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Credit Risk Capital and Interest Rates Shape Bank Net Interest Margin

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Abstract

General Background: Banking profitability is a critical indicator of financial system resilience and intermediation efficiency in emerging economies. **Specific Background:** Net Interest Margin (NIM) reflects banks' ability to manage credit risk, capital adequacy, and macroeconomic fluctuations, particularly during periods of economic uncertainty in Indonesia's banking sector from 2015–2024. **Knowledge Gap:** Previous studies have generally examined internal banking factors or macroeconomic variables separately, while limited evidence integrates credit risk, capital adequacy, interest rates, and inflation simultaneously in explaining NIM dynamics among Indonesian commercialbanks. **Aims:** This study analyzes the relationships between Non-Performing Loans (NPL), Capital Adequacy Ratio (CAR), interest rates, inflation, and NIM using balanced panel data from 12 Indonesian commercial banks during 2015–2024. **Results:** Panel data regression using the Random Effect Model shows that NPL has a negative and significant relationship with NIM, indicating that rising credit risk reduces bank profitability through higher provisioning costs and lower net interest income. CAR demonstrates a positive but statistically insignificant relationship with NIM, suggesting that capital mainly functions as a stability buffer rather than a direct profitability driver. Interest rates also show an insignificant relationship with NIM, indicating indirect monetary policy transmission to banking margins. **Novelty:** This study integrates microprudential banking indicators and macroeconomic variables within a unified panel regression framework to explain NIM behavior in Indonesian commercialbanks. **Implications:** The findings highlightthe strategic importance of credit risk management and financial system stability for sustaining banking profitability and supporting effective banking intermediation.

Highlights:

- Rising non-performing loans reduced banking profitability through higher provisioning pressure.
- Capital resilience primarily functioned as a financial stability buffer across commercial banks.
- Monetary policy transmission to banking margins occurred indirectly during the observation period.

Keywords: Net Interest Margin, Credit Risk, Capital Adequacy Ratio, Interest Rates, Indonesian Commercial Banks

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Introduction

Global economic dynamics characterized by technological innovation, changes in the business environment, and increasing uncertainty have increased the risk exposure faced by financial institutions. This situation has had a significant impact on the banking industry, given its role as the backbone of the financial system and a key driver of economic growth. Therefore, banking sector stability is seen as a primary prerequisite for macroeconomic stability and sustainable economic growth.

Banking profitability is a key indicator in assessing bank resilience and sustainability. One key measure of profitability is the net interest margin (NIM), which reflects the efficiency of the intermediation function and the bank's ability to manage interest rate risk, credit risk, and funding structure. NIM is a central indicator of bank intermediation performance [1]. Empirically, there have been significant fluctuations in the NIM development of commercial banks in Indonesia during the 2015–2024 period across banks and over time, with sharp pressure in 2020–2021 due to the COVID-19 pandemic, before experiencing a gradual recovery post-2021 (Figure 1). This pattern indicates that the ability to manage productive assets and funding structure are crucial factors in maintaining bank profitability.

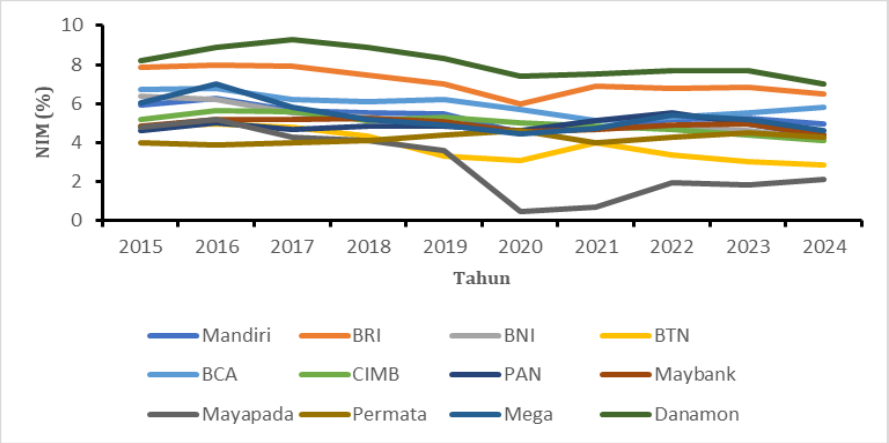

Figure 1. Net interest margin NIM of Commercial Banks in Indonesia

Credit risk is a key determinant of banking performance, particularly during periods of economic turmoil. A systemic increase in credit risk could trigger banking instability and have spillover effects across the financial system [2]. Consistent with this view, the sharp increase in non-performing loans (NPLs) in 2020–2021 reflects the deterioration in credit quality due to the economic contraction (Figure 2). This increase in NPLs negatively impacted the net interest margin (NIM) through increased provisioning costs and decreased net interest income.

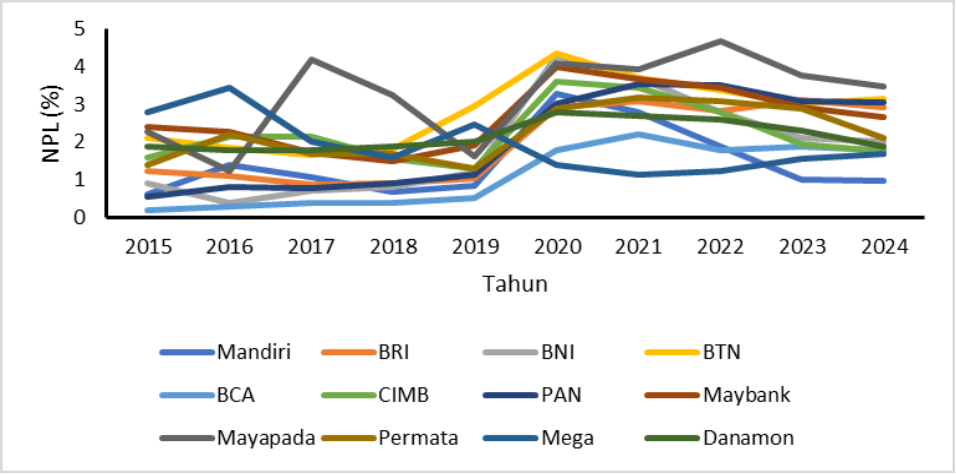

Figure 2. Non-performing loans (NPL) of Commercial Banks in Indonesia

In terms of capital resilience, the capital adequacy ratio (CAR) of commercial banks in Indonesia generally exceeded the regulatory minimum throughout the observation period (Figure 3). The capital adequacy serves as a primary buffer to absorb losses and maintain confidence in the banking system [3]. However, variations in CAR between banks reflect differences in capital management strategies that could potentially impact profitability.

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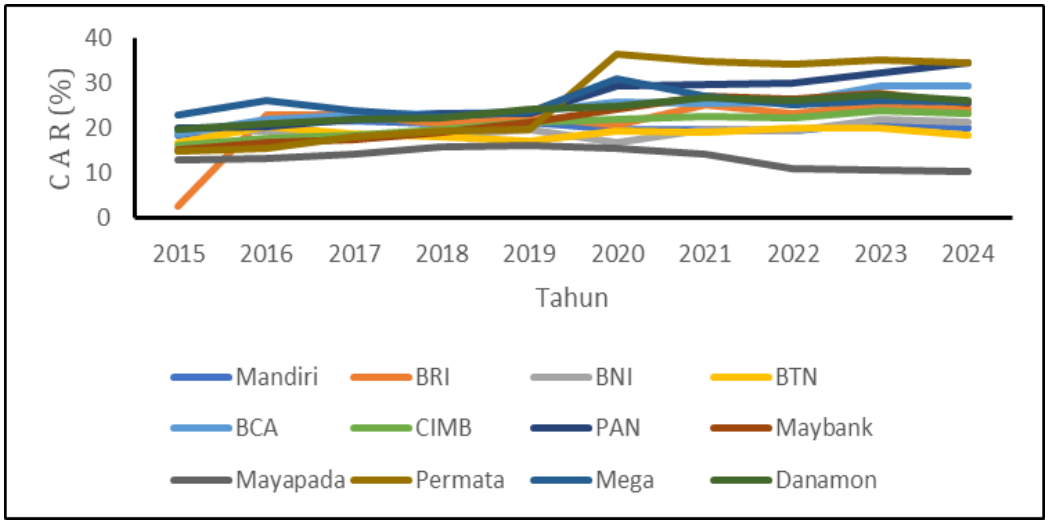

Figure 3. Capital adequacy ratio (CAR) of Commercial Banks in Indonesia

Within a macroeconomic framework, monetary policy plays a crucial role in influencing the performance of banking intermediation. The effectiveness of monetary policy transmission is highly dependent on the health of the banking sector through the interest rate and credit channels [4] [5]. Bank Indonesia's policy interest rate declined to its lowest point in 2020–2021 in response to the economic slowdown, then increased again in 2022–2024 (Figure 4). These interest rate changes directly affect banks' cost of funds and interest income, thus impacting the dynamics of their net interest margin (NIM).

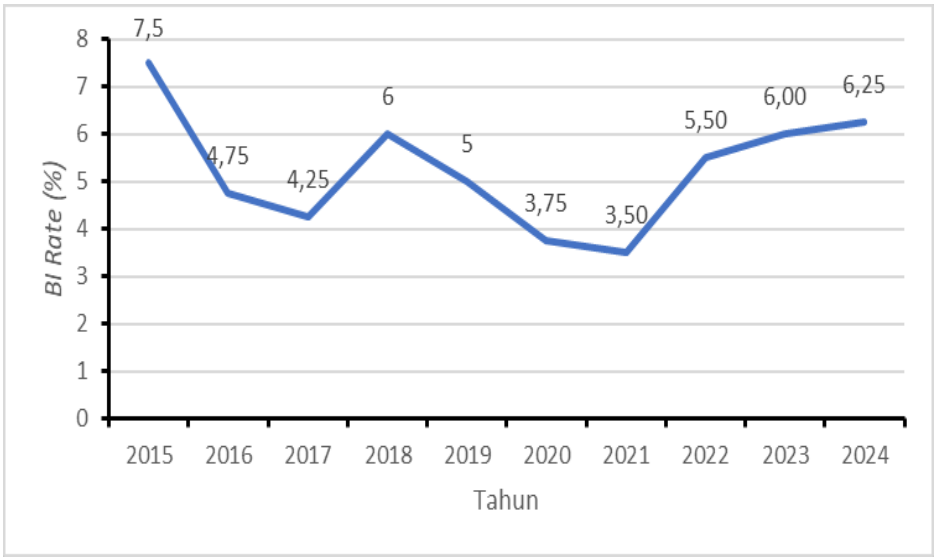

Figure 4. Bank Interest Rates in Indonesia for the period 2015-2024

Overall, banking profitability, as measured by the Net Interest Margin (NIM), is influenced by a combination of internal bank factors—such as Non-Performing Loans (NPL) and Capital Adequacy Ratio (CAR)—and external macroeconomic factors—such as interest rates. The interaction of microprudential risk and macroeconomic conditions is key to maintaining the stability and performance of the national banking system [6]. Therefore, this study aims to analyze the influence of NPL, Capital Adequacy Ratio (CAR), and interest rates on NIM at 12 commercial banks in Indonesia during the period 2015–2024.

Method

This study uses a quantitative approach with a causality design, utilizing balanced panel data from 12 commercial banks in Indonesia for the period 2015–2024, obtained from the banks' annual reports, the Financial Services Authority (OJK), Bank Indonesia, and the Central Statistics Agency. The analysis was conducted using panel data regression to examine the effect of non-performing loans (NPLs), capital adequacy ratio (CAR), interest rate policy, and inflation on net interest margin (NIM). The operational definitions of each variable are presented in Table 1.

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Table 1. Summary of operational definitions of variables

Variables	Operational Definition	Measurement	Source
NIM	Bank profitability	Net interest income/ productive assets	Bank report
NPL	Credit risk	Non-performing loans/ total credit	OJK/Bank
CAR	Capital adequacy	Capital / ATMR	Bank report
IR	Interest rate policy	BI Rate / BI7DRR	Bank Indonesia

This study uses panel data regression analysis to examine the influence of credit risk, capitalization, and macroeconomic factors on bank financial performance. The regression equation model is formulated mathematically in Equation (1), which explains the functional relationship between the dependent and independent variables as follows:

$$NIM_{it} = \beta 0 + \beta 1 NPL_{it} + \beta 2 CAR_{it} + \beta 3 IR_{t} + \beta 4 INF_{t} + \varepsilon_{it} \quad (1)$$

where β0 is a constant; NIM is the net interest margin as a proxy for bank financial performance; NPL represents non-performing loans as a measure of credit risk; CAR indicates the capital adequacy ratio; IR is Bank Indonesia's interest rate policy proxied by the BI 7-Day Reverse Repo Rate; *i* indicates the cross-sectional unit (bank); t indicates the time period; and ε is the error term

The analysis technique used in this study is panel data regression with the Random Effect Model (REM) approach. The REM approach has the advantage of accommodating differences in characteristics between banks that are random and uncorrelated with the independent variables, resulting in more efficient parameter estimates and enabling the generalization of research results to a wider bank population. To determine the most appropriate estimation method among the Common Effect Model, Fixed Effect Model, and Random Effect Model, this study uses the Chow test, the Hausman test, and the Lagrange Multiplier (LM) test. In addition, stationarity tests and classical assumption tests are conducted to ensure that the error components in the REM model meet the Best Linear Unbiased Estimator (BLUE) assumptions, so that the resulting parameter estimates are efficient and reliable.

Results and Discussion

A. Results

1. Research result

This study uses an econometric approach through panel data regression to examine the relationship between NIM and NPL, CAR, and IR. The tests performed include statistical tests including the coefficient of determination, t-test, and F-test, as well as econometric tests including classical assumption testing to ensure the validity of the regression model.

2. Descriptive Statistics

The descriptive statistics in Table 2 provide an overview of the characteristics of the variables in this study, including credit risk, capital adequacy, and interest rate policy. This analysis includes the mean, median, maximum, minimum, and standard deviation values, as well as the probability distribution represented by skewness, kurtosis, and the Jarque-Bera test.

Table 2. Descriptive Statistics

Description	NIM	NPL	CAR	IR
Mean	5.219000	2.151583	21.96683	5.250000
Median	5.010000	1.980000	21.47500	5.250000
Maximum	9.300000	4.700000	36.70000	7.500000
Minimum	0.470000	0.200000	2.590000	3.500000
Std. Dev.	1.511194	1.060457	5.484398	1.182861
Skewness	0.029433	0.225668	0.130712	0.206502
Kurtosis	4.241397	2.194289	4.186510	2.221816
Jarque-Bera	7.722663	4.264373	7.380740	3.880710
Observasi	120	120	120	120

Descriptive statistics (Table 2) show that the average NIM was 5.22%, with a minimum value of 0.470 and a maximum value of 9.30, with moderate volatility, reflecting the stability of banking intermediation performance during the observation period. The NIM distribution was relatively symmetrical, although not completely normal. NPL averaged 2.15%, indicating relatively controlled credit risk, with a minimum value of 0.200 and a maximum value of 4.70, while CAR averaged 21.97% with a minimum value of 2.60 and a maximum value of 36.70, indicating strong banking capital conditions but with quite high variation. External macroeconomic factors showed that interest rates were relatively stable with an average of 5.25%, a minimum value of 3.50 and a maximum value of 7.50. Overall, these descriptive results confirm the existence of variations in both internal banking factors and macroeconomic factors that potentially influence NIM dynamics.

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3 . Regression Testing Using the Random Effects Model (REM)

The results of the Random Effects Model (REM) regression test are shown in Table 3 below.

Table 3. Random Effects Model (REM) Results

Dependent Variable = NIM			
Independent Variables	*Coefficient*	*Std. Error*	*t-Statistic*
Constant	5.320422***	0.644260	8.258187
NPL	-0.282459***	0.083834	-3.369276
CAR	0.021417**	0.016789	1.275653
IR	0.047490**	0.058163	0.816488
Cross Section Effect			
Mandiri	-0.047675		
BRI	1.824658		
BRI	-0.125874		
BNI	-1.081915		
BTN	0.363063		
BCA	-0.174229		
CIMB	-0.481253		
PAN	-0.177743		
Maybank	-1.784609		
Mayapada	-1.044369		
Permata	-0.018838		
Mega	2.748784		
Danamon	-0.047675		
Effect Specifications			
R-squared	0.219126		
Adjusted R-squared	0.191965		
S.E. of regression	0.677680		
F-statistic	8.067708		
Prob(F-statistic)	0.000009		
Durbin-Watson stat	0.219126		
Model Selection			
Chow test	0.0000		
Hausman test	1.0000		
Diagnostic Tests	**Stat.**	**Prob.**	
Diagnostic Tests	7.9584	0.01870	
Breusch-Pagan LM test	262.5961	0.0000	

The results of the regression model obtained the following results

$$NIM = 5.320422 - 0.282459*NPL + 0.021417*CAR + 0.047490*IR + \varepsilon_{it}$$

The results of panel data regression estimation using the Random Effect Model (FEM) show that the intercept/constant value is positive (+), this indicates that NIM will increase by 5.32 percent if all independent variables are constant, then on average all independent variables will increase by 5.32 percent. The NPL coefficient value is negative (-) with a value of 0.282 percent significant to NIM, this means that if the NPL variable value decreases by one percent, then the NIM variable is estimated to decrease by 0.282 percent, and vice versa, assuming other variables are constant. At the constant value of the CAR variable regression, the value is positive (+) at 0.0214 percent, indicating that if the CAR variable increases, the NIM variable will increase by 0.02141 percent. Furthermore, the value of the IR variable is positive (+) at 0.047490 percent, meaning that if the IR variable increases, the NIM variable will increase by 0.047490 percent.

B. Discussion

1. Non-Performing Loans and Net Interest Margin

The results of the random effects model (REM) test show that the Prob. 0.000 value is below the critical value of 0.05 (p-value 0.0010 < 0.05), and the t-statistic is negative (-) at -3.37 < 1.98 (Table 3). These results indicate that non-performing loans (NPLs) significantly impact net interest margin (NIM). An increase in NPLs actually leads to a decrease in the bank's NIM.

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The significant influence of NPLs on NIM reflects that the concept of risk management regarding credit quality is a primary determinant of bank interest profitability. An increase in NPLs increases the risk of default and encourages the formation of allowances for impairment losses (CKPN), which ultimately depresses net interest income. Consequently, NIM is significantly depressed. High NPLs require banks to establish allowances for impairment losses (CKPN). High CKPN can reduce operating income, reduce capital available for productive lending, and thus lower NIM. When NPLs rise, banks tend to be more cautious in disbursing credit by tightening borrower selection. This has slowed credit growth and suboptimal interest income. This situation has led to a decline in the net interest margin (NIM), so banks with higher NPL levels tend to have narrower interest margins. These findings confirm that credit risk management plays a more important role than mere credit expansion in maintaining bank intermediation performance.

The findings of this study are consistent with various international studies showing that increased credit risk directly increases provisioning costs and depresses net interest income. The banks with high levels of non-performing loans tend to have lower interest margins due to increased risk costs and a decline in the quality of productive assets [7] [8]. Similar findings were also obtained [9] [10], who confirmed that credit risk is the most dominant bank-specific factor explaining cross-country variations in NIM. Thus, the results of this study reinforce the view that bank interest profitability is highly sensitive to credit quality, not solely to asset expansion or capital conditions.

2. Capital Adequacy Ratio and Net Interest Margin

The random effects model (REM) test value shows a Prob. 0.2046 value above the critical value of 0.05 (p-value 0.2046>0.05), and the t-statistic value is 1.276<1.98 (Table 3). These results indicate that the capital adequacy ratio (CAR) has no effect on the net interest margin (NIM). This indicates that bank capital serves more as a stability and risk buffer than as a direct determinant of interest margin. The relatively high and stable CAR level among banks during the observation period reduced the variation in its effect on NIM.

Furthermore, regulatory capital policies encourage banks to meet minimum thresholds, rather than optimize interest margins. This finding indicates that increased capital does not automatically translate into improved intermediation efficiency or interest margins [16].

The insignificance of CAR on NIM aligns with several international studies showing that capital plays a greater role as an instrument of financial stability than as a direct determinant of interest margins. CAR is important for bank resilience, its effect on NIM is often weak or insignificant when capital levels are relatively high and homogeneous [11] [9] . This suggests that capital policy is regulative and aims to maintain solvency, rather than optimize interest profitability. Thus, the results of this study are consistent with the literature that conceptually separates stability objectives (CAR) from profitability objectives (NIM) [15].

3. Interest Rates and Net Interest Margin

Meanwhile, the random effects model (REM) test yielded a Prob. value of 0.4159, which is above the critical value of 0.05. Therefore, the Prob. value is (0.4159 > 0.05), and the t-statistic is positive, at 0.816 (Table 3). The findings indicate no effect between interest rates and net interest margin (NIM).

The lack of a significant effect of interest rates on NIM indicates that monetary policy transmission to bank interest margins is indirect. Banks tend to adjust interest rates gradually and asymmetrically, so changes in policy rates have a greater impact on credit volume than on net interest spreads. This indicates the existence of an interest rate smoothing mechanism, where banks maintain stable interest margins or interest income amidst fluctuations in monetary policy.

The findings of this study support the finding that monetary policy transmission is weak to bank interest margins. The banks tend to engage in interest rate smoothing, so changes in policy rates have a greater impact on credit volume than on net interest margins [8] [12]. In this context, policy rates are not always translated symmetrically into lending and deposit rates, thus limiting their impact on NIM. This finding confirms that monetary policy works indirectly on bank profitability, particularly in countries with competitive banking structures and strict regulations.

Empirical studies in various markets show that increasing NPLs tend to put pressure on interest margins, as banks have to set aside reserves for non-performing loans, thereby reducing net interest income [13] [14].

Conclusion

These results align with numerous international studies that find that non-performing loans (NPLs) and credit risk are significant determinants of bank interest margins, while capital, the capital adequacy ratio (CAR), and interest rates show inconsistent results globally. Several studies in Asia have found that the effect of CAR on NIM is weak or insignificant, while monetary policy transmission to interest margins is often indirect through other mechanisms such as price expectations and market competition. These findings strengthen the argument that bank intermediation performance is more determined by credit risk management than by monetary policy and capital instruments alone.

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