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Determinants of profitability in indonesian state-owned banks: The role of credit risk, operational efficiency, and capital adequacy

Abstract

This study examines the determinants of profitability in Indonesian state-owned banks listed on the Indonesia Stock Exchange during 2014–2024. Profitability, measured by Return on Assets (ROA), is analyzed in relation to credit risk (Non-Performing Loans/NPL), operational efficiency (BOPO), and capital adequacy (CAR) using panel data from four major banks and multiple linear regression. The findings reveal that NPL has a positive and significant effect on ROA, indicating that well-managed credit expansion and risk-based pricing can enhance profitability. Conversely, BOPO shows a negative and significant relationship, confirming that higher operational inefficiency reduces financial performance. Meanwhile, CAR has a positive but insignificant effect, suggesting that capital strength supports stability without directly improving short-term profitability. Overall, the study underscores that operational efficiency and effective credit risk management are the primary drivers of bank profitability. These findings provide updated empirical evidence on internal performance factors in state-owned banks within a developing market context.

Keywords: State-owned banks; profitability; Non-Performing Loans; operational efficiency; capital adequacy; Return on Assets

Abstrak

Penelitian ini mengkaji determinan profitabilitas pada bank-bank milik negara di Indonesia yang terdaftar di Bursa Efek Indonesia selama periode 2014–2024. Profitabilitas, yang diukur dengan Return on Assets (ROA), dianalisis dalam kaitannya dengan risiko kredit (Non-Performing Loans/NPL), efisiensi operasional (BOPO), dan kecukupan modal (CAR) menggunakan data panel dari empat bank utama serta analisis regresi linear berganda. Hasil penelitian menunjukkan bahwa NPL berpengaruh positif dan signifikan terhadap ROA, yang mengindikasikan bahwa ekspansi kredit yang dikelola dengan baik serta penerapan risk-based pricing dapat meningkatkan profitabilitas. Sebaliknya, BOPO berpengaruh negatif dan signifikan, yang menegaskan bahwa inefisiensi operasional menurunkan kinerja keuangan. Sementara itu, CAR berpengaruh positif namun tidak signifikan, yang menunjukkan bahwa kecukupan modal lebih berperan dalam menjaga stabilitas dibandingkan meningkatkan profitabilitas jangka pendek. Secara keseluruhan, penelitian ini menegaskan bahwa efisiensi operasional dan pengelolaan risiko kredit yang efektif merupakan faktor utama penentu profitabilitas bank. Temuan ini memberikan bukti empiris terkini mengenai faktor internal yang memengaruhi kinerja bank milik negara dalam konteks pasar berkembang.

Kata Kunci: Bank milik negara; profitabilitas; Non-Performing Loans; efisiensi operasional; kecukupan modal; Return on Assets

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1. Introduction

Bank profitability can be explained by Financial Intermediation Theory, which states that banks act as intermediaries by collecting funds from the public and channeling them into loans. In performing this role, banks face credit risk, operational costs, and capital requirements that may influence profitability. According to Risk-Return Trade-Off Theory, higher risk is generally associated with higher expected returns. In the banking context, an increase in credit risk, reflected by Non-Performing Loans (NPL), may reduce profitability when loan defaults increase. However, controlled credit expansion may also generate higher interest income and support bank profitability. In addition, Capital Structure Theory suggests that adequate capital strengthens a bank's ability to absorb risk and support lending activities. A strong capital position, measured by the Capital Adequacy Ratio (CAR), can enhance financial stability and support sustainable profitability.

Profitability is a key indicator of bank performance, reflecting how effectively banking institutions generate earnings from their assets and capital (Nuhiu, Hoti & Bektashi, 2017: Menicucci & Paolucci, 2016). According Hasmiana & Pintor (2022) & Madugu, Ibrahim & Amoah (2020), bank profitability is influenced by internal risk factors such as credit risk, operational efficiency, and capital adequacy. Credit risk is commonly proxied by the Non-Performing Loan (NPL) ratio, operational efficiency by the ratio of operating expenses to operating income, and capital strength by the Capital Adequacy Ratio (CAR). Empirical evidence generally suggests that higher NPL levels reduce profitability due to increased loan loss provisions and declining income-generating assets (Mendoza & Rivera, 2017), whereas higher efficiency and stronger capital positions enhance banks' ability to generate sustainable profits (Torre Olmo, Cantero Saiz & Sanfilippo Azofra, 2022). Nevertheless, these theoretical relationships are largely derived from studies on commercial banks operating under market-oriented objectives.

In the Indonesian context, the banking sector has shown relatively strong resilience in recent years, even amid global economic uncertainty (Mawardi, Risyad, & Al Mustofa, 2025; Triggs, Kacaribu, & Wang, 2019). Industry-level data indicate that the banking system has maintained stable profitability and strong capital conditions, as reflected in Capital Adequacy Ratios (CAR) that consistently exceed regulatory minimum requirements and positive industry-wide Return on Assets (ROA).However, this overall stability may conceal important structural characteristics within the banking sector. State-owned banks play a dominant role in the Indonesian banking system in terms of asset size and credit distribution. These banks are also actively involved in government-directed lending programs, including financing for micro, small, and medium enterprises (MSMEs), infrastructure development, and subsidized credit schemes (Bruton et al., 2015).Previous studies suggest that policy-driven lending programs may expose state-owned banks to different credit risk dynamics compared to private or foreign banks (Li, Shen, & Meng, 2026; Zhan et al., 2025). Such conditions may become more apparent during periods of economic slowdown or fiscal expansion, when banks are encouraged to expand lending to support economic growth.

Previous studies have widely examined the determinants of bank profitability, particularly the roles of credit risk, operational efficiency, and capital adequacy. However, many studies tend to analyze these variables separately or focus only on one or two aspects of bank performance, leaving limited understanding of how these financial factors jointly influence profitability. This study addresses this gap by examining the

simultaneous effects of credit risk (NPL), operational efficiency (BOPO), and capital adequacy (CAR) on bank profitability (ROA) in Indonesian state-owned banks. By analyzing these variables together, this research aims to provide a more comprehensive understanding of how risk management, operational efficiency, and capital strength interact in shaping bank financial performance. Furthermore, the focus on state-owned banks is important because their distinctive institutional characteristics—such as government ownership and development mandates—may influence managerial decisions related to lending, efficiency, and capital management, thereby offering valuable insights into how multiple financial factors jointly affect bank profitability in a developing country contex.

State-owned banks have a dual role as financial institutions that aim to achieve profitability while also supporting government development programs. This dual function distinguishes them from privately owned banks because their operational decisions may not only be driven by profit considerations but also by broader economic and social objectives established by the government. From the perspective of institutional theory, organizations tend to adapt their behavior to institutional pressures such as regulations, government policies, and societal expectations. In the context of state-owned banks, government ownership creates institutional pressure to support national development priorities, including expanding credit to strategic sectors and supporting economic stability. These institutional demands may influence how banks manage credit risk, operational efficiency, and capital allocation, which in turn affects their financial performance.

Furthermore, agency theory explains the relationship between the principal and the agent within an organization. In state-owned banks, the government acts as the principal, while bank management acts as the agent responsible for managing the bank's operations. However, unlike private firms that mainly pursue profit maximization, government ownership often involves broader policy objectives. As a result, managerial decisions related to lending policies, operational efficiency, and capital management may reflect both economic and policy considerations, which can influence bank profitability.

In addition, the political economy perspective of state-owned enterprises highlights that government-owned institutions often operate within political and developmental frameworks that shape their strategic decisions. Consequently, the financial performance of state-owned banks may be influenced not only by internal managerial efficiency but also by government priorities and policy interventions. Therefore, understanding the institutional characteristics of state-owned banks is important to explain how credit risk (NPL), operational efficiency (BOPO), and capital adequacy (CAR) influence profitability (ROA).

Despite these realities, existing theoretical frameworks have not fully incorporated the unique institutional role of state-owned banks in developing economies such as Indonesia. Most theoretical approaches examine the separate effects of credit risk, operational efficiency, or capital adequacy on bank profitability. However, they rarely explain how these factors interact in banking systems where government policies and social objectives influence lending activities. For example, higher capital adequacy may enable state-owned banks to absorb greater credit risk arising from developmental lending programs (Yeung, 2021). At the same time, operational efficiency may determine whether such policy-driven lending can generate sustainable profitability (Tang & Zhou, 2012). The limited number of empirical studies that simultaneously examine these interactions in the context of Indonesian state-owned banks indicates the presence of a theoretical gap.

Addressing this gap is important to improve the relevance of existing profitability theories in banking systems characterized by strong government involvement and socio-economic responsibilities.

A growing body of empirical research has also examined the determinants of bank profitability in Indonesia. Several studies find that Non-Performing Loans (NPL), as an indicator of credit risk, significantly affect the profitability of Indonesian state-owned banks (Priharta & Gani, 2025; Hidayat et al., 2021). Similarly, Naili and Lahrichi (2022) conclude that non-performing loans are an important determinant of profitability in the Indonesian banking industry, together with bank ownership structure. Other studies show that operational efficiency and capital adequacy also play important roles in determining bank performance, although the empirical results vary across different contexts (Lotto, 2018; Gharaibeh, 2023). These mixed findings indicate that further empirical investigation is needed to better understand how these factors influence bank profitability, particularly in the context of state-owned banks.

State-owned banks have a dual role as financial institutions that seek to achieve profitability while also supporting government development programs, which distinguishes them from privately owned banks whose operational decisions are primarily driven by profit considerations. This dual function can be explained through institutional theory, which suggests that organizations adapt their behavior to institutional pressures such as regulations, government policies, and societal expectations. In the context of state-owned banks, government ownership creates pressure to support national development priorities, including expanding credit to strategic sectors and maintaining economic stability, which may influence how banks manage credit risk, operational efficiency, and capital allocation. Furthermore, agency theory explains that the government acts as the principal while bank management serves as the agent responsible for managing operations; however, unlike private firms that mainly pursue profit maximization, state-owned banks must also consider broader policy objectives. Consequently, managerial decisions related to lending policies, operational efficiency, and capital management may reflect both economic and policy considerations. In addition, the political economy perspective of state-owned enterprises highlights that government-owned institutions operate within political and developmental frameworks that shape their strategic decisions, meaning that the financial performance of state-owned banks may be influenced not only by internal managerial efficiency but also by government priorities and policy interventions. Therefore, understanding the institutional characteristics of state-owned banks is important for explaining how credit risk (NPL), operational efficiency (BOPO), and capital adequacy (CAR) influence profitability (ROA).

Previous studies examining the determinants of bank profitability, particularly the effects of Non-Performing Loans (NPL), Operational Efficiency Ratio (BOPO), and Capital Adequacy Ratio (CAR) on Return on Assets (ROA), have produced inconsistent empirical findings. Several studies report that NPL has a negative and significant effect on bank profitability because higher credit risk reduces income and increases provisioning costs (Arhinful et al, 2025; Bhuiya et al.2023). Similarly, BOPO is often found to have a negative relationship with ROA, indicating that higher operational inefficiency tends to reduce bank profitability (Irawan et al, 2025;Fadhilah, Kusumawardhani & Sari (2025). However, other studies report different results. For instance, some research finds that NPL does not significantly affect profitability under certain banking conditions (Uddin, M. K. (2022). In contrast, several empirical studies

even report a positive relationship between CAR and ROA, suggesting that stronger capital buffers enhance banks' ability to expand lending and absorb risks (Arhinful et al,2025; Hendrawan, Defung,& Wardhani, 2023)

These mixed findings indicate that the relationships among NPL, BOPO, CAR, and bank profitability remain inconclusive across different contexts and time periods. Such inconsistencies highlight the need for further empirical investigation, particularly within the context of Indonesian state-owned banks over a longer observation period. Therefore, this study aims to re-examine the effects of NPL, BOPO, and CAR on ROA using panel data from Indonesian state-owned banks listed on the Indonesia Stock Exchange during the 2014–2024 period.

Most previous studies analyze state-owned and private banks within a single sample. However, state-owned banks have a dual role: they operate as profit-oriented institutions while also implementing government development programs. This institutional characteristic may influence how credit risk, operational efficiency, and capital adequacy affect profitability. Therefore, this study focuses specifically on Indonesian state-owned banks to re-examine the determinants of bank profitability. The novelty of this research lies in its exclusive focus on state-owned banks and its simultaneous examination of credit risk, operational efficiency, and capital adequacy. In addition, the study explores whether operational efficiency and strong capital can mitigate the negative impact of credit risk on profitability. By doing so, this research provides new empirical evidence and contributes to a better theoretical understanding of bank profitability in the context of government-owned banks in developing economies.

Bank profitability is influenced by several financial factors, particularly credit risk, operational efficiency, and capital adequacy. The interaction among these factors plays an important role in determining banks' financial performance, as effective management of risk, efficiency, and capital can support more stable profitability. From the risk–return trade-off perspective, higher lending risk may generate higher returns, but excessive credit risk can increase non-performing loans and reduce profitability, making effective credit risk management essential. In addition, capital buffer theory suggests that banks with stronger capital positions are better able to absorb potential losses and maintain financial stability during economic uncertainty. Furthermore, efficiency theory emphasizes that banks with higher operational efficiency can better control costs and utilize resources effectively, enabling them to maintain profitability even under credit risk pressures. Therefore, the interaction between credit risk management, operational efficiency, and capital adequacy becomes an important determinant of bank profitability.

Previous studies have widely examined the determinants of bank profitability, particularly credit risk, operational efficiency, and capital adequacy. However, many studies analyze these variables separately, so the combined effect of these financial factors on bank profitability is still not fully understood. This study addresses this gap by examining the simultaneous effects of credit risk (NPL), operational efficiency (BOPO), and capital adequacy (CAR) on bank profitability (ROA). The study focuses on Indonesian state-owned banks, which have unique institutional characteristics due to government ownership and development mandates that may influence managerial decisions related to lending, efficiency, and capital management. Therefore, this research provides a more comprehensive understanding of how these financial factors jointly affect bank profitability and represents the main contribution of the study.

This study contributes to the literature on bank profitability by providing a more comprehensive understanding of how key financial factors interact in influencing banking

performance. While previous studies often examine credit risk, operational efficiency, and capital adequacy separately, this research analyzes these variables simultaneously to capture their combined effects on bank profitability. The study focuses on Indonesian state-owned banks, which operate under unique institutional characteristics due to government ownership and their role in supporting national development. By examining this context, the study provides empirical evidence on how credit risk, efficiency, and capital adequacy influence profitability in state-owned banks within a developing country. In addition, the findings offer practical insights for policymakers and banking practitioners by highlighting the importance of effective credit risk management, operational efficiency, and adequate capital in maintaining sustainable bank profitability and strengthening the stability of the banking sector.

2. Literature riview and hypothesis development

The relationships between credit risk, operational efficiency, capital adequacy, and bank profitability can be explained through several theories in banking. The risk–return trade-off theory states that higher risk-taking may generate higher returns, but excessive credit risk, reflected in higher Non-Performing Loans (NPL), can reduce profitability if not managed properly. The capital buffer theory highlights the importance of adequate capital, where banks with higher Capital Adequacy Ratios (CAR) are better able to absorb potential losses and maintain financial stability. Meanwhile, the efficiency theory of banking emphasizes that banks with higher operational efficiency, commonly measured by the BOPO ratio, are better able to control costs and improve profitability. Therefore, the interaction between credit risk management, operational efficiency, and capital adequacy becomes an important factor in explaining bank profitability, providing the theoretical basis for analyzing the effects of NPL, BOPO, and CAR on ROA.

2.1 Credit risk and bank profitability

Credit risk represents the possibility that borrowers fail to fulfill their loan obligations, which can lead to financial losses for banks. From the perspective of the risk–return trade-off theory, higher lending activities may increase potential returns but also expose banks to higher credit risk. An increase in Non-Performing Loans (NPL) indicates that a greater proportion of loans are not being repaid as scheduled. This situation requires banks to allocate higher loan loss provisions, which can reduce net income and ultimately decrease profitability. Therefore, higher NPL levels are generally expected to negatively affect bank profitability. According to Hadian & Phety (2021), Non-Performing Loans (NPL) reflect management's ability to control and manage problem loans. Their findings indicate that NPL has a negative effect on bank profitability. The same results has been found by Laryea, Ntow-Gyamfi & Alu (2016) and their research at Ghanadian Bank and Vinh (2017) at Vietnamese commercial bank. Both of them agreed that NPL has a statistically significant negative effect on banks profitability. It can be explained that an increase in problem loans reduces bank income and increases loan loss provisioning expenses, thereby exerting pressure on profitability performance. In other words, a higher NPL ratio tends to be associated with a lower ROA, and vice versa. Some studies also report different results, showing that NPL can have a positive effect on ROA under certain conditions, particularly when higher credit risk is accompanied by higher interest income

and remains within a manageable level. The result NPL has no significant positive effect on profitability (ROA) (Permatasari & Amboningtyas ,2017).

H1: Non-Performing Loans (NPL) have a significant effect on Return on Assets (ROA).

2.2 Operational efficiency and bank profitability

Operational efficiency reflects the ability of banks to manage their operating costs relative to their operating income. According to the efficiency theory of banking, institutions that are able to manage their resources more efficiently tend to achieve better financial performance. Similarly, the resource-based view suggests that efficient utilization of organizational resources can create a competitive advantage and improve overall performance. The BOPO ratio measures the level of operational efficiency in banks; higher BOPO values indicate higher operational costs relative to income, which may reduce profitability Operational efficiency is commonly measured using the Operating Expenses to Operating Income ratio (BOPO). Higher operating expenses indicate lower efficiency in bank management, which directly reduces bank profits. Therefore, BOPO is considered to influence bank profitability: the higher the BOPO ratio, the lower the company's profit. Empirical evidence generally shows that BOPO has a negative and significant effect on profitability, particularly in state-owned banks listed on the stock exchange (Simanjuntak & Soeparno , 2025 : Priharta & Gani , 2024) . An increase in BOPO leads to a decline in Return on Assets (ROA), whereas a decrease in operating costs reflects improved efficiency and can enhance bank income and overall profitability (Rakshit, 2023).

H2: The Operating Expenses to Operating Income ratio (BOPO) has a significant effect on Return on Assets (ROA).

2.3 Capital adequacy and bank profitability

Capital adequacy reflects the financial strength of a bank in absorbing potential losses. The capital buffer theory suggests that banks maintain sufficient capital reserves to protect themselves from financial shocks and unexpected losses. In addition, financial intermediation theory explains that well-capitalized banks are better positioned to support lending activities and maintain financial stability. Therefore, banks with higher capital adequacy ratios (CAR) are generally expected to have stronger financial Several previous studies report a positive relationship between CAR and profitability, arguing that strong capital positions enhance bank stability and increase the capacity for credit expansion. CAR reflects a bank's ability to absorb potential losses and to support the growth of productive assets. An adequate level of capital enables banks to conduct intermediation activities more safely and efficiently, which can strengthen market confidence and reduce financial vulnerability. Consequently, well-capitalized banks are better positioned to expand credit, manage risks effectively, and achieve higher profitability. Nguyen (2020) found that bank capital adequacy has a positive impact on return on assets for small-sized banks meanwhile it has no significant impact on profitability for large-sized banks in Vietnam. The same result was investigated by Madugu, Ibrahim & Amoah (2020), CAR negatively affects profitability of foreign banks with no apparent impact on local banks.

H3: Capital Adequacy Ratio (CAR) has a significant effect on Return on Assets (ROA).

2.4 Simultaneous effects of credit risk, efficiency, and capital on profitability

Bank profitability is not determined by a single factor but by the interaction between risk management, operational efficiency, and capital strength. Banks that are able to control credit risk, operate efficiently, and maintain adequate capital buffers are more likely to sustain stable financial performance. Therefore, examining these variables simultaneously provides a more comprehensive understanding of the determinants of bank profitability. Bank profitability is not determined by a single financial factor but rather by the interaction of multiple internal performance dimensions. Credit risk management, operational efficiency, and capital strength function as interdependent components of bank performance (Nhleko, & Adelowotan, 2025). Credit expansion without efficiency leads to cost pressures, capital strength without productive asset utilization limits income generation, and efficiency without adequate capitalization constrains growth potential. Previous studies that simultaneously examine NPL, BOPO, and CAR generally find that these variables jointly influence profitability, although the direction and significance of their partial effects vary across institutional contexts. In state-owned banks, this interaction is further shaped by their dual role as commercial institutions and agents of economic development, where policy-driven lending and social mandates coexist with profitability objectives. Therefore, this study proposes a simultaneous effect hypothesis:

H4: Non-Performing Loans (NPL), the Operating Expenses to Operating Income ratio (BOPO), and the Capital Adequacy Ratio (CAR) simultaneously have a significant effect on Return on Assets (ROA).

3. Method

This study employs multiple linear regression as a parsimonious and appropriate estimation technique to examine the direct influence of credit risk (NPL), operational efficiency (BOPO), and capital adequacy (CAR) on profitability (ROA) Classical assumption tests were conducted to ensure the reliability and validity of the regression results. The reason by using this method compare to others because, the number of cross-sectional units is limited to four state-owned banks although the dataset has a panel structure (cross-sectional and time-series dimensions. Given this relatively small sample size, So the use of advanced panel estimation techniques such as Fixed Effects Model (FEM), Random Effects Model (REM), or dynamic panel estimators (GMM) may reduce estimator efficiency and degrees of freedom. Future studies with larger cross-sectional samples may apply panel data regression techniques or dynamic panel models to further enhance methodological rigor and address potential endogeneity concerns.

This study employs a quantitative approach using secondary data in the form of annual financial statements of state-owned banks listed on the Indonesia Stock Exchange (IDX). The population consists of five state-owned banks listed on the stock exchange. The sample was selected using purposive sampling, namely government-owned banks that consistently published complete annual financial reports over an eleven-year period from 2014 to 2024. However, only four banks provided complete financial statements

throughout the entire observation period, while one bank began publishing its financial reports only in 2021. Therefore, the final sample of this study comprises four state-owned banks listed on the Indonesia Stock Exchange that published complete financial reports from 2014 to 2024. It should be noted that the four banks included in this study represent the full population of Indonesian state-owned commercial banks listed on the Indonesia Stock Exchange during the observation period. Therefore, this study applies a population-based approach within the defined institutional category rather than a partial sample. The relatively small number of observations reflects the limited number of state-owned banking institutions in Indonesia.

The data used in this study include Non-Performing Loans (NPL) (X1), Operating Expenses to Operating Income (BOPO) (X2), and the Capital Adequacy Ratio (CAR) (X3) as independent variables, and Return on Assets (ROA) as the dependent variable (Y). The data were processed using SPSS.The analytical methods employed consist of descriptive analysis and multiple linear regression analysis, with the regression model specified as follows:

$$Y = a + bX1 + cX2 + dX3 + e$$

Prior to data processing using SPSS, the data were subjected to classical assumption tests, including tests for normality, multicollinearity, heteroscedasticity, and autocorrelation, to ensure the validity and reliability of the regression model.

4. Results

4.1 Normality test

The normality test is an important part of the classical assumption test, which aims to determine whether the residual values in a regression model are normally distributed. A good regression model is one with normally distributed residuals. Normality test see Figure 1 and Table 1.

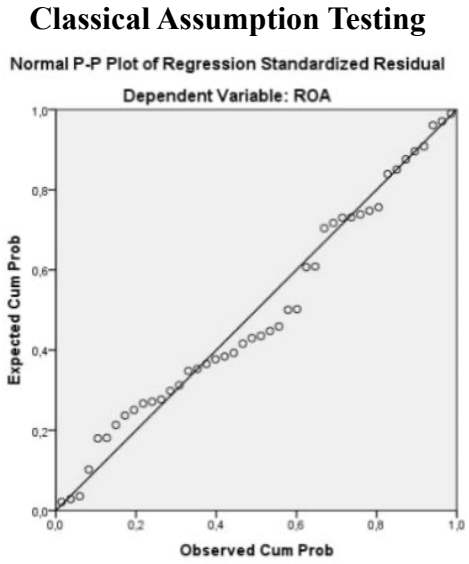

Figure 1. Results of the Normality Test by using Graphical Plot (Visualization Method)

Table 1. One-Sample Kolmogorov-Smirnov Test

		Unstandardized Residual
N		44
Normal Parameters[a,b]	Mean	,0000000
	Std. Deviation	,43480135
Most Extreme Differences	Absolute	,111
	Positive	,111
	Negative	-,080
Test Statistic		,111
Asymp. Sig. (2-tailed)		,200[c,d]

a. Test distribution is Normal.

The results of the One-Sample Kolmogorov–Smirnov test indicate that the Asymp. Sig. (2-tailed) value is 0.200, which exceeds the significance threshold of 0.05. This finding suggests that the residuals are normally distributed. Therefore, the normality assumption of the regression model is satisfied, allowing further analysis to proceed without any violation of the normality assumption.

4.2 Heteroscedasticity test

The scatterplot of standardized residuals against standardized predicted values shows a random distribution of points with no discernible pattern or systematic structure. The residuals are evenly spread above and below the zero line, indicating constant variance across the range of predicted values. This pattern confirms the absence of heteroskedasticity in the regression model, suggesting that the homoscedasticity assumption is satisfied and the model estimates are statistically reliable.

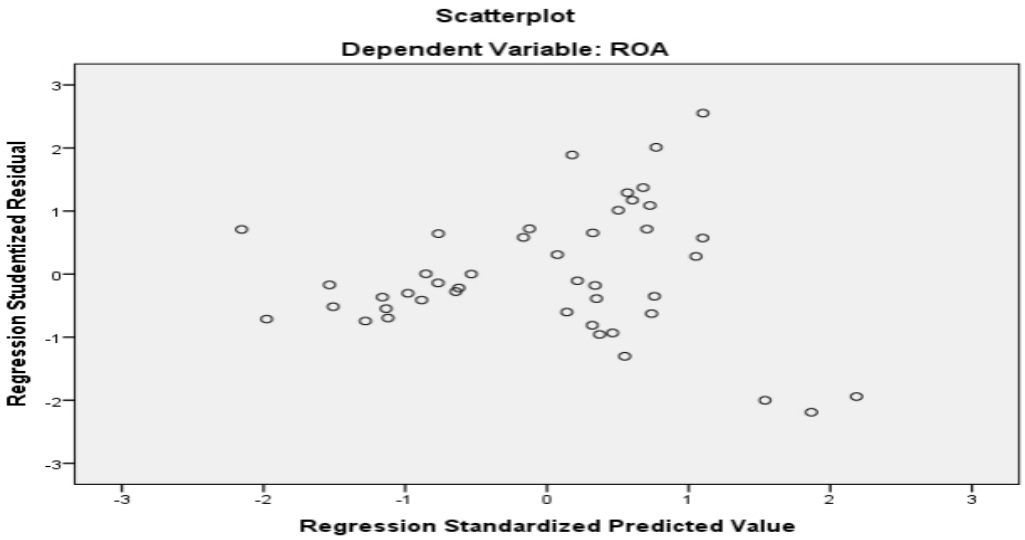

Figure 2. Heteroscedasticity Test Results

4.3 Multicollinearity test

The multicollinearity test results indicate that all independent variables have tolerance values greater than 0.10 and VIF values below 10 (NPL: tolerance = 0.513, VIF = 1.948;

BOPO: tolerance = 0.497, VIF = 2.010; CAR: tolerance = 0.863, VIF = 1.158). These results confirm the absence of multicollinearity in the regression model, indicating that the independent variables are not highly correlated with each other. Therefore, the regression estimates are statistically reliable, and each variable independently contributes to explaining variations in bank profitability (ROA).

Table 3. Multicollinearity test

Coefficients[a]

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Collinearity Statistics	
	B	Std. Error	Beta			Tolerance	VIF
1 (Constant)	9,849	,999		9,863	,000		
NPL	,327	,153	,178	2,135	,039	,513	1,948
BOPO	-,112	,009	-1,017	-12,001	,000	,497	2,010
CAR	,033	,033	,063	,979	,333	,863	1,158

a. Dependent Variable: ROA

4.4 Autocorrelation test

The Durbin–Watson statistic obtained from the Cochrane–Orcutt procedure is 1.689. This value lies within the acceptable range (approximately 1.5–2.5), indicating the absence of autocorrelation in the regression model. Therefore, the residuals are independently distributed, and the regression model satisfies the classical assumption of error independence, ensuring the reliability and validity of the statistical inferences.

Table 4. Results of the autocorrelation test using the cochrane–orcutt method

Model	R	R Square[b]	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.853[a]	.728	.708	.59867	1.689

a. Predictors: Lag_X3, Lag_X2, Lag_X1

4.5 Descriptive statistics analysis

Based on the descriptive statistical results, the average Non-Performing Loan (NPL) ratio is 1.0611%, which remains far below the maximum threshold of 5% established by the Indonesian Financial Services Authority (OJK). An NPL ratio below 5% indicates that the credit quality of state-owned banks is in a sound and healthy condition, as the proportion of non-performing loans is relatively low and remains within the regulatory tolerance limits. At the industry level, the gross NPL ratio of the Indonesian banking sector stood at 2.26% as of June 2024, declining by 18 basis points from 2.44% in June 2023 (Laras, 2024), further confirming the overall improvement in credit quality within the banking system.

The average BOPO value is 74.3909%, reflecting the level of operational cost management efficiency. A lower BOPO ratio indicates higher efficiency in managing operational expenses. According to Jultantyo, Hasan, and Anggarani (2025), a BOPO ratio below 80% is considered an indicator of good efficiency and is commonly used as a benchmark in empirical banking studies. In addition, Bank Indonesia (BI) generally sets the optimal standard for the BOPO ratio at below 90%. Based on these benchmarks, the state-owned banks in this study can be categorized as operationally efficient, as their average BOPO value (74.3909%) remains well below the 90% threshold.

The average Capital Adequacy Ratio (CAR) is 19.5911%. According to Kasmir (2018), a healthy CAR level for banks is at least 8%. The empirical results show that 19.5911% significantly exceeds this minimum standard, indicating that state-owned banks possess very strong capital adequacy and are positioned far above the regulatory minimum requirement. This high level of capitalization reflects a strong capacity to absorb business risks and maintain financial stability. However, such strong capital positions must be accompanied by optimal capital utilization strategies to ensure that excess capital is effectively transformed into productive assets that enhance profitability.

The average Return on Assets (ROA) observed in this study is 2.5177%. According to Adyani and Sampurno (2011), Bank Indonesia's regulatory benchmark for a good ROA level is approximately 1.5%. A higher ROA indicates better financial performance, as it reflects the bank's ability to generate greater returns from its asset base. Since the empirical ROA value of 2.5177% exceeds the 1.5% benchmark, the results suggest that Indonesian state-owned banks exhibit strong profitability performance, demonstrating their capacity to generate profits efficiently from their assets and maintain a healthy level of overall financial performance

Table 5. Descriptive statistics

Variable	N	Minimum	Maximum	Mean	Std. Deviation
NPL	44	,26	2,96	1,0611	,62643
BOPO	44	51,88	98,12	74,3909	10,46029
CAR	44	14,64	25,28	19,5911	2,21505
ROA	44	,13	4,74	2,5177	1,15036
Valid N (listwise)	44				

4.6 Multiple linear regression results

The multiple linear regression analysis produces the following estimated model (See Table 3):

$$ROA = 9.849 + 0.327\ NPL - 0.112\ BOPO + 0.033\ CAR$$

The empirical findings indicate that Non-Performing Loans (NPL) exert a positive and statistically significant effect on Return on Assets (ROA). This result contrasts with a substantial body of prior literature that reports a negative relationship between NPL and bank financial performance. However, the finding is consistent with the study of

Hutahuruk et al. (May 2024), which also documents a positive effect of NPL on ROA. This phenomenon can be explained by the fact that the average NPL level of state-owned banks remains below the regulatory maximum threshold, implying relatively low credit default risk. Under such conditions, an increase in NPL may reflect an expansion of productive lending activities rather than a deterioration in asset quality, thereby contributing to higher profitability.

Furthermore, BOPO (operational efficiency ratio) exhibits a negative effect on ROA, indicating that higher operational costs systematically reduce bank profitability. This finding supports previous empirical studies, including Adhim and Mulyati (2024), who report a significant negative relationship between BOPO and ROA. In the context of state-owned banks, elevated operational expenses are largely associated with extensive branch networks, large numbers of employees, and additional operational burdens arising from government mandates and public service obligations. These structural cost pressures constrain the ability of government-owned banks to generate profits efficiently.

Meanwhile, the Capital Adequacy Ratio (CAR) shows a positive effect on ROA, suggesting that stronger capitalization enhances bank profitability. A higher capital base improves banks' capacity to absorb risk, expand lending activities, and strengthen market confidence, thereby supporting sustainable profit generation. This result is consistent with prior empirical evidence, which emphasizes the strategic role of capital adequacy in promoting financial stability and long-term profitability.

The Adjusted R-squared (see Tabel 4) value of 0.846 indicates that 84.6% of the variation in the Return on Assets (ROA) of Indonesian state-owned banks is explained by the independent variables NPL**,** BOPO, and CAR. This high explanatory power reflects a very strong model fit, demonstrating that internal bank-specific factors constitute the primary determinants of profitability in government-owned banking institutions.

The remaining 15.4% of unexplained variation is attributable to external factors, including macroprudential policies, macroeconomic conditions, and financial market dynamics, which operate beyond the direct control of bank management. These findings highlight that while internal financial management plays a dominant role in shaping profitability, broader structural and systemic forces continue to influence bank performance through regulatory, economic, and market-based transmission mechanisms.

4.7 Partial regression test

Based on Table 3 the results of the partial regression test (t-test), each independent variable demonstrates different statistical effects on the profitability of state-owned banks as measured by Return on Assets (ROA).

The NPL variable shows a positive and statistically significant effect on ROA, with a regression coefficient (B) of 0.327, a t-value of 2.135, and a significance level (p-value) of 0.039 ($p < 0.05$). This indicates that NPL significantly influences ROA at the 5% significance level. The positive coefficient suggests that an increase in NPL is associated with an increase in ROA, which is an atypical result compared to conventional banking theory. However, this finding can be explained by the relatively low average NPL level of state-owned banks, which remains well below the regulatory threshold. According to Grilseda & Riyadi, (2021) investigated that the positive relationship between Non-Performing Loans (NPL) and Return on Assets (ROA) in state-owned banks can be explained by the fact that NPL levels remain within a controlled and regulatory-tolerable

threshold, indicating that credit risk is not economically destructive but rather reflects productive credit expansion. When NPL ratios are maintained below the regulatory limit (5% threshold), increases in NPL do not significantly impair interest income or asset quality. Instead, they accompany aggressive but controlled lending growth that generates higher interest revenues, leading to net positive effects on profitability. In this context, NPL serves as a proxy for risk-taking in intermediation activities, where the return generated from expanded credit portfolios outweighs the marginal increase in credit risk, resulting in a positive association with ROA. In the above research results, Credit Risk does not affect the performance of the profitability of the banking industry in Indonesia. Some previous studies shows that credit risk does not affect ROA. The BI regulation governing each outstanding increase in loans must be covered with a reserve of earning assets by debiting the earning asset reserve account and crediting the write-off of productive assets, so that any increase in loans provided will increase the cost of earning assets which will eventually affect (Harahap, 2018).

The finding of this research which is the positive and significant relationship between NPL and ROA may initially appear inconsistent with conventional banking theory. However, this result can be interpreted within the framework of risk-based pricing strategies. In state-owned banks, lending rates are often adjusted according to borrower risk profiles, meaning that moderate increases in credit risk may be compensated by higher interest margins. As long as NPL levels remain below regulatory thresholds, the additional interest income generated from expanded lending may outweigh the marginal increase in credit loss provisions.

Furthermore, the institutional characteristics of Indonesian state-owned banks must be considered. These banks play a strategic role in government-mandated lending programs, including MSME financing and infrastructure projects. In this context, higher loan exposure may naturally increase NPL ratios slightly, yet still contribute positively to profitability through larger credit portfolios and interest revenues. Therefore, NPL in this study may reflect productive credit expansion rather than deterioration of asset quality.This finding suggests that the relationship between credit risk and profitability is conditional rather than linear, particularly in state-owned banking institutions operating under developmental mandates.

The higher the NPL ratio, the worse the quality of bank credit which causes greater number of non-performing loans and therefore the bank must bear losses in its operational activities, thus affecting the decrease in profit (ROA) obtained by the bank .Under such conditions, moderate increases in NPL may reflect credit expansion rather than deterioration in asset quality, thereby contributing to income growth and profitability. *H_1 is accepted (NPL significantly affects ROA).*

The BOPO variable exhibits a negative and highly significant effect on ROA, with a regression coefficient (B) of −0.112, a t-value of −12.001, and a significance level of 0.000 ($p < 0.01$). This result indicates a very strong inverse relationship between operational costs and profitability. The negative coefficient confirms that higher operational expenses systematically reduce bank profitability. This finding strongly supports efficiency theory in banking, which posits that cost inefficiency directly erodes financialperformance.

H_2 : is accepted (BOPO significantly and negatively affects ROA).

The CAR variable shows a positive but statistically insignificant effect on ROA, with a regression coefficient (B) of 0.033, a t-value of 0.979, and a significance level of 0.333 ($p > 0.05$). This indicates that, although capital adequacy has a positive relationship

with profitability, the effect is not statistically significant in the partial model. This suggests that capital strength alone does not directly translate into higher profitability unless it is efficiently allocated into productive assets and income-generating activities. Excess capital may instead remain idle or be used primarily for risk buffering rather than profit maximization.

H_3: is rejected (CAR does not significantly affect ROA)

Table 6. F-test Results (Simultaneous Test)

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	48,774	3	16,258	79,997	,000[b]
	Residual	8,129	40	,203		
	Total	56,903	43			

a. Dependent Variable: ROA

b. Predictors: (Constant), CAR, NPL, BOPO

The results of the simultaneous test (F-test) indicate an F-statistic value of 79.997 with a significance level of 0.000, demonstrating that NPL, BOPO, and CAR jointly exert a statistically significant effect on ROA. This finding confirms that the proposed model is empirically valid and statistically robust in explaining the determinants of profitability of Indonesian state-owned banks. Therefore, the research model is relevant and appropriate for capturing the internal financial dynamics that shape bank profitability in the Indonesian banking sector.

The empirical analysis further reveals that Non-Performing Loans (NPL) have a positive and significant effect on ROA. This result diverges from a large body of prior studies that document a negative relationship between credit risk and bank performance. However, it is consistent with the findings of Hutahuruk et al. (May 2024), who also report a positive effect of NPL on profitability. This relationship can be explained by the fact that the average NPL levels of state-owned banks remain below the regulatory maximum threshold, indicating relatively low default risk. Under these conditions, increases in NPL may reflect controlled credit expansion and productive lending activities rather than a deterioration in asset quality, thereby contributing positively to income generation and profitability. The empirical results indicate a positive and significant relationship between Non-Performing Loans (NPL) and Return on Assets (ROA). This finding differs from conventional banking theory, which generally predicts a negative relationship between credit risk and profitability. In most banking contexts, increasing non-performing loans reduce profitability due to higher provisioning costs and declining loan quality. However, in the context of Indonesian state-owned banks, this relationship may reflect the expansion of productive lending activities.

State-owned banks often play a strategic role in supporting government development programs, including financing priority sectors such as MSMEs and infrastructure. As a result, moderate increases in credit risk may occur alongside expanding lending portfolios that generate higher interest income. Therefore, the positive

association between NPL and ROA in this study may indicate controlled risk-taking rather than deteriorating asset quality.

In contrast, BOPO exhibits a negative and significant effect on ROA, indicating that higher operational costs systematically reduce bank profitability. This finding is consistent with previous empirical studies, including Adhim and Mulyati (2024), which demonstrate a negative relationship between operational inefficiency and financial performance. This result is consistent with previous empirical studies indicating that operational efficiency is one of the most important determinants of bank performance. For state-owned banks, maintaining operational efficiency is particularly important because these institutions not only compete in the commercial banking market but also carry out developmental mandates. Therefore, efficient cost management becomes a key factor in sustaining profitability while fulfilling broader economic roles.

The positive relationship between the Capital Adequacy Ratio (CAR) and ROA indicates that stronger capital buffers contribute to improved bank performance. Adequate capital enables banks to absorb potential financial shocks, expand lending activities, and maintain financial stability. In addition, well-capitalized banks tend to gain greater confidence from investors and depositors, which may enhance their operational capacity. However, the effect of CAR on profitability is relatively moderate compared with operational efficiency. This suggests that while capital strength remains essential for financial stability, profitability in Indonesian state-owned banks is more strongly influenced by managerial efficiency and credit allocation strategies.

Overall, these findings demonstrate that the profitability of Indonesian state-owned banks is determined by a synergistic interaction between controlled credit risk, operational efficiency, and capital strength. The results highlight that sustainable profitability is not driven by capital accumulation alone, but requires efficient cost management and effective utilization of capital within a well-governed risk framework. This integrated structure provides strong empirical support for a multidimensional approach to performance optimization in government-owned banking institutions.The findings of this study generate several concrete strategic implications for both state-owned bank management and financial regulators.

First, given the strong negative impact of BOPO on profitability, state-owned banks should prioritize optimization of their cost-to-income ratio. This may be achieved through digital transformation initiatives such as expanding digital banking platforms, automating routine operational processes, rationalizing branch networks, and integrating data management systems. These measures can reduce operational costs while improving service efficiency and scalability.

Second, although NPL shows a positive relationship with profitability, maintaining credit risk within a controlled threshold remains essential. Banks should strengthen their risk management systems by implementing early warning mechanisms, enhancing credit scoring models, and adopting real-time loan portfolio monitoring systems. A proactive risk governance framework would allow banks to sustain productive credit expansion while preventing excessive deterioration in asset quality.

Third, even though CAR does not exhibit a statistically significant effect in the partial model, capital strength remains strategically important. State-owned banks should adopt capital allocation policies based on risk-adjusted return metrics, such as evaluating lending segments using risk-adjusted performance indicators. This approach ensures that capital is not merely maintained as a regulatory buffer but is strategically deployed to generate sustainable returns.

From a regulatory perspective, authorities such as the Financial Services Authority (OJK) and Bank Indonesia may encourage efficiency-enhancing reforms by promoting digital innovation, strengthening supervisory frameworks, and ensuring that prudential regulations support balanced credit growth. Policy coordination between financial stability objectives and development financing mandates is essential to sustain long-term profitability in state-owned banks. Overall, sustainable profitability in state-owned banking institutions requires an integrated strategy combining operational efficiency, disciplined risk management, and strategic capital deployment within a supportive regulatory environment.

This study provides empirical evidence on the determinants of profitability in Indonesian state-owned banks by integrating the roles of credit risk, operational efficiency, and capital adequacy within a unified analytical framework. The findings reveal that bank profitability is not driven by a single financial factor, but rather by a dynamic interaction between risk management quality, cost efficiency, and capital strength, reflecting the complex institutional and developmental role of government-owned banking institutions in emerging economies.

5. Discussion

5.1 Credit risk and profitability

The positive and significant relationship between Non-Performing Loans (NPL) and Return on Assets (ROA) suggests that credit risk, when maintained within regulatory thresholds, does not necessarily impair profitability. Unlike conventional theoretical expectations that associate higher NPL levels with deteriorating financial performance, the results indicate that moderate increases in NPL may reflect an expansion of productive lending rather than asset quality deterioration. Given that the average NPL ratio of the sampled banks remains below the regulatory maximum limit, credit risk exposure appears to be effectively managed and absorbed within existing risk governance frameworks. This finding supports the argument that controlled risk-taking can enhance income generation through increased interest revenues and asset utilization, particularly in state-owned banks that operate under developmental and financial inclusion mandates.

5.2 Operational efficiency and profitability

Operational efficiency, as measured by BOPO, exhibits a negative and significant effect on ROA, confirming that cost structures remain a critical constraint on profitability. High operational expenses associated with extensive branch networks, large employee bases, and public service obligations imposed through government assignments substantially weaken the banks' capacity to generate net income. This structural inefficiency reflects institutional rigidities commonly observed in state-owned financial institutions, where social and developmental objectives often coexist with commercial goals. As a result, even when credit expansion and capital adequacy are favorable, profitability remains constrained by persistent operational cost pressures. This finding reinforces the central role of efficiency-driven performance models in explaining bank profitability dynamics.

5.3 Capital adequacy and profitability

The positive and significant impact of Capital Adequacy Ratio (CAR) on ROA highlights the strategic importance of strong capitalization in enhancing bank performance. Adequate capital buffers improve risk absorption capacity, strengthen financial resilience, and increase stakeholder confidence, thereby enabling banks to expand lending activities and optimize asset allocation. In state-owned banks, strong capital positions also enhance credibility in executing large-scale development financing programs while maintaining financial stability. This finding aligns with capital-based banking theories that emphasize the role of capitalization in supporting sustainable profitability and long-term institutional viability.

5.4 Integrated perspective on profitability determinants

Taken together, the results demonstrate that profitability in state-owned banks emerges from a balanced configuration of controlled credit risk, efficient cost management, and robust capital structures. Credit expansion without efficiency improvements leads to cost inefficiencies, while capital strength without productive asset utilization limits income generation. Similarly, efficiency gains without adequate capitalization restrict growth potential. Therefore, sustainable profitability cannot be achieved through isolated financial interventions but requires an integrated management strategy that simultaneously optimizes risk governance, operational efficiency, and capital utilization.

Importantly, the findings indicate that the developmental mandate of state-owned banks does not inherently contradict profitability objectives. Instead, the tension between public service obligations and commercial performance arises primarily from inefficiencies in cost structures and resource allocation rather than from the developmental role itself. This suggests that institutional reforms focused on operational efficiency, digital transformation, and organizational restructuring may enhance profitability without undermining the banks' function as agents of economic development.

From a theoretical perspective, this study contributes to the banking performance literature by providing empirical evidence from state-owned financial institutions in an emerging market context, where the relationship between risk, efficiency, and profitability differs from that of privately owned commercial banks. The findings challenge the conventional assumption that credit risk uniformly deteriorates profitability, highlighting the conditional nature of this relationship under effective risk management regimes.

From a practical standpoint, the results offer strategic insights for policymakers and bank management. Strengthening operational efficiency through cost rationalization, digitalization, and structural reforms should be prioritized alongside prudent credit expansion and capital strengthening. Policymakers should also consider designing regulatory frameworks that support efficiency improvements while preserving the developmental mandate of state-owned banks. For bank managers, the findings emphasize the importance of integrated performance management models that align risk governance, cost efficiency, and capital strategy within a unified institutional framework.

Although this study focuses on internal bank-specific variables, it is important to acknowledge that macroeconomic conditions such as economic growth, inflation, and

monetary policy rates also influence banking profitability. In the Indonesian context, state-owned banks operate within a policy-driven environment where fiscal stimulus programs, benchmark interest rate adjustments, and macroprudential regulations affect lending behavior and financial performance. Therefore, profitability dynamics should be interpreted within the broader macroeconomic framework, even though such variables are not directly incorporated into the present model.

Overall, the findings highlight that profitability in Indonesian state-owned banks is influenced not only by traditional financial ratios but also by the institutional characteristics of these banks. Their dual role as commercial institutions and agents of national development creates a unique balance between profitability, risk management, and economic policy objectives.

Indonesian state-owned banks play a dual role as profit-oriented institutions and agents of national development. Descriptive and quantitative analyses show that these banks exhibit strong financial performance, healthy credit quality, efficient cost management, and robust capitalization. Empirical results indicate that NPL has a positive and significant effect on ROA, BOPO has a negative and significant effect on ROA, and CAR has a positive but insignificant effect on ROA.

The positive impact of NPL reflects that credit risk in state-owned banks remains within manageable levels and does not undermine profitability, supported by average NPL values below the regulatory threshold. Operational efficiency remains the main constraint on profitability, while capital strength supports financial stability and growth capacity.

The empirical results indicate that Non-Performing Loans (NPL) have a positive and statistically significant effect on Return on Assets (ROA). At first glance, this finding may appear counterintuitive, as higher credit risk is generally expected to reduce bank profitability. However, this result can be interpreted through the concept of risk-based pricing, which suggests that banks may charge higher interest rates on loans that are perceived to carry greater risk. By adjusting lending rates according to the level of credit risk, banks may still maintain or even increase profitability despite higher levels of non-performing loans (Stiglitz & Weiss, 1981; Berger & DeYoung, 1997).

In addition, the institutional characteristics of state-owned banks may also help explain this relationship. State-owned banks often play a strategic role in supporting government development programs, including providing credit to priority sectors such as infrastructure, small and medium enterprises, and other development-oriented activities. These lending activities may involve higher credit risk but can still generate relatively stable returns due to government support, regulatory frameworks, or broader policy objectives (Vagliasindi, Cordella & Clifton , 2023; Chiu, B., & Lewis. 2006).

In addition, the institutional characteristics of state-owned banks may also help explain this relationship. State-owned banks often play a strategic role in supporting government development programs, including providing credit to priority sectors such as infrastructure, small and medium enterprises, and other development-oriented activities. These lending activities may involve higher credit risk but can still generate relatively stable returns due to government support, regulatory frameworks, or broader policy objectives

Furthermore, previous empirical studies have also reported similar findings, indicating that the relationship between credit risk and bank profitability may vary depending on institutional context, lending strategies, and market conditions. For example, several studies suggest that banks with effective risk management and pricing

strategies are able to manage higher credit risk without significantly reducing profitability (Berger & DeYoung, 1997; Athanasoglou, Brissimis, & Delis, 2008). Therefore, the positive relationship between NPL and ROA observed in this study may reflect the ability of Indonesian state-owned banks to balance credit risk with revenue generation strategies. Overall, these findings highlight that the relationship between credit risk and bank profitability is complex and may be influenced by institutional factors, risk management practices, and lending strategies. In the context of state-owned banks in developing economies, credit risk may coexist with profitability when banks are able to apply appropriate pricing mechanisms and maintain adequate financial management.

6. Conclusion

This study examines the determinants of profitability in Indonesian state-owned banks by analyzing the effects of Non-Performing Loans (NPL), Operational Efficiency Ratio (BOPO), and Capital Adequacy Ratio (CAR) on Return on Assets (ROA) during the period 2014–2024. The empirical results show that NPL has a positive and statistically significant relationship with ROA. This finding indicates that within the observed period, credit expansion accompanied by manageable levels of credit risk may coincide with higher bank profitability. Furthermore, BOPO shows a negative and statistically significant relationship with ROA, suggesting that variations in operational efficiency are closely associated with differences in bank profitability. Meanwhile, CAR demonstrates a positive but statistically insignificant relationship with ROA, implying that although capital adequacy is important for maintaining financial stability and regulatory compliance, it does not appear to have a direct association with profitability in the observed sample. Overall, the findings indicate that differences in profitability among Indonesian state-owned banks tend to be related to variations in credit risk conditions and operational efficiency, while capital strength appears to play a more supportive role in maintaining financial stability rather than directly influencing profitability

7. Theotical and Practical Implication

The findings of this study contribute to the literature on bank profitability by providing empirical evidence from the context of Indonesian state-owned banks. The positive association between NPL and profitability suggests that the relationship between credit risk and bank performance may vary depending on the institutional context, particularly in banking systems where credit expansion is linked to development-oriented lending programs. In addition, the results highlight the relevance of operational efficiency in explaining variations in bank performance. These findings extend existing theoretical discussions by emphasizing the importance of considering institutional characteristics when analyzing the determinants of bank profitability.

The findings provide important managerial implications for the management of state-owned banks in Indonesia. Bank managers need to strengthen credit risk monitoring and loan portfolio management to ensure that credit expansion remains within manageable risk levels and does not lead to excessive non-performing loans. At the same time, improving operational efficiency through effective cost control, process optimization, and the adoption of digital banking technologies is important to support better financial performance. Although capital adequacy does not appear to have a direct relationship with profitability, maintaining adequate capital buffers remains essential for

supporting business expansion, maintaining public confidence, and ensuring regulatory compliance. Therefore, bank management should adopt a balanced strategy that integrates prudent credit risk management, operational efficiency, and adequate capital strength to sustain long-term profitability

From a practical perspective, the findings provide insights for bank management and policymakers. Bank managers need to maintain prudent credit risk management to ensure that credit expansion remains within manageable risk levels. At the same time, improving operational efficiency remains important to support sustainable financial performance. For policymakers and regulators, the results highlight the importance of maintaining adequate capital buffers while ensuring that development-oriented lending programs implemented through state-owned banks remain consistent with sound risk management practices. The findings also have policy relevance, indicating that regulatory frameworks should continue to encourage prudent credit risk management and operational efficiency in state-owned banks to ensure that development-oriented lending programs can support economic growth without undermining financial sustainability.

8. Limitations and future research directions

This study is limited to internal financial variables and focuses only on state-owned banks. External macroeconomic factors such as inflation, GDP growth, interest rates, and regulatory changes are not included. In addition, the study does not empirically test interaction effects between capital adequacy and credit risk due to model parsimony and the limited number of cross-sectional observations, nor does it employ advanced dynamic panel estimation techniques such as Fixed Effects, Random Effects, or Generalized Method of Moments (GMM). The analysis is also constrained by the relatively small number of observations, as it covers only four state-owned banks over an eleven-year period. Although these banks represent the full population of listed state-owned commercial banks, the limited cross-sectional dimension may restrict broader generalization of the findings. Therefore, future research is encouraged to incorporate macroeconomic variables, examine interaction effects between key banking indicators, apply more advanced panel data approaches, and expand the dataset by using quarterly data, extending the observation period, or including comparative samples of private national banks in order to enhance robustness and external validity.

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