21.66814	16.89533
Jarque-Bera	3731.352	1288,857	19629.37	2816.153	1622,513
Probability	0.000000	0.000000	0.000000	0.000000	0.000000
Sum	584.1182	15121.19	17569.99	57.04634	685.3409
Sum Sq. Dev.	3269.272	406794.5	2619563.	1072.182	1740,466
Observations	170	170	170	170	170

Source: Data processed by researchers, 2026

Statistical analysis shows that the profitability ratio, as measured by return on assets (ROA), has an average of 0.335567, with values going as low as -18.05767 and as high as 4.416733. This reveals the different capabilities of banks in earning profits. The non-performing loan (NPL) ratio has an average of 3.435989, with a range from 0.000000 to 34.14930. This indicates varying levels of credit risk across different banks. The loan to deposit ratio (LDR) has an average of 88.94818, with a minimum of 3.957684 and a maximum of 413.2915. This suggests differences in the banks’ ability to mediate funds. The operational efficiency ratio (BOPO) averages 103.3529, with a range from 4.788227 to 1,300.423, which reflects the variation in operational efficiency among banks. The moderating variable NIM has an average of 4.031417, with a low of -2.309853 and a high of 23.84864, highlighting the differences in how banks generate net interest income from their interest-earning assets.

Model Selection Test

Chow Test

Table 3 Chow Test Results

Effects Test	Statistics	df	Prob.
Cross-Section F	2.567714	(33,133)	0.0001
Cross-Section Chi-square	83.797690	33	0.0000

Source: Data processed by researchers, 2026

Referring to the results of the Chow test presented earlier, the F-statistic probability value is 0.0001, which is well below the set significance level of 0.05. Since $p = 0.0001 < 0.05$, the Fixed Effects Model (FEM) is determined to be the most appropriate model specification.

To further validate this model selection, a Hausman test was subsequently conducted as a confirmatory step.

Hausman test

Table 4 Hausman Test Results

Test Summary	Chi-Sq. Statistic	Chi-Sq. df	Prob.
Cross-Section random	8.384559	3	0.0387

Source: Data processed by researchers, 2026

Referring to the table of Hausman test results presented, the probability value for the cross-sectional random model is recorded as 0.0387, which is below the significance threshold of 0.05. Thus, since $p = 0.0387 < 0.05$, the FEM is once again confirmed as the best model and the most appropriate one to use. Since the optimal model has been definitively determined through the Hausman test, further testing using the Lagrange Multiplier (LM) test is no longer necessary.

Panel Data Regression Analysis

Table 5 Panel Data Regression Analysis Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.200292	0.522038	0.383674	0.7018
NPL	0.118150	0.061814	1.911391	0.0581
LDR	0.008550	0.004657	1.836145	0.0686
BOPO	-0.009978	0.001475	-6.763431	0.0000

Source: Data processed by researchers, 2026

The following model was obtained based on the results of the panel data regression estimation:

$$Y = 0.200292 + 0.118150 (NPL) + 0.008550 (LDR) - 0.009978 (BOPO) + e$$

The constant value of 0.200292 implies that if all independent variables in the model are assumed to be constant or unchanged, the projected Return on Assets (ROA) will be 0.200292. The regression coefficient for the NPL variable is recorded at 0.118150 with a positive direction, indicating a positive relationship between NPL and ROA; however, this effect cannot be statistically confirmed as significant. A similar pattern is observed for the LDR variable, which exhibits a positive coefficient of 0.008550, reflecting a positive relationship with ROA, although this value also does not reach the threshold for statistical significance. In contrast to the previous two variables, the BOPO variable exhibited a negative coefficient of -0.009978 and was found to have a significant effect on ROA. This suggests that any increase in the BOPO ratio will have a tangible impact on weakening banking profitability.

Classical Assumption Test

In reference to the results of the Chow and Hausman tests, the Fixed Effects Model (FEM) was determined to be the most appropriate estimation approach for this study. Consequently, the tests of classical assumptions applied covered only two aspects: multicollinearity and heteroscedasticity (Napitupulu et al., 2021).

Multicollinearity Test

Table 6 Multicollinearity Test Results

	NPL	LDR	BOPO
NPL	1,000,000	-0.202800	0.103628
LDR	-0.202800	1,000,000	-0.030435
BOPO	0.103628	-0.030435	1,000,000

Source: Data processed by researchers, 2026

The multicollinearity test showed that none of the correlation coefficients among the independent variables exceeded 0.80. This indicates that there is no strong relationship among the predictor variables, so the model used in this study can be considered free from multicollinearity issues.

Heteroscedasticity Test

Figure 3 Heteroscedasticity Test Results

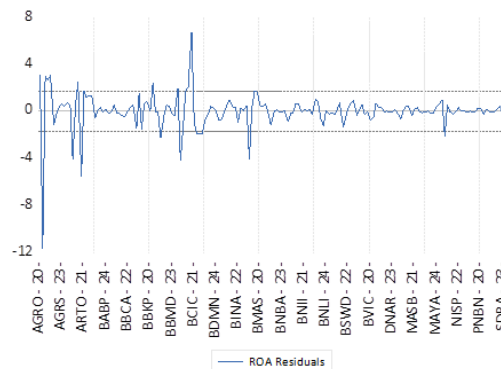
Meanwhile, the results of the heteroscedasticity test showed that the residual distribution for each variable did not exceed the tolerance limits of +500 or -500. More specifically, the measured residual values ranged from -10 to +7, confirming that this research model contains no indications of heteroscedasticity.

Hypothesis Testing

Coefficient of Determination Test

Table 7 Coefficient of Determination Test Results

R-squared	0.630108	Mean dependent var	0.335567
Adjusted R-squared	0.529987	SD dependent var	2.518784
SE of regression	1.726815	Akaike info criterion	4.120279
Sum squared residual	396.5915	Schwarz criterion	4.802777
Log likelihood	-313.2238	Hannan-Quinn criter.	4.397229
F-statistic	6.293459	Durbin-Watson stat	2.422139
Prob(F-statistic)	0.000000		



Source: Data processed by researchers, 2026

Reference to the results of the coefficient of determination calculation yields an Adjusted R^2 value of 0.529987. This indicates that, collectively, the variables NPL, LDR, and BOPO are able to explain 52.99% of the total variation in the ROA variable. While the remaining 47.01% is influenced by other variables outside the scope of this research model. Furthermore, the R^2 value of 0.630108 indicates that the overall regression model explains 63.01% of the variation in the dependent variable.

Partial Test (t-Test)

Table 8 Partial Test Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.200292	0.522038	0.383674	0.7018
NPL	0.118150	0.061814	1.911391	0.0581
LDR	0.008550	0.004657	1.836145	0.0686
BOPO	-0.009978	0.001475	-6.763431	0.0000

Source: Data processed by researchers, 2026

Reference to the t-test results shows that the NPL variable has a probability value of 0.0581, which means that this variable does not have a statistically significant effect on Return on Assets (ROA). Similarly, the LDR variable, with a p-value of 0.0686, also does not show a significant effect on ROA. Conversely, the BOPO variable was found to have a negative and statistically significant impact on ROA, as reflected by its coefficient of -0.009978 with a probability of 0.0000. This finding confirms that efficiency in banking operations management plays a more dominant role in determining profitability levels compared to credit risk or liquidity risk factors.

Moderated Regression Analysis (MRA) Test

Table 9 Moderated Regression Analysis (MRA) Test Results

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Z_X1	0.056525	0.007695	7.345557	0.0000
Z_X2	-0.003310	0.000291	-11.38098	0.0000
Z_X3	-0.009993	0.000367	-27.25025	0.0000

Source: Data processed by researchers, 2026

Within the framework of moderation regression analysis, the net interest margin (NIM) was identified as a moderating variable in the relationship between NPL, LDR, and BOPO and ROA. The interaction between NPL and NIM yields a positive coefficient of 0.056525 with a p-value of 0.0000, indicating that the presence of NIM amplifies and strengthens the effect of non-performing loans on the return on assets. Meanwhile, the interaction between LDR and NIM, as well as between BOPO and NIM, yielded negative coefficients of -0.003310 and -0.009993, respectively, with a p-value of 0.0000, indicating that NIM actually reduces the magnitude of the influence exerted by these two ratios on ROA. Based on these overall results, it can be concluded that NIM plays a crucial role as a moderator in the relationship between non performing loans, the loan to deposit ratio, and the operating expense to operating income ratio with the return on banking assets.

Discussion

The Impact of Non-Performing Loans on Profitability

The test results reveal that non-performing loans (NPLs) do not have a significant impact on bank profitability, as reflected in Return on Assets (ROA). This finding implies that there is no clear, direct correlation between the volume of non-performing loans and a bank's ability to generate profits. This situation is likely due to the fact that banking institutions have implemented a

series of structured and effective credit risk management practices, including periodic loan quality assessments, handling of overdue accounts, and the establishment of adequate loss reserves, thereby significantly mitigating the potential negative impact of non-performing loans.

When viewed through the signal theory framework, a relatively high NPL ratio is not necessarily interpreted as a negative signal by investors, as long as the company is able to maintain consistent financial performance. These results align with the research by VMS et al., (2020) and Ishak et al., (2024), which confirms that banking profitability is determined more by factors beyond the mere quantity of NPLs, such as operational efficiency levels and revenue management strategies. However, these findings are inconsistent with the results of the study by Farhan, G. Z., & Zulfikar, (2024), who argue that an increase in the NPL ratio has the potential to significantly reduce a bank's profitability.

The Impact of Loan to Deposit Ratio on Profitability

The results of this study reveal that the Loan to Deposit Ratio (LDR) does not appear to have an impact on bank profitability as measured by Return on Assets (ROA). This finding confirms that loan expansion alone does not necessarily drive an increase in revenue for banking institutions. In other words, growth in loan volume cannot be taken as a guarantee of increased profitability, given that the success of banking intermediation is also determined by the quality of the credit assets disbursed, the risks inherent in funding sources, and the effectiveness of the fund management practices implemented by the bank in question.

Within the signaling theory framework, a high loan to deposit ratio is not always interpreted as a favorable signal for investors, especially if this condition is not supported by adequate asset quality. Therefore, the recorded LDR does not reflect a significant improvement in the banking sector's overall financial performance. This conclusion aligns with the findings presented by Asih et al., (2023) and Rahmani, (2022), who also did not find a significant effect of the LDR on banking profitability in their studies. On the other hand, this finding contradicts the view of Ishak et al., (2024), who argue that an increase in credit volume has the potential to boost profitability through higher interest income.

The Impact of Operating Expense to Operating Income on Profitability

The research findings confirm that the BOPO ratio has a negative impact on bank profitability as measured by ROA. This means that an increase in the BOPO ratio is inversely proportional to a bank's profit the higher the ratio, the lower the level of profitability achieved. This occurs because the swelling of operating expenses is not offset by proportional growth in operating income, resulting in a decline in the bank's profit margin. Therefore, efforts to control and improve operational efficiency are crucial factors in driving the growth of banking profitability.

When examined from the perspective of signaling theory, the BOPO ratio essentially serves as a reflection of management's capability to manage all of the bank's operational activities. A high BOPO ratio reflects low management efficiency, and this condition is commonly interpreted as a negative signal regarding the financial soundness of the institution in question. This finding aligns with the results of studies by Ferly et al., (2021) and Hasanudin et al., (2023), which consistently found a negative relationship between the BOPO ratio and profitability. On the other hand, Rohimah & Setiadi, (2021) produced different findings, namely that no significant correlation was found between the two variables. The discrepancy in results among these various studies suggests that the extent of the influence of operational efficiency on profitability is highly dependent on the specific conditions and individual characteristics of each bank.

The Role of Net Interest Margin in Moderating the Impact of Non-Performing Loans on Profitability

The findings of this analysis confirm that the net interest margin (NIM) acts as a variable that strengthens the relationship between non-performing loans (NPLs) and return on assets (ROA). This means that the impact of credit risk on banking revenue tends to be more pronounced at banks with high NIMs. Although the presence of non-performing loans is fundamentally a threat to profit generation, a bank's capacity to generate net interest income serves as the determining factor in how significantly that threat actually impacts profitability. This underscores NIM's role as a reflection of management's ability to optimize returns on productive assets; the larger the margin, the clearer the relationship between credit risk and the bank's financial performance.

Within the signaling theory framework, a bank's ability to generate net interest income is viewed as a signal reflecting the quality of its management of income-generating assets as well as the institution's overall financial health. Thus, the NIM plays a strategic role in strengthening the relationship between credit risk and profitability levels. This conclusion aligns with the findings of Haryanto et al., (2021), which indicate that NIM strengthens the correlation between NPLs and banking profitability. Consequently, the extent of credit risk's impact on bank performance depends heavily on the bank's ability to establish and maintain an adequate net interest margin.

The Role of Net Interest Margin in Moderating the Impact of Loan to Deposit Ratio on Profitability

The test results reveal that the Net Interest Margin (NIM) has declined, which ultimately weakens the relationship between the Loan to Deposit Ratio (LDR) and Return on Assets (ROA). This condition indicates that credit volume expansion alone does not necessarily correlate directly with revenue growth; rather, the extent of LDR's influence on ROA is largely determined by the bank's capacity to generate an adequate interest margin. Thus, even as loan disbursements continue to rise, profit growth will not materialize if the interest income generated cannot fully absorb all operational costs and risks inherent in lending activities.

From a signaling theory perspective, the volume of loans disbursed is not always interpreted positively by investors, unless it is accompanied by the bank's ability to consistently drive interest income growth. This conclusion aligns with the findings of Haryanto et al., (2021), who demonstrated the moderating role of NIM in influencing the relationship between LDR and banking profitability. On this basis, the contribution of lending activities to bank profit generation is also influenced by the extent to which management is able to manage interest margins efficiently.

The Role of Net Interest Margin in Moderating the Impact of Operating Expense to Operating Income on Profitability

Findings from further analysis reveal that the Net Interest Margin (NIM) acts as a variable capable of weakening the strength of the relationship between the operating expense-to-operating income ratio (BOPO) and Return on Assets (ROA). This implies that the negative pressure exerted by operational inefficiencies on profit generation can be mitigated when a bank successfully optimizes its net interest income. In other words, an adequate NIM can serve as a buffer for a bank's profitability even when the operational expenses it bears are relatively high.

Within the signaling theory framework, a high BOPO ratio is typically interpreted as a negative signal reflecting weak efficiency in the bank's operational management. However, the intensity of this negative signal can be reduced if the bank maintains a high NIM, as the bank's capacity to generate substantial interest income is deemed capable of sustaining the resilience

of its financial performance. This conclusion aligns with the research findings presented by Farhanditya & Mawardi, (2021) as well as Widia et al., (2025), which consistently demonstrate that NIM has the capacity to mitigate the detrimental impact of BOPO on a bank's profitability levels.

CONCLUSION

This study examines the effects of Non-Performing Loans (NPL), the Loan to Deposit Ratio (LDR), and operational efficiency proxied by the BOPO on bank profitability, as measured by Return on Assets (ROA), with the Net Interest Margin (NIM) serving as a moderating variable. The analysis reveals that NPL and LDR do not have a significant effect on ROA, while BOPO is found to have a significant effect on ROA. In its capacity as a moderating variable, NIM exhibits varying roles: on one hand, NIM strengthens the relationship between NPL and ROA, but on the other hand, it weakens the influence of both LDR and BOPO on ROA. Taken together, these findings confirm that operational efficiency and a bank's capacity to optimize net interest income are crucial determinants in shaping banking profitability levels.

This study is not without a number of limitations that must be acknowledged. In terms of the scope of the study, the sample used only includes domestic commercial banks listed on the Indonesia Stock Exchange from 2020 to 2024. Furthermore, the variables analyzed are limited to NPL, LDR, BOPO, and NIM as moderators, thus failing to encompass all factors that could potentially influence banking profitability. Given these limitations, future research is recommended to expand the scope of analysis by extending the observation period and incorporating additional relevant variables. Practically, the findings of this study have important implications for decision-makers at the bank management level, namely the need for a stronger commitment to improving operational effectiveness and optimizing net interest margin management as a foundation for achieving higher profitability while maintaining sustainable financial stability.

REFERENCE

- Abdurrohman. (2020). Analysis of Factors Affecting Banking Profitability in Indonesia. *Journal of Accounting and Business*, 15(1), 45–57.
- Asih, S., Maftukhin, & Yenny, E. (2023). The Effect of Operating Expense to Operating Income Ratio (BOPO), Loan-to-Deposit Ratio (LDR), and Net Interest Margin (NIM) on Return on Assets (ROA) in Banking Companies Listed on the Indonesia Stock Exchange. *Jurnal Bina Akuntansi*, 10(2), 696–715.
- Aura Salsabila, Eko Sujadi, E. S. (2024). The Effect Of NPL, LDR, And CAR On ROA With NIM As A Mediation Variable In Conventional Bank Listed On The Indonesian Stock Exchange (BEI). *Journal of Economic*, 13(2), 541–554. <https://doi.org/10.54209/ekonomi.v13i02>
- Brigham, E. F., & Houston, J. F. (2019). *Fundamentals of financial management (15th ed.)*. Cengage Learning.
- Chairunisa, M., & Isyanto, P. (2025). The Effect of BOPO on ROA and ROE at PT Bank Jago on the Indonesia Stock Exchange for the Period 2020–2024. *Journal of Economics and Management*, 2(3), 714–723.
- Fanesha, C., Rachmawati, R., & Putri, A. (2021). The Effect of Financial Performance on the Profitability of Commercial Banks in Indonesia. *Journal of Economics and Business*, 24(2), 112–124.
- Farhan, G. Z., & Zulfikar, Z. (2024). The Effect of the Capital Adequacy Ratio (CAR), Loan-to-Deposit Ratio (LDR), Non-Performing Loans (NPL), Net Interest Margin (NIM), and Operating Expense to Operating Income Ratio (BOPO) on Profitability (ROA). *SEIKO : Journal of Management & Business*, 7(1), 1129–1138.
- Farhanditya, F. D., & Mawardi, W. (2021). The Effect of BOPO, NPL, and LDR on Return on Assets with Net Interest Margin as an Intermediary Variable. *Diponegoro Journal of Management*, 10(3),

- 1–15. <http://ejournal-s1.undip.ac.id/index.php/dbr>
- Ferly, M. M., Rinofah, R., & Kusumawardhani, R. (2021). Analysis of the Effects of CAR and BOPO on ROA with NIM as an Intervening Variable at PT Bank Pembangunan Daerah Kalimantan for the Period Tahun 2011 – 2021. *Journal Ekombis Review*, 11(2), 1207–1220. <https://jurnal.unived.ac.id/index.php/er/indexDOI:https://doi.org/10.37676/ekombis.v11i12>
- Handayani, S., Nasution, F. N., & Siregar, N. B. (2024). The Effect of Non-Performing Loans and Loan to Deposit Ratio on Profitability with Inflation as a Moderating Variable in Banking Companies Listed on Indonesia Stock Exchange Period 2018-2022. *International Journal of Current Science Research and Review*, 07(05), 2771–2780. <https://doi.org/10.47191/ijcsrr/v7-i5-37>
- Haryanto, S., Aristanto, E., Assih, P., Aripin, Z., & Bachtiar, Y. (2021). *Loan to Deposit Ratio , Risiko Kredit , Net Interest Margin dan Profitabilitas Bank*. 4(1), 146–154.
- Hasanudin, H., Awaloedin, D. T., & Apriyati, N. (2023). The Effect of LDR Ratio, CAR Ratio and BOPO Ratio on ROA in Conventional Banking on the Indonesia Stock Exchange Period 2015-2020. *JMKSP (Jurnal Manajemen, Kepemimpinan, Dan Supervisi Pendidikan)*, 8(2), 560–571. <https://doi.org/10.31851/jmksp.v8i2.11250>
- Idhiah Nurdianti, Mudhita Elviani, & I Gusti Kade Birawan. (2023). Analysis of factors influencing banking profitability. *Journal of Economics, Business, and Humanities (Eksishum)*, 2(2), 1–11. <https://doi.org/10.63494/eksishum.v2i2.78>
- Ishak, I. M., Pakaya, S. I., & Paramani, R. N. R. (2024). Analysis of the Impact of Non-Performing Loans (NPL) and the Loan-to-Deposit Ratio (LDR) on Return on Assets (ROA) in State-Owned Commercial Banks. *Economic Reviews Journal*, 3(2), 903–917. <https://doi.org/10.56709/mrj.v3i2.220>
- Otoritas Jasa Keuangan. (2025). *RDKB – Stability of the financial services sector remains intact (April 2025)*. OJK.
- Rahmani, N. A. B. (2022). Analysis of the Effects of Non-Performing Loans, Loan-to-Deposit Ratio, and Operating Expenses on Operating Income and Financial Performance in Sharia Commercial Banks. *Dynamics of Accounting, Finance, and Banking*, 11(1), 22–30.
- Regina Arthamevia, R. A., & Husin, R. N. (2023). The Effect of Net Interest Margin (NIM) and Loan-to-Deposit Ratio (LDR) on Return on Assets (ROA) at State-Owned Banks Listed on the Indonesia Stock Exchange (2013–2021). *AKUNTOTEKNOLOGI*, 15(1), 160–176. <https://doi.org/10.31253/aktek.v15i1.2129>
- Rohimah, E., & Setiadi. (2021). Analysis of the Effects of BOPO, CAR, and NPL on ROA in State-Owned Banks Listed on the Indonesia Stock Exchange (2012–2019). *JIMA: Student Journal of Accounting*, 1(2), 133–145.
- Rosandy, N., & Thio, L. S. (2022). The Effect of CAR, NIM, LDR, and BOPO on ROA in Banks Listed on the Indonesia Stock Exchange. *Jurnal Paradigma Akuntansi*, 4(4).
- Saputra, A. J., & Angriani, R. (2023). The Effect of Capital Adequacy Ratio (CAR), Non-Performing Loans (NPL), Net Interest Margin (NIM), Loan-to-Deposit Ratio (LDR), and Operating Expenses to Operating Income (BOPO) on Return on Assets (ROA) at Rural Credit Banks (BPR) in Batam City. *Accounting and Management*, 18(1), 93–115. <https://doi.org/10.30630/jam.v18i1.210>
- Sinta, Y., Jamil, C. P., Abdullah, J. H., & Siti Intan Nurdiana Wong. (2023). The Impact of Non-Performing Loans (NPL) and Loan-to-Deposit Ratio (LDR) on the Profitability of Conventional Commercial Banks Listed on the Indonesia Stock Exchange. *INVEST: Journal of Business and Accounting Innovation*, 4(1), 42–55.
- Spence, M. (1973). Job Market Signaling. *The Quarterly Journal of Economics*, 87(3), 355. <https://doi.org/10.2307/1882010>
- Susilawati, S., & Nurulrahmatiah, N. (2021). The Effect of Non-Performing Loans (NPL) and Loan-to-Deposit Ratio (LDR) on Return on Assets (ROA) with Net Interest Margin (NIM) as a Mediating Variable in State-Owned Banks Listed on the Indonesia Stock Exchange. *Maksipreneur Journal: Management, Cooperatives, and Entrepreneurship*, 11(1), 69. <https://doi.org/10.30588/jmp.v11i1.833>
- VMS, D. Y., Maryono, & Santosa, A. B. (2020). The Effect of the Capital Adequacy Ratio (CAR), Non-Performing Loans (NPL), Net Interest Margin (NIM), Operating Expenses to Operating Income Ratio (BOPO), and Loan-to-Deposit Ratio (LDR) on Return on Assets (ROA). *Dynamics*

of Accounting, Finance, and Banking, 9(2), 189–200.

Widia, E., Sinaga, B., Saajidah, A., Saragih, E. C., Sirait, M. M., Hutabalian, R. A., & Margaret, P. S. (2025). Examining the Impact of LDR and BOPO on ROA through NIM: Evidence from Indonesian Conventional Banks (2014 – 2023). *BALANCE: Jurnal Ekonomi*, 21(1), 53–61.

Zakirah, R. H., & Hasanuh, N. (2024). Analysis of the effects of LDR, NPL, and NIM on ROA in Indonesian banks. *Tirtayasa Ekonomika.*, 19(1), 102–114.