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ANALYSIS OF THE EFFECT OF INFLATION, RUPIAH EXCHANGE RATE, BANK SIZE, LDR, BOPO AND CAR ON NON-PERFORMING LOANS (Case Of Conventional Commercial Banks Registered In BEI For The 2016 To 2020 Period)

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Abstract. The impact of COVID-19 on the Indonesian economy is inevitable, at least on the financial market, due to the weakening of economic growth due to the corona virus pandemic. Banks on a small scale are also at risk of bad credit because they continue to provide loans to debtors. Banks do not only focus on collecting funds from customer deposits, the funds that have been collected are channeled back to the community in the form of loans or credit. This is done so that the money accumulated in the bank can continue to operate, the risk is quite large and can threaten the health of the bank, the most haunting bank is bad credit (NPL - Non-Performing Loan). NPL is a threat to sustainable development for developing countries. The purpose of this research is to look at the effect of inflation, exchange rates (exchange rates), LDR (Loan Deposit Ratio), BOPO (Operating Costs to Operating Income) and CAR (Capital Adequacy Ratio) on NPLs at conventional banks in 2016−2020. The research method is quantitative research based on positive philosophy, used to examine certain populations or samples, sampling techniques are generally carried out randomly, data collection uses research instruments, data analysis is quantitative/statistical in nature with the aim of testing hypotheses that are has been established. The results of the study show that conventional commercial banks listed on the IDX for the period 2016 to 2020 Inflation has no effect on non-performing loans. The Rupiah Exchange Rate has no effect on Non-Performing Loans. Size has no effect on Non-Performing Loans. Size has no effect on Non-Performing Loans. LDR has an effect on Non-Performing Loans. CAR has no effect on Non-Performing Loans.

Keywords: inflation; Rupiah exchange rate; bank size; LDR; BOPO; CAR on non-performing loans

I. INTRODUCTION

Non-performing loans (NPLs) remain a central barometer of banking system resilience because they transmit macro-financial shocks into bank balance sheets and real-sector credit frictions. The COVID-19 downturn heightened default risk for households and firms, with international institutions warning of pressure on asset quality and the need for adequate buffers and timely policy responses [1]–[5]. In Indonesia, stress materialized through a temporary uptick in the industry NPL ratio in 2020 alongside weak credit growth underscoring the importance of bank-specific risk management and macroprudential backstops during cyclical downturns [3], [5], [6]. A large empirical literature documents that both macroeconomic factors (e.g., inflation, exchange rate movements, growth) and bank-specific factors (e.g., capital adequacy, liquidity, operating efficiency) shape NPL dynamics, though findings are often context-dependent and period-specific. Recent global and regional studies reiterate these dual channels but report heterogeneous signs and magnitudes across jurisdictions and cycles [7], [8], [9]. For emerging markets, machine-learning and explainable-AI approaches also highlight complex, nonlinear interactions among determinants—supporting the need for country-specific evidence and careful model selection [8].

Indonesia offers a compelling laboratory because of its diversified banking structure, evolving regulatory toolkit, and exposure to pandemic-era policy interventions (e.g., restructuring, liquidity support) that affected measured credit risk and provisioning [3], [4], [6]. During 2020–2021, international and domestic assessments pointed to adequate system-wide liquidity and capital, yet cautioned that persistent weak recovery could deteriorate asset quality through corporate and household channels [3], [5], [6]. These conditions motivate renewed tests of established NPL drivers under a shock environment. Against this backdrop, the present study focuses on macro variablesinflation and the exchange rate and bank specific variables bank size, loan-to-deposit ratio (LDR), operational efficiency (BOPO), and capital adequacy (CAR) as potential determinants of NPLs in Indonesian conventional banks. These variables are widely used in the NPL literature and align with regulatory and managerial levers relevant to risk governance [7]–[9], [12], [13]. The sample and period (conventional banks listed on the IDX, 2016–2020) were selected to straddle the pre-pandemic

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equilibrium and the first pandemic year, thereby allowing identification of drivers during normal and stress conditions .

Empirically, recent Indonesian evidence remains mixed. Studies document significant roles for bank efficiency (BOPO), capitalization (CAR), and liquidity (LDR) but differ on the sign and significance of macro variables such as inflation and exchange rate—often depending on bank segment, time window, and model specification [10]–[13]. International assessments similarly report asymmetric or nonlinear effects—e.g., depreciation can raise NPLs via foreign-currency borrowers, while inflation's effect may switch sign depending on income dynamics and pricing power [7], [9], [11], [12]. These inconsistencies motivate re-examination with updated samples and rigorous panel techniques.

Accordingly, this study contributes in three ways. First, it provides Indonesia-specific evidence on NPL determinants using a balanced panel of conventional banks over 2016–2020, spanning the onset of COVID-19 and related policy responses, thus complementing broader macro-financial surveillance [3], [5], [6]. Second, it jointly tests macroeconomic and bank-level channels that are directly actionable for supervisors (inflation, exchange rate) and bank management (size, LDR, BOPO, CAR). Third, by situating the analysis within the Basel III and managerial-efficiency frameworks, it articulates practical implications: strengthening cost discipline and capital buffers while monitoring macro headwinds enhances credit-risk resilience and supports sustained intermediation. These contributions speak to journals at the interface of financial management and policy.

The dynamics of Non-Performing Loans (NPLs) reflect the interplay between macroeconomic stability and bank-specific efficiency, both of which influence the resilience of the financial system. According to the signaling theory, financial ratios such as Capital Adequacy Ratio (CAR), Loan to Deposit Ratio (LDR), and BOPO (Operating Expenses to Operating Income) serve as signals to investors and regulators regarding a bank's financial health and managerial performance [16]. Furthermore, the Basel III framework emphasizes adequate capitalization and liquidity to absorb losses and sustain credit intermediation during financial shocks [17].

From a macro-financial perspective, fluctuations in inflation and exchange rates are significant determinants of loan default risk. Inflation can reduce borrowers' real income and debt-servicing capacity, thereby increasing NPLs during economic stress periods [18]. Conversely, moderate inflation may enhance nominal revenues for borrowers, temporarily alleviating debt burdens [19]. Exchange rate depreciation, on the other hand, raises repayment costs for borrowers with foreign-currency exposure, especially in open economies with imported input structures [20]. These mechanisms highlight the sensitivity of NPLs to macroeconomic volatility.

Bank-specific factors, such as bank size, LDR, BOPO, and CAR, represent internal control levers that determine credit quality. Larger banks may exhibit better diversification and risk absorption capacities, although managerial complexity could offset such advantages [21]. High LDR indicates aggressive lending, which may elevate credit risk if accompanied by weak screening procedures [22]. Likewise, BOPO captures operational efficiency; higher ratios indicate cost inefficiency that may signal managerial weakness and increase the likelihood of bad loans [23]. Lastly, CAR functions as a regulatory buffer; higher capital adequacy mitigates the adverse effects of unexpected loan losses [24].

Recent empirical studies from Indonesia and comparable emerging markets confirm that the determinants of NPLs remain multidimensional and context-dependent. For example, Shonhadji (2020) demonstrated that inflation, exchange rate movements, BOPO, and CAR significantly explain variations in NPLs among Indonesian banks using a multivariate adaptive regression spline model. Similarly, Hernawati and Puspasari (2018) found a positive but statistically weak link between inflation and NPLs, while the exchange rate exhibited a stronger positive influence.

Internationally, several recent works (2018–2023) corroborate these mixed dynamics. Nguyen et al. (2018) found that operational inefficiency (BOPO) and liquidity constraints (LDR) significantly increased NPLs in ASEAN banks [25]. Klein and Weill (2020) further established that macroeconomic shocks amplify the effect of poor capitalization on credit risk [19]. Obeidat et al. (2021), using Jordanian data, highlighted that exchange rate volatility and inflation variability exert non-linear influences on NPL trajectories [20]. Similarly, Mabrouk and Bahri (2022) observed that the negative relationship between CAR and NPLs strengthened after the adoption of Basel III capital standards [17].

In the Indonesian context, Fakhrunnas and Komara (2022) confirmed the asymmetric effects of inflation and exchange rates on NPLs, suggesting that inflationary pressures may initially reduce defaults via nominal income gains but later increase them as purchasing power erodes. Widodo et al. (2022) emphasized the mediating role of managerial efficiency, noting that improvements in BOPO ratios significantly reduced credit risk across conventional banks [23]. These studies collectively underscore the complex interaction between macroeconomic instability, internal governance, and prudential regulation in determining loan performance.

II. RESEARCH METHODS

This study adopts a quantitative explanatory design using panel data regression to examine the determinants of Non-Performing Loans (NPLs) among conventional banks listed on the Indonesia Stock Exchange (IDX) for the period 2016–2020. The quantitative approach enables the testing of causal relationships among macroeconomic factors (inflation and exchange rate) and bank-specific variables (bank size, Loan to Deposit Ratio/LDR, Operating Expenses to Operating Income/BOPO, and Capital Adequacy Ratio/CAR) that are hypothesized to influence credit risk. The selection of this time frame captures both pre-pandemic and early pandemic financial conditions, reflecting changes in credit behavior and bank risk management practices.

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Panel data analysis was chosen due to its superior ability to handle heterogeneity across banks and over time, providing more efficient and unbiased estimates compared to pure cross-sectional or time-series models [27]. The estimation process employs three standard specifications: Common Effect Model (CEM), Fixed Effect Model (FEM), and Random Effect Model (REM), followed by diagnostic tests Chow, Hausman, and Lagrange Multiplier (LM) to determine the most appropriate model [28]. Classical assumption tests (normality, multicollinearity, heteroscedasticity, and autocorrelation) were also performed to ensure statistical robustness. All analyses were conducted using EViews 12 and Stata 17 software packages.

The analysis proceeded through several stages. First, descriptive statistics were used to summarize data characteristics (mean, standard deviation, minimum, and maximum) for each variable. Second, correlation matrices were computed to identify potential multicollinearity. Third, panel regression estimation was executed under CEM, FEM, and REM frameworks, with model selection based on Chow, Hausman, and LM tests [29]. Fourth, t-tests (partial effects) and F-tests (joint significance) were employed to examine hypothesis validity, while the coefficient of determination (R^2) measured explanatory power. Finally, robustness checks were conducted using heteroskedasticity-corrected standard errors to mitigate cross-sectional variance bias.

All secondary data utilized were obtained from publicly available, verified financial reports and official databases, ensuring transparency and reproducibility. The study adheres to academic integrity and data-usage ethics by acknowledging all sources and applying objective statistical techniques. Construct validity was ensured through alignment of variable definitions with international banking standards (Basel III) and previous empirical literature. Reliability was enhanced by consistency in variable measurement across all sampled banks and years [30].

III. RESULTS AND DISCUSSION

Descriptive statistics revealed that during 2016–2020, the average Non-Performing Loan (NPL) ratio for Indonesian conventional banks remained below 5%, consistent with Bank Indonesia's prudential threshold. However, fluctuations in inflation (3.6% in 2017 down to 1.7% in 2020) and exchange rate depreciation (from IDR 13,436/USD in 2016 to IDR 14,105/USD in 2020) suggested macroeconomic volatility that could influence credit performance. Panel data regression yielded an adjusted R^2 of 0.611, indicating that approximately 61.1% of NPL variation is explained by the independent variables: inflation, exchange rate, bank size, LDR, BOPO, and CAR. Model selection tests indicated that the Fixed Effect Model (FEM) was most appropriate, as validated by the Hausman test ($p < 0.05$). The model thus controlled for unobserved heterogeneity among banks, reflecting their internal managerial differences and risk profiles [31].

(a) The Effect of Inflation on NPL

The regression results show that inflation has a positive but insignificant effect on NPL. Although higher inflation can erode borrowers' purchasing power, moderate inflation in Indonesia during the observed period did not significantly disrupt credit quality. This finding aligns with the argument that moderate inflation may temporarily improve debt-servicing capacity by increasing nominal income flows [32]. Similar patterns were observed in studies from ASEAN and South Asian contexts, suggesting that inflation's influence depends on the stability of income and price expectations [33].

(b) The Effect of Exchange Rate on NPL

The exchange rate (EXR) displayed a positive but insignificant relationship with NPLs. Rupiah depreciation tends to elevate repayment burdens for borrowers with foreign-currency exposure, especially import-oriented firms. However, hedging practices and regulatory interventions (e.g., Bank Indonesia's stabilization policies) appear to have mitigated systemic risk during the sample period. This result is consistent with findings by Obeidat et al. [34], who reported that exchange rate volatility has a nonlinear but generally mild effect on credit risk in emerging markets.

(c) The Effect of Bank Size on NPL

The coefficient for bank size (SIZE) was negative, implying that larger banks experience lower NPL ratios due to economies of scale and better diversification. This supports the "too-big-to-fail" hypothesis, where larger institutions possess superior credit risk management systems [35]. Similar evidence from regional banks indicates that size enhances stability through wider portfolio diversification and superior access to capital markets.

(d) The Effect of LDR on NPL

The Loan to Deposit Ratio (LDR) recorded a negative but insignificant coefficient (-0.0015, $p = 0.799$). This suggests that higher intermediation activity did not necessarily increase credit risk during the study period. The result contrasts with earlier pre-crisis evidence indicating that excessive lending raises default risk. Instead, it implies that Indonesian banks maintained prudent liquidity management during the pandemic period [36].

(e) The Effect of BOPO on NPL

The BOPO variable exhibited a positive and significant influence on NPL ($\beta = 0.0198$; $t = 4.255$; $p = 0.000$). This confirms that operational inefficiency directly contributes to increased credit risk. Higher BOPO ratios indicate cost inefficiency and weak internal control, consistent with the managerial-efficiency theory that inefficient banks tend to accumulate problem loans [37]. The finding corroborates those of Widodo et al. (2022) and Klein and Weill (2020), who demonstrated that operational efficiency remains a key determinant of NPLs in emerging banking systems.

(f) The Effect of CAR on NPL

The Capital Adequacy Ratio (CAR) had a negative but insignificant coefficient ($\beta = -0.0192$; $p = 0.377$). This suggests that while capitalization supports resilience, the observed variation in CAR levels among conventional banks did not significantly affect credit quality during the sample period. The result aligns with Fakhrunnas and Komara (2022), who found that CAR's influence on NPLs weakens under

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stable macroeconomic conditions due to regulatory ceilings already ensuring sufficient capital buffers.

Overall, the results affirm that both macroeconomic factors and bank-specific variables play critical but asymmetric roles in determining NPLs. The significance of BOPO underscores the dominant role of managerial efficiency and internal control over macroeconomic conditions in shaping credit performance. This outcome strengthens the theoretical proposition of signaling theory, where operational efficiency reflects managerial quality and transmits positive signals to markets [38]. The non-significant effects of inflation, exchange rate, and CAR may also indicate the success of Indonesia's prudential macroeconomic management and post-crisis reforms, including Basel III implementation and OJK oversight. These reforms appear to have mitigated traditional macro shocks that would otherwise elevate default risk. Consequently, maintaining internal efficiency (BOPO) and prudent credit expansion remains pivotal to sustaining financial system stability, especially amid uncertain global conditions.

IV. CONCLUSIONS

This study analyzed the effects of inflation, exchange rate, bank size, Loan to Deposit Ratio (LDR), operational efficiency (BOPO), and Capital Adequacy Ratio (CAR) on Non-Performing Loans (NPLs) in conventional banks listed on the Indonesia Stock Exchange from 2016–2020. Using panel data regression, the findings reveal that BOPO has a positive and significant impact on NPLs, indicating that operational inefficiency is a major internal driver of credit risk in the Indonesian banking system. In contrast, CAR and bank size show negative but insignificant relationships with NPLs, implying that higher capitalization and larger asset bases tend to lower credit risk, though not significantly within the observed sample. Furthermore, inflation, exchange rate, and LDR exhibit statistically insignificant effects, suggesting that macroeconomic factors were largely mitigated by effective regulatory frameworks and monetary stability during the period. Overall, the results demonstrate that bank-specific managerial performance (particularly efficiency) exerts greater influence on NPL dynamics than macroeconomic volatility. This aligns with the signaling theory, where prudent management behavior and efficient operations convey positive signals to investors and regulators regarding creditworthiness and institutional stability. The findings also affirm the Basel III framework's emphasis on internal resilience and risk-based capital adequacy as key elements of sustainable banking governance.

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