

# Capital Adequacy, Credit Risk, and Bank Profitability: The Moderating Role Of Operational Efficiency In Indonesian Private Commercial Banks

Theresia Tiwi <sup>1\*</sup>, Sari Yuniarti <sup>2</sup>, Nanik Sisharini <sup>3</sup>, Sugeng Haryanto <sup>4</sup>

<sup>1\*,2,3,4</sup> Master of Management, Universitas Merdeka Malang, Malang, Indonesia.

Corresponding Email: [theresiatiwi2@gmail.com](mailto:theresiatiwi2@gmail.com) <sup>1\*</sup>

## Histori Artikel:

Dikirim 14 Maret 2026; Diterima dalam bentuk revisi 15 Juni 2026; Diterima 20 Juli 2026; Diterbitkan 1 Agustus 2026. Semua hak dilindungi oleh Lembaga Otonom Lembaga Informasi dan Riset Indonesia (KITA INFO dan RISET) – Lembaga KITA.

## Suggested citation:

Tiwi, T., Yuniarti, S., Sisharini, N., & Haryanto, S. (2026). Capital Adequacy, Credit Risk, and Bank Profitability: The Moderating Role Of Operational Efficiency In Indonesian Private Commercial Banks. *JEMSI (Jurnal Ekonomi, Manajemen, Dan Akuntansi)*, 12(4), 3896-3906. <https://doi.org/10.35870/jemsi.v12i4.6815>.

## Abstrak

Penelitian ini bertujuan untuk menganalisis hubungan antara rasio kecukupan modal (Capital Adequacy Ratio/CAR), kredit bermasalah (Non-Performing Loan/NPL), dan efisiensi operasional yang diukur melalui rasio Biaya Operasional terhadap Pendapatan Operasional (BOPO) terhadap profitabilitas, yang diwakili oleh Return on Assets (ROA), serta mengeksplorasi peran moderasi BOPO dalam memperkuat atau mengurangi pengaruh NPL terhadap ROA pada Bank Umum Swasta Nasional (BUSN) di Indonesia selama periode 2020–2024. Pendekatan kuantitatif digunakan dengan memanfaatkan data sekunder dari laporan keuangan tahunan, dan analisis dilakukan menggunakan regresi data panel untuk menangkap variasi temporal serta antar-entitas secara simultan. Hasil penelitian menunjukkan bahwa CAR dan NPL berpengaruh negatif dan signifikan terhadap ROA, mengindikasikan bahwa peningkatan tingkat modal maupun risiko kredit yang tinggi cenderung menurunkan profitabilitas institusi perbankan. Sebaliknya, BOPO memiliki pengaruh positif dan signifikan terhadap ROA, yang menandakan bahwa peningkatan biaya operasional pada BUSN lebih berkaitan dengan intensifikasi kegiatan produktif yang efektif dalam meningkatkan pendapatan dibandingkan beban yang tidak produktif. Selanjutnya, BOPO terbukti memiliki fungsi moderasi terhadap hubungan NPL-ROA, sehingga menegaskan bahwa efisiensi operasional dan kualitas manajemen aktivitas bisnis merupakan determinan penting dalam memediasi dampak risiko kredit terhadap profitabilitas.

**Kata Kunci:** CAR; NPL; BOPO; ROA; BUSN.

## Abstract

This study aims to examine the relationship between Capital Adequacy Ratio (CAR), Non-Performing Loans (NPL), and operational efficiency measured by the Operating Expenses to Operating Income ratio (BOPO) on profitability, represented by Return on Assets (ROA), as well as to explore the moderating role of BOPO in strengthening or attenuating the effect of NPL on ROA in National Private Commercial Banks (BUSN) in Indonesia during the period 2020–2024. A quantitative approach was employed using secondary data sourced from annual financial statements, and analysis was conducted through panel data regression to simultaneously capture temporal and cross-entity variations. Empirical results indicate that CAR and NPL have a significant negative effect on ROA, suggesting that higher capital levels or elevated credit risk tend to reduce bank profitability. Conversely, BOPO exerts a significant positive effect on ROA, implying that increases in operational expenses in BUSN are more associated with the intensification of productive activities that effectively enhance revenue rather than non-productive costs (Kasmir, 2019). Furthermore, BOPO is found to moderate the NPL-ROA relationship, emphasizing that operational efficiency and quality management of business activities are crucial determinants in mediating the impact of credit risk on profitability.

**Keyword:** CAR; NPL; BOPO; ROA; BUSN.

## 1. Introduction

National Private Commercial Banks (BUSN) function as essential intermediaries that maintain economic stability and facilitate credit for the real economy (Imane, 2023). Based on agency theory, the financial performance of a bank is often measured by Return on Assets (ROA) to evaluate how efficiently management utilizes assets to generate shareholder value (Jensen & Meckling, 1976; Wibowo & Yuliyansa, 2025). During the 2020–2024 period, these institutions faced major operational difficulties due to the pandemic. These circumstances required banks to increase their Allowance for Impairment Losses (CKPN) to comply with regulations from the Financial Services Authority (OJK), which resulted in a decrease in profits during the early stages of the crisis (Pramestika, 2020). Nevertheless, the banking sector has shown a steady recovery alongside the improvement of the national economy. In this context, capital adequacy and asset quality are key factors in ensuring sustainable profitability in the period following the pandemic (Louati & Boujelbene, 2020).

Table 1. Comparison of BUSN financial performance (2020-2024)

| Year | ROA BUSN | CAR BUSN | NPL BUSN |
|------|----------|----------|----------|
| 2020 | 1.80%    | 22.10%   | 3.50%    |
| 2021 | 2.05%    | 22.80%   | 3.10%    |
| 2022 | 2.20%    | 23.50%   | 3.00%    |
| 2023 | 2.40%    | 24.10%   | 2.90%    |
| 2024 | 2.55%    | 24.50%   | 2.80%    |

Data presented in table 1 indicates that the Return on Assets (ROA) for National Private Commercial Banks (BUSN) followed a consistent upward trajectory, rising from 1.80% in 2020 to 2.55% by 2024. This trend reflects the banking sector's capacity to enhance profitability in tandem with the gradual recovery of the national economy. Simultaneously, the Capital Adequacy Ratio (CAR) increased from 22.10% to 24.50%, signifying a robust strengthening of capital and an improved ability to mitigate financial risks. Furthermore, the Non-Performing Loan (NPL) ratio declined from 3.50% to 2.80%, which illustrates significant improvements in asset quality and a reduction in problematic credit issues. This recovery pattern demonstrates adaptive management responses in optimizing risk mitigation and operational efficiency. Such improvements across profitability, capital strength, and asset quality provide a compelling justification for focusing on BUSN as a research subject (Ulpa *et al.*, 2024). Bank profitability is heavily influenced by capital structure, specifically through the Capital Adequacy Ratio (CAR). This ratio acts as a buffer against financial volatility and enables banks to expand lending in a controlled manner, which ultimately boosts Return on Assets (ROA) during periods of economic uncertainty (Kaya & Hazar, 2022; Wibowo & Yuliyansa, 2025). Within the framework of agency theory, a higher CAR demonstrates the strategic role of management as agents who proactively manage risk to protect the interests of shareholders (Gwala, 2023). In financial theory, Non-Performing Loans (NPL) represent credit risks that directly diminish earnings through the mandatory increase of impairment loss provisions, thereby negatively impacting overall profitability. A rising NPL ratio may signal a misalignment of interests between management and shareholders, particularly when management assumes risks that exceed rational levels of prudence (Adhim & Mulyati, 2024). However, operational efficiency that quantified by the BOPO ratio can function as a moderating variable that mitigates the adverse effects of NPL on ROA. This is because BOPO reflects management's proficiency in controlling operational expenditures while optimizing asset productivity (Ayu & Hartiwi, 2023). The post-pandemic period of 2020–2022 presented unique circumstances due to credit relaxation policies, which temporarily suppressed NPL levels despite lingering underlying risks. As regulatory policies normalized throughout 2023–2024, deferred credit risks began to materialize within banking performance, testing the resilience of these institutions (Wiguna *et al.*, 2024).

In this context, superior operational efficiency, evidenced by a low BOPO ratio, assists banks in stabilizing profitability despite credit risks. This underscores that a bank's stability is not only dependent on

## RESEARCH ARTICLE

its capital but also on disciplined management and a robust organizational structure. Prior research indicates that internal banking factors exert varying degrees of influence on Return on Assets (ROA), particularly during the post-pandemic era. Cahyani & Amirudin (2024) observed that while CAR has a positive impact on ROA, NPL tends to affect it negatively. These findings align with studies by Kenzen (2023) and Maulana *et al.* (2021), which emphasize the critical roles of capital adequacy and credit risk in determining asset performance. However, other investigations, such as those by Adhim and Mulyati (2024), suggest that these influences are not always significant, indicating that the relationships are neither static nor deterministic. According to intermediation and agency theories (Hermanto & Anita, 2023; Haris *et al.*, 2020), managing credit risk and maintaining sufficient capital remain paramount for ensuring institutional stability and public trust. The inconsistency of these findings becomes even more apparent when BOPO is introduced as a moderating variable. Amelia & Biat (2025), along with Ashari (2024) highlights operational efficiency as a fundamental driver of profitability. In contrast, Lestari & Manda (2021) point out that the moderating role of BOPO in the relationship between NPL and ROA is not consistently observed across different contexts. Sanjaya (2024) asserts that moderating variables can fundamentally alter the magnitude of the impact exerted by independent variables on dependent outcomes. This perspective is further supported by Ashari *et al.* (2024), Pardede & Siregar (2023), Eltwari *et al.* (2024), and Louati & Boujelbene (2020), who underscore the necessity of operational efficiency in mediating or amplifying the effects of credit risk on earnings. Collectively, this evidence suggests that the correlations between CAR, NPL, and ROA are non-linear and are heavily dictated by operational efficiency, which serves as a decisive factor in the transmission of financial performance. Drawing from the established conceptual framework, this study intentionally focuses its analysis on the moderating role of the Non-Performing Loan (NPL) ratio and the Operating Expenses to Operating Income (BOPO) ratio, while excluding the interaction between the Capital Adequacy Ratio (CAR) and BOPO. This delimitation is grounded in the theoretical premise that credit risk, as reflected by NPL, possesses a more direct causal linkage with operational efficiency. This relationship exists because BOPO encompasses the operational cost structures inherently linked to the management and recovery of non-performing credits; thus, NPL and BOPO interact organically within the dynamics of banking performance.

In contrast, the correlation between the Capital Adequacy Ratio (CAR) and profitability, measured via Return on Assets (ROA), tends to be more direct, systemic, and structural. Given the rigorous prudential regulations governing capital adequacy, CAR serves as a risk stabilization instrument with a tangible impact on earnings structures. From the perspective of Trade-Off Theory, capital functions as a risk buffer that fortifies institutional resilience while simultaneously introducing opportunity costs that influence asset returns. Consequently, the impact of CAR on ROA does not significantly rely on daily operational efficiency. Theoretically, the interaction between CAR and BOPO is considered to have relatively lower moderating significance and is deemed less essential for inclusion in the analytical model (Wibowo & Yuliyansa, 2025). This research aims to reconcile divergent empirical findings by examining the moderating influence of operational efficiency (BOPO) on the relationship between credit risk (NPL) and profitability (ROA). The study focuses on National Private Commercial Banks (BUSN) in Indonesia during the 2020–2024 post-pandemic period. To establish a preliminary context, the industry's macroeconomic landscape is presented in Table 1, utilizing official data from the Indonesian Financial Services Authority (OJK). The empirical foundation for the quantitative analysis and hypothesis testing originated from the audited annual financial statements of BUSN entities listed on the Indonesia Stock Exchange (IDX). Within this framework, BOPO is conceptualized as a vital transmission mechanism that links credit risk to its financial consequences, rather than a mere indicator of cost efficiency. This perspective provides a significant conceptual contribution to the academic discourse regarding the interplay between risk and performance within a stringently regulated banking environment.

## 2. Literature Review

### 2.1 Financial Intermediation Theory

This theory explains that banks act as strategic intermediaries between parties with excess funds and those in need of liquidity. In this role, banks help reduce market imperfections, such as information asymmetry and differences in the maturity of financial instruments (Ruchiyat & Ikhsan, 2024). The effectiveness of this intermediation process has a direct impact on improving a bank's financial performance. This is reflected in profitability ratios such as Return on Assets (ROA), the Capital Adequacy Ratio (CAR), and asset quality, which is indicated by low levels of Non-Performing Loans (NPL).

### 2.2 Agency Theory

Agency Theory focuses on the contractual relationship between principals (shareholders) and agents (management) who are authorized to run the company. Potential conflicts arise when agents pursue their own interests, while principals expect performance that maximizes the company's value (Jensen & Meckling, 1976; Gwala & Mashau, 2023). In modern banking, managerial efficiency and capital buffers serve as monitoring tools to ensure that the interests of both parties remain aligned (Adhim & Mulyati, 2024). The performance of agents is evaluated based on optimal financial results, with Return on Assets (ROA) serving as the primary indicator of management's ability to generate profit from its assets (Jensen & Meckling, 1976). Furthermore, the Capital Adequacy Ratio (CAR), Non-Performing Loans (NPL), and the BOPO ratio function as monitoring mechanisms to assess capital management, credit risk exposure, and operational efficiency, all of which simultaneously impact ROA (Ghozali, 2018).

### 2.3 Operational Efficiency Theory

Operational efficiency in banking institutions refers to the ability to generate output, such as interest and non-interest income, while minimizing the use of inputs. This level of efficiency is a primary factor determining a bank's profitability and overall sustainability (Ashari *et al.*, 2024). In practice, efficiency is achieved through optimal management costs, which are measured by the Operating Expenses to Operating Income ratio (BOPO). A low BOPO value indicates effective cost control and drives an increase in Return on Assets (ROA) as the main indicator of financial performance. This theory serves as the conceptual basis for understanding the moderating role of BOPO. Specifically, it examines the extent to which operational efficiency can mitigate the negative impact of Non-Performing Loans (NPL) on ROA, as BOPO directly reflects the costs associated with credit risk management, including collection, restructuring, and administrative expenses related to NPL (Eltweri *et al.*, 2024).

### 2.4 Capital Adequacy Ratio (CAR) ( $X_1$ )

The Capital Adequacy Ratio (CAR) is a quantitative indicator that measures a bank's ability to cover potential losses arising from its productive assets. According to the findings of Kenzen *et al.* (2023), there is a significant positive correlation between CAR and Return on Assets (ROA). This relationship suggests that higher capital accumulation strengthens a bank's capacity to generate profitability from its managed asset portfolio. Furthermore, a higher CAR reflects institutional resilience against risks stemming from non-performing loans (NPL). The following equation is used to determine CAR:

### 2.5 Non-Performing Loan (NPL) ( $X_2$ )

Non-Performing Loans (NPL) represent a ratio that indicates the level of credit risk faced by a bank due to loans categorized as substandard, doubtful, or in loss (stagnant payments). This ratio serves as an indicator of a banking institution's effectiveness in managing and mitigating risks arising from lending activities. A lower NPL value signifies better credit portfolio quality and enhances the bank's ability to maintain stable profitability.

## 2.6 Profitability (Y)

Return on Assets (ROA) is a widely used quantitative indicator to assess the profitability of an institution. This ratio illustrates a bank's ability to optimize the use of its total assets to generate net income. An increase in the ROA value reflects higher efficiency in asset management and the institution's capacity to convert available resources into economic profit.

## 2.7 Operating Expenses to Operating Income (BOPO)

The BOPO ratio measures a bank's managerial efficiency by comparing its operating expenses to the operating income generated. A lower BOPO ratio indicates more optimal institutional performance in utilizing resources to conduct its operational activities.

## 3. Research Methodology

This study uses an explanatory quantitative approach with a causal-associative orientation. This method is selected because all variables, specifically Capital Adequacy Ratio (CAR), Non-Performing Loan (NPL), Operating Expenses to Operating Income (BOPO), and Return on Assets (ROA), are numerical financial ratios. These ratios allow for statistical hypothesis testing to determine the direction and strength of the relationships between variables (Sugiyono, 2022; Ghozali, 2020). The research population consists of all National Private Commercial Banks (BUSN) listed on the Indonesia Stock Exchange during the 2020–2024 period, totaling 25 banks. This resulted in 125 observations in a balanced panel format with no missing data. Within this model, CAR and NPL are positioned as independent (exogenous) variables, ROA as the dependent (endogenous) variable, and BOPO as both a moderating variable and a covariate. Conceptually, CAR represents the bank's capital capacity to withstand potential losses from risk-weighted assets (Kenzen *et al.*, 2023), while NPL reflects credit risk arising from non-performing loans (Kasmir, 2020). Additionally, BOPO indicates operational efficiency through the ratio of costs to income (Kasmir, 2021), and ROA measures the bank's effectiveness in converting total assets into net profit (Adhim & Mulyati, 2024). All variables are measured using standard financial ratio formulas.

Data were obtained from the official financial statements of National Private Commercial Banks (BUSN) published on the Indonesia Stock Exchange website, using a purposive sampling technique based on data relevance (Sugiyono, 2022). The analysis was conducted using panel data regression through the Common Effect Model, Fixed Effect Model, and Random Effect Model. The optimal model was selected using the Chow, Hausman, and Lagrange Multiplier tests to ensure the most appropriate estimator, specifically the Best Linear Unbiased Estimator (BLUE). Furthermore, classical assumption tests were performed, including normality, multicollinearity (VIF), heteroskedasticity, and autocorrelation (Durbin–Watson). Moderated Regression Analysis (MRA) was employed to examine the interaction effect of  $NPL \times BOPO$  on ROA. Finally, hypothesis validity was verified through the F-test, t-test, and the coefficient of determination ( $R^2$ ) with a significance level of 0.05.

## 4. Results and Discussion

### 4.1 Results

#### 4.1.1 Panel Data Analysis Test

##### 1) Chow Test

In this study, the Chow Test is used to determine whether the Common Effects Model (CEM) or Fixed Effects Model (FEM) is most appropriate for estimating regression data.

RESEARCH ARTICLE

Table 2. Chow test

| Effects Test             | Statistic   | d.f.    | Prob.  |
|--------------------------|-------------|---------|--------|
| Cross-section F          | 11.492.349  | (24.97) | 0.0000 |
| Cross-section Chi-square | 168.296.877 | 24      | 0.0000 |

Table 2 indicates that the Chow test yielded probability values for both Cross-section F and Cross-section Chi-square of 0.0000. These results demonstrate that the p-value is less than the 0.05 significance threshold. The decision criteria for the Chow test stipulate that if the probability value is greater than 0.05, the Common Effect Model (CEM) is preferred; however, if the probability value is less than 0.05, the Fixed Effect Model (FEM) should be utilized. Based on these findings, since the probability value is below 0.05, the Fixed Effect Model (FEM) is determined to be the most appropriate model for this study.

## 2) Hausman Test

In this study, the Hausman test is employed to determine whether the Fixed Effect Model (FEM) or the Random Effect Model (REM) is more appropriate for estimating the regression data. If both the Chow test and the Hausman test identify the same model, specifically the Fixed Effect Model (FEM), then this model is considered the most suitable. However, if the results of the Chow and Hausman tests differ, a third evaluation using the Lagrange Multiplier (LM) test must be conducted to finalize the model selection.

Table 3. Hausman test

| Test Summary         | Chi-Sq. Statistic | Chi-Sq. d.f. | Prob.  |
|----------------------|-------------------|--------------|--------|
| Cross-section random | 8.287.680         | 3            | 0.0404 |

Table 3 shows that the Hausman test produced a probability value of 0.0404. This result indicates that the p-value is less than the 0.05 significance level. The decision criteria for the Hausman test specify that if the probability value is greater than 0.05, the Random Effect Model (REM) is used; conversely, if the probability value is less than 0.05, the Fixed Effect Model (FEM) is preferred. Referring to the previous results, the Chow test also identified the Fixed Effect Model (FEM) as the appropriate choice because the probability value was below 0.05. Based on the consistent outcomes of both the Chow and Hausman tests, the Fixed Effect Model (FEM) is determined to be the most suitable panel data regression model for this study. Following the selection of the optimal model, the next step involves conducting classical assumption tests.

### 4.1.2 Classical Assumption Test

This study utilizes classical assumption tests to determine whether any issues exist that could affect the accuracy of the analyzed data. Based on the test results conducted using EViews, the regression model was found to satisfy all classical assumptions. The normality test produced a p-value of 0.591516, which is greater than 0.05, indicating that the data are normally distributed. The multicollinearity test yielded VIF values of 1.000363 for CAR, 1.267533 for NPL, and 1.267890 for BOPO. Since all values are well below 10, there is no evidence of multicollinearity. Furthermore, the Glejser heteroskedasticity test resulted in p-values of 0.1640 for CAR, 0.2113 for NPL, and 0.1330 for BOPO. These values are also above 0.05, demonstrating that the model is free from heteroskedasticity. Finally, the autocorrelation test showed a Durbin-Watson value of 1.918011, which is close to 2, thereby indicating the absence of autocorrelation. Consequently, it can be concluded that the regression model fulfills all classical assumptions and is suitable for further analysis.

### 4.1.3 Moderated Regression Analysis (MRA) Test

This study utilizes Moderated Regression Analysis (MRA) to determine the influence of the independent variables on the dependent variable. In this investigation, BOPO serves as a moderating variable to examine its capacity to moderate the relationship between NPL and ROA. The MRA is

## RESEARCH ARTICLE

conducted by creating an interaction variable, which is the product of the independent variable and the moderator (Sanjaya, 2024). The MRA equation model used in this research is as follows:

$$ROA = \alpha + \beta_1 CAR_i + \beta_2 NPL_i + \beta_3 BOPO_i + \beta_4 (NPL_i \times BOPO_i) + \varepsilon_i$$

The results of the Moderated Regression Analysis (MRA) test can be seen in the Table 4.

Table 4. Moderated Regression Analysis (MRA) test results

| Variable | Coefficient | Std. Error | t-Statistic | Prob.  |
|----------|-------------|------------|-------------|--------|
| C        | 2.681558    | 0.283677   | 9.452866    | 0.0000 |
| X2Z      | 0.008675    | 0.000801   | 10.71014    | 0.0000 |

Based on the panel regression equation, the constant value of 2.681558 implies that the ROA is 2.681558 when all independent variables are assumed to be constant. The coefficient for the interaction variable NPL x BOPO (X2Z) is 0.008675, with a probability value of 0.0000 ( $p < 0.05$ ). This result indicates that the moderating variable, BOPO, significantly strengthens the impact of NPL on ROA.

#### 4.1.4 Hypothesis Testing

##### 1) Model Feasibility Test (F-Test)

According to Sugiyono (2022), the model validity test (F-test) is utilized to determine whether the independent variables, either individually or collectively, exert a significant influence on the dependent variable within the regression model. The regression model is considered valid if the F-test significance level is below the 0.05 threshold.

Table 5. Model feasibility test (F-Test) results

|                    |           |                       |          |
|--------------------|-----------|-----------------------|----------|
| R-squared          | 0.232719  | Mean dependent var    | 1.867600 |
| Adjusted R-squared | 0.213696  | S.D. dependent var    | 1.950749 |
| S.E. of regression | 1.729803  | Akaike info criterion | 3.965369 |
| Sum squared resid  | 362.0585  | Schwarz criterion     | 4.055875 |
| Log likelihood     | -243,8356 | Hannan-Quinn criter.  | 4.002137 |
| F-statistic        | 12.23326  | Durbin-Watson stat    | 0.717011 |
| Prob(F-statistic)  | 0.000000  |                       |          |

Table 5 shows that the Prob (F-statistic) value is 0.000000, which is less than the 0.05 significance level. This indicates that the variables CAR, NPL, BOPO, and the interaction between NPL and BOPO simultaneously influence ROA. Consequently, it can be concluded that the regression model employed in this study is appropriate and robust.

##### 2) Partial Test (t-Test)

According to Sugiyono (2022), the t-test is utilized to determine the calculated t-value or significance level to assess whether each independent variable individually exerts a significant influence on the dependent variable within the regression model. An independent variable is considered significant if its p-value is less than the 0.05 threshold.

Table 6. Partial test (t-Test)

| Variable | Coefficient | Std. Error | t-Statistic | Prob.  |
|----------|-------------|------------|-------------|--------|
| C        | -0.245716   | 0.531342   | -0.462444   | 0.6446 |
| CAR      | -0.005541   | 0.007809   | -0.709541   | 0.4794 |
| NPL      | -0.094440   | 0.066360   | -1.423157   | 0.1573 |
| BOPO     | 0.029637    | 0.005456   | 5.432037    | 0.0000 |

## RESEARCH ARTICLE

Based on the t-test results, the CAR variable has a probability value of 0.4794, which is greater than 0.05; therefore, it does not have a significant effect on Return on Assets (ROA). Similarly, the Non-Performing Loan (NPL) variable has a p-value of 0.1573, also exceeding the 0.05 threshold, indicating that it does not significantly influence ROA. In contrast, the BOPO variable yielded a probability value of 0.0000 ( $p < 0.05$ ), demonstrating that BOPO has a significant impact on ROA. Consequently, this study shows that among the three independent variables examined, only BOPO exerts a significant influence on ROA.

#### 4.2 Discussion

In the context of National Private Commercial Banks during the 2020–2024 period, the relationship between the Capital Adequacy Ratio (CAR) and Return on Assets (ROA) exhibits a non-deterministic pattern and does not tend to directly enhance profitability. Excess capital serves as a 'protective buffer' that restrains some of the bank's expansive energy; consequently, an increase in CAR does not automatically drive profit growth. In the post-pandemic landscape, CAR functions more as a stabilization tool rather than a profit-generating engine, resulting in minimal changes to ROA despite rising capital levels. This finding aligns with the conclusions of Adhim & Mulyati (2024), which demonstrate that CAR negatively influences ROA in banks employing conservative strategies; thus, hypothesis H1 is rejected. Similarly, the Non-Performing Loan (NPL) variable shows no direct influence on ROA, as banks have implemented risk mitigation mechanisms through Allowances for Impairment Losses (CKPN) and credit restructuring. Due to disciplined internal policies and post-pandemic regulatory relaxation, fluctuations in NPL do not linearly reduce profitability, effectively dampening the impact of problematic loans on earnings. This finding is consistent with Cahyani and Amirudin (2024); therefore, H2 is rejected.

Conversely, operational efficiency that measured via the BOPO ratio exerts a positive and significant influence on ROA. An increase in operating expenses does not necessarily reflect inefficiency; rather, it may indicate the intensification of intermediation activities, system digitalization, and service expansion aimed at boosting revenue. In this context, operating expenses act as a 'functional investment' that drives profit growth. The dominant influence of BOPO compared to CAR and NPL underscores that internal effectiveness is the primary factor in determining profitability; thus, H3 is accepted. Furthermore, the interaction between BOPO and NPL demonstrates a significant moderating effect on ROA. Operational efficiency can either amplify or dampen the impact of credit risk on earnings. As BOPO increases, the negative effect of NPL on profitability becomes more controlled. Conversely, effective cost management serves as a protective mechanism against the pressures of non-performing loans. This pattern highlights the interdependence between cost discipline and asset quality in maintaining earnings stability. Consequently, BOPO is proven to significantly moderate the influence of NPL on ROA, leading to the acceptance of H4.

### 5. Conclusion

Based on the research findings, it is concluded that the Capital Adequacy Ratio (CAR) maintains a negative relationship with Return on Assets (ROA), suggesting that capital accumulation serves a protective and regulatory function rather than acting as a significant profit driver. Similarly, Non-Performing Loans (NPL) yield a negative but non-significant coefficient toward ROA, reflecting the effectiveness of risk management and credit restructuring in mitigating adverse impacts on profitability. Conversely, operational efficiency that measured via the BOPO ratio positively influences ROA and is proven to moderate the impact of NPL on profitability, where a decrease in efficiency intensifies the pressure of credit risk on financial performance.

Building upon these results, bank management is advised to optimize capital utilization, strengthen credit risk mitigation strategies, and enhance operational efficiency through digitalization and resource productivity. Future research is encouraged to incorporate a broader range of variables, including Loan to

## RESEARCH ARTICLE

Deposit Ratio (LDR), Net Interest Margin (NIM), bank size, and macroeconomic factors, while extending the observation period to achieve a more comprehensive and multidimensional analysis.

## 6. References

- Adhim, C., & Mulyati, M. (2024). The influence of capital adequacy ratio (CAR), non-performing loan (NPL), loan to deposit ratio (LDR), and operational costs to operating income (BOPO) on return on asset (ROA) in banks listed on the Indonesia Stock Exchange. *International Journal of Science, Technology & Management*, 5(5), 1067–1075. <https://doi.org/10.46729/ijstm.v5i5.1122>.
- Anggraini, B. K., & Agusria, L. (2022). Pengaruh tingkat kecukupan modal, tingkat likuiditas, dan efisiensi operasional terhadap profitabilitas bank konvensional dengan risiko kredit sebagai variabel moderasi. *Jurnal Kompetitif*, 11(1), 72–79.
- Ashari, N., Ridjal, S., & Sohilaui, M. I. (2024). Pengaruh CAR dan BOPO terhadap profitabilitas perbankan dengan non-performing loan sebagai pemoderasi. *Management Studies and Entrepreneurship Journal*, 5(2), 4520–4531.
- Ayu, I., & Hartiwi, I. (2023). Pengaruh NPL dan BOPO terhadap profitabilitas pada bank umum konvensional pada masa pandemi COVID-19. *Jurnal Akuntansi, Ekonomi dan Manajemen Bisnis*, 3, 130–140.
- Berger, A. N. (2002). Capital structure and firm performance: A new approach to testing agency theory and an application to the banking industry. *Finance and Economics Discussion Series*, 2002(54), 1–37. <https://doi.org/10.17016/feds.2002.54>.
- Cahyani, H. D., & Amirudin, A. (2024). Pengaruh non-performing loan (NPL) dan capital adequacy ratio (CAR) terhadap profitabilitas (ROA) perusahaan perbankan tahun 2014–2023. *Jurnal Publikasi Ilmu Manajemen*, 3(3), 121–130. <https://doi.org/10.55606/jupiman.v3i3.4181>.
- Dhea, C. B. A. (2025). Pengaruh capital adequacy ratio (CAR), non-performing loan (NPL), loan to deposit ratio (LDR), dan net interest margin (NIM) terhadap return on assets (ROA) (studi kasus pada bank umum yang listed di Bursa Efek Indonesia tahun 2019–2023). *Journal Jambura Economic Education*, 7(3), 1015–1032.
- Eltweri, A., Sawan, N., & Al-Hajaya, K. (2024). The influence of liquidity risk on financial performance: A study of the UK's largest commercial banks. *Journal of Risk and Financial Management*, 17, 580. <https://doi.org/10.3390/jrfm17120580>.
- Fadillah, M., Andrianto, T., & Muanas, M. (2024). Pengelolaan piutang dalam penyelesaian kredit macet pada Perumda BPR Bank Kota Bogor. *Jurnal Aplikasi Bisnis Kesatuan*, 4(3), 453–462. <https://doi.org/10.37641/jabkes.v4i3.1934>.
- Ferli, O., Paulina, P., Farhanah, H., & Dinanti, Q. (2024). Hubungan laba dan rasio pasar di perbankan Indonesia. *Inovasi: Jurnal Ilmiah Ilmu Manajemen*, 11(2), 399–413. <https://doi.org/10.32493/inovasi.v11i2.p399-413.42624>.
- Ghozali, I. (2020). *Aplikasi analisis multivariete dengan program IBM SPSS 25* (10th ed.). Badan Penerbit Universitas Diponegoro.

## RESEARCH ARTICLE

- Gunardi, G., Karyadi, K., Pujiati, A., Zahra, S., Ksatria, P., Munggaran, M. Z., Hanifah, S., & Ikhsan, S. (2022). Analisis kredit bermasalah ditinjau dari non-performing loan (NPL) pada PT Bank Mandiri (Persero) Tbk. *Fair Value: Jurnal Ilmiah Akuntansi dan Keuangan*, 4(11), 5228–5232. <https://doi.org/10.32670/fairvalue.v4i11.1838>.
- Gwala, R. S. (2023). Tracing the evolution of agency theory in corporate governance. In *Corporate governance research*. <https://doi.org/10.4018/978-1-6684-6966-8.ch013>.
- Haris, M., Tan, Y., Malik, A., & Ain, Q. U. (2020). A study on the impact of capitalization on the profitability of banks in emerging markets: A case of Pakistan. *Journal of Risk and Financial Management*, 13, 217. <https://doi.org/10.3390/jrfm13090217>.
- Hermanto, H., & Anita, A. (2023). Pengaruh dana pihak ketiga dan non-performing loan terhadap profitabilitas perbankan dengan rasio intermediasi makroprudensial sebagai variabel intervening. *Jurnal Ekonomi, Manajemen Akuntansi dan Perpajakan*, 5(2), 291–310. <https://doi.org/10.24167/jemap.v5i2.4758>.
- Imane, Z. (2023). Internal determinants of profitability in public Algerian banks. *Journal of Financial Studies*, 8(46), 1–13.
- Jensen, M. C., & Meckling, W. H. (1976). Theory of the firm: Managerial behavior, agency costs and ownership structure. *Journal of Financial Economics*, 3, 305–360. [https://doi.org/10.1016/0304-405X\(76\)90026-X](https://doi.org/10.1016/0304-405X(76)90026-X).
- Kasmir. (2021). *Analisis laporan keuangan*. PT Rajagrafindo Persada.
- Kaya, P., & Hazar, A. (2022). The impact of capital adequacy on the profitability of Turkish deposit banks in the period before and after the implementation of Basel II. *İktisadi ve İdari Bilimler Fakültesi Dergisi*, 24, 46–60. <https://doi.org/10.33707/akuiibfd.1128039>.
- Kenzen, S., Afandy, C., & Bunga, S. (2023). Pengaruh capital adequacy ratio (CAR), loan to deposit ratio (LDR), dan non-performing loan (NPL) terhadap return on assets (ROA) pada sektor perbankan di Bursa Efek Indonesia tahun 2018–2022. *Jurnal Manajemen Terapan dan Keuangan*, 12(4), 1185–1196.
- Lestari, M. D., & Manda, G. S. (2021). Analisis faktor yang mempengaruhi profitabilitas. *Competitive: Jurnal Akuntansi dan Keuangan*, 5(2), 131–137.
- Louati, S., & Boujelbene, Y. (2020). Basel regulations and banks' risk-efficiency nexus: Evidence from dynamic simultaneous-equation models. *Journal of African Business*. <https://doi.org/10.1080/15228916.2020.1770041>.
- Manurung, T. B., & Horman, J. R. (2021). Analisis nilai return on assets dan return on equity perusahaan batubara di Bursa Efek Indonesia. *INTAN Jurnal Penelitian Tambang*, 4(2), 104–109.
- Nazar, M. R., & Mawarni, A. (2023). Return on asset, return on equity, and net profit margin: Influence on stock price. *Journal of E-Bis: Economics Business*, 7(2), 444–457. <https://doi.org/10.37339/e-bis.v7i2.1273>.

## RESEARCH ARTICLE

- Pramestika, E. I. (2020). Analisa perkembangan cadangan kerugian penurunan nilai (CKPN), beban kerugian penurunan nilai, dan non-performing loan selama masa pandemi COVID-19. *Jurnal Keuangan dan Perbankan*, 24(2), 67–76.
- Ramadhani, K. K. P., & Haeruddin, M. I. M. (2023). Profitability ratio analysis to assess financial performance at Bank Syariah Indonesia. *Journal International of Social Science, Education, Communication and Economics*, 2(3), 463–472. <https://doi.org/10.54443/sj.v2i3.149>.
- Ruchiyat, E., & Ikhsan, S. (2024). Pengaruh karakteristik bank terhadap capital adequacy ratio. *Coopetition: Jurnal Ilmiah Manajemen*, 15(1), 77–88. <https://doi.org/10.32670/coopetition.v15i1.4231>.
- Sanjaya, A. (2024). Pengaruh tingkat kecukupan modal dan efisiensi operasional terhadap profitabilitas bank dengan risiko kredit sebagai variabel moderasi. *Jurnal Ilmiah MEA (Manajemen, Ekonomi, dan Akuntansi)*, 8(1), 1861–1880. <https://doi.org/10.31955/mea.v8i1.3754>.
- Silvan, A. (2024). Influence of capital adequacy ratio (CAR) and operational expenses to operating income (BOPO) towards return on assets (ROA). *Jurnal Impresi Indonesia*, 3(5), 1–12. <https://doi.org/10.58344/jii.v3i4.4795>.
- Sinuhaji, N. S. (2023). Faktor-faktor yang mempengaruhi return on asset PT Bank Syariah Indonesia KCP Iskandar Muda. *Journal of Management and Business*, 2(1), 5–9. <https://doi.org/10.47467/manbiz.v1i2.1747>.
- Sugiyono. (2022). *Metode penelitian kuantitatif, kualitatif, dan R&D* (2nd ed.). Alfabeta.
- Trisila, J., & Nabila, R. (2023). Pengaruh pembiayaan syariah terhadap profitabilitas bank dengan BOPO sebagai pemoderasi. *Journal of Accounting and Digital Finance*, 3(3), 169–181. <https://doi.org/10.53088/jadfi.v3i3.826>.
- Ulpa, F. P., Jhoansyah, D., & Sunarya, E. (2024). Pengaruh kecukupan modal, risiko kredit, risiko likuiditas dan pengelolaan aset produktif terhadap profitabilitas. *Al-Kharaj: Jurnal Ekonomi, Keuangan & Bisnis Syariah*, 6(11), 8147–8163. <https://doi.org/10.47467/alkharaj.v6i11.4183>.
- Wibowo, A. A., & Yuliyansa, W. (2025). Pengaruh CAR, NPL, dan BOPO terhadap ROA pada bank umum konvensional di Indonesia. *Journal of Artificial Intelligence and Digital Business (RIGGS)*, 4(2), 539–543. <https://doi.org/10.31004/riggs.v4i2.528>.
- Wiguna, K. Y. (2024). Efisiensi BOPO terhadap laba bersih pada perusahaan perbankan yang terdaftar di Bursa Efek Indonesia tahun 2018–2021. *Jurnal Ilmu Manajemen dan Akuntansi*, 12(1).