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## **Macroeconomic Determinants of Non-Performing Loans for Selected Developing Economies**

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**ABSTRACT:** *A wide range of academic literature confirms the harm of rising levels of NPL on macroeconomic performance (for example, GDP growth, unemployment rate, and inflation rate). The core objective of this paper is to identify the macroeconomic determinants which explain the changes in the NPL ratio. The determinants will serve as a guideline for policymakers to design present and future safeguards against rising NPL ratio in the financial sector. Fifteen developing countries were considered for the period ranging from 2008 to 2017. Using the fisher type ADF test, all the macroeconomic variables were tested for unit-root. Afterward, the System GMM Estimation was used to investigate the relationship between macroeconomic variables and the NPL ratio. The inflation and Lending rate become statistically insignificant once lags were introduced to the model. The GDP growth rate and the one period lagged NPL ratio have a statistically significant impact on the NPL ratio in all model specifications.*

**KEYWORDS:** Non-Performing Loan (NPL) Ratio, GMM Estimation, GDP Growth

## 1. Introduction

### 1.1. Background

High levels of Non-Performing Loans (NPL) can have severe detrimental effects on the overall economic health of a nation (Klein, 2013). There are different ways to characterize the term, NPL, are usually referred to loans which have failed to collect a payment, either in the form of Principal or Interest or both within the last 90 days (Saba, Kouser, and Azeem, 2012). NPL ratio is total NPL over total loans issued by financial institutions.

An increase in total NPL can have significant negative consequences for the financial health of the economy. Ghosh (2017) found that an increase in total NPL harmed US Real GDP Growth, product, and labor markets. Klein (2013) concluded that high NPL in many Central, Eastern, and South-Eastern Europe (CESEE) countries negatively affects the pace of economic recovery. Rising NPL is an increase in credit risk and can negatively impact the lending in the form of lower credit supplied by the banks (Cucinelli, 2015), while the rising level of NPL is associated with macroeconomic shocks, lower margins on interest, and higher cost of capital (Fofack, 2005).

GDP growth, change in the exchange rate and global volatility have a major impact on the Non-Performing Asset level of the Indian banking sector which adversely affects the economic development (Roy, 2014). Non-Performing loan rate is the most important issue for banks to survive (Saba, Kouser, & Azeem, 2012).

Therefore, it is important to understand the determinants of the NPL ratio to aware policymakers and pursue corrective action to mitigate the harms of NPL across the globe.

### 1.2 Theoretical Discussion / Literature Review

Macroeconomic and bank-specific factors have been identified to be the main determinants of NPLs by multiple authors investigating NPLs in different countries (Adebola et al., 2011; Badar and Javid, 2013; Ghosh, 2015) or regions (Dimitrios et al., 2016; Chaibi and Ftiti, 2015; Anjom and Karim, 2016). Macroeconomic factors were found to be strongly affecting the level of NPL during the period 1998-2011 for Central, Eastern, and South-Eastern European countries (Klein, 2013). Louzis, Vouldis, and Metaxas (2012) found that the macroeconomic factors (GDP, unemployment rate, public debt, etc.) to be the driving force behind explaining NPL for Greece, while previous research conducted on the Eurozone from 2002 to 2008 corroborated similar patterns, where strong correlations between GDP growth, unemployment and public debt with NPL was observed (Makri, Tsagkanos, & Bellas, 2014). Lack of rigorous credit risk assessment and a weak capital base of Turkish commercial banks contributed to a high percentage of NPL (Masood, & Stewart, 2008), while developed financial systems were found to be statistically significant about low NPL and currency depreciation statistically significant with high NPL in countries where domestic currencies are not primarily employed to place credits (Tanasković, & Jandrić, 2015)

### 1.3 Summary of Research Method/s Employed and Findings

Authors	Research Method/s	Key Findings
Umar and Sun (2018)	Three different models are employed. Models with only macroeconomic variables as independent variables, the model with only bank-specific variables as regressors, and both macroeconomic and bank-specific variables as explanatory variables. GMM estimation technique used to measure coefficients	Significant determinants of NPL in Chinese Banks are GDP Growth, Interest rate (Effective), Inflation Rate, Type of the Bank and Foreign Exchange Rate, Risk-Taking Mentality, Concentration of Ownership, and Credit quality.
Lee, Yahiya, Habibullah and Ashhari (2019)	Hodrick-Prescott filter was adopted and the SGM estimation technique was used on panel data sets of 1053 conventional banks from 2007-2016	NPL is positively driven by lagged one NPL, macroeconomic, bank-specific, and governance factors.
Jayaraman, Lee and Ng (2019)	Panel approach using 16 annual observations from 2000-2001 to 2015-2016 for the public, private and foreign banks categorized by ownership	Macroeconomic and bank-specific factors are significant determinants of non-performing assets.
Kumar, Stauverman, Patel and Prasad (2018)	The balanced sample consisted of the entire banking sector (7 institutions). Pooled OLS estimation, random effects, and fixed effects regression methods to determine bank-specific and macroeconomic determinants of NPL.	Net Interest Margin is found to be statistically significantly positively associated with NPLs, while negative and significantly associated with ROE, Capital Adequacy Requirements, market share based on assets, Unemployment and Time.
Ben Saada (2018)	Panel data regressions on 11 listed banks for the period 2010-2015	The presence of foreign directors affects credit risk and is more effective to reduce NPLs.
Amuakwa-Mensah and Boakye-Adjei (2015)	Panel Regression Model	Bank specific factors (Previous year's NPL, Bank Size, net Interest Margin and current years NPL) and Macroeconomic factors (Previous year's Inflation, Real GDP per Capita Growth and Real Effective Exchange Rate) explain NPLs.
Kjosevski and Petkovski, M (2017)	Panel data regression of 27 Baltic banks for the period 2005-2014	Bank specific variables (Equity to Total Assets, ROA, ROE and Gross Loan Growth) and macroeconomic variables (GDP growth, Inflation and Domestic

		Credit to the Private Sector) explain NPLs.
Beck, Jakubik, and Piliou (2015)	Dynamic Panel Estimates for 75 countries	Macroeconomic Determinants (Real GDP Growth, Share Prices, Exchange Rate and the Lending Rate) significantly impact NPL ratios.
Boudriga, Taktak and Jellouli (2009)	Panel Modelling of 5 countries for 2002-2006	Higher Capital Adequacy ratio and prudent provisioning policy reduce NPLs.
Inekwe (2013)	Product Moment Correlation Coefficient and Time-series Analysis for Nigeria from 1995 to 2009	Real GDP and NPLS have a Significant and Positive Relationship.
Us (2016)	Econometric Estimation Techniques	Determinants of NPL (bank-specific factors) before the global financial crisis have changed to macroeconomic factors after the global financial crisis.
Turan, and Koskija (2014)	Johansen Multivariate Cointegration test for Albania for the period 2003 - 2013	Real GDP, Inflation, Loan Interest Rate, Unemployment and Remittance are cointegrated weakly in the long run.
Škarica (2014)	Panel Dataset using a Fixed Effects Estimator for seven Central and Eastern European (CEE) countries using aggregate country-level data for Q3:2007 to Q3:2012	The primary cause of high levels of NPLs is economic slowdown. Statically significant and Economically large coefficients on GDP, Unemployment and Inflation rate.
Saba, Kouser and Azeem (2012)	Correlation and Regression Tests on US Banking Sector for the period 1985 - 2010 with blended macroeconomic and Bank Specific variables	Real GDP per Capita, Inflation and Total Loans have a statistically significant impact on NPL.
Mondal (2016)	Statistical tests on 22 Commercial Banks in Bangladesh for the period 2005 - 2014	NPL negatively reacts to Inflation Rate and Interest rate Spread and reacts positively to GDP and Unemployment rate.

Table 1. Descriptive Statistics (NPL ratio)					
Country	Mean	Standard deviation	min	max	Observations
Bangladesh	0.089	0.013	0.061	0.108	10
Brazil	0.034	0.004	0.029	0.042	10
Bulgaria	0.124	0.048	0.024	0.169	10
Colombia	0.036	0.006	0.029	0.047	10
Honduras	0.034	0.007	0.024	0.047	10
India	0.046	0.028	0.022	0.100	10
Indonesia	0.025	0.006	0.017	0.033	10
Malaysia	0.025	0.011	0.016	0.048	10
Nigeria	0.112	0.108	0.030	0.373	10
Pakistan	0.122	0.025	0.084	0.162	10
Peru	0.034	0.008	0.022	0.047	10
Philippines	0.026	0.010	0.016	0.046	10
Sri Lanka	0.046	0.019	0.025	0.085	10
Thailand	0.034	0.012	0.023	0.057	10
Ukraine	0.209	0.140	0.039	0.545	10
Total					150

## 2. Methodology

In this study, yearly bank non-performing loans (NPL) to gross loans ratio for fifteen developing countries were collected from Federal Reserve Economic Data (FRED).

Three macroeconomic variables were considered to explain the NPL ratio: Gross Domestic Product growth rate, Inflation and Lending interest rate. Dataset for these variables was collected from the World Bank Database. Here, data ranging from the year 2008 to 2017 was considered to balance

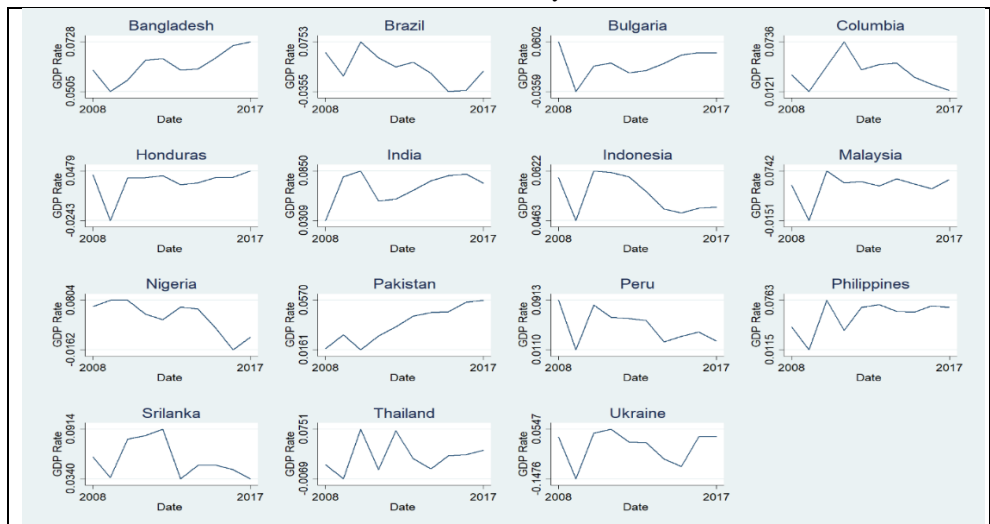


Figure 1. GDP Rate

the panel dataset. This is because, for some countries, data before 2008 were unavailable.

1.6% and as high as 54.5%. On average, Indonesia and Malaysia have the lowest NPL ratio for the past ten

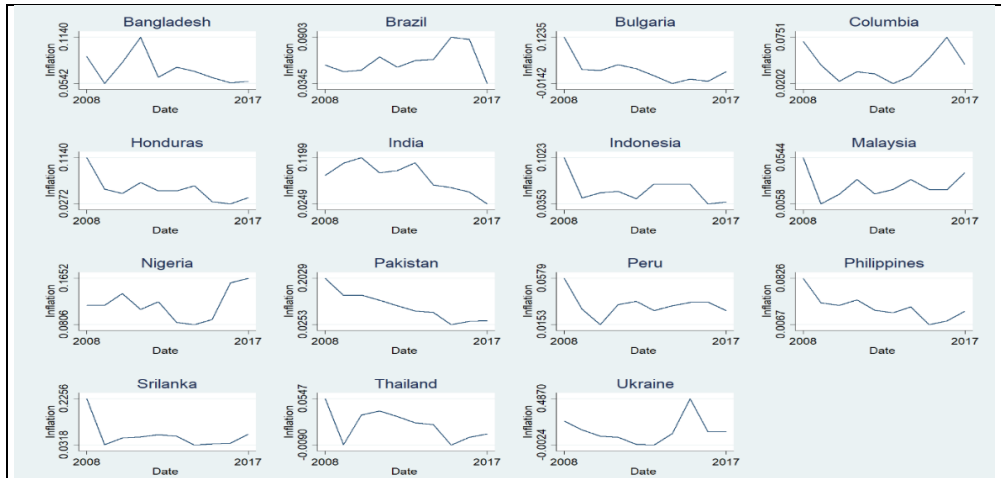


Figure 2. Inflation Rate

Table 1 states the summary statistics of Bank Non-Performing Loans to Gross Loans for fifteen developing countries. Among all the countries, the NPL ratio can get as low as

years, 1.7% and 1.6%, respectively, whereas Ukraine has the highest ratio 54.5%. Figure 1 shows that the GDP growth rate of Bangladesh and Pakistan have been increasing for the last few years. On the

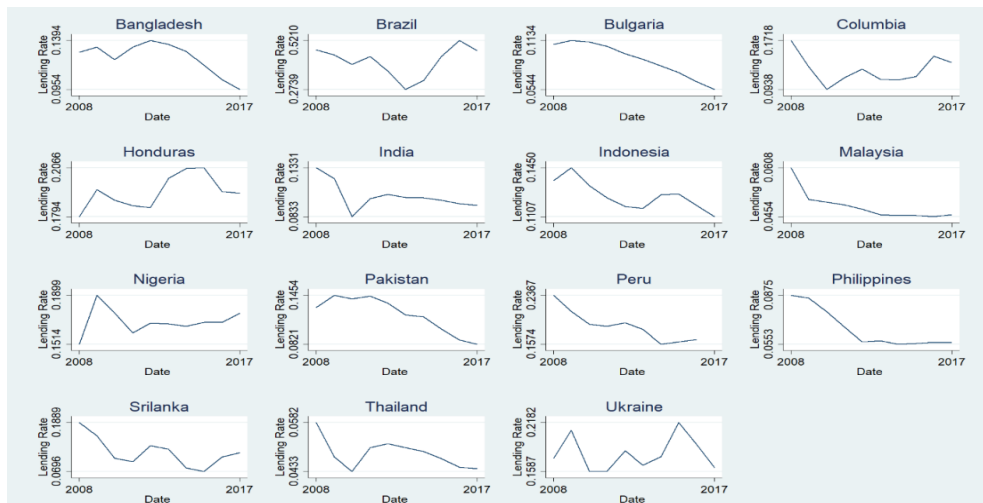


Figure 3. Lending Rate

contrary, the rate has been at a declining phase for Columbia and Srilanka. All the countries have experienced a decrease in inflation and lending rate (Figure 2 and 3).

In this study, the number of cross-sectional observations, the number of countries, is greater than the number of periods. Hence, Generalized Methods of Moments (GMM) estimation is efficient for this panel dataset. According to Caselli et al. (1996) and Bond et al. (2001), GMM estimation can model endogeneity problems, omitted variable bias, and unobserved country heterogeneity. Before employing the GMM estimation, Fisher-type Augmented Dickey-Fuller unit-root test was conducted to investigate the stationarity of all the variables (shown in Table 2). The fisher-type test is comparatively better than Levin-Lin and Im-Pesaran-Shin (IPS) panel data unit root tests (Maddala and Wu, 1999). ADF test found that all the variables are stationary. Afterward, system GMM estimation is used to test the determinants of NPL. STATA statistical software packaged has been used for unit root test and system GMM estimation.

$$\begin{aligned}
 \text{Model 2: } NPL_{it} = & \alpha_i + \beta_i GDP_t \\
 & + \beta_i Inflation_t \\
 & + \beta_i Lending Rate_t \\
 & + \gamma_i NPL_{t-1} \\
 & + \theta_i GDP_{t-1} \\
 & + \theta_i Inflation_{t-1} \\
 & + \theta_i Lending Rate_{t-1} \\
 & + \varepsilon_{it}
 \end{aligned}$$

Here,  $NPL_{it}$  refers to yearly Bank Non-Performing Loans to Gross Loans,  $i$  and  $t$  represent country and period (year), respectively, and  $\varepsilon_{it}$  captures the movements that are not explained by the equation. These three models are estimated by employing the system Generalized Method of Moments (GMM). As an instrument variable, one period lagged dependent and independent variables are considered. These variables satisfy the Sargan test – failed to reject the null hypothesis.

### 3. Results

System GMM estimations are shown in table 3, where t-statistics are in parenthesis. In the first model, all the variables have a statistically significant impact on the NPL ratio. The economic

Table 2. Fisher-type Augmented Dickey-Fuller unit-root test	
Variable	Inverse chi-squared (p-value)
NPL ratio	0.0009
GDP growth rate	0.00
Inflation	0.00
Lending interest rate	0.00

The model specifications for this study are as follow

$$\begin{aligned}
 \text{Model 1: } NPL_{it} = & \alpha_i + \beta_i GDP_t \\
 & + \beta_i Inflation_t \\
 & + \beta_i Lending Rate_t \\
 & + \varepsilon_{it}
 \end{aligned}$$

$$\begin{aligned}
 \text{Model 2: } NPL_{it} = & \alpha_i + \beta_i GDP_t \\
 & + \beta_i Inflation_t \\
 & + \beta_i Lending Rate_t \\
 & + \gamma_i NPL_{t-1} + \varepsilon_{it}
 \end{aligned}$$

magnitude of the GDP growth rate coefficient is higher than the other variables, indicating that any positive changes in GDP would have a greater negative impact on the NPL ratio. The result is consistent with the findings of Umar and Sun (2018), Petkovski (2017), and Beck, Jakubik, and Piloju (2015). Quite the opposite, the coefficient of the inflation variable is positive in nature. Hence, an increase in inflation will

increase the NPL ratio, which supports the conclusion of Umar and Sun (2018). However, the lending rate is negatively related to the NPL ratio.

After adding one period lagged NPL ratio in the equation (model 2), the coefficient of GDP growth rate has experienced a substantial increase, while inflation became statistically insignificant. The coefficient of lagged NPL ratio is statistically significant with a very high economic magnitude, which is consistent

inflation and lending rates become statistically insignificant when once lagged variables are introduced.

#### 4. Implications

One important takeaway is that the policymakers need to be careful to control the NPL ratio, particularly during the periods when GDP growth is slowing down. This is because falling GDP growth might fuel a higher NPL ratio which might, in turn, hamper economic performance in the future.

**Table 3. System GMM estimation**

	1	2	3
$\beta_{GDP}$	-0.576*** (-4.53)	-0.911*** (-4.50)	-1.259** (-3.18)
$\beta_{inflation}$	0.528*** (7.50)	-0.004 (-0.04)	0.0136 (0.09)
$\beta_{Lending\ rate}$	-0.119** (-3.18)	-0.0985* (-2.07)	-0.934 (-1.06)
$\gamma$		0.960*** (12.51)	0.786*** (7.02)
$\theta_{GDP}$			-0.14 (-0.90)
$\theta_{Inflation}$			0.00453 (0.05)
$\theta_{Lending\ rate}$			0.736 (0.93)
$\alpha$	0.0773***	0.0565***	0.0970***

with the findings of numerous studies (Lee et al., 2019; Amuakwa–Mensah and Boakye–Adjei, 2015).

In the third model, one period lagged GDP growth rate, Inflation and lending rate are added as explanatory variables. The estimation states that the GDP growth rate and lagged NPL ratio significantly influence the NPL ratio.

In conclusion, GDP Growth Rate and Lagged NPL ratio are statistically significant in all models. Conversely,

Furthermore, stringent policies should be taken to control the NPL ratio because the lagged NPL ratio is found to have a statistically significant relationship with the current NPL ratio. This can be concluded that non-performing loans will lead to further defaults of loans unless stymied by the collective effort of policymakers and bank management

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