



PUBLISHER: <https://journal.adlermanurungpress.com/>

DOI: <https://doi.org/10.63607/jcmb.v14i2>

DETERMINANTS OF RISK ADJUSTED RETURN ON CAPITAL (RAROC) IN INDONESIAN BANKING COMPANIES LISTED ON THE INDONESIA STOCK EXCHANGE

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Abstrack

Risk Adjusted Return on Capital (RAROC) is a risk-based performance indicator used to assess the effectiveness of banks in generating returns that have been adjusted for the level of risk borne. In the Indonesian banking industry, the importance of risk-based performance measurement has increased in line with the growing complexity of credit risk, liquidity risk, and capital adequacy requirements. This study aims to analyze the influence of the Capital Adequacy Ratio (CAR), Non-Performing Loan (NPL), and Loan to Deposit Ratio (LDR) on RAROC in banking companies listed on the Indonesia Stock Exchange (IDX) during the period 2010–2024. The research applies a quantitative approach using panel data regression analysis. A sample of 16 banking companies was selected with 240 total observations. The results show that: (1) CAR has a negative and significant effect on RAROC; (2) NPL has a negative and significant effect on RAROC; (3) LDR has a positive but non-significant effect on RAROC; and (4) CAR, NPL, and LDR simultaneously have a significant effect on RAROC. The Random Effect Model (REM) was selected as the best model based on the Hausman and Lagrange Multiplier tests. These findings provide

empirical evidence that credit quality and capital efficiency are the primary determinants of risk-adjusted financial performance in Indonesian banking.

Keywords: *RAROC, Capital Adequacy Ratio (CAR), Non-Performing Loan (NPL), Loan to Deposit Ratio (LDR), Indonesian Banking Industry*

INTRODUCTION

The banking sector is one of the most fundamental financial pillars in driving a nation's economic growth. Through its intermediation function, banks play a crucial role in collecting funds from the public and channeling them back in the form of credit to those who need it (Suyasa et al., 2023). Stable and sound banking performance not only reflects the internal financial condition of the institution, but also serves as an important indicator of national financial system stability (Mulyo Haryanto, 2020). In an era of increasing globalization and economic integration, the Indonesian banking industry faces increasingly complex challenges intense competition, global monetary policy changes, financial market volatility, and rising credit risk resulting from economic uncertainty all demand that banks possess strong and efficient risk management systems.

One performance measure that can illustrate the extent to which banks effectively manage risk is Risk Adjusted Return on Capital (RAROC). This concept was first introduced by Bankers Trust in the 1970s and has since become one of the standard methods in risk-based performance measurement. RAROC measures the extent to which bank profits have been adjusted for the level of risk borne assessing not only how much profit is earned, but also how efficiently capital is used in generating profit while accounting for risk (Supriyadi, 2025; Tarigan & Manurung, 2024). In the context of Indonesian banking, risk management has become increasingly important following the global economic crisis and the COVID-19 pandemic. These crises exerted enormous pressure on the national financial system, particularly through increased credit risk, declining credit demand, and weakening asset quality (Ozili, 2025).

Three key indicators are widely recognized as having significant influence on RAROC: the Capital Adequacy Ratio (CAR), Non-Performing Loan (NPL), and Loan to Deposit Ratio (LDR). CAR indicates a bank's capital strength and its ability to absorb potential losses. Based on OJK data (2024), the average CAR of national banking stood at

26.8%, well above the regulatory minimum of 8%, indicating a strong capital base. NPL is the primary indicator of credit risk faced by banks, with high NPL signaling poor asset quality and increasing provisioning burdens. LDR reflects a bank's intermediation capacity, and if overly high, can generate liquidity risk without commensurate return improvement. This study aims to empirically analyze the influence of CAR, NPL, and LDR on RAROC in banking companies listed on the Indonesia Stock Exchange during the period 2010 – 2024.

THEORETICAL REVIEW

Risk Adjusted Return on Capital (RAROC)

RAROC is a financial performance metric that measures the level of return adjusted for risk against the economic capital allocated to absorb unexpected losses. RAROC provides a comprehensive view of bank performance by considering not only the return generated, but also the risk taken to generate it (Liu, 2025). According to Michetti (2020), RAROC is the ratio of risk-adjusted revenue to economic capital allocated to cover that risk. Uyemura (1996) defines RAROC as a performance measure that links the return generated with the risk taken, enabling apples-to-apples comparisons between various business units or products with different risk profiles. The RAROC formula is:

$$RAROC = (Revenue - Cost - Expected Loss) / Risk Required Capital$$

Capital Adequacy Ratio (CAR)

Capital Adequacy Ratio (CAR) is a bank performance ratio that measures a bank's capital adequacy in absorbing potential losses and supporting operational activities. CAR indicates how much of a bank's risk-weighted assets are financed by the bank's own capital (Suroso, 2022). According to Pervez et al. (2023), CAR is the ratio that describes a bank's ability to provide funds for business development and to absorb potential losses arising from banking operations. The higher the CAR, the stronger the bank's ability to bear risk from each credit or productive asset. The formula is: $CAR = Capital / Risk Weighted Assets (RWA) \times 100\%$.

Non-Performing Loan (NPL)

Non-Performing Loan (NPL) refers to credit that is not performing or experiencing problems specifically, credit classified as substandard, doubtful, or loss. High NPL values indicate low asset quality and an increasing provisioning burden, which directly suppresses net income. NPL is the primary indicator of credit risk faced by banks, and its management is essential for maintaining the quality of productive assets and protecting capital adequacy (Ashari & Arifin, 2020).

Loan to Deposit Ratio (LDR)

Loan to Deposit Ratio (LDR) measures a bank's ability to channel third-party funds into credit. An optimal LDR reflects efficient intermediation in generating income. However, if too high, LDR can increase both liquidity and credit risks that negatively impact risk-based performance. Therefore,

balance in LDR is crucial in determining risk-adjusted profitability. According to Piliang (2019), excessively high LDR can increase liquidity risk, while excessively low LDR suggests suboptimal intermediation function.

Hypothesis Development

Based on prior literature and theoretical foundations, the following hypotheses are formulated:

H1: Capital Adequacy Ratio (CAR) has a significant effect on RAROC.

H2: Non-Performing Loan (NPL) has a significant effect on RAROC.

H3: Loan to Deposit Ratio (LDR) has a significant effect on RAROC.

H4: CAR, NPL, and LDR simultaneously have a significant effect on RAROC.

The conceptual framework of this study positions CAR (X1), NPL (X2), and LDR (X3) as independent variables, while RAROC (Y) is the dependent variable, with both direct (H1, H2, H3) and simultaneous (H4) relationships examined.

METHODOLOGY

This study employs a quantitative approach using panel data regression analysis to examine the effect of CAR, NPL, and LDR on RAROC. The data are secondary data sourced from annual financial reports of banking companies listed on the Indonesia Stock Exchange (IDX) over the period 2010–2024.

The population consists of 46 general banks listed on the IDX during the study period. Using purposive sampling with the following criteria: (1) listed on IDX throughout 2010–2024, (2) having complete annual financial reports, (3) not delisting or undergoing mergers during the period, and (4) not classified as a purely sharia bank. The final sample comprises 16 banking companies with 240 total observations (16 banks $\times$ 15 years). The selected banks include BBKA, BBNI, BBRI, BMRI, BDMN, BJBR, BJTM, BNGA, BNII, BNLI, BTPN, BNBA, BBMD, BCIC, AGRS, and ARTO.

The analytical methods used include descriptive statistical analysis, stationarity testing (ADF-Fisher), panel data model selection (Chow test, Hausman test, Lagrange Multiplier test), classical assumption tests (normality, multicollinearity, heteroscedasticity, autocorrelation), and multiple linear regression. The regression equation is: $RAROC = \alpha + \beta_1 CAR + \beta_2 NPL + \beta_3 LDR + \varepsilon$. All analyses were performed using EViews software.

RESULTS

Descriptive Statistics

Descriptive statistical analysis reveals the following characteristics of the research variables. CAR (X1) has a mean of 0.2362 with a minimum of 0.0668 and maximum of 1.6988, indicating that banks generally maintained adequate capital levels well above the OJK minimum of 8%, though with

considerable disparity across banks. NPL (X2) has a mean of 0.0226 with a minimum of 0.0000 and maximum of 0.1285, showing that overall credit quality remained within OJK's 5% threshold, though some banks experienced significant credit stress. LDR (X3) has a mean of 0.8767 with a minimum of 0.1911 and maximum of 1.6306, indicating generally functional intermediation, though some banks channeled credit beyond their total third-party funds. RAROC (Y) has a mean of -0.0024 with a minimum of -0.4320 and maximum of 0.0673, reflecting that banks' ability to generate risk-proportionate returns was suboptimal on average, particularly during the COVID-19 pandemic.

Panel Data Model Selection

Three sequential tests were conducted to determine the best regression model. The Chow test comparing Common Effect Model (CEM) vs. Fixed Effect Model (FEM) yielded a probability value of 0.0000, indicating that FEM is superior to CEM. The Hausman test comparing FEM vs. Random Effect Model (REM) yielded a probability of 0.4859 (> 0.05), indicating that REM is more appropriate than FEM. The Lagrange Multiplier (LM) test comparing CEM vs. REM yielded a Breusch-Pagan statistic of 157.2042 with probability 0.0000, confirming the superiority of REM over CEM. Based on all three tests, Random Effect Model (REM) was selected as the most appropriate model for this study.

Table 1. Panel Data Model Selection Summary

Test	Models Compared	Probability	Selected Model
Chow Test	CEM vs. FEM	0.0000	Fixed Effect Model
Hausman Test	FEM vs. REM	0.4859	Random Effect Model
Lagrange Multiplier	CEM vs. REM	0.0000	Random Effect Model
Final Decision	—	—	Random Effect Model (REM)

Source: EViews Output (data processed, 2026)

Classical Assumption Tests

The normality test using the Jarque-Bera method yielded a value of 3.694201 with probability 0.157694 (> 0.05), confirming that the residuals are normally distributed. The multicollinearity test showed all inter-variable correlations well below 0.80 (CAR–NPL: -0.0585; CAR–LDR: 0.1142; NPL–LDR: -0.1827), indicating no multicollinearity problem. Heteroscedasticity was detected for NPL and LDR using the Glejser test; however, this was addressed through the REM-EGLS estimation method, which inherently accommodates variance differences in panel data. The Durbin-Watson value of 2.012837 indicates the absence of autocorrelation in the model.

Multiple Linear Regression Results

Based on the REM estimation, the regression equation obtained is: $\text{RAROC} = 0.036032 - 0.075576 \text{ CAR} - 1.199542 \text{ NPL} + 0.007455 \text{ LDR}$. The complete hypothesis test results are presented in Table 2.

Table 2. Multiple Linear Regression Results (Random Effect Model)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.036032	0.013320	2.705105	0.0073
CAR (X1)	-0.075576	0.013644	-5.539122	0.0000***
NPL (X2)	-1.199542	0.154551	-7.761453	0.0000***
LDR (X3)	0.007455	0.013604	0.548008	0.5842
F-statistic	29.86907	Prob(F)	0.000000***	—
R-squared	0.275200	Adj. R²	0.265987	—

Note: *** significant at 1% level. Source: EViews Output (data processed, 2026)

DISCUSSION

Effect of CAR on RAROC

CAR proved to have a negative and significant effect on RAROC (coefficient = -0.075576; t-statistic = -5.539122; prob. = 0.0000), leading to the acceptance of H1. This finding indicates that an increase in CAR is associated with a decrease in RAROC, contrary to the direction typically hypothesized. This negative relationship can be explained by the overcapitalization phenomenon: when banks hold excessive capital beyond regulatory requirements, the surplus funds tend not to be utilized productively, resulting in idle capital that reduces the efficiency of risk-adjusted return. This finding aligns with Bitar et al. (2017), who found that overcapitalization causes funds to be underutilized, reducing risk-adjusted return. Berger & Bouwman (2013) similarly showed that banks with high capital tend to be more conservative in credit disbursement, limiting earning potential. Manurung (2020) further confirmed that capital increases without commensurate productive asset efficiency enlarge the denominator in RAROC calculation, thereby reducing its value.

Effect of NPL on RAROC

NPL proved to have a negative and significant effect on RAROC (coefficient = -1.199542; t-statistic = -7.761453; prob. = 0.0000), leading to the acceptance of H2. NPL carries the largest coefficient in absolute terms among all variables, confirming that credit risk is the most dominant determinant of RAROC in this study. Higher NPL directly increases expected losses and expands the economic capital required to cover these losses, while simultaneously suppressing net income through increased provisioning (CKPN) requirements. This finding is consistent with Ozili (2025), who found that NPL has a negative effect on bank profitability; Serrano (2020), who demonstrated that NPL reduces RAROC by increasing economic capital allocation; and Singh et al. (2021), who confirmed that non-performing credit suppresses return through escalating provisioning costs and loss risk. The finding underscores that credit quality management is the most critical lever for improving risk-based banking performance in Indonesia.

Effect of LDR on RAROC

LDR showed a positive but non-significant effect on RAROC (coefficient = 0.007455; t-statistic = 0.548008; prob. = 0.5842), leading to the rejection of H3. Although the direction of the coefficient is positive suggesting that higher credit disbursement tends to slightly increase RAROC the effect is statistically negligible. This indicates that increasing credit volume alone is insufficient to drive risk-based financial performance. When LDR increases without corresponding improvements in credit quality, it may simultaneously raise liquidity risk, offsetting any potential income gains. This finding aligns with Rajindra et al. (2021), who found LDR positively but non-significantly associated with profitability in Indonesian private banks; Sari & Septiano (2020), who demonstrated that LDR's effect on profitability operates indirectly through mediating variables; and Liyundira & Yulianti (2023), who found that in conventional Indonesian banking, LDR is not a primary determinant of profitability when NPL exerts more dominant influence.

Simultaneous Effect of CAR, NPL, and LDR on RAROC

The F-test result (F-statistic = 29.86907; prob. = 0.000000) confirms that CAR, NPL, and LDR jointly have a significant effect on RAROC, supporting H4. This finding demonstrates that risk-based banking performance is not determined by a single factor but emerges from the interaction of capital adequacy, credit quality, and intermediation efficiency. The Adjusted R-squared value of 0.265987 indicates that approximately 26.6% of the variation in RAROC is explained by the three independent variables. The remaining 73.4% is attributable to factors outside the model, such as BOPO (operational efficiency ratio), NIM (net interest margin), bank size, interest rates, and inflation. Notwithstanding this moderate explanatory power, the simultaneous significance confirms the model's validity and the relevance of all three indicators as joint determinants of RAROC.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

Based on the analysis of the influence of CAR, NPL, and LDR on RAROC in 16 Indonesian banking companies listed on the IDX over the period 2010–2024 with 240 observations, the following conclusions are drawn:

1. CAR has a negative and significant effect on RAROC. Banks with excessively high capital ratios tend to experience idle capital, reducing the efficiency of risk-adjusted returns.
2. NPL has a negative and significant effect on RAROC, and proves to be the most dominant variable. High non-performing loans increase expected losses, provisioning burdens, and economic capital requirements, all of which suppress RAROC.
3. LDR has a positive but non-significant effect on RAROC, indicating that credit volume expansion alone does not meaningfully drive risk-based performance.

4. CAR, NPL, and LDR simultaneously have a significant effect on RAROC, confirming that risk-based banking performance is shaped by the combined interaction of capital adequacy, credit quality, and intermediation function.

Recommendations

For bank management: capital should be maintained at an optimal level rather than merely maximized, with emphasis on productive capital allocation. Credit risk management must be prioritized through tighter credit assessment, periodic monitoring, and enhanced technology-based risk management systems. For regulators (OJK and Bank Indonesia): policies should emphasize not only capital adequacy but also the efficiency of capital deployment, and supervisory efforts on credit quality should be strengthened. For investors: risk-adjusted indicators such as RAROC should be considered alongside conventional profitability ratios when evaluating bank performance. For future researchers: additional variables such as BOPO, NIM, bank size, interest rates, and inflation should be incorporated, along with expanded samples and more complex analytical methods to provide a more comprehensive picture of risk-based banking performance determinants.

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