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The Influence of Macroeconomics on Credit Risk with Bank Size as a Moderating Variable

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Abstract

This study is motivated by the vulnerability of regional development banks to credit risk amid macroeconomic fluctuations and the inconsistency of previous research findings. The aims of this study is to analyze the effects of inflation, gross domestic product, exchange rates, and the policy interest rate on credit risk, as well as the moderating role of bank size in 27 regional development banks in Indonesia during the 2020–2024 period. The study employs a causal quantitative approach using a saturated sampling technique (524 observations) and Moderated Regression Analysis. The results show that inflation, gross domestic product, and the policy interest rate have a positive and significant effect on credit risk, while the exchange rate has a negative and significant effect. Bank size is proven to moderate all macroeconomic variables by weakening the effects of inflation, gross domestic product, and the policy interest rate, while strengthening the effect of exchange rates on credit risk. These findings imply that strengthening bank assets and size is a crucial factor in enhancing the resilience of regional development banks in facing economic pressures to maintain credit quality stability.

Keywords

Bank Size, BI-Rate, Credit Risk, Exchange Rate, Gross Domestic Product, Inflation.

1. Introduction

Banks are vital institutions in the economy, acting as financial intermediaries that channel funds from surplus units to deficit units. However, the banking sector in Indonesia is highly vulnerable to credit risk, which remains a major challenge for banks, including Regional Development Banks (*Bank Pembangunan Daerah*/BPD). Credit risk arises when borrowers fail to meet their obligations, potentially threatening bank stability and the broader financial system (Djohanputro, 2008; Kasmir, 2015).

According to the Indonesian Banking Surveillance Report Quarter IV 2024, credit risk showed improvement as reflected in the gross NPL ratio, which declined from 2.19% to 2.08%. However, this decline was not driven by a reduction in nominal NPLs (Barus, 2016). Instead, nominal NPLs increased by 5.12% (yoy), compared to a contraction of -1.02% (yoy) in the previous year. This indicates that the decrease in the NPL ratio was mainly due to higher credit growth rather than actual improvement in credit quality. Therefore, this condition suggests the need for a deeper understanding of the factors influencing credit risk.

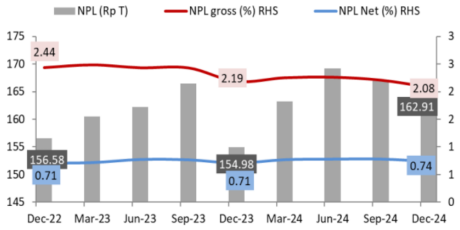

Figure 1. Trend of Gross NPL and Net NPL Ratios

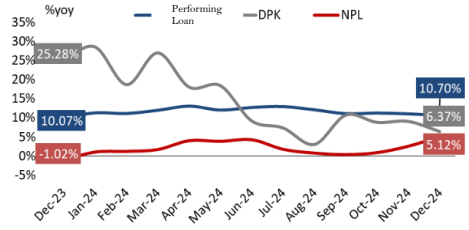

Figure 2. Nominal Growth in Credit Quality

Source: Indonesian Banking Surveillance Report - Q4 2024

Based on Figures 1 and 2, the decline in the gross NPL ratio is mainly attributed to stronger credit growth relative to the rise in nominal NPLs, highlighting the need to examine underlying determinants. Credit risk, commonly proxied by Non-Performing Loans (NPLs), reflects the quality of a bank's credit portfolio, including substandard, doubtful, and loss loans (Zeng, 2012). These arise when borrowers fail to meet repayment obligations and often require restructuring (Margaretha & Kalista, 2016). Beyond internal factors, credit risk is significantly shaped by macroeconomic conditions (Castro, 2013). This study emphasizes inflation, GDP, exchange rates, and the BI-Rate. Inflation reduces purchasing power (Mankiw, 2006), GDP indicates income and repayment capacity, exchange rates affect external exposure, and the BI-Rate influences interest rates and liquidity (Bank Indonesia, 2016).

Despite their importance, previous studies have produced inconsistent findings regarding the relationship between macroeconomic variables and credit risk Lubis and Mulyana (2021). Linda et al. (2017) found that inflation, exchange rates, unemployment, and interest rates had a significant positive effect on NPLs, while GDP had an insignificant negative effect. In contrast, Kusmayadi et al. (2018) reported that only GDP had a significant negative effect on NPLs, whereas Kusnandar et al. (2019) found a significant positive effect of GDP on NPLs. These conflicting results highlight a research gap and indicate the need for further investigation. To address this inconsistency, this study introduces bank size as a moderating variable, representing microeconomic factors measured by total assets (Astutiningsih & Baskara, 2019).

Bank size is considered an important factor because it reflects differences in capital strength, diversification, and risk management capacity. Larger banks tend

to have better resilience to economic shocks. Falestiya and Arifin (2024) found that bank size positively affects profitability, while Tandeas and Setyawan (2024) showed that it negatively influences risk-taking, including credit risk. These findings suggest that bank size may strengthen or weaken the relationship between macroeconomic variables and credit risk.

This study focuses on Regional Development Banks (BPD), which are owned by provincial governments and play a key role in supporting regional development. As of 2024, there are 27 BPDs, consisting of 24 conventional banks and 3 Islamic banks, with continuously growing assets and credit portfolios. However, BPDs recorded the highest NPL ratio at 2.48%, with particularly high risk in working capital loans reaching 7.78%, exceeding the OJK threshold of 5%. Similarly, for Investment Loans (KI), although the NPL ratio was less than 5%, BPD had the highest NPL ratio at 2.45%. The expansion of BPD lending into productive sectors has increased exposure to economic fluctuations, making them relevant objects for analysis.

The study aims to analyze the effect of macroeconomic variables namely inflation, gross domestic product, exchange rates, and the BI-Rate on credit risk as measured by NPLs, and to examine the role of bank size as a moderating variable in strengthening the resilience of Regional Development Banks against macroeconomic pressures during the period 2020–2024.

2. Literature Review and Hypothesis Development

2.1. Inflation, Gross Domestic Product, and Credit Risk

Inflation is a general and persistent increase in the prices of goods and services, leading to a decline in people's purchasing power, especially when income does not increase commensurately (Mankiw, 2006). This decline in purchasing power directly impacts borrowers' ability to meet their credit obligations to banks. Numerous empirical studies have shown that inflation has a positive and significant effect on Non-Performing Loans (NPLs), an indicator of bank credit risk. Albra et al. (2018), Naibaho and Rahayu (2018), and Leka et al. (2019) demonstrated that rising inflation tends to be followed by an increase in non-performing loans due to the declining repayment capacity of borrowers from various economic sectors. From an agency theory perspective Eisenhardt (1989), and Jensen and Meckling (2019) high NPLs indicate poor credit management by bank management. Inflation increases default risk, while signaling theory suggests rising NPLs send negative signals about bank stability (Komariah, 2016).

Gross Domestic Product (GDP) has a negative relationship with the level of NPL. Simons and Rolwes (2009) state that when GDP increases, NPL levels tend to decrease, thus improving bank health. This is in line with Riyanto and Asakdiyah (2016), who explains that increasing GDP is accompanied by increased public income, thereby strengthening the ability to save and repay loans, ultimately reducing bank credit risk. Conversely, during economic slowdowns or recessions marked by declining public income, borrowers' repayment capacity weakens, leading to higher NPL levels (Ginting, 2017; Naibaho & Rahayu, 2018; Szarowská, 2018). From an agency theory perspective, Jensen and Meckling (2019) argue that favorable economic conditions reduce moral hazard and improve credit management quality. Meanwhile, signaling theory suggests that rising GDP sends positive signals regarding bank stability, reflected in lower NPL levels.

H1: Inflation has a positive effect on credit risk.
H2: Gross domestic product has a negative effect on credit risk.

2.2. Exchange Rates and Credit Risk

The exchange rate has a positive relationship with the level of non-performing loans. When the domestic currency depreciates against the US dollar, the payment burden on debtors with obligations in foreign currencies increases, potentially increasing the risk of default. Syahid (2016), Rahmat and Hamin (2019), and Sinaga et al. (2020) demonstrated that the exchange rate has a positive effect on NPLs. This means that a weakening exchange rate tends to be followed by an increase in non-performing loans.

Naibaho and Rahayu (2018) further explain that the depreciation of the rupiah against the US dollar significantly increases the financial burden on debtors with foreign currency obligations. As the exchange rate weakens, the amount of rupiah needed to repay dollar-denominated debt rises, reducing borrowers' repayment capacity. This condition heightens the risk of default and contributes to increasing NPL levels, particularly in banks with substantial foreign currency lending exposure. From an agency theory perspective, exchange rate fluctuations can increase uncertainty and the risk of moral hazard in bank credit management (Jensen & Meckling, 2019). Meanwhile, signaling theory explains that unstable exchange rates and increasing NPLs are negative signals to investors and stakeholders regarding declining bank performance and credibility (Bergh et al., 2014).

H3: Exchange rate has a positive effect on credit risk.

2.3. BI-Rate and Credit Risk

The BI-Rate is an interest rate policy that reflects Bank Indonesia's monetary policy stance and is announced to the public as a benchmark for bank interest rate movements (Bank Indonesia, 2016). Increases in the BI-Rate tend to be followed by increases in lending rates, thereby increasing borrowers' interest burden and reducing their ability to repay. Adam (2021) and Tarchouna et al. (2022) explains that increases in lending rates make credit more expensive, increasing the potential for default and driving up Non-Performing Loans (NPLs). This aligns with research by Nurismalatri (2014) and Rizal and Zulham (2019), which found that the BI-Rate had a positive and significant effect on credit default, leading to increased bank credit risk.

However, the BI-Rate did not always have a significant partial effect on NPLs, although it did, along with other macroeconomic variables, influence NPLs. This suggests that the BI-Rate's influence on credit risk is also influenced by overall macroeconomic conditions. From an agency theory perspective, fluctuations in the BI-Rate can increase the risk of moral hazard in credit management by bank management (Jensen & Meckling, 2019). Meanwhile, signaling theory explains that an increase in the BI-Rate followed by an increase in NPLs is a negative signal to investors and depositors regarding declining bank performance and stability (Putra, 2021).

H4: BI-Rate has a positive effect on credit risk

2.4. Bank Size as a Moderating Variable

Banking credit risk, as reflected in the non-performing loan ratio, is influenced by various macroeconomic factors, including inflation, GDP, exchange rates, and the BI Rate (Castro, 2013). However, the influence of these factors on credit risk is not uniform across banks, as it is influenced by internal characteristics, one of which is bank size. High inflation increases the cost of living and reduces purchasing power, weakening borrowers' ability to meet their credit obligations. This situation has the

potential to increase NPLs and undermine bank health (Demirgüç-Kunt & Detragiache, 1998; Ningsih & Dewi, 2020).

Gross domestic product reflects economic growth. An increase in GDP indicates improving economic conditions and rising public income, thus strengthening borrowers' ability to repay loans and reducing NPLs (Purba & Darmawan, 2020). Sukesi (2019) stated that large banks are better able to manage the impact of economic fluctuations because they have stronger resources and supervisory systems.

Exchange rate fluctuations, particularly rupiah depreciation, increase the payment burden on debtors with foreign currency obligations, potentially increasing non-performing loans (Sefriyani & Khoirudin, 2021). Chan et al. (2010) and Khamisah et al. (2020) emphasized that large banks have better diversification and risk management capabilities in the face of exchange rate volatility. Furthermore, the BI-Rate, as a monetary policy instrument, influences the cost of funds and lending interest rates. An increase in the BI-Rate increases debtors' loan burdens, potentially increasing NPLs (Barus, 2016; Sugiarso & Setiyono, 2024).

From an agency theory perspective, fluctuating macroeconomic conditions can increase the risk of moral hazard and conflicts of interest between bank management (agents) and bank owners (principals) (Jensen & Meckling, 2019). Bank size plays a role in strengthening the effectiveness of risk monitoring and control. Thus, bank size acts as a moderating variable influencing the relationship between inflation, GDP, exchange rates, and the BI Rate on bank credit risk (Ad'hadini & Kusumawardhani, 2016).

H5: Bank size moderates the effect of inflation on credit risk
H6: Bank size moderates the effect of gross domestic product on credit risk
H7: Bank size moderates the effect of exchange rates on credit risk
H8: Bank size moderates the effect of the BI-Rate on credit risk

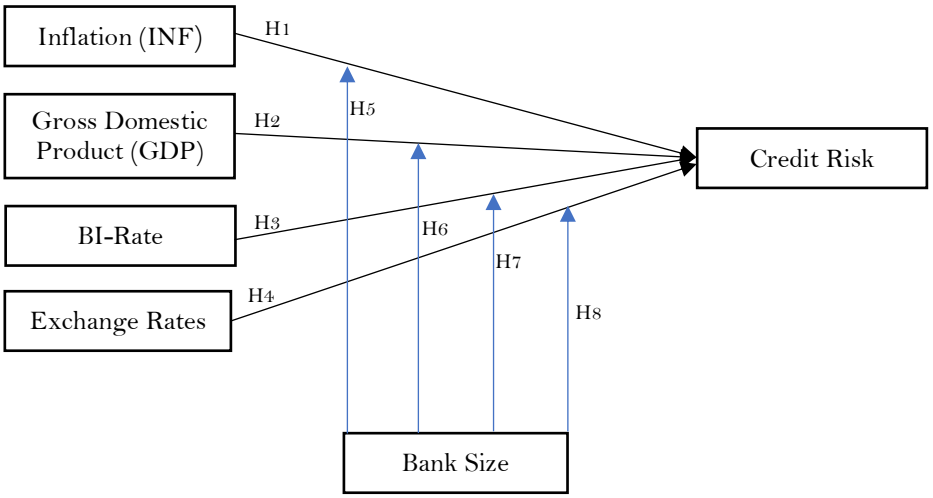

Figure 3. Conceptual Framework

Figure 3 shows a research model depicting the hypothesized relationship between variables. Credit risk is the dependent variable, while inflation, gross domestic product, the exchange rate, and the BI-Rate are independent variables that theoretically have a direct influence on the dependent variable. Furthermore, bank size is positioned as a moderating variable. This means that bank size is assumed to influence or alter the strength of the relationship between the independent variables (inflation, gross domestic product, the exchange rate, and the BI-Rate) and credit risk. The model visually represents these direct and moderating influences through connecting arrows.

3. Methods

This study employs a quantitative causal approach aimed at examining hypotheses about the effects of one or more independent variables on a dependent variable (Sugiyono, 2019). Specifically, it investigates whether inflation, gross domestic product, exchange rates, and the BI-Rate influence credit risk, while also considering bank size as a moderating variable in these relationships.

The object of this study was all 27 regional development banks in Indonesia from 2020 to 2024. The sampling technique used was saturated sampling, where all members of the population were sampled. Secondary data was obtained from relevant official institutions, namely each regional development bank and the Financial Services Authority (*Otoritas Jasa Keuangan*/OJK), through their respective BPD websites, or by obtaining data on credit risk and bank size, which are available in quarterly financial reports and quarterly financial ratio reports. Meanwhile, macroeconomic data (inflation, GDP, exchange rate, and BI Rate) were obtained from Bank Indonesia through the Indonesian Financial System Statistics (*Statistik Sistem Keuangan Indonesia*/SSKI) website.

Using saturated sampling techniques from 27 BPD during 2020-2024, the sample size (N) was 540 observations. However, after testing the classical assumptions, the normality test indicated that the data were not normally distributed. Therefore, an outlier test was performed to detect data with extreme values significantly different from the rest of the data. The 16 outliers were used, namely data from data points 524 to 539, representing PT Bank Pembangunan Daerah Banten, Tbk, from the fourth quarter of 2020 to the third quarter of 2024. After eliminating these 16 outliers, the total number of observations was 524, and the normality test indicated a normal distribution.

Credit risk is measured using the Non-Performing Loan (NPL) ratio, which is the ratio of the number of non-performing loans to the total credit extended by the bank to borrowers within a specific period. Non-performing loans are loans that are delinquent in principal or interest payments for more than 90 days, or as determined by regulatory requirements. The NPL ratio, based on a matrix of parameters or credit risk assessment indicators, can also be calculated using the following formula:

$$NPL\ gross = \frac{Non - Performing\ Loans}{Total\ Loans} x\ 100$$

Bank size is measured based on total assets recorded in quarterly financial reports published on each bank's official website or the OJK website. These total assets include cash, receivables, investments, property, and other assets held by the bank. In this study, bank size is assessed based on total assets held by the bank. Therefore, the calculation of bank size can be formulated as follows:

Bank Size = Ln (Total Aset)

The data in this study were analyzed using panel data regression to examine the effect of inflation, GDP, exchange rates, and the BI-Rate on credit risk, with bank size as a moderating variable. The analysis was conducted through a Moderated Regression Analysis (MRA) approach to assess the interaction effect between independent variables and the moderating variable. Prior to hypothesis testing, classical assumption tests were performed, including normality, multicollinearity, heteroscedasticity, and autocorrelation tests, to ensure the validity of the regression model.

4. Results

Based on the descriptive statistical results below, all research variables show relatively homogeneous data characteristics, because the standard deviation is smaller than the average.

Table 1. Descriptive Analysis Results

Variable	N	Minimum	Maximum	Mean	Std. Deviation
Credit Risk	524	0.0033	0.0896	0.025043	0.0124061
Inflation	524	0.0133	0.0595	0.027436	0.0137996
Gross Domestic Product	524	-0.0532	0.0707	0.033918	0.0337462
Exchange Rate	524	14105	16421	15108	710
BI-Rate	524	0.0350	0.0625	0.047371	0.0108437
Bank Size	524	0.1565	0.1921	0.170015	0.0076655
Valid N (listwise)	524				

Based on Table 1, the credit risk had a minimum value of 0.0033 at PT BPD Central Kalimantan in the first quarter of 2020 and a maximum value of 0.0896 at PT BPD East Kalimantan and North Kalimantan in the second quarter of 2020, with an average of 0.0250 and a standard deviation of 0.0124, indicating an average credit risk level of 2.50% of the loan portfolio.

The inflation variable had a lowest value of 0.0133 in the second quarter of 2021 and a highest value of 0.0595 in the third quarter of 2022, with an average of 0.0274 and a standard deviation of 0.0138, reflecting relatively stable inflation fluctuations throughout the study period. The Gross Domestic Product (GDP) variable had a minimum value of -0.0532 in the second quarter of 2020 and a maximum of 0.0707 in the second quarter of 2021, with an average of 0.0339 and a standard deviation of 0.0337, indicating a recovery in post-pandemic economic growth.

The exchange rate variable had a lowest value of IDR 14,105 in the fourth quarter of 2020 and a highest value of IDR16,421 in the second quarter of 2024, with an average of IDR 15,108.28 and a standard deviation of 709.81, indicating exchange rate fluctuations within a controlled range. The BI-Rate variable had a minimum value of 0.0350 in the fourth quarter of 2021 and a maximum of 0.0625 in the second quarter of 2024, with an average of 0.0474 and a standard deviation of 0.0108, reflecting the stability of interest rate policy. The bank size variable had a lowest value of 0.1565 at PT BPD Banten Tbk in the third quarter of 2020 and a highest value of 0.1921 at PT BPD Jawa Barat and Banten Tbk in the fourth quarter of 2024, with an average of 0.1700 and a standard deviation of 0.0077, indicating relatively small variation in bank size across the study sample.

Tabel 2. Normality Test with Kolmogorov-Smirnov Test

One-Sample Kolmogorov-Smirnov Test		Result
N		524
Normal Parameters[a,b]	Mean	0.0000000
	Std. Deviation	0.01195174
Most Extreme Differences	Absolute	0.055
	Positive	0.055
	Negative	-0.036
Kolmogorov-Smirnov Z		1.251
Asymp. Sig. (2-tailed)		0.088

In Table 2, it can be seen that the Asymp. Sig. (2-tailed) the value of 0.088 is greater than alpha 5% (0.088 > 0.05), so it can be concluded that the residual data is normally distributed. The results of the multicollinearity test indicate that all independent variables meet the required criteria. Each variable has a tolerance value

greater than 0.10 and a Variance Inflation Factor value below 10. Specifically, inflation, gross domestic product, exchange rate, policy interest rate, and bank size all fall within acceptable thresholds. These findings demonstrate that there is no strong correlation among the independent variables included in the regression model. Therefore, it can be concluded that the model is free from multicollinearity issues, allowing all variables to be reliably used in further statistical analysis.

Furthermore, the autocorrelation test results show that the Durbin-Watson value is 0.296. Based on the accepted range between negative two and positive two, this value indicates that the regression model does not suffer from autocorrelation. This suggests that there is no systematic correlation between the residuals across observations. As a result, the model satisfies the assumption of independent errors, which is essential for ensuring the validity and reliability of the regression analysis results.

Table 3. Heteroscedasticity Test Results

Test Statistic	Value	Probability Type	Probability
F-statistic	0.093419	Prob. F(1,521)	0.7600
Obs*R-squared	0.093761	Prob. Chi-Square(1)	0.7594

In Table 3, the results of the heteroskedasticity test using the ARCH method show that the probability values for both the F-statistic (0.7600) and the Chi-square statistic (0.7594) are greater than 0.05. This indicates that the model does not exhibit heteroskedasticity, meaning that the variance of the residuals is constant. Therefore, the regression model satisfies the assumption of homoskedasticity and is appropriate for further analysis.

Table 4. Moderation Test Results (Moderated Regression Analysis – MRA)

Model	Unstandardized Coefficients		Standardized Coefficients	t-statistics	Sig.
	B	Std. Error	Beta		
Constant	0.006	0.004		1.355	0.176
Inflation (INF)	0.565	0.280	1.466	2.016	0.044
Gross Domestic Product (GDP)	0.328	0.117	2.079	2.812	0.005
Exchange Rate (ER)	-1.861E-005	0.000	-2.484	-14.337	0.000
BI-Rate (BIR)	4.530	0.391	9.238	11.571	0.000
Inflation (INF)*Bank Size (BZ)	-3.707	1.642	-1.652	-2.258	0.024
Gross Domestic Product (GDP)*Bank Size (BZ)	-2.260	0.689	-2.438	-3.279	0.001
Exchange Rate (ER)*Bank Size (BZ)	0.000	0.000	3.898	16.182	0.000
BI-Rate (BIR)*Bank Size (BZ)	-27.238	2.298	-9.838	-11.855	0.000

The results of the Moderated Regression Analysis on Table 4 are as follows: CR = 0.006 + 0.565 INF + 0.328 GDP - 1.861E-005 ER + 4.530 BIR - 3.707 INF*BZ - 2.260 GDP*BZ + 0.000 ER*BZ - 27.238 BIR*BZ + ε. Based on the regression results, a constant value of 0.006 was obtained, indicating that if all independent variables (and the interaction variable with bank size are held constant, then credit risk is at 0.006.

Inflation has a regression coefficient of 0.565 with a positive direction, indicating that increasing inflation tends to increase credit risk. GDP has a positive coefficient of 0.328, indicating that an increase in GDP is accompanied by an increase in credit

risk. The exchange rate has a negative coefficient of -1.861E-005, indicating that an increase in the exchange rate tends to decrease credit risk. Meanwhile, the BI-Rate has a positive coefficient of 4.530, indicating that an increase in the BI-Rate tends to increase credit risk.

The results of the moderation test show that the interaction between inflation and bank size has a coefficient of -3.707, indicating that bank size weakens the effect of inflation on credit risk. The interaction between GDP and bank size has a coefficient of -2.260, indicating that bank size weakens the effect of GDP on credit risk. The interaction between exchange rate and bank size has a positive coefficient of 0.000, indicating that bank size strengthens the effect of the exchange rate on credit risk. Meanwhile, the interaction between BI-Rate and bank size has a coefficient of -27.238, which indicates that bank size weakens the influence of BI-Rate on credit risk.

Table 5. Model Feasibility Results (F Statistical Test)

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	0.008	8	0.001	82.090	0.000[b]
Residual	0.006	515	0.000		
Total	0.015	523			

Table 5 presents the model feasibility results using the F-statistic test, showing an F-statistic of 82.090 with a significance level of 0.000. Since the significance value is lower than the alpha level of 0.05, the model is considered statistically significant. This indicates that all independent variables simultaneously have a significant effect on the dependent variable.

Table 6. Results of the Coefficient of Determination (R^2) Test

Model	Value
R	0.749[a]
R Square	0.560
Adjusted R Square	0.554
Std. Error of the Estimate	0.00355

The Table 6 shows that the level of determination (R^2) is 0.560, meaning the independent variable explains 56% of the variation in the dependent variable. The remaining 44% is influenced by other variables outside the research model. Based on the t-test results, a summary of the hypothesis testing results can be seen in the following table:

Table 7. Summary of Hypothesis Testing

No	Hypothesis	Sig.	Decision
1	H1: Inflation has a positive effect on credit risk.	0.044 < 0.05	Accepted
2	H2: Gross Domestic Product (GDP) has a negative effect on credit risk.	0.005 < 0.05	Rejected
3	H3: The exchange rate has a positive effect on credit risk.	0.000 < 0.05	Rejected
4	H4: The BI-Rate has a positive effect on credit risk.	0.000 < 0.05	Accepted
5	H5: Bank size moderates the effect of inflation on credit risk.	0.024 < 0.05	Accepted
6	H6: Bank size moderates the effect of gross domestic product on credit risk.	0.001 < 0.05	Accepted
7	H7: Bank size moderates the effect of the exchange rate on credit risk.	0.000 < 0.05	Accepted
8	H8: Bank size moderates the effect of the BI-Rate on credit risk.	0.000 < 0.05	Accepted

The results of the hypothesis testing (t-test) presented in Table 4 and Table 7 indicate that Hypothesis 1 (H1) is accepted, where inflation has a positive and significant effect on credit risk, with a calculated t-statistic of 2.016 and a significance level of 0.044 < 0.05, indicating that increasing inflation tends to increase credit risk. Hypothesis 2 (H2) is rejected, as GDP shows a positive and significant effect on credit risk, with a calculated t-statistic of 2.812 and a significance level of 0.005 < 0.05, which is inconsistent with the hypothesized negative relationship. Hypothesis 3 (H3) is also rejected, as the exchange rate has a negative and significant effect on credit risk, with a calculated t-statistic of -14.337 and a significance level of 0.000 < 0.05, indicating that an increase in the exchange rate actually reduces credit risk. Furthermore, Hypothesis 4 (H4) is accepted, showing that the BI-Rate has a positive and significant effect on credit risk, with a calculated t-statistic of 11.571 and a significance level of 0.000 < 0.05. In addition, Hypothesis 5 (H5) is accepted, where bank size moderates the effect of inflation on credit risk, with a calculated t-value of -2.258 and a significance level of 0.024 < 0.05. Hypothesis 6 (H6) is also accepted, indicating that bank size moderates the effect of GDP on credit risk, with a calculated t-statistic of -3.279 and a significance level of 0.001 < 0.05. Similarly, Hypothesis 7 (H7) is accepted, showing that bank size moderates the effect of the exchange rate on credit risk, with a calculated t-statistic of 16.182 and a significance level of 0.000 < 0.05. Lastly, Hypothesis 8 (H8) is accepted, indicating that bank size moderates the effect of the BI-Rate on credit risk, with a calculated t-statistic of -11.855 and a significance level of 0.000 < 0.05.

5. Discussion

The research results show that inflation has a positive and significant effect on credit risk. This finding aligns with Linda et al. (2017), Albra et al. (2018), Naibaho and Rahayu (2018), and Leka et al. (2019), which state that rising inflation increases the risk of debtor default, thus driving up NPLs. The phenomenon in Indonesia during the 2020–2024 period reinforces this finding. Inflation surged sharply in the third quarter of 2022, reaching 5.95% due to fuel price adjustments and food pressures, which resulted in increased living and business costs. This situation put pressure on debtors' repayment capacity and drove up NPLs in several regional development banks, such as Bank Jatim, which recorded a gross NPL of 3.72% in the third quarter of 2022. After inflation declined in 2023–2024, the BPD NPL trend began to improve. Thus, rising inflation has been shown to increase credit risk, while decreasing inflation helps stabilize the credit quality of regional banks.

The results of this study indicate that GDP has a positive and significant effect on credit risk, thereby rejecting the hypothesis of a negative relationship. This finding is inconsistent with Simons and Rolwes (2009), Ginting (2017), Naibaho and Rahayu (2018), and Szarowská (2018), but aligns with Kusnandar et al. (2019). Empirically, in 2020, when GDP contracted due to the COVID-19 pandemic, regional development bank non-performing loans increased sharply. During the 2021–2022 recovery, despite GDP growth reaching 5.31% in 2022, credit risk remained high, indicating that economic growth does not necessarily reduce credit risk.

The results of this study indicate that the exchange rate has a negative and significant effect on credit risk, thereby rejecting the hypothesis. This finding is consistent with Kusmayadi et al. (2018), but contradicts Syahid (2016), Rahman and Hamid (2019), and Sinaga et al. (2020). This can be explained by the fact that Regional Development Bank credit portfolios are dominated by MSME, consumer, and local government sectors, which are relatively insensitive to exchange rate fluctuations, and were further supported by OJK restructuring policies during 2020–2021.

The research results show that the BI-Rate has a positive and significant effect on credit risk. This finding aligns with Nurismalatri (2014), Linda et al. (2017), and Rizal and Zulham (2019). The reduction in the BI-Rate during the pandemic (2020–2021) to 3.5% was able to reduce borrowers' interest burden and maintain NPL stability. Conversely, the increase in the BI-Rate from August 2022 to 6.00% in 2023 led to higher loan interest rates and increased installment burdens, particularly in the MSME and consumer segments. As a result, BPD NPLs experienced an upward trend in the 2022–2023 period.

The research results show that bank size negatively moderates the effect of inflation on credit risk. This means that the larger the bank, the weaker the impact of inflation on credit risk. This finding aligns with Kusmayadi et al. (2018). Empirically, BPDs with large assets, such as Bank Jatim and Bank BJB, were relatively better able to maintain NPL stability when inflation spiked in 2022 compared to smaller BPDs with limited capital and portfolio diversification. The findings indicate that bank size plays a significant moderating role in the relationship between macroeconomic variables and credit risk (Szarowska, 2018). Bank size reduces the impact of GDP on credit risk, as larger Regional Development Banks possess stronger capital capacity, greater portfolio diversification, and more advanced risk management systems, enabling them to recover non-performing loans more quickly during the 2020–2024 economic recovery period compared to smaller banks. Conversely, bank size strengthens the impact of exchange rates on credit risk, as larger banks with broader credit exposure are more sensitive to exchange rate fluctuations. However, bank size weakens the effect of the policy interest rate, as large banks were able to maintain non-performing loans below 3% despite rising rates, indicating greater resilience to monetary policy changes.

6. Conclusion

Based on empirical testing and analysis of phenomena at regional development banks in Indonesia for the 2020–2024 period, this study concludes that macroeconomic factors play a significant role in determining credit risk levels. Inflation was found to have a positive and significant effect on credit risk, particularly during the surge in energy and food prices in 2022, which weakened borrowers' purchasing power and repayment capacity. GDP also showed a positive and significant effect on credit risk, indicating that post-pandemic economic recovery was not immediately followed by improvements in credit quality due to delays in real sector recovery and the termination of credit restructuring policies by the Financial Services Authority. Meanwhile, the exchange rate had a negative and significant effect on credit risk, suggesting that IDR depreciation did not directly increase credit risk due to the dominance of domestic consumption and MSME sectors in bank portfolios. The policy interest rate was also proven to have a positive and significant effect, confirming the direct transmission of monetary policy to credit quality.

Furthermore, bank size plays a significant moderating role in shaping the relationship between macroeconomic variables and credit risk. Larger banks tend to mitigate the effects of inflation, GDP, and the policy interest rate due to stronger capital structures, better diversification, and more advanced risk management systems. However, larger banks are more sensitive to exchange rate fluctuations because of their broader exposure across sectors. Despite these findings, this study has several limitations. It focuses only on regional development banks within a specific period, which may limit generalizability. Additionally, the use of quantitative secondary data may not fully capture qualitative aspects such as managerial behavior or institutional dynamics. Future research is recommended to include broader variables and mixed methods approaches.

Reference

Adam, B.A. (2021). *Effect of inflation on the loans default rate of commercial banks in Kenya*. Kenya: University of Nairobi (Undergraduate thesis).

Ad'hadini, N. D., & Kusumawardhani, A. (2016). Analisis pengaruh bank size, LDR, BOPO, pertumbuhan kredit, dan CAR terhadap nonperforming loan (studi kasus pada bank umum konvensional yang terdaftar di bei tahun 2010-2014). *Diponegoro Journal of Management*, *5*(3), 263-275.

Albra, W., Syamni, G., & Habibie, M. (2018). What is the determinant of non-performing financing in Branch Sharia Regional Bank in Indonesia. In *Proceedings of MICoMS 2017* (Vol. 1, pp. 265-271). Leeds: Emerald Publishing Limited.

Astutiningsih, K. W., & Baskara, I. G. K. (2019). *Pengaruh Car, dana pihak ketiga, ukuran bank, dan ldr terhadap profitabilitas bank perkreditan rakyat*. Bali: Udayana University (Doctoral dissertation).

Bank Indonesia. (2016). *BI-Rate. Bank Indonesia, 19 Agustus 2016*. Retrieved on September 24, 2025, from https://www.bi.go.id/id/fungsi-utama/moneter/bi-rate/default.aspx. 19 Agustus 2016.

Barus, A. C. (2016). Analisis faktor-faktor yang mempengaruhi nonperforming loan pada bank umum di Indonesia. *Jurnal Wira Ekonomi Mikroskil*, *6*(2), 113-122.

Bergh, D. D., Connelly, B. L., Ketchen Jr, D. J., & Shannon, L. M. (2014). Signalling theory and equilibrium in strategic management research: An assessment and a research agenda. *Journal of management studies*, *51*(8), 1334-1360.

Castro, V. (2013). Macroeconomic determinants of the credit risk in the banking system: The case of the GIPSI. *Economic modelling*, *31*(6), 672–683.

Chan, Y. S., Greenbaum, S. I., & Thakor, A. V. (2010). Is fairly priced deposit insurance possible?. *The journal of finance*, *47*(1), 227-245.

Demirgüç-Kunt, A., & Detragiache, E. (1998). The determinants of banking crises in developing and developed countries. *Staff papers*, *45*(1), 81-109.

Djohanputro, B. (2008). *Manajemen risiko korporat*. Jakarta: Ppm.

Eisenhardt, K. M. (1989). Agency theory: An assessment and review. *Academy of management review*, *14*(1), 57-74.

Falestiya, A., & Arifin, Z. (2024). Pengaruh ukuran bank, makro ekonomi, risiko bank, diversifikasi pendapatan terhadap profitabilitas perbankan di Indonesia. *Covalue*, *15*(4), 73-91.

Ginting, A. M. (2017). Pengaruh makroekonomi terhadap Non-Performing Loan (NPL) perbankan. *Jurnal Ekonomi & Kebijakan Publik*, *7*(2), 159-170.

Jensen, M. C., & Meckling, W. H. (2019). Theory of the firm: Managerial behavior, agency costs and ownership structure. In *Corporate governance* (pp. 77-132). Wales: Gower.

Kasmir. (2015). *Pengantar manajemen keuangan (Edisi kedua)*. Jakarta: Kencana.

Khamisah, N., Nani, D. A., & Ashsifa, I. (2020). Pengaruh Non Performing Loan (NPL), BOPO dan ukuran perusahaan terhadap Return on Assets (ROA) perusahaan perbankan yang terdaftar di Bursa Efek Indonesia (BEI). *Technobiz: International Journal of Business*, *3*(2), 18–29.

Komariah, E. (2016). Tingkat kesehatan bank umum syariah di Indonesia dari aspek risk profile. *Jurnal Online Insan Akuntan*, *1*(2), 239-260.

Kusmayadi, D., Firmansyah, I., & Badruzaman, J. (2018). The impact of macroeconomic on nonperforming loan: comparison study at conventional and islamic banking. *Iqtishadia: Jurnal Kajian Ekonomi dan Bisnis Islam STAIN Kudus*, *10*(2), 59-82.

Kusnandar, K., Sucihatiningsih, D., & Guritno, A. (2019). Pengaruh PDRB, inflasi, dan suku bunga terhadap kredit bermasalah perbankan di Jawa Barat. *Jurnal Ekonomi dan Bisnis*, *22*(2), 151–168.

Leka, B., Bajrami, E., & Duci, E. (2019). Key macroeconomic drivers on reducing nonperforming loans in Albania. *Academic Journal of Interdisciplinary Studies*, *8*(2), 88-95.

Linda, A., Niken, R., & Lutfi, A. (2017). Pengaruh variabel makroekonomi terhadap risiko kredit sistem perbankan di Asean 3. *Jurnal Ekuilibrium*, *1*(2), 36-42.

Lubis, D. D., & Mulyana, B. (2021). The macroeconomic effects on non-performing loan and its implication on allowance for impairment losses. *Journal of Economics, Finance and Accounting Studies*, *3*(2), 13-22.

Mankiw, N. G. (2006). *Principles of economics: Pengantar ekonomi makro (C. Sungkono, Trans.; R. Widyaningrum, Ed.; 3rd ed.)*. Jakarta: Salemba Empat.

Margaretha, F., & Kalista, V. (2016). Faktor yang mempengaruhi nonperforming loan pada bank di Indonesia. *Jurnal Kesejahteraan Sosial*, *3*(01), 1-12.

Naibaho, K., & Rahayu, S. M. (2018). Pengaruh GDP, inflasi, BI Rate, nilai tukar terhadap nonperforming loan bank umum konvensional di Indonesia. *Jurnal Administrasi Bisnis*, *62*(2), 85-101.

Ningsih, S., & Dewi, M. W. (2020). Analisis pengaruh rasio NPL, BOPO dan CAR terhadap kinerja keuangan pada bank umum konvensional yang terdaftar di BEI. *Jurnal Akuntansi Dan Pajak*, *21*(01), 211-222.

Nurismalatri, N. (2014). Analisis pengaruh makro ekonomi terhadap kredit bermasalah perbankan Indonesia. *Jurnal Sekuritas, Saham, Ekonomi Keuangan & Investasi*, *1*(2), 103–116.

Purba, N. S., & Darmawan, A. (2018). Pengaruh pertumbuhan produk domestik bruto dan inflasi terhadap nonperforming finance bank syariah. *Jurnal Administrasi Bisnis (JAB)*, *61*(2), 172-186.

Putra, I. G. N. M. (2021). Pengaruh risiko kredit terhadap kinerja keuangan bank. *Jurnal Mahasiswa Akuntansi Poltekba*, *4*(3), 199-232.

Rahman, F., & Hamid, M. (2019). Impact of macroeconomic variables on non-performing loan in banking sector of Bangladesh. *The Jahangirnagar Journal of Business Studies*, *8*(1), 157-168.

Riyanto, I. S., & Asakdiyah, S. (2020). Analisis pengaruh inflasi, jumlah uang beredar, dan produk domestik bruto terhadap return on asset bank syariah di Indonesia. *Jurnal Fokus Manajemen Bisnis*, *6*(2), 132-143.

Rizal, A., Zulham, T., & Asmawati, A. (2019). Analisis pengaruh pertumbuhan ekonomi, inflasi, dan suku bunga terhadap kredit macet di Indonesia. *Jurnal Ekonomi dan Kebijakan Publik Indonesia*, *6*(1), 1-16.

Sefriyani, Y., & Khoirudin, R. (2021). Analisis non-performing loan KPR terhadap kesehatan bank. *Jurnal Ilmu Ekonomi dan Sosial*, *10*(1), 19-29.

Simons, D., & Rolwes, F. (2009). Macroeconomic default modeling and stress testing. *International Journal of Central Banking*, *5*(3), 301-311.

Sinaga, J. S., Muda, I., & Silalahi, A. S. (2020). The effect of BI rate, exchange rate, inflation and third-party fund (DPK) on credit distribution and its impact on non performing loan (NPL) on XYZ commercial segment bank. *Universal Journal of Accounting and Finance*, *8*(3), 55-64.

Sugiarso, F., & Setiyono, B. (2024). *Pengaruh BI 7-day reverse repo rate (BI7DRR) terhadap pertumbuhan kredit dan non-performing loan bank umum di indonesia*. Yogyakarta: Universitas Gadjah Mada (Undergraduate thesis).

Sugiyono. (2019). *Metode penelitian kulitatif, kuantitatif. edisi revisi*. Alfabeta. Bandung.

Sukesi, M. (2019). *Pengaruh gross domestic product (GDP), inflasi, bi rate, dan nilai tukar terhadap non-performing loan (NPL)*. Magelang: Universitas Muhammadiyah Magelang (Undergraduate thesis).

Syahid, D. C. N. (2016). Pengaruh faktor eksternal dan internal terhadap kredit bermasalah serta dampaknya terhadap Cadangan Kerugian Penurunan Nilai menurut PSAK 55. *Perbanas Review*, *2*(1), 24-35.

Szarowska, I. (2018). Effect of macroeconomic determinants on non-performing loans in Central and Eastern European countries. *International Journal of Monetary Economics and Finance*, *11*(1), 20-35.

Tandeas, F., & Setyawan, A. (2024). Pengaruh ukuran bank, kredit, kredit bermasalah, modal dan produk domestik bruto terhadap pengambilan risiko bank. *Jurnal Ilmiah MEA (Manajemen, Ekonomi, Dan Akuntansi)*, *8*(3), 303-25.

Tarchouna, A., Jarraya, B., & Bouri, A. (2022). Do board characteristics and ownership structure matter for bank non-performing loans? Empirical evidence from US commercial banks. *Journal of Management and Governance*, *26*(2), 479-518.

Zeng, S. (2012). Bank non-performing loans (NPLS): A dynamic model and analysis in China. *Modern Economy*, *3*(1), 100-110.

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