THE IMPACT OF CAMEL COMPONENTS ON BANK PROFITABILITY: THE MODERATING ROLE OF FIRM SIZE IN INDONESIAN BANKING

Monica Lyras Ayunda[1]
Universitas Muhammadiyah Pontianak, Pontianak, Indonesia
ayundaamonica@gmail.com

Edy Suryadi[2]
Universitas Muhammadiyah Pontianak, Pontianak, Indonesia
edy.suryadi@unmuhpnk.ac.id

Abstract

This study investigates the determinants of bank profitability in Indonesia using the CAMEL framework with firm size as a moderating variable, grounded in signaling theory. The research examines how capital adequacy, asset quality, earnings capacity, operational efficiency, and liquidity function as financial signals that influence bank profitability. The sample consists of banking companies listed on the Indonesia Stock Exchange during the period 2020-2024, comprising 140 firm-year observations. Multiple linear regression and Moderated Regression Analysis (MRA) are employed to assess both direct and moderating effects on profitability, measured by Return on Assets (ROA). The empirical results indicate that Net Interest Margin (NIM) has a positive and statistically significant effect on ROA, while the Operating Expenses to Operating Income Ratio (BOPO) and Loan to Deposit Ratio (LDR) exhibit significant negative effects, underscoring the importance of earnings efficiency, cost control, and prudent liquidity management in enhancing bank profitability. In contrast, Capital Adequacy Ratio (CAR) and Non-Performing Loans (NPL) do not show significant direct effects on ROA, suggesting that regulatory standardization and effective risk management may limit their short-term influence on profitability. Furthermore, firm size does not directly affect ROA but significantly moderates the relationship between credit risk and profitability, indicating that larger banks are better equipped to absorb adverse credit risk. This study contributes to the banking literature by providing empirical evidence from an emerging market context and reinforcing the relevance of signaling theory in explaining how financial indicators shape bank profitability.

Keywords: CAMEL, Bank Profitability, ROA, Firm Size, Signaling Theory

INTRODUCTION

The resilience of a financial system is ultimately reflected in the ability of its banking institutions to maintain profitability while effectively managing risk amid changing economic conditions. In emerging economies such as Indonesia, banks operate in an environment characterized by regulatory tightening, competitive pressures, and heightened exposure to macroeconomic volatility. Within this context, bank profitability functions not only as an indicator of managerial effectiveness but also as a signal of systemic stability, influencing investor confidence, credit allocation, and overall economic performance (Hudaib et al., 2024). Accordingly, identifying the internal financial factors that drive bank profitability remains a critical concern for both academic research and policy formulation.

Bank profitability reflects the effectiveness of management in utilizing assets, controlling risks, and maintaining operational efficiency. Among various profitability indicators, Return on Assets (ROA) is widely regarded as the most appropriate measure of banking performance, as it assesses the efficiency of asset utilization irrespective of capital structure (Setyarini, 2020). A higher ROA indicates a bank's ability to generate greater income from its asset base, whereas a lower ROA may signal inefficiencies, weak credit management, or excessive operating costs. Empirical evidence from Indonesian banking institutions shows that ROA varies significantly across banks, underscoring the importance of identifying internal factors that explain profitability differentials (Siwu et al., 2018).

Traditionally, bank performance and financial soundness have been evaluated using the CAMEL framework, which comprises Capital Adequacy, Asset Quality, Management Efficiency, Earnings, and Liquidity. This framework has been widely adopted by regulators and researchers as a comprehensive tool for assessing banking performance (Hudaib et al., 2024). The Capital Adequacy Ratio (CAR) measures a bank's capacity to absorb potential losses and maintain solvency. Adequate capital enhances public confidence and strengthens resilience to economic shocks. However, prior studies suggest that excessively high capital levels may also reflect inefficient asset utilization, thereby constraining profitability (Setyarini, 2020).

Asset quality, commonly proxied by Non-Performing Loans (NPL), reflects the effectiveness of credit risk management. High NPL ratios indicate deteriorating loan quality and elevated credit risk, which can reduce profitability through increased provisioning costs and lower interest income. Numerous empirical studies report a negative relationship between NPL and ROA, highlighting the critical role of prudent credit management in sustaining bank profitability (Idris & Sa'diah, 2020; Siwu et al., 2018). Nevertheless, some studies find insignificant effects, suggesting that banks with robust risk management systems may be able to mitigate the adverse impact of credit risk on profitability.

Earnings performance and management efficiency are commonly captured by Net Interest Margin (NIM) and the ratio of operating expenses to operating income (BOPO). NIM reflects a bank's ability to generate net interest income from its core intermediation activities. A higher NIM signals effective asset–liability management and strong pricing power, thereby contributing positively to profitability. Prior empirical studies consistently demonstrate a positive and significant relationship between NIM and ROA in Indonesian banking institutions (Setyarini, 2020; Irman & Wulansari, 2018). In contrast, BOPO measures operational efficiency, where higher values indicate inefficiency in cost management. Empirical evidence

strongly supports a negative association between BOPO and ROA, confirming that rising operating costs substantially erode bank profitability (Idris & Sa'diah, 2020; Siwu et al., 2018).

Liquidity, measured by the Loan to Deposit Ratio (LDR), reflects the effectiveness of banks in performing their intermediation function. An optimal LDR indicates efficient allocation of funds to productive lending activities, whereas excessively high LDR levels may expose banks to liquidity risk. Previous studies report mixed findings regarding the effect of LDR on ROA. Some studies identify a positive effect, while others document a negative relationship, particularly when aggressive lending increases liquidity pressure and credit risk (Setyarini, 2020; Siwu et al., 2018). These mixed results suggest that the profitability implications of liquidity management depend on how effectively banks balance risk and return.

Despite the extensive application of the CAMEL framework, empirical findings on the relationship between CAMEL components and bank profitability remain inconclusive. Variations in regulatory environments, bank-specific characteristics, and macroeconomic conditions may explain the inconsistencies observed in prior studies (Hudaib et al., 2024). Moreover, firm-specific factors, such as firm size, may influence how CAMEL indicators translate into profitability outcomes. Larger banks typically possess greater financial resources, more diversified asset portfolios, and more advanced risk management systems, enabling them to absorb shocks more effectively than smaller banks (Kamau, 2023). Consequently, firm size has been widely examined as a moderating variable in banking performance research.

Empirical evidence suggests that larger banks benefit from economies of scale, stronger market power, and better access to capital, which may either strengthen or weaken the impact of CAMEL components on profitability (Shahriar et al., 2023). However, empirical findings on the moderating role of firm size remain limited and fragmented, particularly in the Indonesian banking context. This gap highlights the need for further investigation into how firm size conditions the relationship between financial soundness and profitability.

Existing research indicates that bank profitability arises from a multifaceted interaction among capital strength, asset quality, managerial efficiency, earnings capacity, and liquidity management. Nevertheless, empirical evidence remains fragmented regarding the extent to which these CAMEL components consistently explain profitability differences across banks. Research findings vary substantially across countries, regulatory regimes, and economic cycles, suggesting that the effectiveness of CAMEL indicators is highly context dependent. Despite this heterogeneity, the role of firm size has received relatively limited empirical attention, even though organizational scale may critically shape a bank's ability to absorb risk, realize economies of scale, and convert financial soundness into sustained profitability. Moreover, empirical studies focusing on Indonesian banking institutions remain scarce, despite the sector's distinctive regulatory environment and its strategic importance for national financial stability.

Accordingly, this study aims to examine the influence of CAMEL indicators on bank profitability, measured by Return on Assets, among banking companies listed on the Indonesia Stock Exchange. The research questions are formulated as follows: How do the Capital Adequacy Ratio, Non-Performing Loans, Net Interest Margin, Operating Expenses to Operating Income Ratio, and Loan to Deposit Ratio affect bank profitability in Indonesia? and Does firm size moderate the relationship between CAMEL indicators and bank profitability?.

The findings of this study are expected to contribute to the banking literature by providing empirical evidence from an emerging market perspective, offering managerial

insights for enhancing profitability through effective financial management, and supporting regulators in designing policies that strengthen banking stability. This study is theoretically grounded in signaling theory, which explains how CAMEL indicators function as financial signals that reduce information asymmetry and shape stakeholder perceptions regarding bank performance and stability.

REVIEW OF LITERATURE

Signaling Theory

Signaling theory was first introduced by Michael Spence through his study entitled Job Market Signaling. Spence (1973) states that parties who possess information (signal senders) convey signals in the form of relevant information to parties who do not possess such information (signal receivers) in order to reduce information asymmetry. In the banking context, banks act as information holders, while stakeholders—including customers and investors—serve as information recipients who use these signals as a basis for decision making. This theory emphasizes that information disclosed through financial statements reflects a company's condition and future prospects. Brigham & Houston (2012) emphasize that signaling theory explains how companies should convey signals to financial statement users through the disclosure of performance and financial conditions. These signals may take the form of good news, reflected in improvements in performance and profitability, or bad news, indicated by a decline in company performance.

In the banking industry, the assessment of bank soundness using the CAMEL method results in the classification of banks into healthy, fairly healthy, less healthy, or unhealthy categories. The results of this assessment function as an important signal for stakeholders in evaluating the level of trust and risk of a bank. This information influences stakeholder decisions, particularly those of customers and investors, in entrusting funds or making investments in the respective banks. Therefore, the disclosure of accurate and transparent financial information becomes crucial in shaping market perceptions and supporting economic decision making. One of the primary indicators observed by investors and stakeholders is earnings performance as reflected in the income statement. Earnings growth is viewed as a signal of performance and business sustainability, thereby serving as an important basis for assessing the future prospects and financial stability of banks.

Return on Assets

Return on Assets (ROA) is one of the main ratios used to measure profitability, particularly in the banking industry. ROA reflects management's ability to utilize all bank assets to generate net income before tax, thereby representing the level of efficiency in the use of productive assets in operational activities (Setiawan, 2015). The higher the ROA value, the more effective the bank is in generating profits from its asset base, which in turn reflects a healthier financial condition. According to Kasmir (2015), ROA is used to assess the extent to which investments in total assets are able to generate returns in the form of profits, thus describing the effectiveness of management in managing resources to achieve profitability objectives. In the banking context, ROA also serves as an important indicator in assessing the earnings aspect of the CAMEL framework used by supervisory authorities such as the Financial Services Authority (OJK) and Bank Indonesia. This ratio reflects a bank's ability to generate profits from its intermediation function, namely fund mobilization and credit

distribution. A high ROA indicates optimal asset utilization and strong managerial performance, whereas a low ROA may reflect operational inefficiency or increased credit risk.

Operationalization of Camel Ratio

Capital

Capital reflects a bank's ability to meet minimum capital requirements in order to absorb potential risks arising from operational activities. The assessment of the capital aspect in this study uses the Capital Adequacy Ratio (CAR), as stipulated by Bank Indonesia. CAR indicates the proportion of risk-weighted assets (RWA) financed by the bank's own capital, thereby reflecting the level of solvency and resilience of banks against credit, market, and operational risks (Dendawijaya, 2009). The Minimum Capital Adequacy Requirement (KPMM) obliges banks to maintain a minimum CAR of 8% (Bank Indonesia Circular Letter No. 6/23/DPNP, May 31, 2004). Operationally, CAR is calculated as the ratio between bank capital and RWA.

Asset Quality

Asset quality describes a bank's ability to manage productive assets in generating income while minimizing credit risk. In this study, asset quality is proxied by Non-Performing Loans (NPL), which reflect the proportion of problematic loans relative to total loans. Problematic loans include loans classified as substandard, doubtful, and loss, calculated on a gross basis in accordance with Bank Indonesia regulations (Bank Indonesia Circular Letter No. 12/11/DPNP, March 31, 2010). The NPL ratio indicates the effectiveness of credit risk management, where an NPL level below 5% is categorized as a healthy condition. The lower the NPL, the better the quality of the loan portfolio and the stability of bank income (Dendawijaya, 2009).

Management

The management aspect reflects a bank's ability to manage operational activities and risks effectively. Within the CAMEL framework, the management aspect is measured using the Net Interest Margin (NIM), which indicates a bank's ability to generate net interest income from productive assets. A high NIM reflects efficient asset–liability management as well as management's ability to optimize funding structures and credit distribution. Bank Indonesia stipulates that an NIM above 6% reflects a healthy bank condition (Bank Indonesia Circular Letter No. 6/23/DPNP, May 31, 2004). Thus, NIM serves as an important indicator in assessing management quality and the sustainability of bank interest income (Almilia & Herdiningtyas, 2005 in Wulandari, 2018).

Earnings

The earnings aspect indicates a bank's ability to generate profits on a sustainable basis. In this study, the earnings factor is measured using the Operating Expenses to Operating Income ratio (BOPO). This ratio reflects the level of operational efficiency of banks, where a lower BOPO value indicates more efficient management performance. Operating income primarily derives from intermediation activities, namely credit distribution and other operational activities. Bank Indonesia sets a tolerance limit for BOPO at 94%, whereby ratios below this threshold indicate relatively healthy financial conditions (Wulandari, 2018).

Liquidity

Liquidity reflects a bank's ability to meet short-term obligations, particularly withdrawals by depositors. In this study, liquidity is measured using the Loan to Deposit

Ratio (LDR), which is the ratio between total loans disbursed and third-party funds. LDR reflects the effectiveness of a bank's intermediation function as well as its level of liquidity risk. Bank Indonesia sets a tolerance limit for LDR at 96%, where excessively high values may increase liquidity risk, while excessively low values indicate suboptimal fund distribution (Dendawijaya, 2009).

Firm Size

Firm size in the banking context represents the scale of operations and the financial capacity of banks in performing intermediation functions and maintaining operational stability. Larger banks generally have higher total assets, broader funding bases, more mature risk management systems, and better access to funding compared to smaller banks (Dewi & Pratama, 2023). These conditions enable large banks to be more resilient in facing economic pressures and more flexible in undertaking expansion and technology adoption.

Quantitatively, bank size is measured using the natural logarithm of total assets (Ln Total Assets) to normalize differences in scale across banks. The use of logarithmic transformation provides a more proportional interpretation of the effect of business scale on financial performance. From a strategic perspective, firm size functions as a moderating variable that may strengthen or weaken the relationship between CAMEL indicators and profitability. Large banks tend to benefit from economies of scale, income diversification, and cost efficiency, while smaller banks face capital constraints and operational limitations that may restrict performance and competitiveness.

RESEARCH METHOD

This study employs a quantitative approach using descriptive and analytical methods to examine factors influencing banking profitability. The objective of the study is to analyze the effects of CAMEL components—Capital Adequacy Ratio (CAR), Non-Performing Loans (NPL), Net Interest Margin (NIM), Operating Expenses to Operating Income (BOPO), and Loan to Deposit Ratio (LDR)—on bank profitability measured by Return on Assets (ROA), as well as to examine the moderating role of firm size in this relationship. A quantitative approach is selected because the study focuses on testing causal relationships among financial variables based on financial statement data.

The research population includes all banking companies listed on the Indonesia Stock Exchange (IDX) during the 2020–2024 period. The sample is determined using a purposive sampling technique with the following criteria: (1) banks continuously listed during the observation period; (2) banks publishing complete annual financial statements denominated in Indonesian rupiah; (3) banks providing the necessary data to calculate CAR, NPL, NIM, BOPO, LDR, ROA, and firm size; and (4) banks reporting positive net income throughout the research period.

The data used in this study are secondary data obtained from audited annual financial statements published through the official IDX website and the official websites of the respective banks. All data are analyzed using SPSS version 30 through descriptive analysis, classical assumption tests, multiple linear regression analysis, and Moderated Regression Analysis (MRA).

The direct effects of CAMEL components on profitability are tested using a multiple linear regression model specified as follows: $ROA = \alpha + \beta_1X1 + \beta_2X2 + \beta_3X3 + \beta_4X4 + \beta_5X5 + e$. Furthermore, to test the moderating role of firm size, the model is extended by

incorporating firm size and interaction terms between firm size and each CAMEL component as follows: $ROA = \alpha + \beta_1X1 + \beta_2X2 + \beta_3X3 + \beta_4X4 + \beta_5X5 + \beta_6FS + \beta_7(X1.Z) + \beta_8(X2.Z) + \beta_9(X3.Z) + \beta_{10}(X4.Z) + \beta_{11}(X5.Z) + e$. The interaction variables are used to capture whether the effects of CAMEL components on bank profitability differ according to firm size. This approach allows for the separation of direct and conditional effects, thereby providing a more comprehensive understanding of banking performance.

RESULTS AND DISCUSSION

Classic Assumption Test

Normality Test

The normality test aims to assess whether the residuals in the regression model are normally distributed as a prerequisite for parametric statistical analysis, particularly the t-test and F-test. In this study, the normality test is conducted using the One-Sample Kolmogorov–Smirnov method on unstandardized residuals. The results of the normality test are presented in Table 1:

Table 1
Normality Test Results

Test	Value
N (Sample)	140
(Kolmogorov-Smirnov Z)	.251
Asymp.Sig.(2-tailed)	.081[c]

Source: SPSS Secondary Output Data (2026)

Based on the results in Table 1, the number of observations (N) is 140 with an Asymp. Sig. (2-tailed) value of 0.081. This significance value is greater than the significance level of 5% (0.05), so H_0 is not rejected. Thus, it can be concluded that the residuals in this research model are normally distributed. These results indicate that there is no significant difference between the empirical residual distribution and the theoretical normal distribution. Therefore, the assumption of residual normality has been met, so that the regression model is suitable for further analysis, including hypothesis testing and regression coefficient interpretation.

Multicollinearity Test

The multicolinearity test aims to detect high correlations between independent variables in a regression model that can influence the stability of the estimation coefficient. In this study, the test is conducted using the Tolerance and Variance Inflation Factor (VIF) values, with the criteria of Tolerance > 0.10 and VIF < 10 as indicators of no multicollinearity. The results of the multicollinearity test are presented in Table 2:

Table 2
Multicollinearity Test Results

Variable	Tolerance	VIF
CAR	.864	1.158
NPL	.789	1.267
NIM	.699	1.431
BOPO	.544	1.840
LDR	.869	1.150
SIZE	.789	1.268

Source: SPSS Secondary Output Data (2026)

Based on the results in Table 2, all independent variables have tolerance values above 0.10 and VIF values below 10. These results indicate that there is no multicollinearity between the independent variables in the regression model. Thus, all independent variables can be used simultaneously in the model to explain the variation in ROA, and the regression coefficient estimates can be interpreted validly.

Heteroscedasticity Test

The heteroscedasticity test aims to identify differences in residual variance in regression models that can influence the accuracy of estimates. In this study, the test is conducted using the Glejser test by regressing the absolute residual values against the independent variables. The model is declared free of heteroscedasticity if the significance value of each variable is greater than 0.05. The results of the heteroscedasticity test are presented in Table 3:

Table 3
Heteroskedasticity Test Results

Coefficients[a]						
		Unstandardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	t	Sig.
1	(Constant)	-.517	1.116		-.463	.644
	CAR	-.006	.009	-.056	-.611	.542
	NPL	.023	.083	.027	.277	.782
	NIM	.019	.051	.038	.367	.714
	BOPO	-.001	.006	-.013	-.110	.913
	LDR	-.001	.002	-.034	-.373	.710
	SIZE	.050	.042	.115	1.186	.238
a. Dependent Variable: ROA						

Source: SPSS Secondary Output Data (2026)

Based on the test results in Table 3, all independent variables have significance values above 0.05. In detail, the CAR variable has a Sig. value of 0.542; NPL of 0.782; NIM of 0.714; BOPO of 0.913; LDR of 0.710; and SIZE of 0.238. All of these values exceed the significance limit of 0.05. Thus, it can be concluded that there are no signs of heteroscedasticity in the regression model used. The residual variance is constant, so the regression model meets the assumption of homoscedasticity and is suitable for further analysis.

Autocorrelation Test

The autocorrelation test aims to detect the existence of relationships between residuals in regression models that can influence the reliability of estimates. In this study, the test is conducted using the Runs Test on unstandardized residuals. The model is declared free of autocorrelation if the Asymp. Sig. (2-tailed) value is greater than 0.05, indicating that the residuals are random. The results of the autocorrelation test are presented in Table 4:

Table 4

Autocorrelation Test Results

Runs Test	
	Unstandardized Residual
Test Value[a]	.83156
Cases < Test Value	70
Cases >= Test Value	70
Total Cases	140
Number of Runs	49
Z	1.078
Asymp. Sig. (2-tailed)	.231
a. Median	

Source: SPSS Secondary Output Data (2026)

Based on the test results in Table 4, the Asymp. Sig. (2-tailed) value is 0.231, which is greater than the significance level of 0.05. Thus, it can be concluded that there is no autocorrelation in the regression model residuals. The residuals are random and independent between observations, so the regression model meets the autocorrelation assumption and is suitable for further analysis.

Linearity Test

The linearity test aims to ensure that the relationship between the independent and dependent variables in the regression model is linear. Fulfilling this assumption is important because non-linearity can cause estimation results to be biased, so a linearity test needs to be performed before further hypothesis testing. The results of the linearity test are presented in Table 5:

Table 5
Linearity Test Results

Model Summary[b]					
Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.829[a]	.687	.676	.83274	1.920
a. Predictors: (Constant), LDR, NPL, NIM, CAR, BOPO, SIZE b. Dependent Variable: ROA					

Source: SPSS Secondary Output Data (2026)

Based on the test results in Table 5, an R^2 value of 0.687 is obtained with a total of 140 observations. Based on this value, a calculated c^2 value of 96.18 is obtained. This value is then compared with the c^2 table at a significance level of 0.05 with a degree of freedom of 140, which is 169.707. Because the calculated c^2 is smaller than the c^2 table, it can be concluded that the regression model used in this study is a linear model. Thus, the assumption of linearity has been fulfilled, and the regression model is suitable for further analysis.

Statistical Analysis

Moderated Regression Analysis Test

Moderated Regression Analysis (MRA) is used to assess the role of moderating variables in strengthening or weakening the relationship between independent and dependent

variables through the formation of interaction variables. The results of the MRA test are presented in Table 6:

Table 6
MRA Results Equation 1

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	7.238	.681		10.622	<.001
	CAR	-.006	.010	-.030	-.589	.557
	NPL	.006	.093	.004	.066	.947
	NIM	.164	.057	.167	2.897	.004
	BOPO	-.077	.007	-.734	-11.852	<.001
	LDR	-.361	.063	.043	-2.201	.029
a. Dependent Variable: ROA						

Source:SPSS Secondary Output Data (2026)

Based on the test results in table 6 for equation 1, the following regression equation is obtained:

Y = 7.238 - 0.006CAR + 0.006NPL + 0.164NIM - 0.077BOPO - 0.361LDR + e

From the above equation, we can see the following:

a. The constant value is 7.238 and is positive, indicating that if all independent variables, namely Capital Adequacy Ratio (CAR), Non-Performing Loan (NPL), Net Interest Margin (NIM), Operating Expenses to Operating Income (BOPO), and Loan to Deposit Ratio (LDR), are equal to zero (0), then the resulting Return on Assets (ROA) is 7.238.
b. The coefficient of the Capital Adequacy Ratio (CAR) variable is -0.006 and is negative, indicating that for every one-unit increase in CAR, ROA will decrease by 0.006, assuming other variables remain constant.
c. The coefficient of the Non-Performing Loan (NPL) variable is 0.006 and is positive, indicating that for every one-unit increase in NPL, ROA will increase by 0.006, assuming other variables remain constant.
d. The coefficient of the Net Interest Margin (NIM) variable is 0.164 and is positive, indicating that for every one-unit increase in NIM, ROA will increase by 0.164, assuming other variables remain constant.
e. The coefficient of the Operating Expenses to Operating Income (BOPO) variable is -0.077 and is negative, indicating that for every one-unit increase in BOPO, ROA will decrease by 0.077, assuming other variables remain constant.
f. The coefficient of the Loan to Deposit Ratio (LDR) variable is -0.361 and is negative, indicating that for every one-unit increase in LDR, ROA will decrease by 0.361, assuming other variables remain constant.

The results of moderated regression analysis (MRA) test for equation 2 are presented in Table 7:

Table 7
MRA Results Equation 2

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	16.063	7.248		2.216	.028
	CAR	-.373	.254	-1.892	-1.469	.144
	NPL	-2.820	1.268	-1.654	-2.223	.028
	NIM	-.981	.717	-1.003	-1.369	.174
	BOPO	-.116	.073	-1.105	-1.595	.113
	LDR	.025	.040	.472	.626	.532
	SIZE	-.520	.398	-.604	-1.305	.194
	CAR*SIZE	.019	.014	1.846	1.423	.157
	NPL*SIZE	.166	.073	1.668	2.275	.025
	NIM*SIZE	.065	.040	1.311	1.617	.108
	BOPO*SIZE	.002	.004	.351	.551	.583
	LDR*SIZE	-.001	.002	-.435	-.545	.587
a. Dependent Variable: ROA						

Source:SPSS Secondary Output Data (2026)

Based on the test results in table 7 for equation 2, the following regression equation is obtained:

Y = 16.063 - 0.373CAR - 2.820NPL - 0.981NIM - 0.116BOPO + 0.025LDR - 0.520SIZE + 0.019 (CAR*SIZE) + 0.166(NPL*SIZE) + 0.065(NIM*SIZE) + 0.002(BOPO*SIZE) - 0.001(LDR*SIZE) + e

From the above equation, the following can be determined:

a. The constant value is 16.063 and is positive, which states that if all independent variables, including Capital Adequacy Ratio (CAR), Non-Performing Loan (NPL), Net Interest Margin (NIM), Operating Expenses to Operating Income (BOPO), Loan to Deposit Ratio (LDR), Firm Size (SIZE), and all interaction variables of the moderating variables are zero (0), then the resulting Return on Assets (ROA) is 16.063.
b. The Capital Adequacy Ratio (CAR) variable has a value of -0.373 and is negative, indicating that for every one unit increase in CAR, ROA will decrease by 0.373, assuming other variables remain constant.
c. The Non-Performing Loan (NPL) variable has a value of -2.820 and is negative, indicating that for every one-unit increase in NPL, ROA will decrease by 2.820, assuming other variables remain constant.
d. The Net Interest Margin (NIM) variable has a value of -0.981 and is negative, indicating that for every one-unit increase in NIM, ROA will decrease by 0.981, assuming other variables remain constant.
e. The value of the Operating Expenses to Operating Income (BOPO) variable is -0.116 and is negative, indicating that for every one-unit increase in BOPO, ROA will decrease by 0.116, assuming other variables remain constant.
f. The value of the Loan to Deposit Ratio (LDR) variable is 0.025 and is positive, indicating that for every one-unit increase in LDR, ROA will increase by 0.025, assuming other variables remain constant.

g. The Firm Size (SIZE) variable has a value of -0.520 and is negative, indicating that for every one-unit increase in SIZE, ROA will decrease by 0.520, assuming other variables remain constant.
h. The value of the interaction variable between Capital Adequacy Ratio (CAR) and Firm Size (SIZE) as a moderating variable is 0.019 and is positive, indicating that an increase in the interaction between CAR and SIZE by one unit will increase ROA by 0.019.
i. The value of the interaction variable between Non-Performing Loan (NPL) and Firm Size (SIZE) is 0.166 and positive, indicating that an increase in the interaction between NPL and SIZE by one unit will increase ROA by 0.166.
j. The interaction variable value of Net Interest Margin (NIM) with Firm Size (SIZE) is 0.065 and positive, indicating that a one-unit increase in the interaction between NIM and SIZE will increase ROA by 0.065.
k. The value of the interaction variable between Operating Expenses to Operating Income (BOPO) and Firm Size (SIZE) is 0.002 and positive, indicating that a one-unit increase in the interaction between BOPO and SIZE will increase ROA by 0.002.
l. The value of the interaction variable between Loan to Deposit Ratio (LDR) and Firm Size (SIZE) is -0.001 and is negative, indicating that an increase in the interaction between LDR and SIZE by one unit will decrease ROA by 0.001.

Correlation Coefficient Analysis (R)

The correlation coefficient (R) describes the strength of the relationship between all independent variables (X) and the dependent variable (Y). The results of the correlation coefficient test are presented in Table 8:

Table 8
Correlation Coefficient Test Results (R) Equation 1

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.829[a]	.687	.676	.83274	1.920

a. Predictors: (Constant), LDR, NPL, NIM, CAR, BOPO
b. Dependent Variable: ROA

Source: SPSS Secondary Output Data (2026)

Based on the test results in Table 8, it is known that the R value (correlation) obtained is 0.829. This indicates that the relationship between the variables LDR, NPL, NIM, CAR, BOPO, and SIZE to ROA is 0.829. This value falls within the coefficient interval of 0.80 - 1.000, which indicates that the level of relationship between the independent and dependent variables is very strong.

The results of the correlation analysis test for equation 2 are presented in Table 9:

Table 9
Correlation Coefficient Test Results (R) Equation 2

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.848[a]	.719	.695	.80753	1.959

a. Predictors: (Constant), LDR*SIZE, BOPO*SIZE, CAR*SIZE, NPL, SIZE, NIM, BOPO, NPL*SIZE, LDR, NIM*SIZE, CAR
b. Dependent Variable: ROA

Source: SPSS Secondary Output Data (2026)

Based on the results in Table 9, the second model equation, the correlation coefficient (R) obtained a value of 0.848. This value indicates that there is a very strong relationship between Capital Adequacy Ratio, Non-Performing Loan, Net Interest Margin, Operating Expenses to Operating Income, and Loan to Deposit Ratio with ROA, with Firm Size as a moderating variable.

Analysis of the Coefficient of Determination R^2

The coefficient of determination (R^2) test is used to assess the ability of independent variables to explain the variation in dependent variables and the accuracy of the regression model constructed. The results of the R^2 value calculations for each equation are presented in Table 8 and Table 9.

Based on Table 8, the R Square value in the first equation is 0.687 or 68.7 percent, which indicates that ROA variation can be explained by the variables Capital Adequacy Ratio, Non-Performing Loan, Net Interest Margin, Operating Expenses to Operating Income, and Loan to Deposit Ratio. Meanwhile, the remaining 31.3 percent is explained by other variables outside this research model.

Furthermore, based on Table 9, the R Square value in the second equation is 0.719 or 71.9 percent. This indicates that ROA variation can be explained by the variables CAR, NPL, NIM, BOPO, and LDR as well as their interaction with company size as a moderating variable. Thus, there is an increase in the model's ability to explain ROA variation after including the moderating variable, while the remaining 28.1 percent is influenced by other variables not observed in this study.

Statistical Test F

The F test aims to assess the simultaneous influence of all independent variables on the dependent variable. In this study, the F test is used to test whether LDR, NPL, NIM, CAR, and BOPO together have a significant influence on Return on Assets (ROA). The F test results are presented in Table 10:

Table 10
Statistical Test Results F Equation 1

Model	Sum of Squares	Mean Square	F	Significance
Regression	204.147	40.829	58.878	<.001[b]
Residual	92.923	.693		
Dependent Variable: ROA Predictors: (Constant), LDR, NPL, NIM, CAR, BOPO				

Source: SPSS Secondary Output Data (2026)

Based on the results in Table 10 for equation 1, a significance value (Sig.) of < 0.001 is obtained, which is smaller than the significance level of 0.05. This indicates that simultaneously, the variables LDR, NPL, NIM, CAR, and BOPO have a significant influence on Return on Assets (ROA). Thus, the regression model constructed in the first equation has been able to explain the simultaneous influence of independent variables on the dependent variable.

The F test results for equation 2 are presented in Table 11:

Table 11
Statistical Test Results F Equation 2

Model	Sum of Squares	Mean Square	F	Significance
Regression	213.602	19.418	29.778	<.001[b]

Residual	83.469	.652

Dependent Variable: ROA
Predictors: (Constant), LDR*SIZE, BOPO*SIZE, CAR*SIZE, NPL, SIZE, NIM, BOPO, NPL*SIZE, LDR, NIM*SIZE, CAR

Source: SPSS Secondary Output Data (2026)

Based on the results in Table 11 for equation 2, the aim is to determine whether the variables LDR, NPL, NIM, CAR, BOPO, and SIZE simultaneously influence Return on Assets (ROA). Based on the simultaneous test results (F-test) in the table, a significance value (Sig.) of < 0.001 is obtained, which is smaller than the significance limit of 0.05. This indicates that the variables LDR, NPL, NIM, CAR, BOPO, and SIZE simultaneously have a significant influence on Return on Assets (ROA). Thus, the regression model in the second equation has been able to explain the variation in Return on Assets (ROA) based on the variables used in the study.

Statistical Test t

The partial test (t-test) is used to test the influence of each independent variable on the dependent variable. The results of the t-test are presented in Table 12:

Table 12
Statistical Test Results t Equation 1

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	7.238	.681		10.622	<.001
	CAR	-.006	.010	-.030	-.589	.557
	NPL	.006	.093	.004	.066	.947
	NIM	.164	.057	.167	2.897	.004
	BOPO	-.077	.007	-.734	-11.852	<.001
	LDR	-.361	.063	.043	-2.201	.029
a. Dependent Variable: ROA						

Source: SPSS Secondary Output Data (2026)

Based on the results in Table 12 for equation 1, which shows that the influence of independent variables (CAR, NPL, NIM, BOPO, and LDR) on the dependent variable (Return on Assets/ROA) can be seen by comparing the significance values, namely:

a. The Capital Adequacy Ratio (CAR) variable shows a Sig. value of 0.557 > 0.05 and a t-value of -0.589, which is smaller than the t-table (-0.589 < 1.656), so the hypothesis that the CAR variable has no partial effect on ROA is rejected.
b. The Non-Performing Loan (NPL) variable shows a Sig. value of 0.947 > 0.05 and a t-value of 0.066, which is smaller than the t-table value (0.066 < 1.656). Therefore, the hypothesis that the NPL variable has no partial effect on ROA is rejected.
c. The Net Interest Margin (NIM) variable shows a Sig. value of 0.004 < 0.05 and a t-value of 2.897, which is greater than the t-table value (2.897 > 1.656), so the hypothesis that the NIM variable has a partial effect on ROA is accepted.

d. The Operational Expenses to Operating Income (BOPO) variable shows a Sig. < 0.001 < 0.05 and a t-value of -11.852, which is smaller than the t-table value (-11.852 < -1.656). Therefore, the hypothesis that the BOPO variable has a partial effect on ROA is accepted.
e. The Loan to Deposit Ratio (LDR) variable shows a Sig. value of 0.029 < 0.05 and a t-value of -2.201, which is smaller than the t-table value (-2.201 < -1.656), so the hypothesis that the LDR variable has a partial effect on ROA is accepted.

The results of the t-test for equation 2 are presented in Table 13:

Table 13
Statistical Test Results t Equation 2

Coefficients[a]						
Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	16.063	7.248		2.216	.028
	CAR	-.373	.254	-1.892	-1.469	.144
	NPL	-2.820	1.268	-1.654	-2.223	.028
	NIM	-.981	.717	-1.003	-1.369	.174
	BOPO	-.116	.073	-1.105	-1.595	.113
	LDR	.025	.040	.472	.626	.532
	SIZE	-.520	.398	-.604	-1.305	.194
	CAR*SIZE	.019	.014	1.846	1.423	.157
	NPL*SIZE	.166	.073	1.668	2.275	.025
	NIM*SIZE	.065	.040	1.311	1.617	.108
	BOPO*SIZE	.002	.004	.351	.551	.583
	LDR*SIZE	-.001	.002	-.435	-.545	.587
a. Dependent Variable: ROA						

Source: SPSS Secondary Output Data (2026)

Based on the results in Table 13 for equation 2, it can be explained as follows:

a. The Capital Adequacy Ratio (CAR) variable shows a Sig. value of 0.144 > 0.05 and a t-value of -1.469, which is smaller than the t-table value (-1.469 < 1.656). Therefore, the hypothesis indicates that CAR does not have a partial effect on ROA.
b. The Non-Performing Loan (NPL) variable shows a Sig. value of 0.028 < 0.05 and a t-value of -2.223, which is smaller than the t-table value (-2.223 < -1.656). Therefore, the hypothesis indicates that NPL has a partial effect on ROA with a negative relationship.
c. The Net Interest Margin (NIM) variable shows a Sig. value of 0.174 > 0.05 and a t-value of -1.369, which is smaller than the t-table value (-1.369 < 1.656). Therefore, the hypothesis indicates that NIM does not have a partial effect on ROA.
d. The Operating Expenses to Operating Income (BOPO) variable shows a Sig. value of 0.113 > 0.05 and a t-value of -1.595, which is smaller than the t-table value (-1.595 < 1.656). Therefore, the hypothesis indicates that BOPO does not have a partial effect on ROA.
e. The Loan to Deposit Ratio (LDR) variable shows a Sig. value of 0.532 > 0.05 and a t-value of 0.626, which is smaller than the t-table value (0.626 < 1.656). Therefore, the hypothesis indicates that LDR does not have a partial effect on ROA.

f. The Firm Size (SIZE) variable shows a Sig. value of 0.194 > 0.05 and a t-value of -1.305, which is smaller than the t-table value (-1.305 < 1.656). Therefore, the hypothesis indicates that firm size does not have a partial effect on ROA.
g. The CAR*SIZE interaction variable shows a Sig. value of 0.157 > 0.05 and a t-value of 1.423, which is smaller than the t-table value (1.423 < 1.656). Therefore, firm size is not able to moderate the effect of CAR on ROA.
h. The NPL*SIZE interaction variable shows a Sig. value of 0.025 < 0.05 and a t-value of 2.275, which is greater than the t-table value (2.275 > 1.656). Therefore, firm size is able to moderate the effect of NPL on ROA.
i. The NIM*SIZE interaction variable shows a Sig. value of 0.108 > 0.05 and a t-value of 1.617, which is smaller than the t-table value (1.617 < 1.656). Therefore, firm size is not able to moderate the effect of NIM on ROA.
j. The BOPO*SIZE interaction variable shows a Sig. value of 0.583 > 0.05 and a t-value of 0.551, which is smaller than the t-table value (0.551 < 1.656). Therefore, firm size is not able to moderate the effect of BOPO on ROA.
k. The LDR*SIZE interaction variable shows a Sig. value of 0.587 > 0.05 and a t-value of -0.545, which is smaller than the t-table value (-0.545 < 1.656). Therefore, firm size is not able to moderate the effect of LDR on ROA.

CONCLUSION

Based on the results of the analysis of banking financial performance using the CAMEL approach, which includes CAR, NPL, BOPO, NIM, and LDR on Return on Assets (ROA) with firm size as a moderating variable, it can be concluded that the regression model has met all classical assumptions and is therefore suitable for use. The analysis results show a very strong relationship between all independent variables and ROA, with a model explanatory power of 68.7%. The MRA test indicates that NIM, BOPO, and LDR have a significant effect on ROA, while CAR and NPL do not show a significant effect. Firm size was found to only moderate the relationship between NPL and ROA, but did not act as a moderator for other variables. In addition, simultaneous testing showed that all variables together had a significant effect on ROA, while NIM, BOPO, and LDR continued to show a significant effect individually, both before and after the inclusion of the moderating variable. Based on the findings of the study, banking management is advised to prioritize improving earnings performance and management efficiency as reflected in NIM and BOPO, as these have been proven to have a significant influence on ROA. Therefore, optimizing interest income and controlling operating costs are key to increasing profitability. Banking regulators are expected to continue strengthening the application of prudential principles, particularly in maintaining asset quality and capital adequacy, even though CAR and NPL do not show a direct influence on ROA. For investors, the assessment of bank performance should not only focus on capital and liquidity aspects, but also consider management efficiency and the scale of the bank's business. Furthermore, future research is recommended to expand the research period and variables, including factors outside CAMEL and more diverse methodological approaches, in order to obtain a more comprehensive understanding of the determinants of banking profitability.

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