




## Article

# The Impact of Financial Development and Macroeconomic Fundamentals on Nonperforming Loans among Emerging Countries: An Assessment Using the NARDL Approach

Aamir Aijaz Syed <sup>1</sup>, Muhammad Abdul Kamal <sup>2</sup>, Simon Grima <sup>3,4,\*</sup> and Assad Ullah <sup>5</sup>

<sup>1</sup> Institute of Management, Commerce and Economics, Shri Ramswaroop Memorial University, Lucknow 225003, India

<sup>2</sup> Department of Economics, Abdul Wali Khan University, Mardan 23200, Pakistan

<sup>3</sup> Department of Insurance and Risk Management, Faculty of Economics, Management and Accountancy, University of Malta, MSD Msida 2080, Malta

<sup>4</sup> Faculty of Business, Economics and Management, University of Latvia, 1586 Riga, Latvia

<sup>5</sup> Department of Economics, Henan University, Zhengzhou 450046, China

\* Correspondence: [simon.grima@um.edu.mt](mailto:simon.grima@um.edu.mt)

**Abstract:** The relationship between financial development indicators and non-performing loans (NPLs) has garnered significant attention, especially in emerging countries. The puzzle of whether financial sector development increases or decreases Non-performing Loans (NPLs) has not been resolved to the satisfaction of the curious mind. This research attempts to answer the above question by studying the asymmetric and symmetric association between financial sector development and NPLs, by utilizing the novel non-linear autoregressive distribution lag (NARDL) and the linear autoregressive distribution lag (ARDL) approach. Moreover, to make the study inclusive, we have added a series of proxies to measure financial sector development and macroeconomic vulnerabilities. Our main findings confirm that financial sector development and NPLs move together in the long run, and there is significant evidence of the asymmetric relationship. We infer that NPLs react differently to the negative and positive shocks of financial development and macroeconomic variables both in the short and long run. In the long-run positive shocks in financial intermediation, banking efficiency, banking depth, banking stability index, and banking non-interest income significantly impact the NPLs in emerging countries. The positive shocks of financial sector development (financial intermediation and size of banks) increase NPLs in emerging countries and vice-versa. Furthermore, regarding the macroeconomic variables, the positive shock of inflation, unemployment, and interest rate positively affect NPLs. The empirical analysis also concludes that in the long-run foreign bank presence is an insignificant factor affecting NPLs in the selected countries. This study emphasizes that, unlike the linear model, the non-linear model provides a more realistic and robust result by highlighting hidden asymmetries, which will help policymakers make appropriate strategic decisions.

**Keywords:** symmetric; asymmetric; NARDL; non-performing loans; emerging countries; developing countries



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## 1. Introduction

The banking industry is going through a challenging phase due to the ongoing COVID-19 pandemic, triggering a sluggish global economic growth rate. Around the world, non-performing loans (NPLs) are considered the most vulnerable component of the banking industry [1]. NPLs are those loans that cease to produce principal and interest within a stipulated time frame. The increase in the proportion of NPLs harms the banking credit system and the banks' balance sheets. Banks' profitability and lending rely on their loan portfolios, and if banks have a large portion of problem loans, their profitability and potential business prospects are also affected [2]. Banks with huge NPLs are required to

maintain sufficient capital to mitigate such losses; thus, these bad loans reduce the credit available for loan disbursement. Numerous scholars and researchers have investigated the determinants of banking NPLs [3,4]. Some studies have considered macroeconomic variables, while others focused on bank-specific determinants [5,6].

Nevertheless, studies exploring financial development's role in controlling NPLs are still scant. Financial development refers to an economic situation with sufficient capital, resources, and financial intermediation. Empirical evidence reveals that financial development plays a prominent role in economic development and stability; economies with a well-developed financial system are more stable than countries with a less developed financial system. During the global financial crisis, countries having an adequate level of financial sector development were least affected by the financial crisis, and this is also one of the reasons that the impact of the recession was much more severe among emerging countries compared to the developed countries [6].

Previous studies document that even though the opportunity for financial expansion is vast in emerging countries, the financial development in emerging countries is still going through a transition phase. Emerging countries like India, Pakistan, Brazil, Indonesia, etc., provide significant investment and growth opportunities due to their evolving markets and growth potentials. Higher than the average economic growth rate creates sufficient opportunities for banks, insurance companies, and other financial institutions in such countries. The increased growth rate in emerging countries has resulted in the emergence of an educated middle class that aspires to an affluent lifestyle in which financial institutions play a prominent role. The increase in the middle class is expanding the global demand for financial services from established providers and creating sufficient new entrants' opportunities. However, due to the state dominance of financial institutions and the lack of developed financial institutions, debts have accumulated more in emerging countries than in developed countries. In emerging Asia, Debt has increased from 199% of GDP (\$18 trillion) in 2009 to 265% of GDP (\$57 trillion) in 2019. The household and corporate sector is the prominent part of the increased Debt in emerging countries. The increased Debt is due to the lack of well-developed financial institutions and regulatory mechanisms. Increased domestic demand and tough competition make the financial sector of emerging countries more susceptible to the financial crisis.

The level of financial development is imperative for tackling the financial crisis issue, as it provides capital buffer and professional loss mitigation strategies. Studies have shown that developing/emerging countries rely more on financial assistance, resources, imports, and technology from developed countries. Thus, in periods of global instability, they are also more vulnerable to the financial crisis because of excessive financial reliability [7]. Studies have concluded that after the 2008 recession, non-performing loans rose dramatically in emerging countries. Countries with a well-developed banking system were the least affected during the 2008 financial crisis. Therefore, from the standpoint of literature, studying the significance of financial sector development in regulating NPLs is essential. Emerging countries need an adequate level of investment and consumption to sustain the speed of economic growth and compete with developed countries [8]. A sound level of financial development and banking structure is the paramount need of emerging countries, along with adequate resources, credit, investment opportunities, market demands, and a stable financial sector [9].

However, previous studies show that most developing countries, such as Greece, India, Bangladesh, Sri Lanka, Pakistan etc., do not go through a decent state in their banking conditions and financial structure [10]. Due to higher NPLs, most countries struggle with lower profitability and a shrinking banking sector. Therefore, this study aims to concentrate on the non-performing loan situation of selected emerging countries by integrating the effects of financial sector development and macroeconomic variables on NPLs. A review of previous studies highlights that there are scant studies that have focussed on the issue of financial sector development and NPLs among emerging countries. Therefore, to mitigate the literature void, the research work tries to study the impact of

various financial development indicators and macroeconomic indicators like financial intermediation, efficiency, banking stability, banking depth, adequacy of capital, banking business growth, inflation, unemployment, and economic growth, on the NPLs. This study focuses only on emerging countries as financial development is still at a transformation pace. In addition, emerging countries also serve as an excellent opportunity for global economic growth. Thus, reviewing the significance of financial sector development from the standpoint of banking stability will provide insightful findings.

This study contributes to the extant literature in the following ways. First, this study incorporates the role of financial development, which has not been explored comprehensively in previous studies in the context of emerging countries. Financial development is important for bank profitability and efficiency, and its importance has been discussed in a few empirical studies [11]. Moreover, in practice and policy, NPLs arising from bank lending is an indicator of bank performance, and bank performance is also influenced by the level of financial sector development [12,13]. Thus, we can conclude that policymakers need to understand the role of financial development in the persistence of NPLs.

Furthermore, examining the significance of financial sector development is also required because it assists in exacerbating or reducing the systemic losses in the financial system, particularly losses arising from massive NPLs among lending institutions. Second, the study is focused on the selected emerging countries which are struggling with the issue of banking instability, low financial development, and higher NPLs. The average NPLs in the sampled emerging countries is more than 10%, which is more than the global average of 5.86%. The mean of financial development indicators is also low in such countries. For instance, the mean value of financial intermediation (42.70%), foreign bank presence (14.05%), and size of the banks (39.01%) are low in the sampled countries in comparison to other developed countries. The primary focus of this article was on the BICS economies; Additionally, we took the cases of Pakistan, Indonesia, Mexico, Ukraine, Greece, and Bangladesh owing to the fact that the issue of banking stability, low financial inclusion, and NPLs substantially prevails in these countries. Taking the case of emerging countries, Murshed & Saadat [14] observed that banks in emerging markets, including India, Pakistan, Greece, Ukraine, Brazil, and others, have struggled with non-performing loans (NPLs) over the last two decades. Few other studies have also highlighted the alarming situation of high NPLs and banking stability in Bangladesh, Indonesia, Mexico, and South Africa [15–17]. In addition to these issues, the sampled countries, on the positive side, also serve as the potential source of global economic growth due to their market potential and abundant resources. Hence, studying the above relationship in context to the sample countries will add a new dimension to the Literature on NPLs.

Third, the present study examines the asymmetric and symmetric impact of financial development and macroeconomic indicator on NPLs by employing a novel technique of the non-linear autoregressive distributed lag model (NARDL), in addition to an advanced structural break and unit root test. A vast body of literature shows that most of the previous studies have only investigated the symmetric relationship between macroeconomic variables and NPLs, e.g., studies conducted by Nkusu [4]; Son et al. [18]. However, as Shahbaz et al. [19] highlighted, time series may have a bidirectional relationship, and therefore to fill the above research gap, we have explored both the symmetric and asymmetric relationship between financial development indicators and NPLs. The NARDL approach is also employed as it provides valid estimates in the presence of mixed order integration. Besides, it also assists in ascertaining hidden cointegration, often ignored by the linear models. In addition, the study also contributes from the viewpoint of policy formulation, as it focuses on the role of financial development via measuring the efficiency, depth, financial intermediation, and stability of the NPLs. As a corollary, the relevance of financial sector development in reducing NPLs and contributing to formulating appropriate policies for financial sector development in emerging nations is highlighted. Analyzing symmetric and asymmetric responses to financial sector development and macroeconomic variables

will assist policymakers in comprehending the short-run and long-run consequences of the selected variables.

The paper proceeds as follows: Section 2 focuses on the review of previous literature and theoretical background, Section 3 covers the methodology employed for analysis, Section 4 focuses on the analysis part, and the last part will incorporate the conclusion and policy inference of the study.

## 2. Review of Literature and the Conceptual Framework

A review of previous literature shows that there is extensive literature on bank-specific and macroeconomic indicators of NPLs. However, the literature on the nexus of financial sector development and its impact on NPLs is still scarce. The subsequent section highlights a detailed overview of the broad Literature on NPLs and their relationship with macroeconomic and bank-level variables.

Nkusu [4] studied the relationship between macro-financial vulnerabilities and NPLs in 26 advanced countries using the vector autoregressive approach. He concludes that NPLs directly link credit risk and macro-financial issues. The findings substantiate that a slow growth rate reduces debt service problems resulting in NPLs. Similarly, Espinoza and Prasad [20] also investigated the impact of macroeconomic factors on NPLs in 80 banks of the Gulf Cooperation Council region. The finding suggested that interest rate and growth rate increase NPLs. Likewise, Chaibi and Fiti [21] studied the determinants of NPLs in France and Germany, covering the period from 2005 to 2011. The findings show that variables like unemployment, growth rate, interest rate, and exchange rate affect NPLs. In continuation, Zribi & Boujelbene [22] also conducted a similar study focused on macroeconomic determinants and their impact on credit risk for Tunisia using a panel data approach from 1995 to 2008. The empirical outcome suggests that growth rate, interest rate, and inflation have a significant role in explaining NPLs in Tunisian Banks, and they share a mixed relationship with NPLs. Staehr and Uusküla [23] also strengthen the above findings by investigating the impact of macroeconomic determinants on the NPLs of European Union countries. The result substantiates that macro-financial and macroeconomic factors are significant determinants in ascertaining NPLs. Gross domestic product, lower inflation, and lower Debt are significantly substantial for NPLs and show a negative relationship with NPLs. The study conducted by Siakoulis et al. [24] also collaborates with the above empirical outcome and concludes that reduced unemployment and increased economic growth help reduce NPLs.

The above literature shows that in most previous studies, the common macroeconomic factors that affect NPLs are economic growth rate, unemployment, inflation, exchange rate, and interest rate. In most studies, the growth rate positively impacts NPLs, and an increase in economic growth helps reduce NPLs to some extent [25]. The Literature review shows that unemployment and NPLs have a direct and significant effect; high unemployment reduces the income of individuals and hence, debt servicing capabilities [26,27]. There is a mixed response in the context of inflation and interest rate. A few studies project a direct relationship, whereas other shows an indirect association with NPLs [28–30]. However, few studies have also considered the significant impact of the exchange rate and global disturbances on NPLs [21,31]. In addition, to the study on the influence of macroeconomic determinants on NPLs, few studies have investigated the impact of bank-specific determinants on NPLs. For instance, Li et al. [32] conducted a study on the dataset set of 199 Taiwan commercial banks from 1996 to 1999. The study concluded that the size of the banks is inversely related to NPLs. Rajan and Dhal [33] also reported a similar outcome and pointed out that credit disbursement, profitability, and bank size significantly influence NPLs in Indian commercial banks. Salas and Saurina [34] investigated determinants of default loans in Spanish commercial banks taking variables like the size of the banks, market reach, and banking regulatory capital ratio. The study concluded that the institutional framework and bank size significantly affect NPLs. Related research was also done by Sinky and Greenawalt [35], who evaluated the loan loss model of United States commercial banks

by employing linear regression. The study highlighted that banks' lending patterns and fund volatility directly impact the NPLs of the United States commercial banks. Similarly, Klein [36] suggested that lower capital adequacy and profitability significantly affect non-performing loan, as lower capital promotes risky lending and thus increase NPLs.

The above literature review infers that various bank-specific determinants affect NPLs, and if the bank has a high portion of NPLs, it will significantly affect its overall performance. However, there is limited literature that focuses on studying the level of financial development and its effect on NPLs' persistence level. Thus, providing a suitable gap to analyze the missing interlinking variables, as financial development is important for banking performances. Naude [37] suggested that countries with an adequate level of financial development are least affected by the economic and financial crises. Studies conducted by Demirgüç-Kunt, [11]; Tecles and Tabak, [13] Ozili, [38] emphasized the role of financial development on banking performance, but as NPLs are also a significant part of banking performance, some relationship can be established between NPLs and the level of financial development. Few studies have focused on certain financial development key indicators while studying banking and macroeconomic determinants of NPLs. For instance, studies conducted by Tanaskovic and Jandricm [39]; Giannetti and Ongena [40] have investigated the role of foreign banks and bank credit to the private sector on NPLs. Annexure 1 presents a detailed summary of extant literature. Based on the above Literature, the current study focus on two conceptual arguments. The first strand of theoretical perspective believes that the level of financial development promotes efficiency in banking management. Increased financial development help in providing better technology, efficient banking management, and adequate resources, leading to better banking performance [41]. Likewise, financial development lowers the effect of risk ratios on banks' efficiency. Developed capital markets reduce financing frictions as they enable banks to raise additional equity to expand their lending scope, and therefore their efficiency level increases [42,43]. Contrary to the first viewpoint, the second one highlights that a higher level of financial development leads to tough competition and undue interference from foreign entities, creating monopolistic tendencies and lower technical efficiency. Thus, lowering banking performance and stability and negatively affecting banking NPLs [44–46].

Thus, drawing inferences from these contradictory conceptual arguments and literature gaps, and since the level of financial development is considerably important for such countries, this study focuses on studying the impact of the level of financial development among emerging countries. Moreover, it focuses on all the aspects of financial development, like financial intermediation, level of financial efficiency, financial outreach, foreign bank presence, and financial stability, along with certain traditional macroeconomic variables. An extended chronological summary of literature is provided in Appendix A.

### 3. Data Description and Empirical Model

#### 3.1. Data Source

The current study has included various independent variables to study the impact of financial development on NPLs among the selected emerging countries. Data is extracted from the global financial indicator database of the World Bank, covering the period from 1995 to 2020. This study includes the data of 12 emerging economy countries selected based on their growth rate, per capita income, and the classification done by the world bank. Only 12 countries are included out of the total emerging countries due to the lack of data availability of some of the variables and the convenience of sampling. In context to the bank-specific variable affecting NPLs, this study has included bank cost-to-income ratio (B.I.) to measure banking efficiency [47], loan to deposit (L.D.) for measuring banking liquidity [48], bank non-interest income to total Income (N.I.) for considering bank dependencies on interest income of loans [49], and regulatory capital (R.A.) for measuring banking stability [50].

This study has used the following variables to measure financial development. Bank deposit to GDP (BDGDP) for measuring the size of the bank [11], private credit to GDP(PCGDP)

for measuring financial intermediation [51], and measure the influence of financial liberalization, foreign bank asset to total bank asset ratio (FABA) is considered [40]. Apart from the above to measure banking competitiveness and stability, this study has also used Lerner (L.R.) index for competitiveness and Z-score for banking stability besides incorporating macroeconomic variables growth rate (G.R.), unemployment (U.N.), inflation (IN), and interest rate (I.R.). Table 1 shows the expected relationship between the explanatory and the outcome variables. In addition, it also highlights the reasonable justifications for the above relationship supported by previous empirical literature. Table 1. shows that we expect that the following variables, bank cost to income ratio, bank non-interest income to total income, regulatory capital, bank deposit to GDP ratio, foreign bank asset to total bank asset ratio, Z-Score, and growth rate exert a negative influence on the NPLs, whereas, loan to deposit ratio, private credit to GDP ratio, unemployment rate, inflation rate, and interest rate exerts a positive impact on the NPLs.

**Table 1.** Expected relationship, logic, and reason for selecting variables and detail of Emerging countries.

Independent Variable's	Expected Sign	Reason and Logic Based on Literature
Bank cost to income ratio (B.I.)	-	Higher costs and lower income show the inefficiency of banks, thus resulting in high NPLs.
Loan to deposit ratio (L.D.)	+	Higher loan as compared to deposit shows banks are using faulty credit disbursement policy, which may lead to high NPLs.
Bank non-interest income to total Income (N.I.)	-	High other sources of income will reduce the dependability of loan income, and thus lower loans will reduce the chances of high NPLs.
Regulatory capital (R.A.)	-	Higher regulatory capital promotes lower risk and high stability; thus, the chances of loan default and bank insolvency are low.
Bank deposit to GDP ratio (BDGDP)	-	High deposit induces more credit; however, it also shows that the bank has adequate capital; thus, the chances of bank default are low.
Private credit to GDP (PCGDP)	+	High NPLs due to higher private lending, as private lending is less stable.
Foreign bank asset to total bank asset ratio (FABA)	-	Foreign bank presence increases competition and promotes efficiency, thus lower NPLs
Lerner (C.O.)	Mixed	High competition, high risk and efficiency, thus mixed response
Z-Score (S.T.)	-	High stability denotes efficiency and productivity; thus, lower NPLs
Growth rate (GDP)	-	High growth promotes better productivity and income, thus lower NPLs.
Unemployment (U.N.)	+	High unemployment reduces the income of individuals and thus their payment capacity, which increases the chance of loan default.
Inflation (IN)	+	High inflation, low Debt servicing capability, thus high NPLs
Interest rate (I.R.)	+	High inflation, low Debt servicing capability, thus high NPLs
Emerging Countries: India, Pakistan, China, Brazil, Greece, Ukraine, Sri Lanka, Saudi Arabia, Indonesia, Bangladesh, Mexico, and South Africa.		

Source: Authors' Compilations.

### 3.2. Econometric Methodology

This study has used the Autoregressive Distribution Lag (ARDL) method given by Pesaran et al. [52] and Nonlinear Autoregressive Distribution Lag (NARDL) method as suggested by Shin et al. [1], as these methods provide a robust result when the data set is small, and variables are mixed integrated, i.e., I(0) and I(1). NARDL approach is utilized because this method provides the best results after jointly checking the cointegration and asymmetry of the data. Moreover, it also considers hidden cointegration [53]. The only precondition before applying ARDL or NARDL is that none of the variables is of the second order of integration, and to check this Augmented dicky fuller test and CIPS unit root test is used.

An extension of Auto-Regressive Distribution Lag is the Non-linear Auto-Regressive Distribution Lag; thus, we provide the basic form of unrestricted error correction linear ARDL method:

$$\Delta y_t = \alpha_0 + \sum_{i=1}^{p-1} b_i \Delta y_{t-i} + \sum_{i=0}^{q-1} c_i \Delta x_t - i + \rho y_{t-1} + \theta x_{t-1} + e_t \tag{1}$$

where  $x_t$  vector of regressors,  $y_t$  dependent variable;  $\alpha_0$  Intercept;  $\Delta$  shows variables are in difference;  $b_i, c_i$  represents short-run coefficient;  $p$  and  $q$  represent restricted lags and  $e_t$  is the error term.

In the ARDL methodology, we determine cointegration among variables based on the upper and lower bound values. The null hypothesis states no cointegration, whereas the alternative hypothesis entails the presence of cointegration. The Upper bound values take variables as I(1) order of integration; the lower bound value considers that variables are of I(0). In our study, some variables are I(1), and some are I(0), so we can consider both the lower and upper bound values. Subsequently, based on the F-statistic value for the upper and lower bound mentioned in the below tables, we can accept or reject the null and alternative hypothesis. The ARDL technique assumes a symmetric response between the dependent variable and all exogenous variables. Therefore, we have used the following equation:

$$\begin{aligned} \Delta \text{LnNPL}_t = & a_0 + \sum_{i=1}^{p-1} b_i \Delta \text{LnNPL}_{t-1} + \sum_{i=0}^{q1} c_{1,i} \Delta \text{LnBI}_{t-1} + \sum_{i=0}^{q2} c_{2,i} \Delta \text{LnLD}_{t-1} + \sum_{i=0}^{q3} c_{3,i} \Delta \text{LnNI}_{t-1} + \\ & \sum_{i=0}^{q4} c_{4,i} \Delta \text{LnRA}_{t-1} + \sum_{i=0}^{q5} c_{5,i} \Delta \text{LnBDGDP}_{t-1} + \sum_{i=0}^{q6} c_{6,i} \Delta \text{LnPCGDP}_{t-1} + \sum_{i=0}^{q7} c_{7,i} \Delta \text{LnFABA}_{t-1} + \\ & \sum_{i=0}^{q8} c_{8,i} \Delta \text{LnCO}_{t-1} + \sum_{i=0}^{q9} c_{9,i} \Delta \text{LnST}_{t-1} + \sum_{i=0}^{q10} c_{10,i} \Delta \text{LnGDP}_{t-1} + \sum_{i=0}^{q11} c_{11,i} \Delta \text{LnUN}_{t-1} + \sum_{i=0}^{q12} c_{12,i} \Delta \text{LnIN} + \\ & \sum_{i=0}^{q13} c_{13,i} \Delta \text{LnIR}_{t-1} + \rho \text{LnNPL}_{t-1} + \theta_1 \text{LnBI}_{t-1} + \theta_2 \text{LnLD}_{t-1} + \theta_3 \text{LnNI}_{t-1} + \theta_4 \text{LnRA}_{t-1} + \theta_5 \text{LnBDGDP}_{t-1} + \\ & \theta_6 \text{LnPCGDP}_{t-1} + \theta_7 \text{LnFABA}_{t-1} + \theta_8 \text{LnCO}_{t-1} + \theta_9 \text{LnST}_{t-1} + \theta_{10} \text{LnGDP}_{t-1} + \theta_{11} \text{LnUN}_{t-1} + \\ & \theta_{12} \text{LnIN}_{t-1} + \theta_{13} \text{LnIR}_{t-1} + e_t \end{aligned} \tag{2}$$

In Equation (2), Ln shows that all the explanatory and outcome variables are in the natural log form. Here, NPL denotes non-performing loans, B.I. denotes bank cost to income ratio, L.D. denotes loan to deposit ratio, N.I. Indicates non-interest income to total income ratio, R.A. depicts regulatory capital, BDGDP denotes bank deposit to GDP ratio, PCGDP denotes private credit to GDP ratio, FABA denotes foreign bank asset to total bank asset, C.O. represents Lerner index, S.T. denotes Z-score, GDP shows growth rate, U.N. denotes unemployment, IN denotes inflation rate, I.R. shows interest rate, and finally  $e_t$  is the error term.

Shin et al. (2014) used the following asymmetric long-run model for checking the asymmetric relationship among the variables:

$$y_t = \beta^+ x_t^+ + \beta^- x_t^- + e_t \tag{3}$$

where  $\beta^+$  and  $\beta^-$  represents the long-run asymmetric coefficients;  $e_t$  and  $x_t$  shows error term and vector regressors, respectively.  $x_t$  is further divided into negative and positive terms, shown in Equation (4).

$$x_t = x_0 + x_t^+ + x_t^- \tag{4}$$

The partial sum of negative and positive shocks can be further represented as follows:

$$x_t^+ = \sum_{i=1}^t \Delta x_t^+ = \sum_{i=1}^t \max(\Delta x_i, 0) \tag{5}$$

$$x_t^- = \sum_{i=1}^t \Delta x_t^- = \sum_{i=1}^t \min(\Delta x_i, 0) \tag{6}$$

Moving further with the model formulation, we combine Equations (1) and (2) to derive the asymmetric ECM, which is mentioned below:

$$\Delta y_t = a_0 \sum_{i=1}^{p-1} b_i \Delta y_{t-i} + \sum_{i=1}^{q-1} (c_i^+ \Delta x_{t-i}^+ + c_i^- \Delta x_{t-i}^-) + \rho y_{t-1} + \theta^+ x_{t-1}^+ + \theta^- x_{t-1}^- + e_t \tag{7}$$

where  $\theta^+ = -\rho\beta^+$  and  $\theta^- = -\rho\beta^-$  are short-run adjustments for positive and negative shocks. Finally, the NARDL equation for short and long-run asymmetries in our case can be expressed as follows:

$$\begin{aligned} \Delta LnNPL = & a_0 + \sum_{i=1}^{p-1} b_i \Delta LnNPL_{t-1} + \sum_{i=0}^{q1} c_{1,i}^+ \Delta LnBI_{t-1}^+ + \sum_{i=0}^{q2} c_{1,i}^- \Delta LnBI_{t-1}^- + \sum_{i=0}^{q3} c_{2,i}^+ \Delta LnLD_{t-1}^+ + \\ & \sum_{i=0}^{q4} c_{2,i}^- \Delta LnLD_{t-1}^- + \sum_{i=0}^{q5} c_{3,i}^+ \Delta LnNI_{t-1}^+ + \sum_{i=0}^{q6} c_{3,i}^- \Delta LnNI_{t-1}^- + \sum_{i=0}^{q7} c_{4,i}^+ \Delta LnRA_{t-1}^+ + \sum_{i=0}^{q8} c_{4,i}^- \Delta LnRA_{t-1}^- \\ & + \sum_{i=0}^{q9} c_{9,i}^+ \Delta LnBDGDP_{t-1}^+ + \sum_{i=0}^{q10} c_{10,i}^- \Delta LnBDGDP_{t-1}^- + \sum_{i=0}^{q11} c_{11,i}^+ \Delta LnPCGDP_{t-1}^+ + \sum_{i=0}^{q12} c_{12,i}^- \Delta LnPCGDP_{t-1}^- \\ & + \sum_{i=0}^{q13} c_{13,i}^+ \Delta LnFABA_{t-1}^+ + \sum_{i=0}^{q14} c_{14,i}^- \Delta LnFABA_{t-1}^- + \sum_{i=0}^{q15} c_{15,i}^+ \Delta LnCO_{t-1}^+ + \sum_{i=0}^{q16} c_{16,i}^- \Delta LnCO_{t-1}^- \\ & + \sum_{i=0}^{q17} c_{17,i}^+ \Delta LnST_{t-1}^+ + \sum_{i=0}^{q18} c_{18,i}^- \Delta LnST_{t-1}^- + \sum_{i=0}^{q19} c_{19,i}^+ \Delta LnGDP_{t-1}^+ + \sum_{i=0}^{q20} c_{20,i}^- \Delta LnGDP_{t-1}^- + \sum_{i=0}^{q21} c_{21,i}^+ \Delta LnUN_{t-1}^+ \\ & + \sum_{i=0}^{q22} c_{22,i}^- \Delta LnUN_{t-1}^- + \sum_{i=0}^{q23} c_{23,i}^+ \Delta LnIN_{t-1}^+ + \sum_{i=0}^{q24} c_{24,i}^- \Delta LnIN_{t-1}^- + \sum_{i=0}^{q25} c_{25,i}^+ \Delta LnIR_{t-1}^+ + \sum_{i=0}^{q26} c_{26,i}^- \Delta LnIR_{t-1}^- \\ & + \rho LnNPL_{t-1} + \theta_1^+ LnBI_{t-1}^+ + \theta_1^- LnBI_{t-1}^- + \theta_2^+ LnLD_{t-1}^+ + \theta_2^- LnLD_{t-1}^- + \theta_3^+ LnNI_{t-1}^+ + \theta_3^- LnNI_{t-1}^- + \theta_4^+ LnRA_{t-1}^+ \\ & + \theta_4^- LnRA_{t-1}^- + \theta_5^+ LnBDGDP_{t-1}^+ + \theta_5^- LnBDGDP_{t-1}^- + \theta_6^+ LnPCGDP_{t-1}^+ + \theta_6^- LnPCGDP_{t-1}^- + \theta_7^+ LnFABA_{t-1}^+ \\ & + \theta_7^- LnFABA_{t-1}^- + \theta_8^+ LnCO_{t-1}^+ + \theta_8^- LnCO_{t-1}^- + \theta_9^+ LnST_{t-1}^+ + \theta_9^- LnST_{t-1}^- + \theta_{10}^+ LnGDP_{t-1}^+ + \theta_{10}^- LnGDP_{t-1}^- \\ & + \theta_{11}^+ LnUN_{t-1}^+ + \theta_{11}^- LnUN_{t-1}^- + \theta_{12}^+ LnIN_{t-1}^+ + \theta_{12}^- LnIN_{t-1}^- + \theta_{13}^+ LnIR_{t-1}^+ + \theta_{13}^- LnIR_{t-1}^- + e_t \end{aligned} \tag{8}$$

where, *Ln* denotes Natural Log, and + and - sign denotes the positive and negative variation of explanatory and outcome variables.

Prior to utilizing the Non-linear ARDL methodology, it is essential to check variables' stationarity. We have ensured the stationarity of the variables via ADF and CIPS unit root tests, and no I(2) integrated variable was found. The conventional unit root test does not have the power to detect breaks in the series. To this end, we utilized Zivot and Andrews unit root test, which not only captures breaks in the data but also further validates the integration order. The study further reported to Brock, Dechert, and Scheinkman (BDS) test in order to confirm nonlinearity. The outcomes of the BDS test indicate that the data is not identical and independently distributed through the rejection of the null hypothesis. The outcomes of the BDS test allow us to proceed with the Asymmetric/non-linear ARDL approach. The Non-linear autoregressive distribution lag method is used similarly to the linear autoregressive distribution lag is used. Initially, the error correction model is evaluated through ordinary least square then the asymmetric long-run relationship is investigated by employing the bound test along with examining the null hypothesis of no-cointegration by considering lower and upper bounds. Finally, the asymmetric and the symmetric effect is inspected on exogenous variables both for the short-run period and long-run period by using the Wald test.

### 3.3. Analysis and Discussion

Before proceeding with the symmetric and asymmetric analysis, descriptive properties of the variables are discussed. Table 2 reports the details of the descriptive statistics of the explanatory and outcome variables. The mean of NPLs in the selected emerging countries is comparatively higher, which is 11.57%. Likewise, the proportion of non-interest income (32.42) and the mean of economic growth (4.02) is low. In addition, the descriptive statistic also reveals a low level of financial sector development in the panel of selected countries. For instance, the mean score of private credit to GDP ratio (42.70%), bank asset to GDP ratio (39.01), and foreign bank presence (14.05) is low compared to other developed



economies. Moreover, competitive and stability levels are also low in the selected emerging countries. Furthermore, the descriptive statistic also shows that the data is not normal, which motivates us to proceed with the non-linear approach.

**Table 2.** Descriptive Statistics of Emerging Countries.

Variables	Mean	Median	Maximum	Minimum	Std. Dev	Jarque-Bera	Prob.
NPLs	11.57	7.52	54.50	0.95	11.38	14.49	0.0000
BI	55.70	55.71	166.25	15.45	15.46	21.79	0.0900
LD	108.97	87.54	337.19	29.12	59.90	38.09	0.0510
NI	32.42	30.68	84.06	7.96	11.96	20.16	0.0000
RA	14.11	14.10	22.70	2.50	4.08	2.64	0.2663
BDGDP	39.01	36.79	100.19	5.97	17.13	64.98	0.0000
PCGDP	42.70	30.00	149.73	1.73	31.7	91.77	0.0000
FABA	14.05	5.00	59.00	0.0000	15.44	58.41	0.0630
C.O.	.24	.23	0.58	−0.38	0.13	50.34	0.0000
ST	12.36	12.43	96.68	0.016	8.13	19.84	0.0000
GDP	4.02	4.53	14.23	−14.80	4.09	24.79	0.0000
UN	8.21	5.75	27.47	2.49	6.19	27.83	0.0600
IN	8.66	5.85	376.00	−1.70	23.89	47.22	0.0000
IR	7.20	4.67	77.60	−67.00	14.19	11.72	0.0810

Source: Authors’ Compilations.

Assessing the level of data integration is one of the preconditions of applying the ARDL and NARDL models. Therefore, the augmented dicky fuller technique and CIPS unit root test is employed to confirm the stationarity of data. A broad strand of the literature suggests that NARDL and ARDL approach is best suited when the data is of the mixed level of integration, and none of the variables is of the second order of integration. The result of the ADF test and CIPS test (Table 3) further substantiate mixed integration and reveal that variables like private credit and bank deposit to GDP, non-interest income, growth rate and unemployment are integrated at levels, whereas all the other variables are integrated at first difference.

**Table 3.** (a): Augmented Dicky Fuller Unit root test result. (b): CIPS unit root test result.

(a) Variables	Levels		First Difference	
	Constant (at 5%)	Constant and Trends (at 5%)	Constant (at 5%)	Constant and Trends (at 5%)
NPLs	−0.121 (−2.023)	−1.231 (−3.126)	−4.123 (−1.311) *	−4.984 (−3.519)
B.I.	−3.241 (−1.234)	−2.543 (−3.002)	−3.114 (−1.542)	−5.881 (−3.184) *
L.D.	−4.141 (−2.132)	−0.194 (−2.914)	−3.153 (−3.151) *	−4.003 (−3.651)
NI	2.421 (−1.114) *	−4.184 (−3.115)	−3.561 (−2.174)	−3.709 (−2.612)
RA	−1.325 (−2.142)	−2.091 (−3.126)	−4.661 (−3.167) *	−4.852 (−3.510)
BDGDP	1.784 (−1.564)	−1.893 (−2.189)	−3.559 (−3.691)	−5.016 (−3.114) *
PCGDP	−3.613 (−2.612) *	−0.155 (−3.154)	−3.712 (−2.116)	−4.639 (−4.110)
FABA	−0.132 (−2.132)	−1.113 (−2.518)	−0.112 (−2.576) *	−3.176 (−2.501)
C.O.	−2.143 (−2.112)	−0.119 (−3.154)	−3.509 (−2.988) *	−4.087 (−3.342)
S.T.	−0.143 (−1.327)	−1.114 (−2.111)	−4.692 (−3.943) *	−4.119 (−3.117)
GDP	−2.691 (−2.541) *	−0.132 (−2.543)	−0.385 (−2.663)	−5.905 (−4.584)
UN	−1.843 (−2.001)	−1.612 (−3.113) *	−3.195 (−2.661)	−4.119 (−3.231)
IN	0.125 (−1.325)	−2.116 (−3.154)	−4.601 (−3.392) *	−3.319 (−2.064) *
I.R.	−2.511 (−3.110)	−0.0196 (−3.112)	−3.442 (−4.119) *	−4.845 (−3.672)

**Table 3.** *Cont.*

(b) NPLs	−2.371	−3.983 *
BI	−2.829	−2.934
LD	−3.186	−4.192 **
NI	2.942	−3.267
RA	−1.489	−3.531
BDGDP	2.193 *	−4.842 **
PCGDP	−2.331	−3.965
FABA	−1.592	−2.321 ***
CO	−3.184	−3.236 **
ST	−1.731	−3.932
GDP	−2.892 *	−5.632 **
UN	−4.424 *	−3.963
IN	2.183	−3.352 **
IR	−3.113	−4.916

Table 3(a) \* 5% level of significance; Table 3(b) \*, \*\*, \*\*\* at 10, 5, and 1% level of significance, **Source: Authors' Compilations.**

Sometimes traditional unit root test provides spurious results due to ignoring the concept of a structural break. Thus, Zivot and Andrews' (Z.A.) 1992 structural break test is used to make this study robust and error-free. Table 4 shows the outcome of the Z.A. test, which substantiates a structural break in the series. The result of the Z.A. test also confirms that none of the variables is of second-order integration.

**Table 4.** Zivot and Andrews Test.

Variables	Levels		First Difference	
	<i>t</i> -Statistic	Time Break	<i>t</i> -Statistics	Time Break
NPLs	−2.1345 *	2008	−3.1242 *	2008
B.I.	−3.1093 *	2008	−5.2426 *	2007
L.D.	−2.4156 *	2000	−3.1934 *	2001
NI	−4.3267 **	2001	−5.1242 *	2001
RA	−5.1289	2000	−7.1213 ***	2000
BDGDP	−2.5158	2010	−8.1253 ***	2010
PCGDP	−4.1284 *	2008	−2.4313 **	2007
FABA	−3.1265 *	2004	−1.3569 *	2005
CO	−1.2524 ***	2008	−5.4255 *	2010
S.T.	−4.3264 *	2008	−4.3252 *	2008
GDP	−6.1254 *	2007	−1.2390 ***	2008
UN	−3.2675 *	2008	−3.6510 *	2008
IN	−2.6513 ***	1995	−4.9120 *	1998
I.R.	−1.3463 *	2000	−3.5219 ***	2000

\*, \*\*, \*\*\* at 10, 5, and 1% level of significance, **Source: Authors' Compilation.**

As the data suffers from the issue of time break, it is required to check the nonlinearity of the series. The study further uses Brock, Dechert, and Scheinkman (BDS) test to confirm nonlinearity. The findings of the BDS test conclude that the data is not identical and independently distributed by rejecting the null hypothesis. Table 5 shows the result of the BDS test. As all the results of the unit root project that none of the variables is of the second order of integration, the study further proceeds with the analysis of variables using the ARDL and NARDL approaches.

**Table 5.** BDS Test.

BDS Variables	Embedded Dimensions = m				
	m = 2	m = 3	m = 4	m = 5	m = 6
NPLs	0.1265 ***	0.2132 ***	0.2154 ***	0.2241 ***	0.2482 ***
BI	0.3417 ***	0.3521 ***	−0.3612 ***	0.2198 **	0.2198 **
LD	0.1918 ***	0.1652 ***	0.1983 **	0.2174 ***	0.2911 ***
NI	0.1092 **	0.1453 **	0.1712 ***	0.2109 ***	0.2914 ***
RA	0.2871 ***	0.3412 ***	0.3621 ***	0.3793 *	0.3843 **
BDGDP	0.0612 ***	0.0853 ***	0.1613 ***	0.1918 ***	0.2731 *
PCGDP	0.0762 ***	−0.0763 **	0.1093 ***	0.1325 ***	0.2915 ***
FABA	0.1831 ***	0.0781 ***	0.1871 ***	0.1981 ***	0.1992 ***
CO	0.1982 ***	0.2319 ***	0.2819 *	−0.3481 **	0.3842 **
ST	0.0741 **	0.1241 **	0.1571 ***	0.1692 ***	0.1944 ***
GDP	0.1812 ***	0.1913 ***	0.2173 ***	0.2724 ***	0.3671 **
UN	0.1119 *	0.1214 ***	0.2198 **	0.2240 **	0.3081 ***
IN	0.1732 ***	0.1452 *	0.1841 ***	0.1732 ***	−0.1193 ***
IR	0.0190 ***	0.2139 ***	0.0732 ***	0.2119 ***	0.2111 ***

\*, \*\*, \*\*\* at 10, 5, and 1% level of significance, **Source:** Authors' Compilation.

To analyze the short-run and long-run relationship between the variables, ARDL and NARDL methods are employed, using a maximum of four lags. Using Akaike's Information Criteria (AIC), various models are estimated, and the appropriate model is selected based on the lower value of AIC. Table 6 (section a) shows a detailed analysis of the ARDL model. The short-run result of the ARDL model reveals that banking efficiency and banking regulatory capital has a negative and significant impact on banking NPLs. It implies that higher efficiency and regulation help in reducing NPLs. Higher regulation and efficiency enhance accountability and promote traceability, hence assisting in lowering the proportion of NPLs. However, in the short run, the loan-to-deposit ratio positively and significantly affects NPLs in emerging countries. In context to macroeconomic variables, growth rate, interest rate, and inflation are prominent factors affecting NPLs. The short-run result depicts that financial development is not so important determinant for emerging countries. The short-run outcome of the macroeconomic variables corroborates the findings of Nkusu [4], Staehr and Uusküla [23].

To further substantiate the findings, the long-run results of the ARDL model are also analyzed, which shows that in the long run, emerging countries banking NPLs are significantly affected by financial development. Findings show that banking efficiency (B.I.), banking stability capital (R.A.), banking other sources of Income (N.I.), and banking stability index (S.T.) has a significant and negative impact on NPLs. It implies that higher banking efficiency, adequate regulatory capital, stable banking index, and higher dependency on other sources of income other than interest income can help lower NPLs in emerging countries. On the other hand, financial intermediation (PCGDP), banking outreach (L.D.), and competition (C.O.) have a significant and positive impact on NPLs. Meaning that higher competition, higher financial intermediation, and too much credit lead to risky decision and thus increases NPLs. The resulting outcome supports the conceptual viewpoint, which emphasizes that rapid financial sector development raises the probability of systematic risk, and at a certain point, the benefits of financial sector development outweigh the cost [54]. The long-run outcome of the ARDL model also strengthens the above conceptual argument. In addition, the findings also reveal that foreign bank presence is not so significant for emerging countries. Although the coefficient shows a negative sign as foreign bank presence is low in emerging countries. In context to traditional macroeconomic factors, unemployment and growth are the significant factors contributing to NPLs in emerging countries. The findings do not support the work of Boyd and De Nicolo [55] in the context of the competition index, who argued that higher competition increases efficiency and reduces NPLs. However, in the context of financial intermediation, regulatory capital, and stability, this study supports the work of Ozili [56].

**Table 6.** ARDL result.

<i>ARDL Short-run Result (Section a)</i>		Lags			
Dependent Variable: NPLs	0	1	2	3	
Δ in B.I.	−0.23 (−1.02) *				
Δ in LD		0.09 (2.13) **			
Δ in NI	0.14 (1.81)		0.12 (2.08)		
Δ in RA	−0.05 (−2.54) ***				
Δ in BDGDP	0.06 (1.42)				
Δ in PCGDP		0.41 (3.14)			
Δ in FABA	0.10 (2.41)				
Δ in CO	0.96 (3.14)				
Δ in ST	1.31 (2.93)				
Δ in GDP		−2.53 (−3.15) *			
Δ in UN	0.85 (2.99)				
Δ in IN			0.33 (1.65 *)		
Δ in IR	0.91 (1.42 **)				
<i>ARDL Long-run Result</i>					
Ln BI	Ln LD	Ln NI	Ln RA	Ln BDGDP	
−0.15(−0.76) *	2.12 (2.85) **	−0.74 (−0.67) **	−0.16 (−2.43) *	−1.12 (−2.13) **	
Ln PCGDP	Ln FABA	Ln CO	Ln S.T.	Ln GDP	
0.61(1.42) *	−1.19 (−3.49)	0.54 (1.13) **	−0.12 (−1.10) **	−1.14 (−2.51) **	
Ln UN	Ln IN	Ln IR	Ln C		
0.51(1.29) **	1.98 (2.44) *	0.21 (1.35) *	5.06 (0.43)		
<i>Diagnostic Test (Section b)</i>					
ECMt-1	Wald (Joint Sig)	Adj. R <sup>2</sup>	RESET	LM	
−0.008 (0.00 ***)	4.15 *** (Bound)	0.62	11.13	4.2	

\*, \*\*, \*\*\* Indicate the rejection of the null hypothesis at 10, 5, and 1% level of significance. **Source:** Author's Compilation.

Before applying the ARDL test, diagnostic tests are performed, and the results of which are reported in Section b of Table 6. To check the level of cointegration among the variables Wald test, as proposed by Pesaran et al. [52], and the error correction model (ECM) is used. F-statistic is 4.15, which is more than the upper bound value. Thus, it can be concluded that variables have a long-run cointegration and error correction model, which further supports the results of the Wald test as the ECM is negative and significant. The L.M. test and RESET test are employed to test serial correlation and model specification. The result shows that there is no serial correlation as the value of the L.M. test (4.2) is insignificant at a 5% level of significance. Ramsey's RESET test result confirms that the model is correctly specified, as the value (11.13) is more than the critical value. Lastly, the R-square value, which is 0.62, also substantiates that the model enjoys a good fit.

The ARDL model depicts the short-run and long-run symmetric relationships among the variables. However, we employed the NARDL approach to investigate positive and negative shocks and how these alter among the independent and dependent variables. The NARDL model uses a similar procedure as followed by the ARDL model. The NARDL model reported in Section a of Table 7 shows that in the short-run, a decrease in bank efficiency in terms of cost-to-income ratio increases NPLs, whereas an increase in bank efficiency reduces NPLs. It implies a short-run asymmetric relationship between banking efficiency and NPLs. In addition, in context to the macroeconomic variables, the result shows that negative shocks in the growth rate increase NPLs, and a positive shock in the interest rate and inflation rate increases NPLs. This substantiates that there is a short-run symmetric relationship between macroeconomic variables and NPLs. Furthermore, the result also highlights that financial development indicators have an insignificant relationship with the NPLs in the short run. Because the changing dynamics of financial development vary in the countries studied, the response of these financial development policies to the level of economic growth and the banking industry is a long-term phenomenon [46].

Table 7. NARDL Result.

<i>NARDL Short-run Result</i> (Section a)		Lags		
Dependent Variable: NPLs	0	1	2	
$\Delta$ in BI <sup>+</sup>	0.12 (0.32) **	−0.04 (−0.03)	0.94 (1.15)	
$\Delta$ in BI <sup>−</sup>	−0.11 (−0.41) *	0.65 (1.32)	0.15 (0.91)	
$\Delta$ in LD <sup>+</sup>	0.21 (0.79)	0.09 (1.13)	−0.08 (1.10)	
$\Delta$ in LD <sup>−</sup>	0.16 (0.65)	0.15 (0.76)	−0.81 (0.94)	
$\Delta$ in NI <sup>+</sup>	−0.14 (1.81)	−0.12 (0.34)	0.12 (2.08)	
$\Delta$ in NI <sup>−</sup>	−0.73 (1.12)	−0.16 (1.12)	0.17 (1.12)	
$\Delta$ in RA <sup>+</sup>	0.05 (1.54)	−0.05 (−0.67)	−0.04 (2.12)	
$\Delta$ in RA <sup>−</sup>	0.12 (0.62)	0.07 (0.53)	−0.54 (1.91)	
$\Delta$ in BDGDP <sup>+</sup>	0.06 (1.42)	0.13 (0.16)	0.11 (0.83)	
$\Delta$ in BDGDP <sup>−</sup>	0.22 (1.43)	0.09 (1.04)	0.09 (0.22)	
$\Delta$ in PCGDP <sup>+</sup>	0.31 (0.79)	0.41 (1.14)	0.04 (1.09)	
$\Delta$ in PCGDP <sup>−</sup>	0.42 (0.86)	0.19 (2.13)	−0.91 (1.14)	
$\Delta$ in FABA <sup>+</sup>	−0.10 (1.41)	−0.05 (1.11)	−0.83 (1.19)	
$\Delta$ in FABA <sup>−</sup>	−0.17 (1.21)	−0.12 (0.54)	0.05 (1.86)	
$\Delta$ in CO <sup>+</sup>	0.06 (1.14)	0.18 (1.13)	0.16 (0.98)	
$\Delta$ in CO <sup>−</sup>	0.01 (2.13)	0.04 (.40)	0.71 (1.14)	
$\Delta$ in ST <sup>+</sup>	−0.31 (−1.93)	0.19 (1.43)	0.54 (0.95)	
$\Delta$ in S.T. <sup>−</sup>	−0.38 (−1.87)	0.18 (2.05)	1.31 (1.08)	
$\Delta$ in GDP <sup>+</sup>	−0.18 (−0.89)	−0.53 (−1.15)	0.91 (1.21)	
$\Delta$ in GDP <sup>−</sup>	0.91 (1.21)	0.40(0.18) **	0.04 (1.12)	
$\Delta$ in UN <sup>+</sup>	0.85 (1.99)	0.10(1.11)	0.67 (0.98)	
$\Delta$ in UN <sup>−</sup>	0.26 (0.98)	0.20(0.92)	0.18 (0.16)	
$\Delta$ in IN <sup>+</sup>	0.13 (0.83)	0.13 (0.19) *	0.33 (1.65) *	
$\Delta$ in IN <sup>−</sup>	0.10 (0.11)	−0.11 (−0.27)	0.01 (0.06)	
$\Delta$ in IR <sup>+</sup>	0.11 (0.12)	1.13 (1.54) **	0.42 (0.52)	
$\Delta$ in I.R. <sup>−</sup>	−0.03 (−0.19)	−0.26 (−1.14)	0.07 (1.92)	
<i>NARDL Long-run Result</i>				
Ln BI <sup>−</sup>	Ln LD <sup>−</sup>	Ln NI <sup>−</sup>	Ln RA <sup>−</sup>	Ln BDGDP <sup>−</sup>
−0.31 (−0.83) **	−0.15 (−1.65) *	0.18 (0.83) *	0.08 (1.11) *	−0.12 (−1.98) *
Ln PCGDP <sup>−</sup>	Ln FABA <sup>−</sup>	Ln CO <sup>−</sup>	Ln S.T. <sup>−</sup>	Ln GDP <sup>−</sup>
−1.05 (−1.31) *	−0.17 (−1.29)	−0.24 (−1.23) *	0.16(1.14) **	0.12 (1.21) **
Ln U.N. <sup>−</sup>	Ln IN <sup>−</sup>	Ln I.R. <sup>−</sup>		
−0.31 (−1.32) *	−1.21-2.44) *	−0.62 (−1.22) *		
Ln BI <sup>+</sup>	Ln LD <sup>+</sup>	Ln NI <sup>+</sup>	Ln RA <sup>+</sup>	Ln BDGDP <sup>+</sup>
0.03(0.91) **	1.08 (1.65) *	−0.15(−0.97) **	−0.09 (−1.23) **	1.10 (1.13) *
Ln PCGDP <sup>+</sup>	Ln FABA <sup>+</sup>	Ln CO <sup>+</sup>	Ln ST <sup>+</sup>	Ln GDP <sup>+</sup>
1.41 (1.23) *	1.08 (1.21)	0.27 (1.30) *	−0.13 (−1.58) **	−1.19(−1.41)*
Ln UN <sup>+</sup>	Ln IN <sup>+</sup>	Ln IR <sup>+</sup>		
0.43 (1.49) **	1.24 (1.44) **	0.14 (1.31) *		
<i>Diagnostic Test Result</i> (Section b)				
ECMt-1	(Joint Sig)	Adj. R <sup>2</sup>	RESET	LM
−0.012 (0.00 ***)	9.15 ***	0.68	7.21	16
F	Ln BI <sub>SR</sub>	Ln LD <sub>SR</sub>	Ln NI <sub>SR</sub>	Ln RA <sub>SR</sub>
2.13	0.04 (0.003) *	2.11 (0.98)	0.86 (0.96)	0.45 (0.78)
Ln BDGDP <sub>SR</sub>	Ln PCGDP <sub>SR</sub>	Ln FABA <sub>SR</sub>	Ln CO <sub>SR</sub>	Ln ST <sub>SR</sub>
0.44 (0.65)	1.13 (0.86)	0.12 (0.94)	0.65 (0.81)	0.36 (0.21)
Ln GDP <sub>SR</sub>	Ln UN <sub>SR</sub>	Ln IN <sub>SR</sub>	Ln IR <sub>SR</sub>	Ln BI <sub>LR</sub>
1.12 (0.04) **	0.98 (0.34)	1.11 (0.02) *	0.22 (0.05) **	1.43 (0.001) ***
Ln LD <sub>LR</sub>	Ln NI <sub>LR</sub>	Ln RA <sub>LR</sub>	Ln BDGDP <sub>LR</sub>	Ln PCGDP <sub>LR</sub>
0.65 (0.041) **	0.41 (0.003) **	1.52(0.004) **	1.21 (0.011) *	0.45 (0.003) **
Ln FABA <sub>LR</sub>	Ln CO <sub>LR</sub>	Ln ST <sub>LR</sub>	Ln GDP <sub>LR</sub>	Ln UN <sub>LR</sub>
1.31 (0.98)	0.32 (0.001) **	1.11 (0.04) *	0.34 (0.04) *	0.12 (0.02) *
Ln IN <sub>LR</sub>	Ln IR <sub>LR</sub>			
0.91 (0.011) **	0.01 (0.045) *			

\*, \*\*, \*\*\* Indicate the rejection of the null hypothesis at 10, 5, and 1% level of significance, Source Authors' Compilation.

Proceeding to long-run asymmetric estimation, the results show that all the financial development indicators and traditional macroeconomic variables have a significant impact on the NPLs, except for foreign banks' presence, which is insignificant for emerging countries, as the concentration of foreign banks is less in emerging countries. The long-run result shows that the positive shocks of financial development indicators (financial intermediation, size of the banks) and banking indicators (bank cost to income ratio, banking competition, loan to deposit ratio) have a significant positive impact on NPLs. In other words, when a positive shock is exerted on financial intermediation, size of the banks, bank cost-to-income ratio, banking competition, and loan-to-deposit ratio, NPLs tend to increase. However, when a negative shock is given to the above variables, NPLs show a decreasing trend. It implies an asymmetric long-run relationship between financial development and NPLs. Such a relationship exists because the initial pace of financial deepening in emerging countries generates financial sector instability. It has been documented that a rapid transformation in the financial structure which is weakly regulated and monitored, can be accompanied by greater risk-taking, competition, and high leverage, thereby increasing the consequences of a banking crisis in emerging countries [57].

Furthermore, prior research suggests that when a threshold limit of private credit to GDP is reached, financial development slows growth since credit expansion beyond a certain point is a major determinant of banking non-performing loans (NPLs) [58–60]. The excessive competition created by new entrants also leads to credit expansion. Excessive competition raises the risks of inadequate credit redressal processes, which leads to an increase in non-performing loans (NPLs) and vice versa. The same arguments, on the other hand, do not hold to countries with well-developed and regulated financial systems. A well-established financial system, especially in developed countries, aids in adapting to financial crises and maintaining a sound banking system [61,62]. In addition, structured financial development creates a platform for healthy competition in developed economies. The above arguments corroborate the existence of a non-linear relationship between financial development and NPLs and strengthen the outcome that a high level of financial intermediation and competition increases the NPLs in emerging countries and vice versa.

Our study also concludes that when a positive shock (negative shock) is given to non-interest sources of income, stability index, and regulatory capital, NPLs tend to show a decreasing trend (increasing trend). The plausible reason is that with an increase in banking efficiency, regulation and monitoring enhances, and thus NPLs decrease. Berger and DeYoung [63] also supported the above outcome and concluded that an increase in operating efficiency increases investments in underwriting and thus reduces NPLs. On the other hand, due to skimping hypothesis, low operating efficiency leads to higher NPLs. Similarly, diversifying the bank's source of income also limits the excessive reliance on bank interest rate spread which ultimately reduces excessive credit disbursement, and hence NPLs decrease.

In contrast, too much dependency on the bank interest source of income increases the loan disbursement, often resulting in higher NPLs. These explanations also support a non-linear relationship between banking efficiency, non-interest source of income, and NPLs and further align with the studies conducted by (Fernandes et al. [42]; Berger and DeYoung [63]. Moreover, in the context of traditional macroeconomic variables, our study shows that in the long run, positive shocks in the unemployment rate, inflation, and interest rate positively and significantly impact NPLs. It implies that with the increase(decrease) in the above-mentioned macroeconomic variables, NPLs increase (decrease). Higher unemployment, inflation, and interest rate restrict the debt servicing capacity of the borrowers and thus creates positive pressure on the NPLs.

Conversely, a low unemployment rate, moderate inflation, and stable interest rate assist in increasing the Debt servicing capability, and hence NPLs show a decreasing trend. Lastly, the results also concluded that positive shocks in the growth rate help reduce NPLs in the long run, whereas negative shocks increase NPLs. A favourable economic growth rate creates an optimistic business environment that assists in generating savings,

consumption, and investments. An increase in consumption, saving and investments assist in income generation, and higher income promotes fewer loan defaults and vice-versa. The explanation and outcome are in line with the study carried out by (Nkusu [4]; Staehr, and Uusküla [23]).

Before applying NARDL, diagnostic checks are also performed to confirm the suitability of the model. The result of the diagnostic test (Section (b) of Table 7) shows that there is a cointegration among the variables in the long run based on the joint significance F-value, which is 9.15. The ECM value also substantiates the findings of F statistics. L.M. and RESET tests show that the data has no serial correlation and is well specified as the value is lower than the critical value. The adjusted R-square value of the NARDL model is 68%, which supports that the findings of NARDL are more robust than the ARDL model, which has an R-square value of 62%. The diagnostic test also shows the WALD value of long-run and short-run analysis, which confirms the presence of an asymmetric relationship among the variables in the long-run and short-run. Refer to Appendix B for a list of econometric tests carried out.

#### 4. Conclusions

Financial development is a vital factor for sustainable growth in emerging countries. Developed financial institutions provide sufficient investments and credit opportunities to meet the growing market demand. However, financial sector development without adequate regulation and supervision adversely affects the banking industry. A vast body of literature shows that credit portfolios and non-performing loans constitute an important component of the overall health of the banking industry. Therefore, taking into cognizance of the above issue, the current study attempts to answer a fundamental question: how do financial development parameters, banking stability dimensions, and traditional macroeconomic factors affect the NPLs of the selected emerging market economies? The findings suggest that emerging countries' banking structure lacks sufficient infrastructure to sustain a high pace of financial sector development. The banks in emerging countries are not so efficient; they lack adequate regulatory capital buffers, robust supervisory mechanisms, and resources to reap the benefits of financial sector expansion. In continuation, financial intermediation is also high in the banks of emerging countries, resulting in low screening standards and higher NPLs. The findings also suggest that banks in developing nations lack stability and have a low overall stability index, owing to the fact that banks are still fragmented and not centralized like in industrialized countries. Result highlights that too much internal competition in emerging countries' banks creates pressure for sales and faulty business activities, which results in poor banking decisions and default loans. Banks in emerging countries have a lower non-interest income, more inclined toward earning profit through the distribution of loans. Hence, they have a higher loan-to-deposit ratio, which is also a prominent factor contributing to NPLs. In the context of foreign banks, the results are insignificant, as the total contribution of foreign banks in emerging countries is almost negligible. Emerging countries are also struggling with other macroeconomic issues like growth rate, unemployment, inflation, and interest rate fluctuation. Thus, the sampled countries should also work on macroeconomic fundamentals and banking policies to ease the issue of mounting NPLs.

The study also emphasizes the understanding of the asymmetric and symmetric nature of the impact of various determinants of NPLs. Policymakers should comprehend the implication of positive and negative shocks of variables, which will assist in policy formulation. Our empirical analysis shows that positive shock of financial sector intermediation, stability, and regulatory mechanism significantly impact NPLs. In emerging countries, NPLs increase with the increase in financial intermediation. NPLs increase because of weak lending standards and due to the presence of non-banking financial institutions in the financial intermediation process.

Furthermore, growing financial intermediation among emerging countries due to the active involvement of middle and low-income clients increases transaction costs. In

addition to transaction and information expenses, financial inefficiencies are exacerbated by insufficient collateral. To address the challenges mentioned above, authorities should keep a close eye on loan supervision, governance, and the financial intermediation process. They should also maintain a balance between financial sector development and financial stability, as the studies show that financial sector stability reduces NPLs indirectly.

Besides the above policy-oriented findings, the study suggests the following measures to control NPLs in emerging countries. As previously stated, financial intermediation and bank size destabilize financial development in emerging countries. As a result, emerging countries must focus on the financial development dimension of financial access. Financial inclusion will be aided through financial access, and the bank's regulatory capital will increase. Hence banks will become more efficient and stable in the long run. In the context of banking efficiency and stability, we can recommend that policymakers work on increasing the bank's operating efficiency by reducing fragmented banking and emphasizing concentrated banking. In addition, the bank should invest more in the underwriting and credit-risk assessment of the borrowers so that the NPLs can be minimized. Banks need to put a threshold on the private credit to growth ratio to limit the credit disbursement beyond a certain limit. Credit expansion competition also needs to be monitored to avoid laxity in loan disbursement.

Moreover, banks are required to limit their dependency on interest sources of income and look for alternative sources of income to restrain unhealthy loan distribution. In addition, banks need to create a regulatory capital buffer to avoid any unexpected contingencies. Finally, banks must also monitor the macroprudential policies to avoid the repercussion of macroeconomic factors on banking profitability and NPLs. Thus, based on the overall empirical evidence, we can conclude that rapid transformation in the financial structure without adequate resources and infrastructure is detrimental to the overall health of the banking industry. Therefore, policymakers and regulators must adopt suitable strategies to avoid the systematic risk of financial development and implement financial development more sequentially.

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### Appendix A. The Chronological Summary of Extant Literature

Authors	Countries	Year	Variables	Methods	Findings
Espinoza and Prasad [19]	GCC countries	1995–2008	Interest rate and growth rate	VAR	The study concludes that interest rate increases NPLs.
Tecles & Tabak [12]	Brazilian banking Sector	2000–2007	Banking efficiency and Foreign bank presence	Bayesian Stochastic frontier approach	The result concludes large barge banks are more efficient and have lower NPLs.
Nkusu [4]	26 developed countries	1998–2009	Growth rate, inflation, unemployment, interest rate.	VAR	The study concluded a direct link between macroeconomic factors and NPLs.
Louzis et al. [63]	Greek banking	2003–2009	Growth rate, inflation, unemployment, interest rates, management efficiency	GMM	The results concluded that in the Greek banking system, NPLs could be explained by macroeconomic factors and management roles.
Chaibi [20]	Germany and France	2005–2011	Growth rate, interest rate, exchange rate, inefficiency.	GMM	The result indicates that in France, NPLs are more susceptible to bank-specific factors. The study also concluded that except for inflation, all the other macroeconomic variables affect NPLs.
Syed A & Aidiyngul.Y [64]	Developed and Developing	1995–2009	Bank profitability, Bank return on equity, Fiscal deficit, GDP, unemployment	GMM	The GMM result concludes that economic growth and bank profitability have a negative impact, whereas unemployment and deficit have a positive impact on NPLs.
Beck et al. [11]	75 Countries	2000–2010	Growth rate, lending rate, share price lending and exchange rate	Lagged regression model	The study highlights that share price, lending rates, and exchange rate are significant determinants of NPLs.
Karsten. S & Uusküla. L [65]	EU countries	1997–2017	Macro-financial and Macroeconomic variables like GDP, unemployment, debt	Fixed effect panel model	The study concludes that macro-financial and macroeconomic variables are a predictor of NPLs. GDP, inflation, and Debt are important determinants of NPLs.
Nikolaidou & Vogiazas [66]	5 Sub-Saharan African countries	2004–2014	Bank-specific factors, money supply	ARDL	The results conclude that in the sample countries, bank-specific variables are the prominent reasons for NPLs. Money supply and country-specific conditions also indirectly affect NPLs.

Authors	Countries	Year	Variables	Methods	Findings
Chen et al., [1]	31 provinces in China	2005–2016	Size of banks, financial inclusion index, Education, unemployment, inflation, investment in assets	Panel regression analysis	The result concludes that financial inclusion increases NPLs.
Huhtilainen [67]	339 Finland Banks	2002–2018	Cost inefficiency and Income diversification	2-System GMM	The study concludes income diversification helps in reducing NPLs, and cost inefficiency increases NPLs.
Thai-Ha Le et al. [68]	31 Asian countries	2004–2016	Financial efficiency, Financial Inclusion and sustainability	PCA, FGLS	The results conclude that financial inclusion negatively affects financial efficiency.
Ozili [37]	138 Countries	2003–2014	Foreign bank presence, bank deposit to GDP ratio, private credit to banks, bank efficiency	Regression model, Sensitivity analysis	The study concludes that foreign bank presence positively affects NPLs. However, bank efficiency and development inversely affect NPLs
Son et al. [17]	120 countries	2004–2017	Corruption, economic growth	3SLS regressions	The result concludes that corruption leads to lower growth resulting in higher NPLs.

Source: Authors' Compilation.

Appendix B. Tests

Table 1	Expected relationship and detail of Emerging countries
Table 2	Descriptive Statistics of Emerging Countries
Table 3a	Augmented Dicky Fuller Unit root test result
Table 3b	CIPS unit root test
Table 4	Zivot and Andrews Test
Table 5	BDS test
Table 6	ARDL result
Table 6a	Diagnostic test ARDL
Table 7	NARDL Result
Table 7a	Diagnostic test NARDL

Source: Authors' Compilation.

References

- Chen, F.W.; Feng, Y.; Wang, W. Impacts of financial inclusion on non-performing loans of commercial banks: Evidence from China. *Sustainability* **2018**, *10*, 3084. [CrossRef]
- Dimitrios, A.; Helen, L.; Mike, T. Determinants of non-performing loans: Evidence from Euro-area countries. *Financ. Res. Lett.* **2016**, *18*, 116–119. [CrossRef]
- Ari, A.; Chen, S.; Ratnovski, L. *The Dynamics of Non-Performing Loans during Banking Crises: A New Database*; IMF Working Paper 19/272; International Monetary Fund: Washington, DC, USA, 2019.
- Nkusu, M.M. *NPLs and Macro Financial Vulnerabilities in Advanced Economies*; No. 11-161; International Monetary Fund: Washington, DC, USA, 2011.
- Naceur, S.B.; Omran, M. The effects of bank regulations, competition, and financial reforms on banks' performance. *Emerg. Mark. Rev.* **2011**, *12*, 1–20. [CrossRef]
- Ozili, P.K. Banking stability determinants in Africa. *Int. J. Manag. Financ.* **2018**, *14*, 462–483. [CrossRef]

7. Park, C.-Y.; Shin, K. Contagion through National and Regional Exposures to Foreign Banks during the Global Financial Crisis. *J. Financ. Stab.* **2020**, *46*, 100721. [[CrossRef](#)]
8. Syed, A.A.; Ahmed, F.; Kamal, M.A.; Ullah, A.; Ramos-Requena, J.P. Is There an Asymmetric Relationship between Economic Policy Uncertainty, Cryptocurrencies, and Global Green Bonds? Evidence from the United States of America. *Mathematics* **2022**, *10*, 720. [[CrossRef](#)]
9. Makri, V.; Tsagkanos, A.; Bellas, A. Determinants of non-performing loans: The case of Eurozone. *Panoeconomicus* **2014**, *61*, 193–206. [[CrossRef](#)]
10. Demirgüç-Kunt, A.; Huizinga, H. *Financial Structure and Bank Profitability*; World Bank Publications: Washington, DC, USA, 2000.
11. Beck, R.; Jakubik, P.; Piloju, A. Key determinants of non-performing loans: New evidence from a global sample. *Open Econ. Rev.* **2015**, *26*, 525–550. [[CrossRef](#)]
12. Tecles, P.L.; Tabak, B.M. Determinants of bank efficiency: The case of Brazil. *Eur. J. Oper. Res.* **2010**, *207*, 1587–1598. [[CrossRef](#)]
13. Murshed, M.; Saadat, S.Y. An empirical investigation of non-performing loans and governance: A South Asian perspective. *World Rev. Bus. Res.* **2018**, *8*, 188–206.
14. Ghosh, R.; Sen, K.K.; Riva, F. Behavioral determinants of non-performing loans in Bangladesh. *Asian J. Account. Res.* **2020**, *5*, 327–340. [[CrossRef](#)]
15. Babar, S.; Latief, R.; Ashraf, S.; Nawaz, S. Financial stability index for the financial sector of Pakistan. *Economies* **2019**, *7*, 81. [[CrossRef](#)]
16. Yusgiantoro, I.; Soedarmono, W.; Tarazi, A. Bank consolidation and financial stability in Indonesia. *Int. Econ.* **2019**, *159*, 94–104. [[CrossRef](#)]
17. Son, T.H.; Liem, N.T.; Khuong, N.V.; Luo, R.H. Corruption, non-performing loans, and economic growth: International evidence. *Cogent Bus. Manag.* **2020**, *7*, 1735691. [[CrossRef](#)]
18. Shahbaz, M.; Zakaria, M.; Shahzad, S.J.H.; Mahalik, M.K. The energy consumption and economic growth nexus in top ten energy-consuming countries: Fresh evidence from using the quantile-on-quantile approach. *Energy Econ.* **2018**, *71*, 282–301. [[CrossRef](#)]
19. Espinoza, R.A.; Prasad, A. *NPLs in the GCC Banking System and Their Macroeconomic Effects*; No. 10-224; International Monetary Fund: Washington, DC, USA, 2010.
20. Chaibi, H.; Ftiti, Z. Credit risk determinants: Evidence from a cross-country study. *Res. Int. Bus. Financ.* **2015**, *33*, 1–16. [[CrossRef](#)]
21. Boujelbene, Y.; Nabila, Z. Impact of Internal Mechanisms of Governance on the Tunisian Banks' Risk-Taking. *IUP J. Corp. Gov.* **2011**, *10*, 56.
22. Staehr, K.; Uusküla, L. Macroeconomic and macro-financial factors as leading indicators of non-performing loans. *J. Econ. Stud.* **2020**, *48*, 720–740. [[CrossRef](#)]
23. Petropoulos, A.; Siakoulis, V.; Mylonas, D.; Klamargias, A.; Alexakis, P.D.; Samantas, I.G. *A Combined Statistical Framework for Forecasting Default Rates of Greek Financial Institutions' Credit Portfolios*; No. 243; Bank of Greece Printing Works: Athens, Greece, 2018.
24. Anastasiou, D.; Louri, H.; Tsionas, M. Non-performing loans in the euro area: A re core–periphery banking markets fragmented? *Int. J. Financ. Econ.* **2019**, *24*, 97–112. [[CrossRef](#)]
25. Castro, V. Macroeconomic determinants of the credit risk in the banking system: The case of the GIPSI. *Econ. Model.* **2013**, *31*, 672–683. [[CrossRef](#)]
26. Škarica, B. Determinants of non-performing loans in Central and Eastern European countries. *Financ. Theory Pract.* **2014**, *38*, 37–59. [[CrossRef](#)]
27. Berge, T.O.; Boye, K.G. *An Analysis of Banks' Problem Loans*; Norges Bank: Oslo, Norway, 2007.
28. Vogiazas, S.D.; Nikolaidou, E. Investigating the determinants of NPLs in the Romanian banking system: An empirical study with reference to the Greek crisis. *Econ. Res. Int.* **2011**, *2011*, 214689. [[CrossRef](#)]
29. Umar, M.; Sun, G.; Majeed, M.A. Bank capital and liquidity creation: Evidence of relation from India. *J. Asia Bus. Stud.* **2017**, *11*, 152–166. [[CrossRef](#)]
30. Fofack, H.L. *NPLs in Sub-Saharan Africa: Causal Analysis and Macroeconomic Implications*; The World Bank: Washington, DC, USA, 2005.
31. Li, Y.; Hu, J.L.; Liu, H.W. Non-performing loans and bank efficiencies: An application of the input distance function approach. *J. Stat. Manag. Syst.* **2009**, *12*, 435–450. [[CrossRef](#)]
32. Rajan, R.; Dhal, S.C. Non-performing loans and terms of credit of public sector banks in India: An empirical assessment. *Reserve Bank India Occas. Pap.* **2003**, *24*, 81–121.
33. Salas, V.; Saurina, J. Credit risk in two institutional regimes: Spanish commercial and savings banks. *J. Financ. Serv. Res.* **2002**, *22*, 203–224. [[CrossRef](#)]
34. Sinkey, J.F.; Greenawalt, M.B. Loan-loss experience and risk-taking behavior at large commercial banks. *J. Financ. Serv. Res.* **1991**, *5*, 43–59. [[CrossRef](#)]
35. Klein, N. *Non-Performing Loans in CESEE: Determinants and Impact on Macroeconomic Performance*; No. 13-72; International Monetary Fund: Washington, DC, USA, 2013.
36. Naudé, W. *The Financial Crisis of 2008 and the Developing Countries*; No. 2009/01; WIDER Discussion Paper; UNU-WIDER: Helsinki, Finland, 2009.

37. Ozili, P.K. Non-performing loans and financial development: New evidence. *J. Risk Financ.* **2019**, *20*, 59–81. [[CrossRef](#)]
38. Tanasković, S.; Jandrić, M. Macroeconomic and institutional determinants of non-performing loans. *J. Cent. Bank. Theory Pract.* **2015**, *4*, 47–62. [[CrossRef](#)]
39. Giannetti, M.; Ongena, S. Financial integration and firm performance: Evidence from foreign bank entry in emerging markets. *Rev. Financ.* **2009**, *13*, 181–223. [[CrossRef](#)]
40. Syed, A.A. Does banking efficiency, regulation, and operations affect banking performance in South Asia: Dynamic correlated model approach. *Front. Appl. Math. Stat.* **2020**, *6*, 38. [[CrossRef](#)]
41. Fernandes, F.D.S.; Stasinakis, C.; Bardarova, V. Two-stage DEA-Truncated Regression: Application in banking efficiency and financial development. *Expert Syst. Appl.* **2018**, *96*, 284–301. [[CrossRef](#)]
42. Zhang, R.; Naceur, S.B. Financial development, inequality, and poverty: Some international evidence. *Int. Rev. Econ. Financ.* **2019**, *61*, 1–16. [[CrossRef](#)]
43. Syed, A. Assessing the Impact of Banking Efficiency, Operations and Regulation on Banking Performance: Fresh Insight Using Dynamic Correlated Framework on the Data Set of Russia and Ukraine. *J. East. Eur. Cent. Asian Res.* **2021**, *8*, 89–99. [[CrossRef](#)]
44. Rao Subramaniam, V.P.; Ab-Rahim, R.; Selvarajan, S.K. Financial Development, Efficiency, and Competition of ASEAN Banking Market. *Asia-Pac. Soc. Sci. Rev.* **2019**, *19*, 185–202.
45. World Bank. *Global Financial Development Report 2019/2020: Bank Regulation and Supervision A Decade after the Global Financial Crisis*; The World Bank: Washington, DC, USA, 2019.
46. Lin, X.; Zhang, Y. Bank ownership reform and bank performance in China. *J. Bank. Financ.* **2009**, *33*, 20–29. [[CrossRef](#)]
47. Van den End, J.W. A macroprudential approach to address liquidity risk with the loan-to-deposit ratio. *Eur. J. Financ.* **2016**, *22*, 237–253. [[CrossRef](#)]
48. Ozili, P.K.; Uadiale, O. Ownership concentration and bank profitability. *Future Bus. J.* **2017**, *3*, 159–171. [[CrossRef](#)]
49. Caporale, G.M.; Rault, C.; Sova, A.D.; Sova, R. Financial development and economic growth: Evidence from 10 new European Union members. *Int. J. Financ. Econ.* **2015**, *20*, 48–60. [[CrossRef](#)]
50. Cihak, M.; Demirgüç-Kunt, A.; Feyen, E.; Levine, R. *Benchmarking Financial Systems Around the World*; The World Bank: Washington, DC, USA, 2012.
51. Pesaran, M.H.; Shin, Y.; Smith, R.J. Bounds testing approaches to the analysis of level relationships. *J. Appl. Econom.* **2001**, *16*, 289–326. [[CrossRef](#)]
52. Shahzad, S.J.H.; Kumar, R.R.; Zakaria, M.; Hurr, M. Carbon emission, energy consumption, trade openness and financial development in Pakistan: A revisit. *Renew. Sustain. Energy Rev.* **2017**, *70*, 185–192. [[CrossRef](#)]
53. Svirydzenka, K. *Introducing a New Broad-Based Index of Financial Development*; International Monetary Fund: Washington, DC, USA, 2016.
54. Boyd, J.H.; De Nicolo, G. The theory of bank risk taking and competition revisited. *J. Financ.* **2005**, *60*, 1329–1343. [[CrossRef](#)]
55. Ozili, P.K. How bank managers anticipate non-performing loans. Evidence from Europe, US, Asia and Africa. Evidence from Europe, US, Asia and Africa. *Appl. Financ. Account.* **2015**, *1*, 73–80. [[CrossRef](#)]
56. Ben Naceur, S.; Candelon, B.; Lajaunie, Q. Taming financial development to reduce crises. *Emerg. Mark. Rev.* **2019**, *40*, 100618. [[CrossRef](#)]
57. Arcand, J.L.; Berkes, E.; Panizza, U. Too much finance? *J. Econ. Growth* **2015**, *20*, 105–148. [[CrossRef](#)]
58. Moiseev, N.; Mikhaylov, A.; Varyash, I.; Saqib, A. Investigating the relation of GDP per capita and corruption index. *Entrep. Sustain. Issues* **2020**, *8*, 780. [[CrossRef](#)]
59. Matveeva, N. Legislative Regulation Financial Statement Preparation by Micro Entities: International Experience. *Financ. J.* **2021**, *13*, 125–138. [[CrossRef](#)]
60. Varyash, I.; Mikhaylov, A.; Moiseev, N.; Aleshin, K. Triple bottom line and corporate social responsibility performance indicators for Russian companies. *Entrep. Sustain. Issues* **2020**, *8*, 313–329. [[CrossRef](#)]
61. Bushukina, V. Specific Features of Renewable Energy Development in the World and Russia. *Financ. J.* **2021**, *13*, 93–107. [[CrossRef](#)]
62. Berger, A.N.; DeYoung, R. Problem loans and cost efficiency in commercial banks. *J. Bank. Financ.* **1997**, *21*, 849–870. [[CrossRef](#)]
63. Louzis, D.P.; Vouldis, A.T.; Metaxas, V.L. Macroeconomic and bank-specific determinants of non-performing loans in Greece: A comparative study of mortgage, business and consumer loan portfolios. *J. Bank. Financ.* **2012**, *36*, 1012–1027. [[CrossRef](#)]
64. Syed, A.A.; Aidyngul, Y. Macro economical and bank-specific vulnerabilities of nonperforming loans: A comparative analysis of developed and developing countries. *J. Public Aff.* **2022**, *22*, e2414. [[CrossRef](#)]
65. Staehr, K.; Uusküla, L. Forecasting Models for Non-Performing Loans in the EU Countries. *Bank of Estonia Working Papers wp2017-10*, Bank of Estonia: Tallinn, Estonia, 2017; revised 9 November 2017.
66. Nikolaidou, E.; Vogiazas, S. Credit Risk Determinants for the Bulgarian Banking System. *Int. Adv. Econ. Res.* **2014**, *20*, 87–102. [[CrossRef](#)]
67. Huhtilainen, M. Banks' Trust in the E.U. Macroprudential Regulation. *J. Bank. Financ. Econ.* **2019**, *12*, 29–38. [[CrossRef](#)]
68. Le, T.H.; Chuc, A.T.; Taghizadeh-Hesary, F. Financial inclusion and its impact on financial efficiency and sustainability: Empirical evidence from Asia. *Borsa Istanbul. Rev.* **2019**, *19*, 310–322. [[CrossRef](#)]