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Jl. Letjen S. Parman No 1, Jakarta Barat 11440

PHONE
+62 21-5671 747 (Hunting)
+62 21-5695 8723 (Admission)

EMAIL
humas@untar.ac.id

WEBSITE
untar.ac.id


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The Effect of Credit Risk Management on Bank Profitability: Evidence from Listed Government-Owned Banks

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Michael Jeremi Zebua, Department of Development Economics, Faculty of Development Economics
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The Effect of Credit Risk Management on Bank Profitability: Evidence from Listed Government-Owned Banks

Andreas¹, Sarwo Edy Handoyo^{2*}

Tarumanagara University, Jakarta

Corresponding Author: Sarwo Edy Handoyo sarwoh@fe.untar.ac.id

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ABSTRACT

This study analyzes the influence of credit risk management on the profitability of state-owned banks listed on the Indonesia Stock Exchange (IDX) during the 2016–2025 period by employing credit risk indicators such as the Non-Performing Loan Ratio (NPL), Loan Loss Provision Ratio (LLP), Capital Adequacy Ratio (CAR), and Cost-to-Income Ratio (CIR), while profitability is measured using Return on Assets (ROA). A quantitative approach with panel data regression was applied to 40 observations from four state-owned banks. The results show that CAR has a positive effect on profitability, whereas CIR has a negative effect, highlighting the importance of capital strength and operational efficiency in enhancing bank performance. Meanwhile, NPL and LLP do not exhibit a significant influence on ROA. These findings provide empirical insights into the role of credit risk in shaping banking performance and offer practical implications for bank management and policymakers in strengthening risk management effectiveness within Indonesia's banking sector.

INTRODUCTION

The banking sector is essential for facilitating a nation's economic progress. Banks, as financial intermediaries, facilitate the flow of cash through lending activities, thereby promoting economic growth and enhancing company trust. Nevertheless, the allocation of credit without sufficient certainty of repayment frequently engenders hazards that might undermine financial stability and diminish profitability. If inadequately managed, such risks may result in institutional failure. Following the global financial crisis, numerous countries have redirected their risk-management priorities to enhance credit risk governance as a precautionary strategy against potential losses (Saleh & Abu Afifa, 2020).

Bank profitability serves as a key measure for evaluating the vitality and competitiveness of the financial sector. Return on Assets (ROA) is commonly utilised as it indicates a bank's capacity to produce earnings from its assets. Elevated profitability not only advantages shareholders but also fortifies financial system resilience via enhanced capital positions and improved intermediation (Mahaseth, 2024). Consequently, comprehending the factors influencing profitability, particularly credit risk, has become imperative in contemporary banking.

Banks face multiple risk categories, including credit, liquidity, legal, operational, management, and market risks. Among these, credit risk is crucial as it pertains directly to a borrower's capacity to fulfil financial obligations. Inadequately handled credit risk can diminish interest income, escalate provisioning expenses, and undermine a bank's financial stability. To prevent potential losses, banks employ various risk-control techniques, including risk-limit establishment, credit portfolio surveillance, and capital adequacy evaluations. Effective credit risk management is essential for ensuring operational stability and long-term sustainability (El Qirem & Alshehadeh, 2025).

The non-performing loan ratio (NPL) is a critical metric of credit risk that could jeopardise financial system stability. An elevated NPL ratio undermines asset quality, hinders intermediation, and may precipitate systemic instability. Increases in non-performing loans (NPLs) are frequently linked to financial crises, as they diminish income, elevate unemployment, and impede economic progress (Siddique et al., 2022). Alongside NPL, the loan loss provision ratio (LLP) is crucial for sustaining banking stability. LLP indicates a bank's readiness to mitigate future credit risks. While increased loan loss provisions diminish short-term profitability, they reflect caution in credit portfolio management (Abbas et al., 2023).

The capital adequacy ratio (CAR) is a crucial metric that assesses a bank's capacity to absorb losses and endure market fluctuations. A high Capital Adequacy Ratio (CAR) signifies robust capital resilience; however, it does not necessarily correlate with increased profitability if the capital is not utilised efficiently (Batekele & Maseka, 2025). Operational efficiency, assessed via the cost-to-income ratio (CIR), is essential in influencing profitability. A high expense-to-Income Ratio (CIR) indicates expense pressures that could diminish

profitability, rendering cost management crucial for sustaining success (Setyowati et al., 2020).

Empirical evidence in Indonesia indicates that the profitability of state-owned banks varied considerably between 2016 and 2025. The Financial Services Authority (OJK) said that the average Return on Assets (ROA) of state-owned banks was approximately 2.32 percent in 2016, rose to 2.45 percent in 2018, and then fell to 1.60 percent in 2020 as a result of the COVID-19 epidemic. ROA subsequently rebounded to 2.12 percent in 2023 and is anticipated to stabilise at approximately 2.20 percent in 2025. These variations demonstrate that profitability is significantly affected by asset quality and the efficacy of credit risk management.

The NPL ratio of state-owned banks displayed erratic trends. From 2016 to 2019, the gross non-performing loans (NPL) fluctuated between 2.3 and 2.7 percent, increasing to 3.1–3.2 percent in 2020–2021 as a result of economic strains during the pandemic, and thereafter decreasing to 2.4–2.6 percent in 2023–2025. Loan loss provisions rose markedly in 2020–2021 as banks projected future defaults, directly impacting net income. During the period from 2016 to 2025, the Capital Adequacy Ratio (CAR) remained robust at 19–22 percent; however, elevated CAR did not consistently correlate with increased Return on Assets (ROA). Operational efficiency, indicated by the CIR, exhibited significant fluctuations, increasing to 50–60 percent during the pandemic before enhancing to 42–47 percent in 2023–2025.

Despite extensive examination of credit risk indicators such as NPL, LLP, CAR, and CIR, previous research results are conflicting. The contradictions generate a research gap necessitating further inquiry, especially regarding Indonesian state-owned banks, which contrast with private banks and banks in other nations in terms of scale, strategic functions, and governmental involvement.

Research regarding the impact of non-performing loans on profitability yields inconclusive findings. Numerous studies indicate a substantial adverse impact of NPL on ROA (Batekele & Maseka, 2025; Mahaseth, 2024; Athallah & Syaichu, 2024), but others observe negligible effects in certain emerging nations. This indicates that the influence of non-performing loans on profitability is significantly contingent upon banking structure and macroeconomic conditions.

Studies on loan loss provisions reveal inconsistency. Numerous studies demonstrate a substantial negative impact of Loan Loss Provisions (LLP) on Return on Assets (ROA) (Alhadab & Alsahawneh, 2016; Poudel, 2023; Saleh & Abu Afifa, 2020); however, certain research on large banks suggests that LLP does not invariably diminish profitability, as provisioning may be anticipatory. This prompts enquiries regarding the impact of LLP on profitability in state-owned banks with varying risk profiles and capital arrangements.

Likewise, research on the capital adequacy ratio produces diverse outcomes. Certain studies indicate a substantial positive correlation between CAR and ROA (Batekele & Maseka, 2025; Bhandari, 2024; Mehdi et al., 2025), but others observe no significant correlation (Sam et al., 2025; Amarasinghe, 2022).

The disparities indicate that the CAR profitability link is contingent upon corporate strategy and regulatory frameworks.

Discrepancies are also observed in research regarding the cost-to-income ratio. Numerous studies reveal a substantial negative impact of CIR on ROA (Mahaseth, 2024; Saleh & Abu Afifa, 2020; Sam et al., 2025), while certain research on digital banks suggests that cost efficiency does not invariably correlate with profitability. This suggests that the correlation between operational efficiency and profitability may vary based on cost structures and business types.

LITERATURE REVIEW

Credit risk management and operational efficiency are essential factors influencing a bank's financial success and long-term viability. Kasmir (as cited in Shonhadji, 2020) asserts that the Non-Performing Loan (NPL) ratio assesses management's capacity to manage problematic loans, with a higher NPL signifying declining credit quality, an uptick in uncollectable loans, and heightened credit risk that may jeopardise financial performance and institutional stability.

In conjunction with this measure, Loan Loss Provision (LLP), as defined by Rose and Hudgins (quoted in Fakhrunnas et al., 2022), denotes reserve funds allocated to mitigate possible losses from defaulted loans, hence indicating anticipated credit losses and the quality of the loan portfolio. Moreover, the Capital Adequacy Ratio (CAR), as noted by Rivai et al. (quoted in Susanto & Salim, 2020), illustrates a bank's ability to sustain adequate capital to mitigate risks from operational and investment activities, thereby assuring robustness against unforeseen losses.

In addition to risk management and capital adequacy, bank profitability is influenced by operational efficiency and asset utilisation. Koch and MacDonald (2015) characterise the Cost to Income Ratio (CIR) as a metric of efficiency that reflects the ratio of operating expenses to operating income, therefore assessing management's proficiency in cost control and resource allocation. The European Central Bank (ECB) identifies the Cost-to-Income Ratio (CIR) as a crucial metric of banking efficiency, illustrating a bank's capacity to produce income relative to its cost structure (Budianto & Dewi, 2023).

Return on Assets (ROA) is considered one of the most complete metrics for assessing profitability. Harahap (2018) characterises ROA as an indicator of a firm's capacity to produce net profit from its asset portfolio, signifying the efficacy and efficiency of resource deployment. Brigham and Houston (2019) contend that ROA quantifies the net profit produced per unit of assets utilised, reflecting the efficiency of assets in generating revenue and enduring profitability.

METHODOLOGY

Model of the Study, The relationship between the dependent variable and the independent variables in this study can be illustrated as follows:

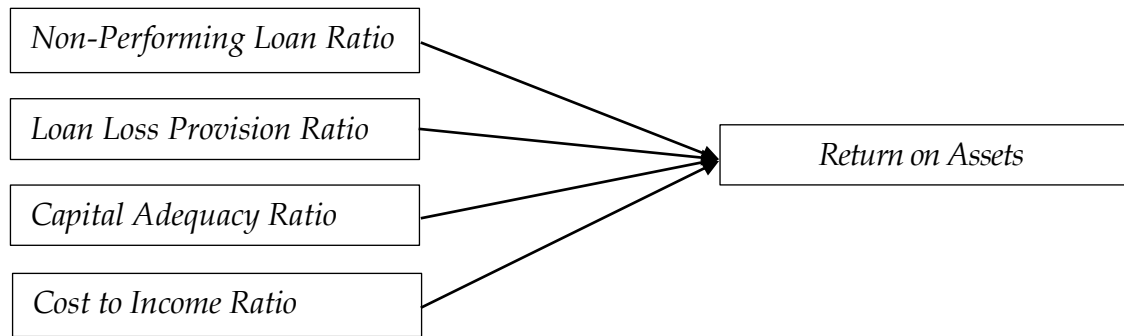


Figure.1 Research Model

The Influence of Non-Performing Loan Ratio on Profitability

The non-performing loan ratio (NPL) is one of the most critical indicators of credit risk because it directly reflects the quality of a bank's loan portfolio and the effectiveness of its credit risk management practices. A higher NPL ratio indicates that a larger portion of the bank's loans has become problematic, which reduces interest income, increases the need for credit loss provisioning, and ultimately weakens the bank's financial performance. Elevated NPL levels also signal inefficiencies in credit assessment, monitoring, and recovery processes, which can erode profitability over time. Prior empirical studies consistently demonstrate the negative implications of rising NPLs. Batekele & Maseka (2025), Al-Sharkas & Al-Sharkas (2022), Eltweri et al. (2024), and Siddique et al. (2022) all found that NPL exerts a significant negative effect on ROA, confirming that deteriorating asset quality is detrimental to bank profitability. Based on this evidence, the first hypothesis is formulated as follows:

Ha 1: The non-performing loan ratio influences profitability.

The Influence of Loan Loss Provision Ratio on Profitability

The loan loss provision ratio (LLP) represents the reserves that banks allocate to cover potential credit losses arising from non-performing loans. While provisioning is essential for maintaining prudence and financial stability, an increase in LLP directly reduces net income because provisions are recorded as expenses. As a result, higher LLP levels tend to suppress profitability, especially when credit risk intensifies. LLP also reflects management's expectations regarding future credit deterioration; therefore, a rising LLP ratio often signals heightened credit risk exposure. Empirical findings strongly support this negative relationship. Studies by Batekele & Maseka (2025), Alhadab & Alsahawneh (2016), Saleh & Abu Afifa (2020), and Poudel (2023) consistently show that LLP has a significant negative effect on ROA. These results indicate that increased provisioning burdens reduce earnings and weaken financial performance. Thus, the second hypothesis is stated as follows:

Ha 2: The loan loss provision ratio influences profitability.

The Influence of Capital Adequacy Ratio on Profitability

The capital adequacy ratio (CAR) measures a bank's ability to absorb losses and maintain financial resilience in the face of credit, market, and operational risks. A higher CAR indicates stronger capital buffers, which enhance the bank's capacity to withstand financial shocks and support sustainable business expansion. Adequate capital also strengthens stakeholder

confidence, enabling banks to pursue profitable lending activities while maintaining regulatory compliance. Empirical studies widely acknowledge the positive role of capital strength in improving profitability. Research by Batekele & Maseka (2025), Bhandari (2024), Mehdi et al. (2025), and Al-Sharkas & Al-Sharkas (2022) found that CAR positively influences ROA, suggesting that well-capitalized banks are better positioned to generate stable returns. Based on these findings, the third hypothesis is formulated as follows:

Ha 3: The capital adequacy ratio influences profitability.

The Influence of Cost-to-Income Ratio on Profitability

The cost-to-income ratio (CIR) is a key indicator of operational efficiency that compares operating expenses to operating income. A higher CIR reflects greater cost pressures relative to revenue generation, indicating inefficiencies in operational processes, resource utilization, or cost management strategies. When operating expenses rise faster than income, profitability declines because the bank retains a smaller portion of its revenue as net earnings. Numerous empirical studies have confirmed the negative relationship between CIR and profitability. Research by Batekele & Maseka (2025), Molla & Kaur (2025), Saleh & Abu Afifa (2020), and Al-Sharkas & Al-Sharkas (2022) consistently demonstrates that CIR has a significant negative effect on ROA. These findings highlight the importance of maintaining operational efficiency to sustain financial performance. Therefore, the fourth hypothesis is stated as follows:

Ha 4: The cost-to-income ratio influences profitability.

Research Method

This study adopts a causality research approach designed to empirically examine how credit risk indicators—Non-Performing Loan Ratio (NPL), Loan Loss Provision Ratio (LLP), Capital Adequacy Ratio (CAR), and Cost-to-Income Ratio (CIR)—influence the profitability of state-owned banks in Indonesia, as measured by Return on Assets (ROA). The causality approach is appropriate because the objective of the study is not merely to describe financial conditions, but to test directional relationships and determine whether changes in credit risk variables contribute to variations in bank profitability over time.

The research focuses on four state-owned banks listed on the Indonesia Stock Exchange (IDX) throughout the 2016–2025 period. These banks were selected because they play a strategic role in the national financial system, operate under similar regulatory frameworks, and consistently publish audited financial statements, making them suitable for longitudinal analysis. The ten-year observation period provides a comprehensive view of bank performance across different economic cycles, including periods of expansion, contraction, and post-pandemic recovery.

A purposive sampling technique was employed to ensure that the selected banks met specific criteria aligned with the research objectives. The sampling criteria were as follows:

1. State-owned banks consistently listed on the IDX during 2016–2025, ensuring data continuity and comparability across the observation period.
2. Banks reporting financial statements in rupiah, allowing uniformity in financial measurement and eliminating currency translation effects.

3. Banks publishing audited annual reports for the entire period, ensuring that the financial data used in the study are accurate, reliable, and verified by independent auditors.
4. Banks generating positive net income during the observation period, ensuring that profitability analysis is meaningful and not distorted by extreme financial distress.

This methodological framework ensures that the study is grounded in reliable data, focuses on institutions with comparable characteristics, and employs an analytical approach capable of identifying causal relationships between credit risk management and profitability.

Table 1. Research Variables and Measurement

Variable	Indicator	Measurement Formula	Scale
Return on Assets	ROA	Net Income / Total Assets	Ratio
Non-Performing Loan	NPL	Non-Performing Loans / Total Loans	Ratio
Loan Loss Provision	LLP	Loan Loss Provisions / Total Loans	Ratio
Capital Adequacy Ratio	CAR	Capital / Risk-Weighted Assets	Ratio
Cost to Income Ratio	CIR	Operating Expenses / Operating Income	Ratio

The data used in this study were obtained entirely from secondary sources, specifically audited annual financial statements published by state-owned banks listed on the Indonesia Stock Exchange (IDX). All financial reports were accessed through the official websites of each bank and the IDX, covering the period 2016–2025. These reports contain comprehensive financial information presented in rupiah and verified by independent auditors, ensuring the reliability, accuracy, and consistency of the data used throughout the analysis. The use of audited financial statements also strengthens the validity of the research findings, as the data reflect the actual financial condition of each bank during the observation period.

To provide an initial overview of the dataset, descriptive statistical analysis was conducted. This analysis includes the minimum, maximum, mean, and standard deviation values for each variable, enabling a clear understanding of the distribution and variability of the data. Descriptive statistics serve as an essential foundation for interpreting how the independent variables – Non-Performing Loan Ratio (NPL), Loan Loss Provision Ratio (LLP), Capital Adequacy Ratio (CAR), and Cost-to-Income Ratio (CIR) – relate to the dependent variable, Return on Assets (ROA). By examining these descriptive measures, the study gains insight into the general performance trends of state-owned banks over the ten-year period.

Following the descriptive analysis, a series of model selection tests were performed to determine the most appropriate panel data regression model. Because panel data combine both cross-sectional and time-series dimensions,

selecting the correct model is crucial for obtaining unbiased and efficient estimates. Three statistical tests were employed: the Chow Test to compare the Common Effect Model and the Fixed Effect Model, the Hausman Test to determine whether the Fixed Effect Model or Random Effect Model is more suitable, and the Lagrange Multiplier Test to evaluate whether the Random Effect Model provides a better fit than the Common Effect Model. The final model was selected based on the significance levels produced by these tests, ensuring that the regression analysis aligns with the underlying structure of the data.

Once the appropriate model was identified, the F-test was conducted to assess whether the independent variables collectively influence profitability. This test evaluates the overall explanatory power of the model and determines whether NPL, LLP, CAR, and CIR jointly contribute to variations in ROA. In addition, the Goodness of Fit test, measured using Adjusted R², was used to evaluate how well the independent variables explain changes in the dependent variable. A higher Adjusted R² value indicates that the model provides a stronger explanation of profitability across the observed period.

The hypothesis testing stage employed the t-test to examine the partial effect of each independent variable on ROA. This test determines whether each credit risk indicator individually exerts a statistically significant influence on profitability at a 5 percent significance level. The use of panel data regression enhances the robustness of the analysis, as it accounts for both temporal dynamics and differences across banks, allowing for more accurate estimation of the relationships among variables.

The regression model used in this study is expressed as follows:

$$ROA = \beta_0 + \beta_1 NPL + \beta_2 LLP + \beta_3 CAR + \beta_4 CIR + e$$

Where ROA represents profitability, NPL denotes the non-performing loan ratio, LLP refers to the loan loss provision ratio, CAR indicates the capital adequacy ratio, CIR represents the cost-to-income ratio, and e is the error term. This model forms the analytical basis for evaluating how credit risk management practices influence the profitability of state-owned banks in Indonesia.

RESEARCH RESULT AND DISCUSSION

Descriptive Statistics

Descriptive statistics were used to provide an overview of the distribution and characteristics of the variables examined in this study. Table 2 presents the minimum, maximum, mean, and standard deviation values for NPL, LLP, CAR, CIR, and ROA across 40 observations from four state-owned banks during the 2016–2025 period. These descriptive measures offer an initial understanding of the financial conditions and performance variations among the sampled banks. These descriptive findings illustrate the dynamic financial conditions of state-owned banks and provide a foundation for further regression analysis.

Table 2. Results Test Descriptive Statistics

Variables	N	Minimum	Maximum	Mean	Standard Deviation
NPL	40	0,010553	0,044984	0,026456	0,009297
LLP	40	0,011185	0,086353	0,047824	0,019714
CAR	40	0,167816	0,252848	0,205897	0,019423
CIR	40	0,602798	0,981251	0,770482	0,089540
ROA	40	0,000671	0,031374	0,017192	0,007979

Source: Output e-views 9

The NPL variable has a mean value of **0.026456**, with a minimum of **0.010553** and a maximum of **0.044984**, indicating moderate variation in credit quality across banks and years. The standard deviation of **0.009297** suggests relatively low dispersion around the mean.

LLP shows a mean of **0.047824**, with values ranging from **0.011185** to **0.086353**, and a standard deviation of **0.019714**, reflecting noticeable variation in provisioning policies, particularly during periods of heightened credit risk.

CAR exhibits a mean of **0.205897**, with a minimum of **0.167816** and a maximum of **0.252848**, and a standard deviation of **0.019423**, indicating that state-owned banks maintain strong and relatively stable capital adequacy levels.

CIR has a mean of **0.770482**, with values ranging from **0.602798** to **0.981251**, and a standard deviation of **0.089540**, suggesting substantial variation in operational efficiency across banks.

ROA has a mean of **0.017192**, with a minimum of **0.000671** and a maximum of **0.031374**, and a standard deviation of **0.007979**, indicating fluctuations in profitability over the ten-year period.

Model Selection Test

The data analysis in this study employs multiple regression using panel data. In panel data analysis, three estimation models may be applied: the common effect model, the fixed effect model, and the random effect model. Before conducting the regression test, a model selection procedure is performed to determine the most appropriate model. The results of the model selection test indicate that the fixed effect model is the most suitable for this study.

The Chow Test shows that the probability value of the cross-section Chi-Square is 0.0000, which is lower than the significance level of $\alpha = 0.05$. Therefore, H_0 is rejected, and the fixed effect model is selected as the appropriate estimation model.

The multiple regression analysis aims to examine whether the independent variables NPL, LLP, CAR, and CIR influence the dependent variable ROA. The regression output produces the following estimation equation:

$$ROA = -0.045350 - 0.159154(NPL) - 0.036398(LLP) + 0.144125(CAR) - 0.078266(CIR)$$

Table 3. Chow Test Result

Model	Variabel	Chi-Square	Prob	Keputusan
Model 1	ROA	44,357550	0,0000	H ₀ ditolak

Source: Output e-views 9

Hypothesis Testing (t-Test)

The t-test is used to determine the extent to which each independent variable explains the variation in the dependent variable. The statistical hypothesis testing is conducted by examining the probability values generated from the EViews 9 output. The decision rule is based on a significance level of 0.05 ($\alpha = 5\%$).

If the probability value is **greater than 0.05**, the hypothesis is rejected, indicating that the regression coefficient is not significant and the independent variable does not have a partial effect on the dependent variable. Conversely, if the probability value is **less than or equal to 0.05**, the hypothesis is accepted, meaning that the regression coefficient is significant and the independent variable has a partial effect on the dependent variable.

Table 4 Presents the Results of The Regression Model Estimation

Variable	Coefficient	Standard Error	Probability	Notes
C	0,045350	0,009354	0,0000	-
NPL	0,159154	0,095401	0,1042	Not significant
LLP	-0,036398	0,028348	0,2076	Not significant
CAR	0,144125	0,027586	0,0000	Significant positive
CIR	-0,078266	0,009711	0,0000	Significant negative

Source: Output e-views 9

Based on the regression results presented in Table 4, the t-test provides detailed insights into the partial effect of each independent variable on profitability (ROA). The NPL variable shows a probability value of **0.1042**, which exceeds the 0.05 significance threshold. This indicates that NPL does not have a statistically significant effect on ROA. Although the coefficient of **-0.159154** suggests a negative direction—implying that higher levels of non-performing loans tend to reduce profitability—the effect is not strong enough to be considered significant. This result suggests that fluctuations in credit quality during the 2016–2025 period did not materially influence the profitability of state-owned banks, possibly due to strong capital buffers or effective credit restructuring strategies.

The LLP variable also demonstrates an insignificant effect on ROA, with a probability value of **0.2076**, which is greater than 0.05. The coefficient of **-0.036398** indicates a negative relationship, meaning that higher provisioning tends to reduce profitability. However, the effect is statistically insignificant, implying that provisioning practices may be forward-looking or influenced by regulatory requirements, resulting in no immediate impact on profitability. This finding

suggests that changes in LLP during the observation period did not meaningfully alter the banks' ability to generate returns from their assets.

In contrast, the CAR variable shows a probability value of **0.0000**, which is well below the 0.05 significance level, accompanied by a positive coefficient of **0.144125**. This indicates that CAR has a positive and significant effect on ROA. Higher capital adequacy strengthens a bank's ability to absorb losses, expand lending activities, and maintain financial stability, ultimately enhancing profitability. Adequate capital also increases stakeholder confidence, which can further support business growth and financial performance. Thus, CAR plays a crucial role in strengthening the profitability of state-owned banks.

The CIR variable also exhibits a significant effect on ROA, with a probability value of **0.0000**, which is below the 0.05 threshold, and a negative coefficient of **-0.078266**. This indicates that CIR has a negative and significant effect on ROA. A higher CIR reflects inefficiency in cost management, where operating expenses exceed operating income, directly reducing profitability. The significant negative coefficient confirms that operational efficiency is a key determinant of profitability in state-owned banks, emphasizing the importance of effective cost control and process optimization.

F-Test (Simultaneous Test)

The F-test is used to determine whether all independent variables jointly influence the dependent variable. Based on the regression output, the model is statistically significant, indicating that NPL, LLP, CAR, and CIR collectively have an effect on ROA. This means that although not all variables are individually significant, the independent variables as a group contribute to explaining variations in profitability.

Adjusted R-Squared (Goodness of Fit)

The Adjusted R² value from the regression model indicates the proportion of variation in ROA that can be explained by the independent variables. The value demonstrates that the model has meaningful explanatory power, showing that credit risk indicators and operational efficiency variables contribute to explaining changes in bank profitability during the 2016–2025 period.

CONCLUSIONS AND RECOMMENDATIONS

This study examines the impact of credit risk indicators – Non-Performing Loan Ratio (NPL), Loan Loss Provision Ratio (LLP), Capital Adequacy Ratio (CAR), and Cost-to-Income Ratio (CIR) – on the profitability of state-owned banks listed on the Indonesia Stock Exchange from 2016 to 2025. The study presents numerous key insights utilising panel data regression with the Fixed Effect Model.

NPL exerts no substantial influence on ROA. Despite the coefficient indicating a negative trend, the effect is statistically negligible, implying that variations in credit quality did not substantially affect profitability throughout the observation period. Secondly, LLP does not substantially influence ROA. The negative coefficient indicates that increased provisioning generally diminishes profitability; nonetheless, the impact is insufficient to be deemed significant.

Conversely, CAR exerts a favourable and considerable influence on ROA. This discovery underscores the significance of robust capital sufficiency in bolstering financial stability, facilitating lending capacity, and augmenting profitability. Ultimately, CIR exerts a negative and considerable influence on ROA, signifying that operational efficiency is crucial in assessing bank success. Elevated operating expenses in relation to revenue diminish the bank's capacity to produce returns.

The study shows that profitability in state-owned banks is predominantly influenced by capital strength and operational efficiency, but credit quality indicators such as non-performing loans (NPL) and loan loss provisions (LLP) do not significantly affect return on assets (ROA) during the study period.

Based on the findings, numerous recommendations may be articulated for banking professionals and legislators. For bank management, reinforcing capital adequacy must continue to be a strategic goal, as the Capital Adequacy Ratio (CAR) has demonstrated a substantial impact on profitability. Banks must prioritise strengthening operational efficiency through the optimisation of cost structures, advancement of digital transformation, and the simplification of internal procedures to decrease the Cost-to-Income Ratio (CIR). While NPL and LLP did not significantly influence profitability, it is imperative to uphold appropriate credit risk management to guarantee long-term financial resilience.

The findings highlight the necessity for regulators to implement policies that foster robust capital buffers and enhance efficiency in the banking system. Regulatory frameworks that endorse risk-based supervision, digital innovation, and cost-efficiency initiatives may enhance the performance of state-owned banks.

The findings offer valuable insights into the financial attributes of state-owned banks for investors. Investors may prioritise capital adequacy and operational efficiency when evaluating the long-term profitability potential of banks.

This study possesses numerous shortcomings that warrant acknowledgement. The sample is confined to four state-owned banks listed on the Indonesia Stock Exchange, potentially constraining the generalisability of the findings to the wider Indonesian banking sector, especially private banks or regional development banks that may possess distinct risk profiles and operational frameworks. The study solely depends on financial ratio data derived from audited financial accounts, which may inadequately reflect qualitative elements of credit risk management techniques, internal policies, or managerial decision-making processes that could affect profitability.

The research model has solely four internal variables NPL, LLP, CAR, and CIR excluding macroeconomic indices such as GDP growth, inflation, interest rates, or exchange rate variations, which could also influence bank profitability. The application of a linear panel regression model may inadequately address potential endogeneity, dynamic effects, or nonlinear correlations between credit risk indicators and profitability. The study period of 2016–2025 encompasses the COVID-19 pandemic, which provided exceptional economic conditions that may have affected bank performance in ways not entirely accounted for by the model.

ADVANCED RESEARCH

Future study may broaden the analytical framework by integrating supplementary internal and external variables, such liquidity ratios, macroeconomic data, or company governance elements. Researchers might further broaden the sample to encompass private banks or undertake comparative analyses across state-owned and private institutions to provide more comprehensive insights into profitability patterns.

Moreover, subsequent research may utilise alternative profitability metrics such as Return on Equity (ROE) or Net Interest Margin (NIM) to assess various aspects of financial performance. Longitudinal research examining pre- and post-pandemic eras may yield a more profound comprehension of the impact of economic shocks on the linkages between credit risk and profitability.

Future advanced study may investigate more comprehensive and multidimensional methodologies to elucidate the relationship between credit risk management and bank profitability. A possible approach is to incorporate macroeconomic factors, like GDP growth, inflation, interest rates, and exchange rate volatility, into the analytical framework to reflect the wider economic context affecting credit risk and profitability dynamics. Integrating these external factors may yield profound insights into the interaction between systemic conditions and internal bank features.

A further interesting approach is the utilisation of advanced econometric approaches, such dynamic panel models (GMM), quantile regression, or machine-learning predictive models. These methods may provide enhanced explanatory power and mitigate potential endogeneity issues that conventional panel regression fails to fully address. Advanced modelling may potentially uncover nonlinear correlations or threshold effects between credit risk indicators and profitability that are not detectable with linear models.

Future research could expand the analysis to compare state-owned banks with private banks or regional development banks to discern systemic differences in risk management strategies. Cross-country comparative analyses of ASEAN banking systems may enhance the comprehension of how regulatory frameworks, ownership structures, and market conditions influence the link between credit risk and profitability.

Moreover, researchers may integrate qualitative methodologies – such as interviews with risk managers, regulators, or bank executives – to enhance quantitative results. This mixed-method approach may reveal managerial attitudes, governance procedures, and institutional elements that affect the efficacy of credit risk management but are not reflected in financial statements.

Future research may investigate the influence of digital transformation, fintech integration, and sophisticated risk-scoring systems on credit risk and profitability. As banking operations progressively embrace digital platforms, comprehending the impact of technology innovation on credit evaluation, operational efficiency, and long-term profitability will become increasingly pertinent for both scholars and practitioners.

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