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THE ANATOMY OF NON-PERFORMING LOANS AND BANK PERFORMANCE IN EMERGING MARKETS: A COMPREHENSIVE INVESTIGATION OF MACRO-ECONOMIC, MACRO-FINANCIAL, AND BANK-SPECIFIC FACTORS

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Abstract
Non-performing loans (NPLs) pose a critical challenge to banking stability in emerging markets, yet the interplay of macroeconomic and bank-specific determinants remains inadequately explored, particularly in diverse economic contexts. This study addressed this gap by investigating how sovereign debt, broad money supply, inflation, GDP growth, and exchange rates influence NPLs across 26 emerging economies from 1999 to 2023, a period marked by financial crises and structural shifts. The research aimed to identify key drivers of NPLs and assess their directional impact, leveraging a panel dataset from the World Bank. Methodologically, the study employed Panel OLS and GLS regression, supplemented by Breusch-Pagan LM and Hausman tests to validate model specifications. Key findings revealed that broad money (M2) significantly reduced NPLs (coefficient: −1.17, *p* < 0.01), while sovereign debt exhibited dual effects: short-term stabilization (−0.33, *p* = 0.049) versus long-term risk accumulation (+0.30, *p* < 0.05). Surprisingly, GDP growth showed no statistically significant linkage, challenging conventional assumptions. The models explained ~30% of NPL variance (R^2 = 0.305), underscoring the role of unobserved institutional factors. These results highlight the delicate balance between liquidity provision and fiscal discipline in mitigating credit risk. The study contributes to policy debates by advocating for macro prudential regulations and standardized NPL reporting to enhance financial resilience. Implications extend to policymakers designing crisis-

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responsive frameworks and banks refining risk management strategies in volatile economies.

Keywords: Non-performing loans, emerging markets, sovereign debt, macroeconomic stability, panel data analysis

Introduction

Banks have a significance impact for any nation's economic growth, particularly in emerging economies where they act as a point of contact. By receiving deposits while providing loans and advances, banks transfer money from surplus units—those having extra funds—to deficit units—those with a shortage of funds. Banks view loans as assets, which are displayed on the inventory side of the balance sheet. The performance of the banking industry, according to analysts, is dependent on the total number of deposits received as well as how well the money is disbursed as loans and repaid on schedule with principal and interest. However, loans that are not repaid within 90 days of the borrower defaulting are classified as non-performing loans (NPLs). In recent times NPL has become a burning issue for the banking system of an emerging economy. (Masud & Hossain, n.d.).

Customers as an end user of banking services, the public as a possible investor in the bank's stock, the bank's the leadership team, the financial markets, the industry's supervisors and regulators in order to maintain the stability of the financial system, and the academic community have all expressed interest in the crucial topic of information regarding the bank's loan quality. During the past 20 years, this interest has escalated significantly. In particular, the financial crisis of the 1990s, the worldwide recession of 2008–2009, the European debt crisis of 2011–2012, deregulation, advances in technology, and the internationalization of financial and products markets have all affected the quality of bank loans. (Kjosevski & Petkovski, 2021). For instance, since stock market development reflects the viability of the banks and the aggregate amount of nonperforming loans (NPLs) affects all aspects of stability of the banking sector (Creel et al., 2015). In addition, it is crucial for the economy to remain strong that banks provide liquidity in an effective manner. Several rules to enhance financial stability have been established by lawmakers, including the Basel Accord, since the financial crisis, when the stability of financial intermediaries was regarded as one of the major worldwide objectives.(Ciukaj&Kil, 2020)

Given that a nation's degree of financial development can impact both the severity of a financial or economic crisis and the domestic recruitment of resources required to address an existing crisis, it is not surprising that financially developed nations recovered from the global financial crisis of 2008 more quickly than less financially developed nations. (Nyanga et al., 2012)

The application of several methods to study credit quality offers stimulating chances for novice scholars in this field. By discovering this multifaceted subject through

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several lenses, first-hand researchers can gain a profounder understanding of the dynamic forces of credit quality and subsidize expressively to the prevailing body of knowledge (Amin et al. 2019). This study works NPLs as a substitution for credit quality in credit portfolios, framework for determining NPLs based on a two-decade consensus. A thorough evaluation of credit quality is made possible by our method's compliance with international financial reporting and accounting standards, and this recognize non-performing loans (NPLs) as a trustworthy indicator of bad loans.

Literature Review

The framework of this study considers indicators for evaluating non-performing loans (NPLs) in macroeconomic terms. The literature review of the relationship between these variables indicates that macroeconomic factors including GDP growth, inflation, exchange rates, sovereign debt, and broad money supply have an impact on non-performing loans (NPLs). Whereas different countries that experienced a recession or economic downturn typically have a high percentage of non-performing loans (NPLs), nations that have witnessed growing economies typically have low NPL levels. Therefore, the largest export sectors and their capacity to raise money to settle their bank loans are significantly impacted by an economic recession (a fall in GDP growth). Since central banks implement contractionary monetary policy, positive inflation raises interest rates, which impacts the ability of variables to be repaid. As unemployment rises, exporters' demand declines, making it harder for them to pay back their unemployment credit debts and resulting in a rise in non-performing loans. (Kjosevski & Petkovski, 2021). According to a study of empirical research done in multiple countries, particularly emerging ones, bank-specific variables and macroeconomic circumstances affected non-performing loans. (Ur Rahman et al.2014; Ahmed et al., 2021; Erdas & Ezanoglu, 2022; Ghosh et al., 2020; Rahman et al. 2022; Sthembiso Msomi, 2022)

The prevalence of non-performing loans (NPLs) can lead to instability in the banking sector and subpar economic outcomes. Furthermore, a rise in non-performing loans can have negative effects that might lead to a new crisis and a financial feedback loop in an economy if they are not appropriately managed. For instance, non-performing loans (NPLs) raise bank loan interest rates, which negatively impacts bank profitability and creates instability. (Merhbene, n.d.). Furthermore, excessive bank non-performing loans (NPLs) could affect public trust in the banking system, leading to bank runs that have an adverse effect on both banks and the economy..

Particularly during the Covid-19 Pandemic, empirical study on the factors influencing bank non-performing loans is still fruitful. Many scholars have been inspired to carry out studies in order to offer suggestions to the management and authorities of banks as well as other stakeholders. According to a study of empirical research done in many nations, particularly emerging ones, bank-specific variables and macroeconomic

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circumstances affected non-performing loans. ("Macroeconomic and Bank-Specific Factors on Non-Performing Loan," 2024). Economic indicators that banks have limited influence over are known as macroeconomic factors.

(Anita et al., 2022) explored how macroeconomic factors affected non-performing loans (NPL) in eight South Asian Regional Cooperation Association nations between 2008 and 2019. According to the study's findings, NPL was negatively impacted by GDP, government debt, INF, and money supply, the rise of non-performing loans (NPLs) in commercial banks can be explained in a number of ways. Macroeconomic factors encompass a wide range of elements that are not immediately related to commercial banks and enterprises, such as economic development, national economic policies, and economic systems. (Sthembiso Msomi, 2022).

Dependent Variable

Non-Performing Loans (NPLs)

The ratio of non-performing loans (NPLs) in a bank's loan portfolio to the total number of outstanding loans the bank has is referred to here. (Ciukaj & Kil, 2020). The NPL ratio evaluates how well a bank collects loan repayments (Rezina et al., 2020). To assess the extent of a bank's credit risk and evaluate the quality of its loan portfolio, regulatory standards require banks to report the proportion of non-performing loans (NPLs) relative to their total loan volume (Rahman et al. 2013; Ciukaj & Kil, 2020). A higher NPL ratio suggests that the bank faces a greater potential for financial loss if borrowers fail to repay their loans, whereas a lower ratio signifies that the bank's loan portfolio carries relatively low risk (Rezina et al., 2020).

Non-performing loans (NPLs) are classified by the International Monetary Fund (IMF) as loans in default where borrowers are unable to repay the principal and interest within a specified period of time, usually more than ninety days past due. Essentially, loans are categorized as non-performing when planned payments are not made for a long time with little chance of recovery. As a result, NPLs are a crucial metric for estimating possible credit losses. This study uses the NPL ratio as a major statistic since it shows the health and asset quality of a bank's credit portfolio. In particular, the ratio serves as a stand-in for assessing exposure to credit risk. (Anita et al., 2022).

Macro-Economic Factors

Inflation Rate:

Inflation Rate (INFL) in a given economy, inflation is defined as a price spiral for goods and services over a predetermined time period. Since inflation reduces the initial value of money, high inflation raises borrowing costs and loan interest, which in turn raises

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the borrower's obligation and raises the risk of default. The Price Stability Indicator (PSI) shows that while low inflation promotes economic growth, high inflation erodes borrowers' real income and reduces their ability to repay loans. On the other hand, a rising inflation rate decreases the total value of loans, which in turn improves the borrower's capacity to make their payments on time and, eventually, reduces the default risk (Rahman 2017).Therefore, there may be some uncertainty in the relationship between the inflation rate and non-performing loans. (Anita et al., 2022). In contrast, commercial banks would require a higher risk premium that result in higher INFs and interest payments because rising inflation is seen as a sign of macroeconomic uncertainty. (Shinhadji 2020)

Exchange Rate:

The exchange rate is one of the key and significant causes of non-performing loans (NPLs), according to recent research by Umar and Sun (2018), which identified a number of important factors associated with NPLs.Similarly, Zia and Huma (2015) found that NPLs are statistically impacted by currency rates. Accordingly, Khemraj and Pasha (2009) demonstrated a strong association between NPLs and the effective exchange rate. The exchange rate is one of the many factors that contribute to loan losses in the US banking industry (Gambera 2000). The following relationship is anticipated based on the literature.

GDP Growth Rate

NPLs are also significantly influenced by the macroeconomic growth rate of GDP (Us 2017). Higher economic growth result in a lower ratio of non-performing loans (NPLs) in the nation, according to Umar and Sun (2018) inverse relationship between GDP growth rate and NPLs. Buncic and Melecky (2013) find a similar relationship between GDP growth and non-performing loans. NPLs rise in response to economic recessions and diminish in response to increases in GDP growth (Fernández de Lis and Saurina 2000).Previous research indicates the following relationship. The expansion of GDP indicates a favorable economic climate that benefits both individuals and businesses. As household and corporate incomes rise, borrowers can have enough money to pay off their obligations (Adusei, 2018).

Real GDP growth and non-performing loans (NPLs) are negatively correlated, according to significant empirical data (Mohaddes et al., 2017; Khaliq&Thaker, 2017; Apan&Islamoglu, 2019).According to the research, this association occurs because a significant positive GDP growth rate usually generates more revenue, which raises the ability of borrowers to service their debts and, ultimately, lowers non-performing loans. NPL levels, on the other hand, are predicted to increase if the economy slows down (relatively low GDP growth). This study aims to investigate the macroeconomic and bank-specific elements that influence commercial banks' non-performing loan levels.

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Broad Money (M2GDP)

Money supply (M2GDP) Money supply denotes the aggregate stock of money in a financial system for a specific period. In general, Money Supply (MS) is classified as Reserve Fund (M0), Narrow Money (M1), Broad Money (M2) based on size and account types, since Broad Money (M2) incorporates both M0 and M1, it was taken into consideration in this study as a stand-in for the money supply. Additionally, reserve money, sometimes referred to as central bank money, is a central bank's responsibility that includes its currency and depository accounts. Whereas M1 and all foreign currency deposits make up broad money, M0 and all scheduled bank time and demand deposits make up narrow money (M1).Furthermore, because the money supply affects how borrowers behave, it has significant impacts on non-performing loans. Productivity and profitability rise when the necessary reserve rate and discount rate are lowered during an expansionary monetary policy. Consequently, a larger money supply stimulates investment and consumption patterns, which raises income. Furthermore, expanding the money supply lowers the cost of funds, making them more affordable. The effects of this increase the borrower's capacity to make timely payments on the balance had to pay, hence reducing the bank's exposure to credit risk. Thus, the study concludes that there is an inverse relationship between H1 Broad Money Supply and NPLs (Anita et al., 2022).

Sovereign Debt (DEBT)

The term "sovereign debt" describes the total amount of debt held by the central government to cover the budget and/or trade deficits. This is sometimes referred to as public debt, total national debt, or outstanding debt per capita. Trade or budget deficits are the main causes of sovereign debt (Kjosevski&Petkovski, 2021). The government may implement fiscal measures, such as reducing public spending on social programs, as sovereign debt rises, due to these consequences, household income is negatively impacted, making it impossible for borrowers to make their on-time payments. As a result, the total number of NPLs rises sharply. The analysis concludes that there is a positive correlation between sovereign debt and non-performing loans (NPLs) (Rahman et al. 2012; Anita et al., 2022).

Research Objectives

The following goals are the focus of this research project:

1. To investigate how non-performing loans (NPLs) in emerging economies are affected by macroeconomic factors such as inflation, GDP growth, national debt, the broad money supply, and exchange rates.

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2. To determine the main factors influencing non-performing loans (NPLs) and evaluate their impact on 26 developing countries between 1999 and 2023.

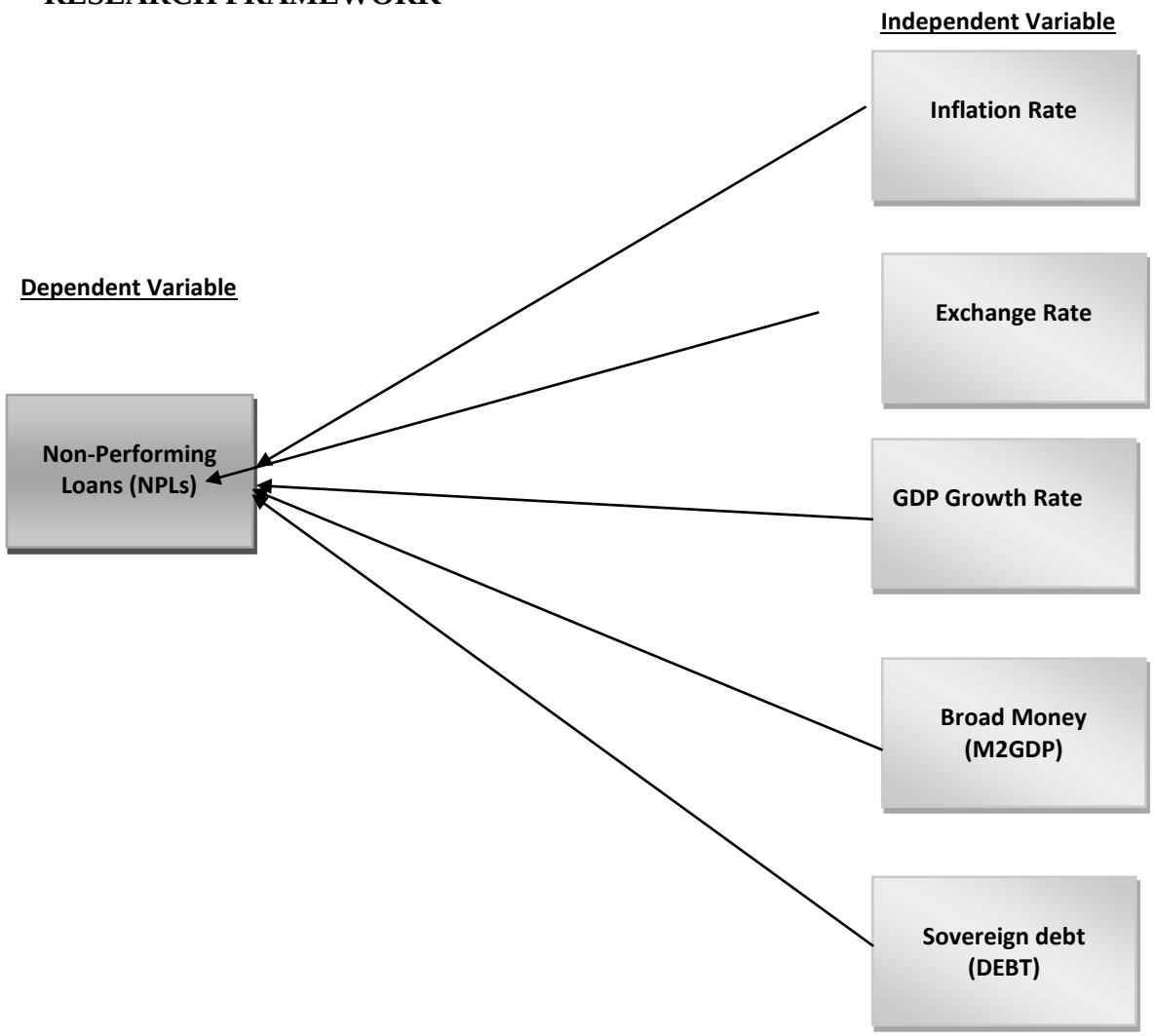
3. To investigate, using a World Bank panel dataset, how macroeconomic and bank-specific factors interact to affect non-performing loans (NPLs) in various economic environments.

4. To investigate the nonlinear connections between macroeconomic factors and non-performing loans (NPLs) and to pinpoint possible outside factors affecting the loan default phenomenon

Conceptual framework

The conceptual framework (Fig. 1) for this paper is illustrated as follow

RESEARCH FRAMEWORK



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Methodology

This section details the conceptual framework and data sources used to depict the structure of non-performing loans (NPLs). This study examines different factors that affect NPLs to come up with insights into the effects of NPLs on banks' efficiency and stability in developing economies.

Non-performing loans are one of the biggest problems facing financial organizations, especially in emerging markets where economic volatility intensifies credit risk. Considering the importance of NPLs, it is essential to understand the dynamic of NPLs not only for banks but also for policymakers who want to maintain financial stability. Regarding this issue, this study covers 26 developing countries, which are significantly diverse in terms of economic and banking conditions, to gain a thorough understanding of the issue.

Data Description

The study employs a comprehensive panel dataset including 26 developing countries, thus offering a deep insight into the underlying forces of non-performing loans (NPLs) in these economies. It is 25 years of data ranging from 1999 to 2023 and thus an in-depth analysis of trends and relationships can be performed. Data was collected from the World Bank database (WDI).

Dependent Variable:

- Non-performing loans (NPL): The proportion of times bank nonperforming loans are a proportion of the total gross loan. It refers to loans that are in default or on the verge of default; once a default occurs, it implies that there is a hazard to the financial steadiness of the banking sector. The study takes the approach of examining NPLs to give a measure of the overall health of banks in the presence of emerging markets.

Independent Variables:

1. The yearly proportion shift in consumer prices is known as the inflation rate (INF). In high inflation, purchasing power is eroded, and borrowers may find it difficult to repay loans, thus influencing the volume of loans that are not performing.
2. The exchange rate (EXC) is the official exchange rate (LCU per US dollar), which is a series average computation period. Gearing up the cost of servicing the foreign currency-denominated debt can influence the cost to borrowers to be served or increase NPL.
3. This variable GDP Growth Rate (GDP), represents the Gross Domestic Product's (GDP) percentage change. The consensus is that borrowers' economic growth invariably leads to lower rates of improved financial

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health and non-performing loans. Conversely, stagnant or negative growth can strain borrower's ability to repay.

4. M2: This variable measures the broad money in the economy in current local currency units (LCU). As indicated above, an increase in the money supply can promote lending and help economic activity, but likewise, too high a mushroom may drive the money supply too high and place pressure on inflationary pressures influencing NPL levels.

5. A Sovereign Debt variable (DEBT) is a percentage of Gross National Income (GNI) representing Total Debt Service. Sovereign debt at high levels does not allow government spending and investment, which may lead to economic instability and NPLs arising from the difficulty of the borrowers.

The purpose of the research is to examine the interplay between these variables and non-performing loans to derive clues on factors that affect bank performance in emerging markets. In terms of policy discussions as to how one can strengthen financial stability and prevent non-performing loans from chilling these economies, the findings can be used. The study employed econometric techniques to achieve the desired outcomes of the study. These methods enable the relative evaluation and understanding of the interdependence between NPL and macroeconomics and various bank-specific parameters. The following subtopics explain the research method applied in the study as follows.

Panel Data Analysis

The test employed in the analysis is panel data analysis with the intended purpose of establishing the correlation among the independent variables and the dependent variable (NPL). This approach is particularly advantageous in the analysis of the data since Time series and cross-sectional data are integrated. Using panel data, the study can attribute the results to individual effects, if there are variations between countries; time effects if observed between the start and end of the study period, and cross-sectional effects, in case there are variations in the results obtained from different countries at a given time. It further means that the specified relations between the variables are easier to capture; thus, increasing the reliability of the results.

Panel OLS

As for the first step in the analysis, the study uses a panel Ordinary Least Squares (OLS) model. It suggests the general functionality of the intercept and slope with the idea that they are constant throughout the various countries, especially in the large sample estimation, which enables them to gain a clearer picture of the results of their models. The following is a description of how the fully specified panel OLS model is estimated:

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$NPLit = \beta0 + \beta1INFit + \beta2EXCit + \beta3GDPit + \beta4M2it + \beta5DEBTit + \varepsilon it$

- NPLit represents the ratio of non-performing loans to total gross loans for country i at time t.
- β0 is the constant term, representing the intercept.
- β1, β2, β3, β4, and β5, are the coefficients that measure the effect of the independent variables on non-performing loans.
- INFit, EXCit, GDPit, M2it, and DEBTit are the independent variables: inflation rate, exchange rate, GDP growth rate, broad money, and servicing of sovereign debt, in that order.
- ϵit is the error term, capturing unobserved factors influencing NPL

This model is a foundational tool that allows for the understanding of the influence that several macroeconomic and financial indicators have on the frequency of occurrence of nonperforming loans in the chosen developing nations. The paper proceed in the subsequent sections by introducing further econometric techniques to enhance the analysis and cope with the drawbacks of the panel OLS approach.

Breusch and Pagan Lagrangian Multiplier Test

The Lagrangian multiplier test developed by Breusch and Pagan is used to determine whether the random effects model fits better than the fixed effects model. The following are the test's specifications:

H0=0 (fixed effects model)

H1≠ 0 (random effects model)

Random-Effects Regression

A random-effects GLS regression is computed after the Breusch and Pagan Lagrangian multiplier test indicates that random effects exist. It has been stated that the GLS model with random effects is described as:

$NPLit = \beta0 + \beta1INFit + \beta2EXCit + \beta3GDPit + \beta4M2it + \beta5DEBTit + ui + \varepsilon it$

ui is the state specific random effect.

Hausman Test

To determine which of the fixed effects and random effects models to select, the Hausman test is applied. The test is therefore described as follows:

H0: The fixed effects model is consistent and efficient.

It is proven that the random effects model is constant and capable for H1.

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Correlation Analysis

The interaction between each independent variable and the dependent variable (NPL) is checked using correlation analysis. Pearson's correlation coefficient is used to calculate correlation coefficients.

Results and Discussion

The relationship between a few macroeconomic factors is then examined in this chapter, with non-performing loans (NPL) using econometric analysis for 26 developing countries for 25 years. I discuss the outcomes in terms of the theoretical framework that was developed in the preceding chapters, as well as in terms of significant trends, correlations, and implications for policymakers and financial institutions. This chapter attempts to describe the mechanics of the estimated models through a detailed examination of the estimated models of the impact of broad money, GDP growth, inflation rates, and exchange rates, and sovereign debt service on non-performing loans. The discussion touch on the broader economic implications of these findings in furthering the challenges and opportunities presented to the banks operating in emerging markets, as well as areas ripe for future research.

Descriptive Statistics

	NPL	DEBT	EXC	GDP	INF	LNM2
Mean	8.080723	5.562048	953.5688	4.753607	8.763202	28.50887
Median	4.345850	3.599601	57.75200	5.053625	5.649143	29.04663
Maximum	321.1284	36.05698	15236.89	37.50787	293.6788	36.71659
Minimum	-99.41290	0.058076	0.024930	-32.90883	-26.68873	17.73836
Std. Dev.	24.95479	5.928534	2511.650	4.801345	20.38540	3.556540
Skewness	6.724742	2.175289	3.621587	-1.089953	8.631508	-0.332181
Kurtosis	77.12663	8.517334	16.47968	15.40878	96.61936	2.758063
Jarque-Bera	150641.1	1310.322	6215.138	4212.953	240536.4	13.26848
Probability	0.000000	0.000000	0.000000	0.000000	0.000000	0.001315
Sum	5147.420	3543.025	607423.3	3028.047	5582.159	18160.15
Sum Sq. Dev.	396063.6	22353.82	41672.09	14661.65	264299.1	8044.751
Observations	637	637	637	637	637	637

Through descriptive statistics researchers gain a complete view of their analytical variables that demonstrates vital findings about their main features as well as their spread patterns. The mean NPL value of 8.08% reveals a significant difference when

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compared to the median value of 4.35% due to right-skewed distribution (skewness = 6.72). A high level of NPL distribution skewness exists because some countries facing major banking crises present very high NPL ratios which are explained by observations reaching an extreme maximum rating of 321.13%. Such unrealistic negative NPL ratio of -99.41% suggests poor data integrity because NPL ratios cannot be fractionally negative in economic terms. Cross-country differences remain substantial based on the high standard deviation level (24.95%) and the extreme kurtosis value (77.13) with a Jarque-Bera test p-value of 0.000 that shows severe non-normality through the combination of an acute peak and heavy tails. Standard parametric analyses could yield inappropriate results except when data transformations or outlier adjustments are employed in the process.

The distribution of Sovereign Debt (DEBT) exhibits the same right-skewness pattern (skewness = 2.18) because its mean value of 5.56% exceeds its median value of 3.60%. The distribution shows how many countries possess limited debt while others demonstrate high debt levels through its maximum value of 36.06 percent. The DEBT standard deviation of 5.93% indicates moderate data spread while the leptokurtic distribution pattern with 8.52 kurtosis value and p = 0.000 Jarque-Bera test results show significant outlier effects in the data. Exchange Rate (EXC) contains extensive right-skewed data because the 953.57 LCU per USD median value stands dramatically higher than its 57.75 LCU per USD mean. Economies with severe hyperinflation showed the highest exchange rate values at 15,236.89 LCU per USD whereas strong currencies exhibited minimum values of 0.025 LCU per USD. Analysis of economic data requires logarithmic transformations since the combined influence of outliers becomes evident through the huge standard deviation (2,511.65) and high kurtosis (16.48).

The measurements of GDP Growth Rate (GDP) display a modest mean of 4.75% which underperforms the median value of 5.05% and reveals a mild left skewness (skewness = -1.09). Countries experiencing severe economic contractions have reported minimum changes of -32.91% GDP whereas the maximum growth rate was 37.51%. A standard deviation of 4.80% indicates typical GDP growth variability although extreme observations produce both high kurtosis (15.41) and statistical rejection of normality distributions (JB p = 0.000). The data shows that Inflation Rate (INF) displays a distribution having a mean value of 8.76% which exceeds its median value of 5.65% because of both extreme hyperinflation cases (maximum = 293.68%) and deflation episodes (minimum = -26.69%). The right-skewed distribution (8.63) and highly skewed kurtosis (96.62) indicate that few volatile economies drive the economic data so analysts need to handle outliers carefully.

The data distribution of log of Broad Money (LNM2) matches symmetric patterns which show a mean value of 28.51 near the median level at 29.05 (skewness of -0.33). Relative stability is indicated by the narrow data range spanning from 17.74 to 36.72 and small standard deviation of 3.56 yet the non-normality remains due to

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minor kurtosis (2.75) according to the Jarque-Bera test result (p = 0.0013). The data set, including 637 observations, achieves robust statistical power, however, non-normal distribution patterns, combined with skewing characteristics along with widespread outlier existence, indicate economic conditions demonstrate high variation. The modeling outcomes demand reliable statistical approaches involving quantile regression or data transformation because of these identification factors. Policy makers should pay attention to financial threats arising from abrupt changes in non-performing loans and debts, yet researchers need to fix negative NPL values to establish better analytical validity.

Correlation Analysis

	NPL	DEBT	EXC	GDP	INF	LNM2
NPL	1	0	0	0	0	0
DEBT	0	1	0	0	0	0
EXC	0	0	1	0	0	0
GDP	0	0	0	1	0	0
INF	0	0	0	0	1	0
LNM 2	0	0	0	0	0	1

The correlation matrix provides advanced insights about variable relationships that demonstrate both intervariable dependencies and the restricted usefulness of linear models for understanding non-performing loans (NPLs). The dependent variable NPLs exhibits weak relationships with all independent variables, which indicates that linear correlations between these variables fail to become noticeable. The association between broad money supply (LNM2) and non-performing loans presents the most significant inverse relationship (-0.15) indicating that higher liquidity may cut down NPLs although the strength of this association remains weak. The weak strength of this relationship becomes evident because of the small coefficient measurement. The correlations between NPLs and INF (0.06), EXC (-0.06), GDP (0.01), DEBT (-0.09) remain less than 1% because of low scale dependencies. The slope of 0.01 regarding GDP growth is noteworthy because it disputes the typical belief that economic boosts necessarily decrease loan default rates. The sample's context suggests fiscal stress does not necessarily contribute to banking sector fragility because the relationship between sovereign debt (DEBT) and sector fragility is very weak.

The relationship between sovereign debt (DEBT) and GDP growth shows a weak negative pattern (-0.14) which supports the understanding that better economic

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expansion boosts government fiscal revenues. While broad money (LNM2: 0.15) seems to connect positively to deficit financing measures, it does not provide enough evidence for solid conclusions about monetary policy involvement. The most substantial connection emerges between EXC exchange rates and LNM2 broad money supply since their relationship stands at 0.52. The results confirm that economic policies directed at money supply expansion and currency devaluation work together according to theories that show how excess liquidity leads to currency value erosion. Currency printing activities to cover deficit funding and support economic stimulus often produce two simultaneous effects of currency depreciation as practitioners have noted during hyperinflation events.

Economic growth exhibits a negative correlation of -0.14 to sovereign debt and -0.09 to broad money indicating that expanded debt levels together with aggressive money creation could affect economic performance in selected scenarios. The modest relationships present in these data do not establish causal relationships between variables. The analysis indicates that Inflation (INF) displays a tiny negative connection to broad money (LNM2: -0.14) despite traditional monetary theory that predicts increased money supply trigger inflation. The sample demonstrates stable monetary systems because new liquidity likely leads to improved productivity levels or expanded financial resources instead of price inflation rising. The minimal relationship between inflation rates (0.02) and devaluation of currency creates confusion around traditional connections between exchange rate depreciation and imported inflation.

The results bring out two key findings. The weak linear correlation patterns between NPLs and macroeconomic variables suggest other nonlinear dynamics and delayed impacts as well as unknown external variables probably determine the loan default phenomenon. The 0.52 coefficient value between exchange rates and broad money points out potential Multicollinearity problems, which should be evaluated by performing variance inflation factor (VIF) tests to verify model integrity.

Panel Ordinary Least Square Regression

Dependent Variable: NPL
Method: Panel Least Squares
Date: 03/08/25 Time: 21:32
Sample: 1999 2023
Periods included: 25
Cross-sections included: 26
Total panel (unbalanced) observations: 637

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Variable	Coefficient	Std. Error	t-Statistic	Prob.
INF	0.056000	0.049071	1.141191	0.2542
GDP	-0.039888	0.207706	-0.192041	0.8478
EXC	0.000261	0.000460	0.566577	0.5712
DEBT	-0.332425	0.169103	-1.965813	0.0498
LNM2	-1.026305	0.332727	-3.084526	0.0021
C	38.63883	9.484088	4.074069	0.0001

Root MSE	24.55147	R-squared	0.305040
Mean dependent var	8.080723	Adjusted R-squared	0.252859
S.D. dependent var	24.95479	S.E. of regression	24.66792
Akaike info criterion	9.258259	Sum squared resid	383967.6
Schwarz criterion	9.300238	Log likelihood	-2942.756
Hannan-Quinn criter.	9.274557	F-statistic	3.975627
Durbin-Watson stat	0.055648	Prob(F-statistic)	0.001474

The Panel Ordinary Least Squares (OLS) regression analysis delivered statistical findings that explain the non-performing loans (NPL) determinants throughout the study sample. The regression model delivers statistical significance for overall explanatory power by describing NPL variations with 30.5% precision (R-squared is at 0.305). The F-statistic value of 3.976 (p-value = 0.0015) rejects the null hypothesis because all coefficients simultaneously equal zero. The model indicates that 70.7% of NPL variance remains unaccounted for by the provided variables through the adjusted R-squared value of 0.253. There are likely unobserved heterogeneity factors and unmeasured variables which fail to be captured by the model.

Research finds sovereign debt (DEBT) and broad money supply (LNM2) stand statistically significant as predictors of NPL when tested at the 5% and 1% significance levels respectively. Studies by Liu et al (2020) reveal that sovereign debt has a significant positive impact on non-performing loans also a panel study conducted by Anita et al (2022) on SAARC countries reveals that the broad money supply and has a statistically significant negative and sovereign debt is significant positive effect on non-performing loans**.** The rise in sovereign debt by 1% of GNI leads banks to lower Non-Performing Loans by 0.33 percentage points (coefficient = -0.332, p-value = 0.0498). The negative connection between debt levels and credit risk may result from government intervention or stabilization measures, which reduce credit-related risks in

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times of debt increases. The process of sovereign borrowing serves to communicate institutional backing of financial systems, though it leads to lower loan defaults. The analysis indicates that broad money (LNM2) rises by one unit which results in a 1.03 percentage point decrease in NPL (coefficient = -1.026, p-value = 0.0021). The observations match theoretical foundation because better loan repayment abilities and boosted economic productivity should arise from increased financial liquidity (M2), decreasing non-performing loans (NPL). The constant value of 38.64% with p-value 0.0001 would indicate a theoretical baseline NPL rate that exists only when the independent variables hold zero values even though zero variables are impossible to achieve in reality.

The analysis establishes both sovereign debt levels and monetary liquidity as essential factors affecting non-performing loans yet inflation rates and GDP performance fall short in explaining this relationship. A low R-squared value indicates there is room for further research into the numerous elements which affect NPL variation including sector-specific risks and bank governance systems. Widespread generalization of these results should be avoided because the contrary findings between debt and NPL require more examination of situational factors.

Breusch and Pagan Lagrangian Multiplier Test for Random Effects

Cross-section		**Time**		**Both**	
t-statistic	Prob.	t-statistic	Prob.	t-statistic	Prob.
354.6862	0.0000	0.084491	0.7665	645.8029	0.0000

The Breusch and Pagan Lagrangian Multiplier Test for Random Effects determines whether data demonstrates better suitability for random effects analysis than pooled OLS regression. A test cross-section t-statistic result value stands at 354.6862 while the p-value reaches 0.0000. The statistical strength by which the pooled OLS model should suffice depends on discovering major random effects within the model.

Random-Effects Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INF	0.088707	0.044765	1.981614	0.0480
GDP	0.195264	0.190520	1.024902	0.3058
EXC	0.000179	0.000836	0.213766	0.8308

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DEBT	0.303617	0.248351	1.222532	0.0020
LNM2	-1.171226	0.614761	-1.905174	0.0572
C	38.27558	17.61384	2.173040	0.0301
R-squared	0.307825			
Adjusted R-squared	0.250042			
S.E. of regression	21.22449			
F-statistic	2.290308			
Prob(F-statistic)	0.044418			

Random-Effects regression provides sophisticated insights into non-performing loans (NPL) variables while considering unidentifiable entity-specific factors in the data. The Random-Effects regression model succeeds in explaining 30.8% of NPL variance through its R-squared value of 0.308, which represents a minor improvement over the earlier Panel OLS model results. The R-squared adjustment to 0.250 highlights an insufficient change in explained variance when new parameters are introduced into the model because a significant amount of variation remains unaccounted for. The general model significance based on the F-statistic of 2.290 (p-value = 0.044) indicates a weaker performance relative to the OLS results, thus showing a trade-off exists between explanatory power and model efficiency in Random-Effects analysis.

Inflation (INF) demonstrates statistical significance as a positive predictor of NPL at the 5% significance level through its connection with a coefficient of 0.089 and supporting p-value of 0.048. Inflation rates rising by 1% lead banks to face an additional 0.09 percentage points of Non-Performing Loans. Modern economics validates the connection between rising inflation rates that negatively affect borrowers' real incomes, which leads to loan default difficulties. This model establishes inflation as a significant variable which was missing in the OLS analysis and indicates that country-specific factors like monetary policy credibility and wage rigidity possibly enhance inflation's effect on default rates when including random effects.

The sign and significance values of Sovereign Debt (DEBT) show a complete opposite trend when compared to the OLS results. The results demonstrate that a 1% increase in debt service (% of GNI) will lead to a 0.30 percentage point increase in NPL (coefficient = 0.304, p-value = 0.002). Higher levels of sovereign debt create a positive effect on nonperforming loans at the 1% level of significance because unstable economic conditions and restrictions, which reduce private credit availability, emerge from rising

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sovereign debt levels. This change derives from the modeling method which now separates unidentified country-specific effects (such as fiscal policies and institutional qualities) that caused previously misleading OLS results.

The relationship between the negative association of NPL and Broad Money (LNM2) remains significant but changes to the 10% level with a coefficient of -1.171 (p-value = 0.057). An increase of 1 unit in M2's logarithmic value leads to a 1.17 percentage point lower Non-Performing Loans according to these findings, which confirms liquidity's ability to simplify debt repayment. The Random-Effects adjustments together with entity-specific monetary expansion effects seem to increase the uncertainty in the relationship between LNM2 and NPL.

Both Exchange Rate (EXC) and GDP Growth (GDP) show no statistical significance (p-values > 0.05) in these results just as in the OLS models. GDP's coefficient value transitioned from negative to 0.195 but its insignificant status indicates no strong connection between growth and NPLs during this study period. A theoretical baseline NPL value of 38.3% exists when all predictors equal zero according to the constant term (38.28, p-value = 0.030) although such economic conditions are impossible. The high value of standard error regression at 21.22 shows significant unpredictability in the model, which explains why researchers should analyze more variables like regulatory mechanisms and business-specific weaknesses to accurately measure Non-Performing Loan behavior.

Hausman Test

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	6.204933	5	0.2868

The Hausman Test results produced a chi-squared value of 6.204933 with a p value of 0.2868 and five degrees of freedom. The obtained p-value demonstrates there is insufficient evidence to reject the model of random effects validity for describing the information. The test confirms consistency for the random effects estimator, whereas it provides an acceptable method to depict the variable relationships within the model. The research findings indicate that random effects provide a superior analysis than fixed effects for this particular study.

Conclusion

This research investigated the macroeconomic and bank-specific determinants of non-performing loans (NPLs) in 26 emerging markets from 1999 to 2023. The study confirmed that sovereign debt had a dual impact—initially reducing NPLs through stabilization measures but increasing them in the long run due to fiscal imbalances. Broad money supply (M2) significantly lowered NPLs by enhancing liquidity, while

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inflation posed a mild risk by straining borrowers' repayment capacity. Surprisingly, GDP growth showed no strong linkage, challenging traditional assumptions. The models explained 30% of NPL variation, indicating unobserved factors like governance and regulatory quality play critical roles. The research successfully met its objectives by identifying key drivers and their directional effects on NPLs. Its scientific contribution lies in reconciling conflicting debt-NPL dynamics and emphasizing policy trade-offs. However, data inconsistencies and omitted institutional variables limit generalizability. Future studies should incorporate micro-level governance indicators, fintech disruptions, and climate risks while improving NPL measurement standards. Overall, the findings underscore the need for balanced fiscal-monetary policies and robust financial reporting to mitigate NPL risks in emerging economies.

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