

The Effect of Non-Performing Loan, Loan to Deposit Ratio, Net Interest Margin, and Capital Adequacy Ratio on Return on Asset in Private Banks Listed on the Indonesia Stock Exchange for the Period 2021–2025

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Abstract: *This study examines the effects of Non-Performing Loans (NPL), Loan-to-Deposit Ratio (LDR), Net Interest Margin (NIM), and Capital Adequacy Ratio (CAR) on Return on Assets (ROA) among private banks listed on the Indonesia Stock Exchange (IDX) during the 2021–2025 period. This study employs a quantitative approach using secondary data obtained from the annual financial reports of the sampled banks. The population consisted of 35 private banks listed on the IDX, of which 10 banks were selected through purposive sampling. The five-year observation period generated 50 bank-year observations. Data were analyzed using multiple linear regression with SPSS version 26. The results show that NPL, LDR, NIM, and CAR simultaneously have a significant effect on ROA ($F = 14.308$, $p < 0.001$). The model explains 56.0% of the variation in ROA ($R^2 = 0.560$), while the adjusted coefficient of determination is 52.1% (Adjusted $R^2 = 0.521$). Partially, NPL has a negative and significant effect on ROA ($t = -4.576$, $p < 0.001$). In contrast, LDR ($t = 2.032$, $p = 0.048$), NIM ($t = 2.309$, $p = 0.026$), and CAR ($t = 2.450$, $p = 0.018$) have positive and significant effects on ROA. These findings indicate that credit quality, lending intermediation, net interest income generation, and capital adequacy are important determinants of profitability in the sampled private banks.*

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Introduction

As a financial institution, a bank plays an important role in the economic system through its intermediation function, that is, connecting parties with surplus funds to parties that need funds. In addition, banks are entrusted by the public to collect funds and channel them back productively in order to encourage improvements in public welfare (F. D. Saputri & Putra, 2023). In carrying out this function,

banks have the main objective of achieving maximum profitability, which is reflected in the condition of their financial statements (Silpiani & Kusumawardani, 2025).

Credit growth in the banking sector continued to strengthen in early 2026. Bank Indonesia reported that bank lending in March 2026 grew 9.49% year on year (yoy), higher than the 9.37% recorded in February 2026. Amid global dynamics, including the escalating conflict in the Middle East, the resilience of the national banking sector is considered to remain strong, as reflected in a non-performing loan ratio of 2.17% gross and 0.83% net, as well as a capital adequacy ratio at a high level of 25.83% in February 2026 (Nurdiana & Mayasari, 2026). Nevertheless, banks have begun to apply more prudent lending standards in the face of an economic environment that remains cautious.

Return on Asset (ROA) is widely used as the primary measure in assessing a bank's level of profitability because it measures how effectively a bank utilizes its assets to generate profit (Andriyani, 2015). Bank Indonesia stipulates that in order to become a core bank within the banking system, a bank must have a minimum ROA of 1.5% (Hidayat et al., 2022). A high ROA indicates that a bank is able to manage its assets effectively to earn profit, whereas a decline in ROA indicates that asset management and risk control by the bank are less than optimal.

A number of financial ratios are thought to influence Return on Assets (ROA). One of them is Non-Performing Loan (NPL), a ratio that shows the proportion of problem loans compared to a bank's total loans. Based on Bank Indonesia Regulation Number 23/2/PBI/2021, a healthy gross NPL value does not exceed 5% (Prihatinto & Setiadi, 2023). Furthermore, Loan to Deposit Ratio (LDR) is a ratio used to assess a bank's effectiveness in channeling funds collected from the public into loans. According to Bank Indonesia's provisions, the LDR range considered safe is between 78% and 110%, while an excessively high LDR has the potential to increase credit distribution risk while decreasing the bank's liquidity level (Joysinta & Amalina, 2026). Meanwhile, Net Interest Margin (NIM) reflects a bank's ability to earn net interest income through the utilization of productive assets, with a minimum standard set by Bank Indonesia of 6% (Hidayat et al., 2022). Capital Adequacy Ratio (CAR) is a ratio that shows the level of a bank's capital adequacy in bearing risk-weighted assets, thereby reflecting the bank's ability to face various potential financial risks (Tahu et al., 2025).

The objects analyzed in this study are private banks listed on the Indonesia Stock Exchange (IDX), including Bank Central Asia, Bank Danamon, Bank CIMB Niaga, Bank Maybank Indonesia, Bank Permata, Bank Pan Indonesia, Bank OCBC NISP, Bank Mega, Bank SMBC Indonesia, and Bank Victoria International. Preliminary observation of the financial ratios of these banks during the 2021–2025 period shows considerable fluctuation in NPL, LDR, NIM, CAR, and ROA from year to year, so that the relationship between bank soundness indicators and profitability needs to be examined further through empirical analysis.

Based on the research data, the development of financial ratios in private banks listed on the IDX during the 2021–2025 period shows fluctuating conditions. The Non-Performing Loan (NPL) ratio is generally at a relatively low level, although it experienced increases and decreases in several periods. The Loan to Deposit Ratio (LDR) tends to decline compared to 2021, reflecting an adjustment in credit distribution relative to third-party funds. Meanwhile, Net Interest Margin (NIM) is relatively stable with no significant change, indicating that the bank's ability to generate net interest income remains steady. Capital Adequacy Ratio (CAR) also fluctuates, but overall remains above the regulator's minimum requirement, indicating an adequate capital position. Return on Assets (ROA) fluctuated during the study period, reflecting differences in each bank's ability to generate profit from its assets.

Referring to previous studies, a research gap remains regarding the effect of Non-Performing Loan (NPL), Loan to Deposit Ratio (LDR), Net Interest Margin (NIM), and Capital Adequacy Ratio (CAR) on Return on Assets (ROA). Yahya & Devirosawati (2024) found that NPL has a negative effect on ROA, whereas Putri (2026) stated that NPL has no effect on ROA, even though both studies used Signalling Theory. For the LDR variable, Putri (2026) found an effect on ROA, while Astuti et al. (2023) obtained an insignificant result. Furthermore, Setyaningsih et al. (2023) showed that NIM affects ROA, while Fiqih & Ardiansyah (2025) stated there is no significant effect. Differences in results were also found for the CAR variable, where Alfayad et al. (2025) found an effect on ROA, while Yahya & Devirosawati (2024) obtained the opposite result. In addition, A & Bella (2025) concluded that NPL, LDR, NIM, and CAR simultaneously have a significant effect on ROA. Bagus & Taswan (2021) also found that the four variables jointly affect ROA, although using a different theoretical basis. These

differences in research results indicate that the relationship between financial ratios and bank profitability remains inconsistent, so further research is needed.

The variety of findings from previous studies indicates that inconsistencies or empirical gaps remain, so further research is needed to re-examine the effect of these variables—NPL, LDR, NIM, and CAR—particularly on private banks listed on the IDX, given that research covering the most recent 2021–2025 period is still limited. This study aims to fill that gap by empirically analyzing the effect of NPL, LDR, NIM, and CAR, both simultaneously and partially, on ROA in private banks listed on the IDX.

Literature Review

Agency Theory

Jensen and Meckling (1976), as cited in Dewi et al. (2025), describe agency theory as a theory explaining the agency relationship that arises when capital owners delegate the authority to manage a company to management to carry out operational activities on the owners' behalf. In public institutions, responsibility for carrying out the company's operational activities lies with management, while shareholders act as the party delegating managerial authority for the benefit of shareholders. Conflicts of interest can arise when agents, who have direct access to operational information, act in their own interest, resulting in suboptimal decisions. In the banking context, agency theory emphasizes the importance of sound credit risk management by management, because a failure to manage credit risk can generate losses that harm shareholders.

Financial Intermediation Theory

Financial Intermediation Theory is an important foundation for this study because it explains the primary role of banks as intermediary institutions that collect funds from parties with a surplus of funds (savers) and channel them to parties in need of funds (borrowers), particularly in the form of credit. This function is important for maintaining the stability of the financial system and encouraging economic growth, as well as helping to overcome the problem of information asymmetry between lenders and borrowers A. D. Saputri et al. (2025). Under this theory, credit distribution decisions are more influenced by fund availability, liquidity, and risk structure than by operational cost efficiency Satriana et al. (2026).

Signalling Theory

Spence (1973) states that companies send signals to stakeholders through financial information. In the banking sector, sound financial ratios reflect positive performance and can therefore increase public trust Tahu et al. (2025).

Return on Asset (ROA)

Return on Assets (ROA) shows the level of a company's effectiveness in utilizing assets to generate profit Andriyani (2015). This indicator reflects how efficiently assets are used to generate profit and serves as a measure of a company's management efficiency Widyantini (2023).

Non-Performing Loan (NPL)

NPL measures the proportion of problem loans compared to the total credit extended by a bank. This ratio reflects the condition of debtors who are unable to make payments according to the agreed schedule (Tsany & Daniel Bagana, 2022). An increase in the NPL ratio reflects less-than-optimal credit management by the bank, which ultimately weakens the bank's profitability as reflected in ROA Wenno & Laili (2022).

Loan to Deposit Ratio (LDR)

LDR describes a bank's effectiveness in utilizing third-party funds to be channeled as credit. A ratio at an ideal level can support an increase in interest income; however, if the value is too high, it can trigger liquidity risk as well as credit risk, which in turn can reduce ROA (Wenno & Laili, 2022).

Net Interest Margin (NIM)

NIM shows a bank's success in generating net interest income through the use of productive assets, such as loans and securities. A high NIM value indicates increasingly effective intermediation performance, which has the potential to increase profitability as reflected in ROA (Jonardy & Hasanuh, 2022).

Capital Adequacy Ratio (CAR)

CAR reflects the strength of a bank's capital in bearing risk arising from productive assets. An adequate CAR level reflects the bank's ability to maintain financial stability and support the growth of company profit (Tahu et al., 2025).

Research Methods

This study applies a quantitative approach with an associative research design to examine the effect of Non-Performing Loan (NPL), Loan to Deposit Ratio (LDR), Net Interest Margin (NIM), and Capital Adequacy Ratio (CAR) on Return on Assets (ROA). The data analyzed are secondary data in the form of the annual financial statements of private banks obtained from the official publications of the Indonesia Stock Exchange (IDX) during the 2021–2025 period.

The study population comprises 35 private banks listed on the Indonesia Stock Exchange. The sample was determined using purposive sampling based on several criteria, namely private banks listed on the IDX, actively operating throughout the 2021–2025 period, and publishing complete annual financial statements. Based on these criteria, 10 banks were obtained as the research sample, namely Bank Central Asia, Bank CIMB Niaga, Bank Danamon Indonesia, Bank Permata, Bank OCBC NISP, Bank Maybank Indonesia, Bank Pan Indonesia, Bank Mega, Bank SMBC Indonesia, and Bank Victoria International. With an observation period of five years, the total data analyzed amounted to 50 observations.

Data were collected through the documentation method, namely by compiling annual financial statements published on the official IDX website. The research variables were measured using financial ratios: NPL is calculated from the ratio of non-performing loans to total loans, LDR from total loans to third-party funds, NIM from net interest income to productive assets, CAR from capital to risk-weighted assets, while ROA is measured using the ratio of net profit to total assets.

Data analysis was carried out using multiple linear regression with the help of SPSS version 26. Prior to hypothesis testing, classical assumption tests were performed, comprising a normality test (Kolmogorov-Smirnov and Normal P-P Plot), a multicollinearity test (Tolerance and Variance Inflation Factor/VIF), a heteroscedasticity test (scatterplot), and an autocorrelation test (Durbin-Watson). The regression equation used is as follows:

$$Y = a + b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + e$$

where Y is Return On Asset, a is the constant, b₁–b₄ are the regression coefficients, X₁ = NPL, X₂ = LDR, X₃ = NIM, X₄ = CAR, and e is the residual error. Hypotheses were tested using the F test and t test at a significance level of 0.05. In addition, the correlation coefficient and coefficient of determination (R²) were used to measure the strength of the relationship between variables and the model's ability to explain the variation in Return on Assets (ROA).

Result and Discussion

Results

Ten private banking financial institutions listed on the Indonesia Stock Exchange are the objects of this study. The issuers used as the research sample include PT Bank Central Asia Tbk, PT Bank CIMB Niaga Tbk, PT Bank Danamon Indonesia Tbk, PT Bank Permata Tbk, PT Bank OCBC NISP Tbk, PT Bank Maybank Indonesia Tbk, PT Bank Pan Indonesia Tbk, PT Bank Mega Tbk, PT Bank SMBC Indonesia Tbk, and PT Bank Victoria International Tbk. This study uses the companies' financial statement data for the 2021–2025 period.

Description of Research Data

Descriptive statistical analysis aims to describe the condition of each variable studied, namely NPL, LDR, NIM, CAR, and ROA, in private banks listed on the Indonesia Stock Exchange for the

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2021–2025 period. The characteristics of the data are shown through the minimum, maximum, mean, and standard deviation values. The results are presented in the following table:

Table 1. Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
NPL	50	0.30	3.24	1.2066	0.76880
LDR	50	68.04	126.70	92.2368	17.08432
NIM	50	2.58	7.43	5.0552	1.13232
CAR	50	22.19	69.00	33.7570	14.02318
ROA	50	0.80	3.90	2.0556	0.84923

Source: Data processed with SPSS 26 (2026)

Based on Table 1. above, the distribution of the research data can be characterized as follows:

1. Non-Performing Loan (NPL) has an average of 1.21%, indicating a low and relatively homogeneous level of problem loans.
2. Loan to Deposit Ratio (LDR) recorded an average value of 92.24%, illustrating the bank's ability to channel funds to debtors, with a still acceptable degree of data variation.
3. Net Interest Margin (NIM) of 5.06% reflects the bank's ability to earn net interest income from the productive assets managed during the study period.
4. Capital Adequacy Ratio (CAR) has an average of 33.76%, indicating that the banks' capital position is at an adequate level to support operational activities and to bear various risks.
5. Return on Assets (ROA) obtained an average value of 2.06%, indicating that all sample banks were able to generate profit from their assets during the observation period.

Classical Assumption Test

Normality Test

The normality test is used to identify whether the data distribution conforms to a normal distribution. In this study, the test was carried out using the One-Sample Kolmogorov-Smirnov Test, with the criteria that a significance value above 0.05 indicates the data meets the normality assumption, while a value below 0.05 indicates otherwise (Sahir, 2021). The test results are shown in the table below.

Table 2. Normality Test Results (One-Sample Kolmogorov-Smirnov Test)

		Unstandardized Residual
N		50
Normal Parameters	Mean	0.0000000
	Std. Deviation	0.56342412
Most Extreme Differences	Absolute	0.091
	Positive	0.091
	Negative	-0.060
Test Statistic		0.091
Asymp. Sig. (2-tailed)		0.200

Source: Data processed with SPSS 26 (2026)

The Asymp. Sig. (2-tailed) value from the Kolmogorov-Smirnov test is 0.200 (> 0.05), so the residuals meet the normality assumption. This result is consistent with the Normal P-P Plot graph, which shows that the distribution of points follows the diagonal line, as shown in Figure 1.

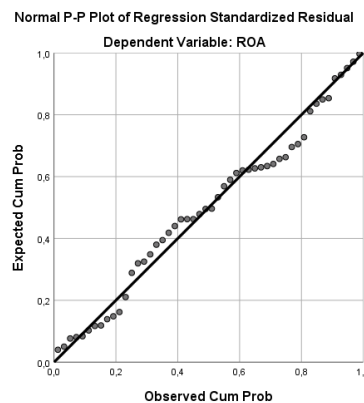


Figure 1. Normal P-P Plot Test Results

Source: Data processed with SPSS 26 (2026)

Figure 1. shows a distribution of points following the diagonal line, so the residuals are declared to meet the normality assumption.

Multicollinearity Test

The multicollinearity test is used to ensure there is no strong correlation among the independent variables. The criteria used are a Tolerance value > 0.10 and a VIF < 10.00 (Sahir, 2021). A summary of the regression coefficients together with the Tolerance and VIF values is shown in Table 3 below; this same table is also referred to later in the discussion of the regression and t-test results.

Table 3. Regression Coefficients, Tolerance, and VIF

Model	B	Std. Error	Beta	t	Sig.	Tolerance	VIF
(Constant)	0.166	0.660	-	0.252	0.802	-	-
NPL	-0.531	0.116	-0.481	-4.576	0.000	0.886	1.128
LDR	0.011	0.006	0.231	2.032	0.048	0.756	1.322
NIM	0.192	0.083	0.256	2.309	0.026	0.797	1.255
CAR	0.015	0.006	0.245	2.450	0.018	0.976	1.024

Source: Data processed with SPSS 26 (2026)

Table 3. shows that all variables have a Tolerance value above 0.10 and a VIF below 10. Therefore, the regression model is declared free of multicollinearity and is suitable for further analysis.

Heteroscedasticity Test

The heteroscedasticity test is used to determine whether the regression model is free from heteroscedasticity, as one of the classical assumption requirements (Sahir, 2021).

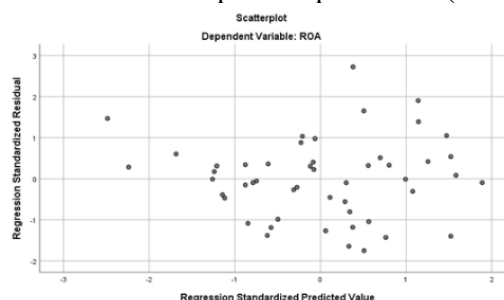


Figure 2. Heteroscedasticity Test Results

Source: Data processed with SPSS 26 (2026)

The distribution pattern of the points in Figure 2 appears random and does not form a clear pattern. Thus, the regression model is declared free of heteroscedasticity.

Autocorrelation Test

Autocorrelation was tested using the Durbin-Watson (DW) method to determine the independence of the residuals in the regression model (Sahir, 2021). The decision criteria for the autocorrelation test are as follows:

1. A DW value in the range $0 < DW < dL$ indicates positive autocorrelation.
2. Negative autocorrelation occurs when the DW value is in the range $4 - dL < DW < 4$.
3. If the DW value is in the range $dU < DW < 2$ or $2 < DW < 4 - dU$, there is neither positive nor negative autocorrelation.
4. A DW value in the range $dL \leq DW \leq dU$ or $4 - dU \leq DW \leq 4 - dL$ falls in the inconclusive zone, requiring further testing or additional data.
5. The regression model is declared free of autocorrelation if the DW value is in the range $dU < DW < 4 - dU$.

The following Model Summary table reports the R, R Square, Adjusted R Square, and Durbin-Watson values used throughout the remaining classical-assumption, correlation, and determination tests below.

Table 4. Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	0.748 ^a	0.560	0.521	0.58793	2.108

Source: Data processed with SPSS 26 (2026)

Based on Table 4, the Durbin-Watson (DW) value is 2.108, with $dU = 1.7214$ and $dL = 1.3779$. This value meets the criterion $1.7214 < 2.108 < 2.2786$ ($4 - dU$). Therefore, the test results indicate that there is no autocorrelation problem in the regression model, so the model meets the classical assumption standards required for regression analysis.

Multiple Linear Regression Test

Multiple linear regression analysis is a statistical method used to determine the relationship and effect of several independent variables on a single dependent variable (Sahir, 2021). In this study, the method was applied to analyze the extent to which NPL, LDR, NIM, and CAR affect ROA, both individually and jointly. Using the unstandardized coefficients (B) reported earlier in Table 3, the following regression equation is obtained:

Table 5. Multiple Linear Regression Test Result Coefficients^a

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	,166	,660		,252	,802
NPL	-,531	,116	-,481	-4,576	,000
LDR	,011	,006	,231	2,032	,048
NIM	,192	,083	,256	2,309	,026
CAR	,015	,006	,245	2,450	,018

a. Dependent Variable: ROA

$$ROA = 0,166 - 0,531X_1 + 0,011X_2 + 0.192X_3 + 0.015X_4 + e$$

1. The constant of 0.166 means that the value of ROA is 0.166 when all independent variables are held constant or equal to zero.
2. The NPL coefficient of -0.531 indicates a negative relationship, meaning that an increase in NPL can decrease ROA by 0.531 units.
3. The LDR coefficient of 0.011 indicates that an increase in LDR is followed by an increase in ROA of 0.011 units.
4. The NIM coefficient of 0.192 indicates a positive effect, where an increase in NIM can increase ROA by 0.192 units.
5. The CAR coefficient of 0.015 indicates that an increase in CAR has the potential to increase ROA by 0.015 units.

Correlation Coefficient Test

The correlation coefficient test was conducted to examine the strength and direction of the relationship among the research variables.

Table 6. Correlation Coefficient Test Result

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	0.748 ^a	0.560	0.521	0.58793	2.108

Source: Data processed with SPSS 26 (2026)

Referring back to the R value of 0.748 in Table 4, and based on the relationship-strength criteria, this value falls into the strong category, as it lies within the range of 0.60–0.799. This indicates that NPL, LDR, NIM, and CAR jointly have a strong relationship in explaining changes in ROA.

Coefficient of Determination Test

The coefficient of determination (R^2) aims to measure the extent to which the independent variables contribute to explaining changes in the dependent variable. An R^2 value closer to one indicates that the research model is better at explaining the dependent variable, while the remainder is influenced by other variables not included in the study (Sahir, 2021).

Table 7. Coefficient of Determination Test Result

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	0.748 ^a	0.560	0.521	0.58793	2.108

Source: Data processed with SPSS 26 (2026)

Based on Table 7, the Adjusted R Square value is 0.521, meaning that the variables NPL, LDR, NIM, and CAR contribute 52.1% to changes in ROA in private banks listed on the IDX during the 2021–2025 period. The remaining 47.9% of the variation in ROA is influenced by variables outside the study, such as efficiency levels, company characteristics, governance implementation, and general economic conditions.

Statistical Hypothesis Testing

F Test (Simultaneous Significance)

The F test was conducted to determine the joint effect of NPL, LDR, NIM, and CAR on ROA. The test decision is based on the significance value, where Sig. < 0.05 indicates a significant simultaneous effect (Sahir, 2021).

Table 8. F Test (ANOVA) Results

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	19.784	4	4.946	14.308	0.000 ^b
Residual	15.555	45	0.346		
Total	35.338	49			

Source: Data processed with SPSS 26 (2026)

Based on the ANOVA test results, an F-value of 14.308 was obtained, which is greater than the F-table value of 2.58, with a significance value of $0.000 < 0.05$. This result indicates that H_0 is rejected and H_1 is accepted, so NPL, LDR, NIM, and CAR jointly have a significant effect on ROA in private banks listed on the IDX during the 2021–2025 period.

t Test (Partial Significance)

The t test is used to examine the partial effect of each independent variable on ROA. Testing is carried out with the criterion that a Sig. value < 0.05 indicates a significant effect, while a Sig. value > 0.05 indicates no effect (Sahir, 2021). Referring back to the t and Sig. values in Table 3, the following results were obtained for each independent variable:

Table 9. T Test Result

Coefficients ^a					
Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
1 (Constant)	,166	,660		,252	,802
NPL	-,531	,116	-,481	-4,576	,000

LDR	,011	,006	,231	2,032	,048
NIM	,192	,083	,256	2,309	,026
CAR	,015	,006	,245	2,450	,018

a. Dependent Variable: ROA

Source: Data processed with SPSS 26 (2026)

1. NPL has a t-value of -4.576 and a significance of $0.000 < 0.05$, so NPL has a negative and significant effect on ROA. Thus, H_1 is accepted and H_0 is rejected.
2. LDR has a t-value of 2.032 and a significance of $0.048 < 0.05$, so LDR has a positive and significant effect on ROA. Thus, H_2 is accepted and H_0 is rejected.
3. NIM has a t-value of 2.309 and a significance of $0.026 < 0.05$, so NIM has a positive and significant effect on ROA. Thus, H_3 is accepted and H_0 is rejected.
4. CAR has a t-value of 2.450 and a significance of $0.018 < 0.05$, so CAR has a positive and significant effect on ROA. Thus, H_4 is accepted and H_0 is rejected.

Discussion

The Effect of Non-Performing Loan, Loan to Deposit Ratio, Net Interest Margin, and Capital Adequacy Ratio on Return on Asset

The SPSS analysis results show that the regression model meets the classical assumptions and can be used for hypothesis testing. Simultaneously, NPL, LDR, NIM, and CAR have a significant effect on ROA, with an explanatory power of 52.1%, while the remaining 47.9% is influenced by other factors outside the model. This result supports the study by A & Bella (2025), which states that there is a simultaneous effect of the independent variables on the dependent variable.

The results indicate that NPL, LDR, NIM, and CAR play a role in determining a bank's level of profitability. This finding is in line with Agency Theory, Financial Intermediation Theory, and Signalling Theory, which emphasize the importance of credit risk management, liquidity, interest income, and capital. These financial ratios can also serve as considerations for investors in evaluating a bank's performance.

The Effect of Non-Performing Loan on Return on Asset

Non-Performing Loan (NPL) is shown to have a negative and significant effect on Return on Assets (ROA). The t test results show a t-value of -4.576 with a significance of $0.000 < 0.05$, so H_1 is accepted. This means that the higher the NPL, the lower the ROA, because an increase in problem loans reduces a bank's ability to generate profit.

This finding is consistent with Jensen and Meckling's (1976) Agency Theory, which explains that management needs to manage credit risk properly to maintain financial performance. This result is also in line with Yahya & Devirosawati (2024), who stated that an increase in NPL has a negative impact on ROA because high levels of problem loans can decrease a bank's profitability.

The Effect of Loan to Deposit Ratio on Return on Asset

Loan to Deposit Ratio (LDR) has a positive effect on ROA. The t test results show a t-value of 2.032 with a significance of $0.048 < 0.05$, so H_2 is accepted. This indicates that an increase in LDR can encourage an increase in ROA in private banks during the 2021–2025 period.

Based on Signalling Theory, LDR can serve as information for investors in assessing a bank's ability to manage funds and credit. However, the results of this study show that LDR's effect on ROA is only marginally significant, as bank profitability is also influenced by other factors such as asset quality, efficiency, and credit risk. This result is in line with Astuti et al. (2023), who found that LDR does not significantly affect ROA.

The Effect of Net Interest Margin on Return on Asset

Net Interest Margin (NIM) has a positive and significant effect on ROA. The t test results show a t-value of 2.309 with a significance of $0.026 < 0.05$, so H_3 is accepted. This means that an increase in NIM will increase ROA because the bank's ability to generate net interest income improves.

Based on Spence's (1973) Signalling Theory, a high NIM can serve as positive information for investors regarding a bank's ability to manage productive assets and generate income. This result is in line with Silpiani & Kusumawardani (2025), who stated that NIM has a significant effect on ROA in banking companies.

The Effect of Capital Adequacy Ratio on Return on Asset

Capital Adequacy Ratio (CAR) has a positive and significant effect on ROA. The t test results show a t-value of 2.450 with a significance of $0.018 < 0.05$, so H_4 is accepted. This indicates that an increase in capital adequacy can support a bank's ability to generate profit.

Based on Spence's (1973) Signalling Theory, a high CAR can serve as a positive indicator for investors regarding a bank's ability to maintain stability and manage risk. This result is in line with HHafiz et al. (2025), who stated that CAR has a significant effect on ROA, so that sound capital adequacy can support improvements in bank financial performance.

Conclusion and Recommendation

Conclusion

The results of this study on the effect of NPL, LDR, NIM, and CAR on ROA in private banks listed on the IDX during the 2021–2025 period produce the following conclusions:

1. Non-Performing Loan (NPL) has a negative and significant effect on Return on Assets (ROA) in private banks listed on the Indonesia Stock Exchange during the 2021–2025 period.
2. Loan to Deposit Ratio (LDR) has a positive but not significant effect on ROA in private banks listed on the Indonesia Stock Exchange during the 2021–2025 period.
3. Net Interest Margin (NIM) has a positive and significant effect on ROA in private banks listed on the Indonesia Stock Exchange during the 2021–2025 period.
4. Capital Adequacy Ratio (CAR) has a positive and significant effect on ROA in private banks listed on the Indonesia Stock Exchange during the 2021–2025 period.
5. Simultaneously, NPL, LDR, NIM, and CAR have a significant effect on ROA in private banks listed on the Indonesia Stock Exchange during the 2021–2025 period.

Recommendation

Based on the research findings and conclusions described above, the researchers propose several recommendations as follows:

1. *For Investors*
Investors are advised to pay attention to NPL, LDR, NIM, and CAR as considerations in assessing a bank's financial condition and profitability before making investment decisions.
2. *For Private Banks*
Private banks are expected to improve the management of credit risk, liquidity, interest income, and capital adequacy to support an increase in ROA and maintain the stability of financial performance.
3. *For Future Researchers*
Future researchers are advised to develop this research by including additional variables, extending the observation period, and broadening the research objects and sample in order to obtain more comprehensive results.

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