The Impact of Foreign Direct Investment on Non-Performing Loans in Bangladesh

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Abstract

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Non-performing loans (NPL) and foreign direct investment (FDI) are pivotal financial parameters exerting contrasting effects on economic performance, particularly in developing and emerging economies. Foreign direct investment, known for stimulating economic activity, has the potential to reduce the number of non-performing loans. This paper investigates how foreign direct investment influences non-performing loan dynamics using data from Bangladesh spanning from 1991 to 2022 alongside key macroeconomic variables. The findings indicate that, overall, FDI has a very minimal positive impact on NPL, underscoring that the relationship between foreign investment and banking stability is complex and likely influenced by multiple factors beyond just FDI.

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1 Introduction

In the contemporary global economy, foreign direct investment (FDI) plays a pivotal role in shaping the economic landscape of developing nations. For a country like Bangladesh, emerging as a dynamic and fast-growing market, foreign direct investment represents a key driver of economic growth, offering opportunities for technological advancement, job creation, and infrastructure development. On the other hand, non-performing loans, which occur when borrowers fail to meet repayment obligations for an extended period, pose a significant risk to financial stability and can hamper the effectiveness of monetary policy transmission and credit allocation.

Despite efforts to address this issue, Bangladesh has struggled to effectively manage non-performing loans, which have remained stubbornly high in recent years. Figure 1 in the Appendix shows the trend of non-performing loan ratios in Bangladesh, indicating a clear upward trajectory in recent years, with a few sudden declines. Elevated non-performing loans can erode banks' profitability, weaken their capital adequacy ratios, and constrain their ability to extend credit to productive sectors of the economy, including small and medium-sized enterprises (SMEs). Additionally, non-performing loans can undermine investor confidence, deter foreign investment, and hinder economic growth prospects. In the latest fiscal year, the banking sector in Bangladesh experienced the lowest profitability (indicated by Return on Asset) in South Asia. This is largely due to the high prevalence of non-performing loans, reduced operational efficiency, and elevated funding costs.

While extensive research has examined the determinants of non-performing loans and foreign direct investment individually, there is a growing interest in exploring the potential interplay between these variables. A recent study by Salko, Mamo, and Mustaqe (2024) shows a positive relationship between NPL and FDI. However, findings by Ozili, Salman, and Ali (2020) show an opposite effect, indicating that the relationship between foreign direct investment and non-performing loans is complex and context-specific influenced by factors such as the quality of governance, regulatory environment, and macroeconomic stability. Bangladesh, like many other countries, faces difficulties in attracting foreign direct investment inflows while simultaneously grappling with a rise in non-performing loans. Given the country's economic context and institutional framework, understanding the dynamics between foreign direct investment and non-performing loans in Bangladesh is crucial.

The primary objective of this thesis paper is to empirically examine the relationship between foreign direct investment inflows and non-performing loans in Bangladesh. By focusing on macroeconomic variables such as GDP growth rate, inflation, foreign direct investment, and unemployment rate, which have been found to have a strong impact on non-performing loans in previous research works by Koju, Abbas, and Wang 2018, Salko, Mamo, and Mustaqe (2024) and Roy, Dey, and Bhowmik (2014), this study aims to uncover

long-term relationships and causal linkages between FDI inflows and non-performing loan levels through the Vector Autoregression (VAR) approach, followed by impulse response function analysis and variance decomposition.

The results indicate that foreign direct investment has a positive but minimal impact on non-performing loans. This finding aligns with the recent work by Salko, Mamo, and Mustaqe (2024), which concluded that there is a significant positive connection between foreign direct investment and non-performing loans. Among the variables analyzed, unemployment along with the GDP growth rate of Bangladesh and the USA were found as significant determinants of non-performing loans. Interestingly, foreign direct investment is identified as a significant determinant of unemployment, indicating its impact on non-performing loans through employment levels.

This suggests an indirect relationship between non-performing loans and foreign direct investment, where the direct impact of foreign direct investment on non-performing loans is not easily discernible in the long run due to various intermediate factors and multiple layers of interaction. The indirect influence of FDI on NPL through its effect on unemployment highlights the intricate nature of economic relationships, making it challenging to isolate the direct impact of foreign direct investment on non-performing loans.

However, this thesis paper differs from the studies by Ozili, Salman, and Ali (2020) and Salko, Mamo, and Mustaqe (2024) by employing VAR modeling instead of the OLS modeling used previously, allowing for a more dynamic analysis of the interplay between variables over time. Additionally, this thesis concentrates on macroeconomic variables, to focus on broad economic trends and their effects on non-performing loans, while avoiding complications from more specific factors. A distinguishing feature is the inclusion of the GDP growth rate of the USA, given that Bangladesh's exports are highly dependent on the USA. This consideration allows for speculation on potential spillover effects on Bangladesh's economy. By applying this approach and filling the research gap, the study seeks to provide valuable insights into how foreign direct investment can influence the financial health of the banking sector in Bangladesh.

This paper is organized as follows. Section 2 presents a brief survey of the previous empirical literature on the macro-financial feedback effects of non-performing loans. Section 3 provides an overview of Bangladesh's economy wiith a hypothesis of the FDI-NPL relationship. Section 4 estimates the VAR model. Section 5 details the data selection process. Section 6 presents data analysis and findings. Section 7 provides discussions. Section 8 concludes.

2 Literature Review

Non-performing loans have been a focal point of research globally due to their profound impact on economic stability and growth. Researchers have extensively studied non-performing loans to understand their causes, effects, and determinants, investigating various economic, institutional, and market factors across different countries and contexts. In the exploration of non-performing loans and foreign direct investment, I begin by reviewing global research on the determinants of non-performing loans. This includes studies that identify macroeconomic influences and country-specific dynamics, encompassing insights from various regions and economic contexts. Moving to Bangladesh, I examine how non-performing loans are studied within the local banking sector, focusing on the impacts of macroeconomic variables on NPL trends followed by the factors driving foreign direct investment in the economy, considering factors such as trade openness and institutional frameworks. Lastly, it includes a survey of the relatively sparse research on the relationship between foreign direct investment and non-performing loans, highlighting a gap in the current literature.

In the quest to understand the micro and macroeconomic determinants of non-performing loans, Messai and Jouini (2013) aim to identify the determinants of non-performing loans among a sample of 85 banks across three countries (Italy, Greece, and Spain) from 2004 through 2008, a time marked by financial challenges following the 2008 subprime crisis. The analysis includes a mix of macroeconomic variables and bank-specific factors to explore their influence on non-performing loans. Their study reveals that GDP growth and return on assets negatively impact non-performing loans, whereas unemployment and real interest rates have a positive relationship with non-performing loans.

Erdinc and Abazi (2014) explore the determinants of non-performing loans in emerging Europe, confirming that non-performing loans are counter-cyclical and that adverse macroeconomic shocks worsen credit risk. They show that NPL dynamics are particularly sensitive to specific macroeconomic variables, most notably real GDP growth and inflation. The findings from various studies on the determinants of non-performing loans across different countries show several commonalities. Sandica and Dudian (2017), Ristić and Jemović (2021), and Us (2020) independently discover similar patterns for Romanian, Serbian, Turkish banking sectors respectively. Furthermore, both Sandica and Dudian (2017) as well as Us (2020) highlight that high credit growth is linked to increased non-performing loans.

Regarding non-performing loans in Bangladesh, most research has focused on identifying their determinants using various criteria, types of banks, and different variables. Koju, Abbas, and Wang (2018) investigate the macroeconomic factors influencing non-performing loans across 19 Asian countries spanning low to high-income economies, employing the dynamic panel data model estimated by the Generalized Method of Moments (GMM) approach with data from 1998 to 2015. The findings highlight remittances as a significant factor in

reducing non-performing loans, particularly in low-income countries like Bangladesh, where they contribute to increased household incomes and enhance financial intermediation. Interestingly, the study finds that the impact of foreign direct investment on non-performing loans is negative but statistically insignificant in both middle-income and low-income groups contrary to the authors' hypothesis that capital import enhances capital formation and production capacity.

Roy, Dey, and Bhowmik (2014) analyze the impact of macroeconomic variables on the non-performing loans of local private commercial banks in Bangladesh, using data from 2004 to 2013 covering 18 scheduled banks. They apply regression analysis and identify GDP growth, inflation, and interest spread as key determinants, finding that GDP growth negatively affects the non-performing loans ratio, while inflation has a positive effect. Similarly, Mondal (2016) studies the effects of additional macroeconomic variables, including unemployment, on non-performing loans in Bangladesh from 2005 to 2014 across 22 commercial banks by OLS estimation. However, the findings diverge regarding inflation and GDP, showing that non-performing loans are negatively sensitive to inflation but positively sensitive to GDP and unemployment rates.

Researchers have also sought to understand how foreign direct investment impacts various aspects of the economy and what drives this investment. In exploring the relationship between foreign direct investment and the banking industry, Alam et al. (2023) examine the relationship between banking performance and foreign direct investment in Bangladesh because of its significant amount of FDI inflows from the rest of the world and its adoption of many liberalization policies. Using an autoregressive distributed lag (ARDL) model for time series data, the study uncovers an unexpected finding: efficient banking performance which is measured by the return on assets, paradoxically diminishes foreign direct investment inflows. The key factors driving foreign direct investment in Bangladesh include trade openness, inflation rate, and infrastructural development, while market size appears insignificant.

In a separate study, Alam, Tahir, and Omar Ali (2024) investigate the impact of credit risk on foreign direct investment inflows. To provide empirical evidence within the South Asian context, the study focuses on all eight member economies from the region. Using a panel dataset spanning 2011 to 2019, the study employs various econometric techniques including pooled least squares, fixed effects, generalized least squares, and two stages least squares for analysis. The results highlight a significant negative correlation between credit risk in the banking sector and FDI inflows. Conversely, inflation and market size are identified as major factors driving foreign direct investment inflows in SAARC countries. Interestingly, institutional factors do not appear to play a significant role in attracting foreign direct investment across the sampled countries.

In recent years, there has been a growing interest in exploring the impact of foreign

direct investment on non-performing loans. Avetisyan (2018) apply an econometric model to identify the factors influencing the rate of non-performing loans, with a focus on the post-crisis period. Using aggregate data from a panel of 28 countries for the period 2008-2016 and employing the difference GMM estimation technique, the study finds a negative relationship between non-performing loans and foreign direct investment. Baum, Pundit, and Ramayandi (2017) employ a dynamic panel data model to analyze the Malaysian commercial banking system from 1997 to 2012. They find that foreign direct investment net outflows have a significant positive effect on the NPL ratio, with a one-year lag. The authors conclude that the Malaysian commercial banking system is highly sensitive to foreign direct investment.

The study by Ozili, Salman, and Ali (2020) yields mixed results. They use the Ordinary Least Squares (OLS) technique to study the impact of foreign direct investment inflows on non-performing loans in UAE banks during the economic crisis from 2008 to 2017. They find that foreign direct investment inflows helped reduce non-performing loans during the crisis. However, when combined with better institutions, foreign direct investment inflows unexpectedly increased non-performing loans. On the other hand, the combination of higher bank efficiency and greater foreign direct investment inflows reduces non-performing loans for banks.

Salko, Mamo, and Mustaqe (2024) also use an Ordinary Least Squares (OLS) model to assess the relationship between foreign direct investment and non-performing loans in Albania and find a significant and positive relationship between them. The study examines the data for the period 2008–2022 while controlling for other relevant non-performing loan determinants. Their study reveals that higher foreign direct investment inflows, particularly through the banking sector, led to increased credit growth and a potential deterioration in credit standards, resulting in higher non-performing loans in the economy.

Despite some evidence of the interplay between non-performing loans and foreign direct investment, there remains a significant gap in understanding their relationship comprehensively. Bangladesh, as an emerging country, faces the challenge of rising non-performing loans, declining GDP growth rates, and a financial account deficit. Exploring the role of foreign direct investment in this context is crucial given the conflicting evidence surrounding its impact. Therefore, this paper aims to investigate the impact of foreign direct investment on non-performing loans in Bangladesh, along with other determinants, to identify strategies for reducing non-performing loans and improving economic stability.

3 An Overview of Bangladesh's Financial Dynamics

This section provides an analysis of key economic indicators relevant to Bangladesh. The data discussed here are sourced from the World Bank, Bangladesh Bank and BEPZA, offering

a comprehensive view of the country's economic landscape.

3.1 Economic Growth and Key Drivers in Bangladesh

Bangladesh has experienced impressive economic growth over the past few decades, transforming from a low-income to a lower-middle-income country. The country's economy is primarily driven by agriculture, manufacturing, and services, with significant contributions from sectors such as textiles, leather goods, pharmaceuticals, and information technology.

Bangladesh's rapid economic growth is a result of a combination of strategic factors and transformative developments. Central to this progress is the ready-made garment (RMG) industry, which has catapulted Bangladesh to become one of the world's largest exporters of apparel. This sector has not only generated millions of jobs but also stimulated growth in ancillary industries such as textiles and logistics.

The government's proactive role in creating a conducive environment for business through economic reforms, infrastructure development, and favorable trade policies has been instrumental. Also, investment in infrastructure, including roads, ports, and energy, has improved connectivity and efficiency, further supporting economic expansion.

3.2 Role and Impact of Foreign Direct Investment in Bangladesh

Foreign Direct Investment plays a crucial role in Bangladesh's economy, contributing to capital formation, technological advancement, and employment generation. FDI inflows are recorded under the capital and financial account of the Balance of Payments (BOP) statement, indicating its significance in determining the country's financial account surplus or deficit.

FDI-financed companies, especially those with export-oriented business models, significantly benefit from increased exports. These firms often have a competitive edge due to their knowledge of international markets, efficient distribution channels, and ability to adapt to global market dynamics. The formulation of Export Processing Zone (EPZ) policies has enhanced the positive relationship between FDI inflows and exports, making FDI a valuable approach for addressing Bangladesh's trade deficit in the long term.

The government of Bangladesh has adopted an open-door policy to welcome FDI, aiming to accelerate industrialization and achieve rapid economic growth. The Bangladesh Economic Processing Zone Authority (BEPZA) is a key organization promoting and facilitating foreign investment in the country's economic zones. The government has also set an ambitious goal of establishing 97 economic zones and 28 high-tech parks nationwide, providing flexible options for foreign investment, including joint collaborations and public-private

partnership (PPP) arrangements. Furthermore, Bangladesh offers various tax incentives to attract foreign investors, including tax holidays, reduced corporate tax rates, and exemptions on customs duties. Special incentives are provided for export-oriented industries and businesses operating in Special Economic Zones (SEZs) and Export Processing Zones (EPZs). Additionally, investors benefit from provisions such as accelerated depreciation on machinery and equipment, and exemptions from certain taxes on dividends and capital gains.

Notably, the country has seen significant foreign investment in private power generation and gas exploration and production. Additionally, Bangladesh has attracted substantial investment in industries such as cellular telephony, textiles, and pharmaceuticals. However, despite Bangladesh's strong efforts, FDI inflows as a percentage of GDP keeps declining following the pandemic. This negative shift is evident from Figure 2 in the Appendix.

3.3 Challenges of Rising Non-Performing Loans in Bangladesh

While Bangladesh has made efforts to attract foreign direct investment with some success, it continues to struggle with a rising threat to its economy: the rapid increase in non-performing loans, particularly following the COVID-19 pandemic. This surge in NPLs is slowing economic growth by undermining financial stability and limiting the availability of credit for businesses and consumers.

In the year 2023, Bangladesh saw a record high in non-performing loan ratio, which surged to 10.1%, up from 8.2% in the previous year. This increase of approximately 23% within just one years underscores a significant concern for the banking sector, as persistent record-breaking NPL levels threaten the sustainability of the industry.

The escalating NPLs have precipitated acute liquidity crises and capital shortfalls among many banks, which are resorting to borrowing from the Bangladesh Bank to address their liquidity shortages. The central bank has been providing continuous liquidity support to stabilize these banks and mitigate the adverse effects. The sharp rise in NPLs can be attributed to various factors, including inadequate loan management, lack of due diligence, economic slowdowns, political influences, and instances of money laundering.

This situation highlights the ongoing economic challenges Bangladesh faces despite its efforts to boost FDI. The impact of these non-performing loans on the financial sector emphasizes the need for targeted measures to address the root causes and stabilize the banking system.

3.4 Hypothesis drawn from Bangladesh's Economic Situation

The direct impact of foreign direct investment on reducing non-performing loans may not be immediately evident. On one hand, increased foreign direct investment can raise the availability of loans as investors fund new projects or expand existing ones. This surge in lending may lead to higher debt levels, which, if not managed properly, could result in higher default rates. Additionally, foreign direct investment often may target lower-risk, high-return projects, potentially displacing local investments that are more prone to risk. This displacement can push local investors toward riskier ventures, increasing the overall risk in the financial system and potentially exacerbating non-performing loans.

On the other hand, FDI can also have a favorable effect on reducing NPL. It is hypothesized that increased foreign direct investment could play a pivotal role in enhancing the overall financial health of the economy. By injecting foreign capital, foreign direct investment boosts industrial production capacity, generates employment opportunities, and improves income levels, which, in turn, enhances borrowers' repayment capacities. This increased liquidity in the banking sector supports better credit management and strengthens loan portfolios, thereby potentially reducing default risks.

Moreover, firms supported by foreign direct investment often benefit from superior management practices and access to international markets, contributing to a more stable and resilient economic environment. Foreign direct investment fosters a competitive business climate and encourages innovation, indirectly influencing the reduction of non-performing loans over time. The hypothesis driving this research is that sustained foreign direct investment inflows into key sectors will create a more robust economic framework. This, in turn, is expected to facilitate sustainable economic growth and contribute to a reduction in non-performing loans. To test this hypothesis, the paper aims to evaluate the impact of foreign direct investment on non-performing loans, thereby offering a compelling rationale for policymakers to concentrate on attracting foreign investment. By doing so, the research seeks to address the NPL crisis effectively and promote long-term economic stability in Bangladesh.

4 Methodology

The study utilizes Vector Autoregressive (VAR) models to analyze the relationship between non-performing loans and other macroeconomic variables. These variables include foreign direct investment, inflation, unemployment, the GDP growth rate of Bangladesh and the USA. Several compelling reasons emerge when selecting them as key variables for studying their impact on non-performing loans. Studies by Roy, Dey, and Bhowmik (2014), Mondal (2016), Erdinc and Abazi (2014) have underscored the intrinsic links between non-performing

loans and unemployment, inflation, and GDP, validating their relevance as critical determinants of credit risk. Recent research by Ozili, Salman, and Ali (2020) and Salko, Mamo, and Mustaqe (2024) has further highlighted the significant role of FDI in shaping NPL dynamics, emphasizing its importance in comprehensive economic analyses.

Moreover, these variables are pivotal in economic policymaking, where governments and policymakers implement fiscal and monetary measures to stabilize economies and financial markets. The inclusion of these factors in our regression model is essential for ensuring the robustness and reliability of our results, providing a comprehensive framework to understand and manage credit risks effectively. Furthermore, there is a possibility that USA GDP fluctuations could influence Bangladesh's NPLs by potentially altering demand for Bangladeshi exports and impacting global investor sentiment and financial flows, which in turn could affect economic stability and credit risk. In addition to Bangladesh's heavy reliance on exports to the USA, which accounted for about 16% of total exports over the past five years, the USA is also one of the top three investors in Bangladesh. Therefore, the GDP growth rate of the USA has been included as a variable in this analysis to account for these potential impacts.

In this analysis, all variables are typically considered endogenous, meaning they are mutually determined within the model. However, the GDP growth of the USA is treated as an exogenous variable. This distinction implies that Bangladesh's inflation, unemployment, GDP, foreign direct investment and non-performing loan have limited impact on US GDP because the US economy is vast and diverse, capable of absorbing external shocks from smaller economies like Bangladesh. Trade and investment flows between the two countries are minimal, and the US has stronger economic ties with major trading partners such as China, Canada, and the EU. Additionally, US GDP is predominantly influenced by domestic economic policies and activities, with lower economic integration between Bangladesh and the USA compared to other significant global economies. By specifying this variable as exogenous, the study acknowledges that changes in the GDP growth of the USA may influence the endogenous variables of interest but are not directly influenced by them.

Hence the model,

$$Y_t = c + \sum_{i=1}^{2} A_i Y_{t-i} + \sum_{i=1}^{2} B_i X_{t-i} + \epsilon_t \tag{1}$$

where, Y_t is a vector of endogenous variables, X_t is a vector of exogenous variables, A and B are matrix of coefficients, and ϵ_t is a vector of error terms.

The vector of endogenous variables includes variables related to non-performing loans, foreign direct investment, unemployment, inflation, and the GDP growth rate of Bangladesh. The vector of exogenous variables includes the GDP growth rate of the USA.

4.1 Stationarity Test

Applying a VAR (Vector Autoregressive) model necessitates stationary time series, where the statistical properties remain consistent over time. Stationarity ensures that variables do not exhibit trends or systematic patterns that could lead to misleading statistical results in regression analyses. Non-stationary time series poses the risk of spurious regressions, where correlations between variables can be falsely inflated due to shared trends rather than genuine relationships. For instance, if two non-stationary time series both exhibit upward trends over time, a regression of one series on the other may show a high correlation purely due to their trending nature, even if there is no underlying causal relationship between them. This phenomenon, known as spurious regression, highlights the importance of ensuring stationarity before applying statistical models like VAR, as it helps distinguish true relationships from coincidental trends.

Stationarity is typically evaluated using unit root tests, which assess the presence of non-stationary characteristics such as trends or random walks in time series data. There are various methodologies available for conducting unit root tests in time series analysis, each serving distinct purposes in assessing stationarity. Among these, the Augmented Dickey-Fuller test (ADF) stands out as a widely employed approach due to its robustness and versatility. For this analysis, an Augmented Dickey-Fuller test was employed to assess the stationarity of the time series data. The ADF test allows for testing the null hypothesis that a series contains a unit root against the alternative of stationarity.

4.2 Lag Length Selection

Selecting the optimal number of lags in a time series model involves a delicate balance. Too few lags may fail to capture important temporal patterns, potentially leading to autocorrelated errors that violate the model's assumptions. This autocorrelation can undermine the reliability of statistical tests and distort parameter estimates, compromising the model's predictive accuracy. Conversely, including too many lags increase model complexity without necessarily improving predictive power. This excess complexity can result in coefficients that are statistically insignificant due to overfitting, reducing the degrees of freedom available for meaningful inference. This test, conducted for the analysis in the paper to determine the appropriate lag length, ensures that the model strikes the right balance between capturing relevant information and maintaining statistical robustness.

5 Data

This study utilizes annual time-series data spanning a period of thirty-two years, from 1991 to 2022. Data on non-performing loans in Bangladesh were gathered from multiple annual reports issued by the Bangladesh Bank (Central Bank of Bangladesh). Additionally, data on inflation, unemployment, foreign direct investment, and real GDP growth rate were sourced from the World Economic Forum archives available in the World Bank database. The variables are defined more precisely in Table 1 of the Appendix.

6 Results and Analysis

Before presenting the findings, it is essential to review the key preliminary analyses conducted for this study. These include tests for stationarity, correlation among variables, and the selection of lag lengths for the model.

Following the Augmented Dickey-Fuller (ADF) tests presented in Table 2, the stationarity of the time series data was examined both before and after transformations. Notably, inflation and GDP growth rates for Bangladesh and the USA exhibited rejection of the null hypothesis ($p < 0.05$), indicating non-stationarity. Consequently, first-order log differentiation was applied to non-performing loans, foreign direct investment, and unemployment. Subsequent ADF tests on the transformed data confirmed stationarity ($p < 0.05$), facilitating the continuation of the analysis using this modified dataset.

Table 3 presents the descriptive statistics for the analyzed variables. The inflation exhibits significant variation, with a maximum mean value of 6.14% and a standard deviation of 2.225. The GDP growth rate of the USA shows the second-highest variability, with a standard deviation of 1.862. The mean of the GDP growth rate of Bangladesh is higher than that of the USA, aligning with the Solow model's concept that poorer economies' per capita incomes tend to grow faster than richer economies.

Diving into Table 4 reveals the outcomes from the Pearson correlation analysis conducted among the variables under study. Notably, the highest correlation of 0.3315 emerges between the GDP growth rate of the USA and the first-differenced logarithm of foreign direct investment, pointing to a weak relationship. This finding underscores the limited direct linear association between these economic indicators. Moreover, the analysis indicates that other variables exhibit similarly weak correlations, further indicating that multicollinearity is not a significant issue within this dataset.

Considering various pre-estimation criteria for lag order selection statistics, as detailed in Table 5, the Final Prediction Error (FPE), Akaike Information Criterion (AIC), and Hannan-Quinn Information Criterion (HQIC) recommended a lag length of 2, while the

Schwarz Bayesian Information Criterion (SBIC) suggested zero lags. Given the lagged effects observed on variables like non-performing loans and supported by multiple criteria, the analysis proceeds with a lag length of two for robust modeling.

6.1 Granger Causality Test

To assess whether lagged values of foreign direct investment have a meaningful impact on non-performing loans, a Granger causality test was conducted. This test is a common method for examining causal relationships in time series data. It involves regressing the dependent variable on lagged values of the potential causal variable and then testing the null hypothesis that the coefficients on the lagged values of the variables are jointly zero. The results, shown in Table 6, provide insights into whether past changes in foreign direct investment levels help to predict non-performing loans.

The Granger causality test result reveals that lagged values of foreign direct investment do not exhibit short-run causality on non-performing loans. This suggests that changes in foreign direct investment from previous years do not help predict movements in non-performing loans. Conversely, the test result indicates that changes in unemployment play a significant role in explaining NPL variations.

Furthermore, the study finds that inflation, non-performing loans and the GDP of Bangladesh collectively help to predict foreign direct investment at 1%, 5%, and 10% significance levels respectively. This Granger causality result also suggests a uni-directional causality running from non-performing loans to foreign direct investment.

Additionally, foreign direct investment, inflation, the GDP growth rate of Bangladesh and the USA granger cause unemployment. On the other hand, unemployment and foreign direct investment jointly granger cause inflation indicating a bilateral causality between inflation and unemployment and also between inflation and foreign direct investment. Interestingly, lagged values of any of these variables can not forecast changes in the GDP growth rate of Bangladesh at any level of significance except for the GDP growth rate of the USA. Since the GDP growth rate of the USA is an exogenous variable, no other variable can predict it. However, it helps predict movements in unemployment, inflation, and GDP growth rate in Bangladesh.

In summary, the causality analysis indicates that only past values of unemployment can help predict non-performing loans.

6.2 Impulse Response Functions

An impulse response measures the reaction of a dynamic system to a temporary external shock or disturbance, showing how the effect evolves over time. Following the approach by Wieringa and Horváth (2005), who demonstrated that the responses induced by a shock to one of the variables are much easier to interpret if the effects are expressed in the same units as the variables, I present the impulse response functions (IRF) using the original variables with log transformation only. This method ensures that the results are more straightforward and aligned with the actual units of the data, facilitating clearer interpretation and practical application.

All shocks are orthogonalized using Cholesky decomposition, which means that variables listed earlier in the order are considered more exogenous, while those listed later are considered more influenced by other variables (endogenous). In this context, it is more likely that the GDP of the USA influences macroeconomic changes in Bangladesh, followed by unemployment affecting GDP, inflation, and non-performing loans in Bangladesh. Therefore, these variables appear earlier in the ordering, indicating they are more exogenous, while non-performing loans, being affected by all other macroeconomic variables, appear last, indicating it is the most endogenous among all.

Figure 3 illustrates the generalized impulse response functions: 8-period responses of non-performing loans to one unit of positive innovations of non-performing loans, foreign direct investment, unemployment, inflation, GDP of Bangladesh and USA.

From an economic perspective, we anticipate a negative response of non-performing loans to a shock in foreign direct investment. Higher foreign direct investment stimulates economic activity by increasing production and employment, which enhances borrowers' ability to repay loans. However, the results presented in Figure 3 contrast with this expectation demonstrating an upward trend (during the first period) in non-performing loans following a shock from foreign direct investment. The confidence interval, which eventually includes zero, suggests diminishing statistical significance. This indicates that the observed finding, in the long run, may not reliably differ from random chance.

Regarding the persistence of a non-performing loan to its own shock, a shock to a non-performing loan itself shows a positive relationship with the non-performing loan in the short run. This finding aligns with the assumption that higher levels of non-performing loans lead to further increases in non-performing loans. However, this impact is only significant till the first period and dies out afterward. An unemployment shock causes an immediate positive change in non-performing loans, which is in line with the conventional idea that higher unemployment diminishes individuals' capacity to repay loans. This finding is consistent with the results of Sandica and Dudian (2017), reinforcing the notion that unemployment is a key driver of NPL dynamics. However, these effects last only till period one and become

insignificant as the confidence interval includes zero.

The GDP growth rates of Bangladesh and the USA have opposing effects on non-performing loans. Changes in the GDP growth rate of Bangladesh by one standard deviation consistently exhibit a very small negative effect on non-performing loans till period 4. This indicates that stronger GDP growth enhances people's earnings and their ability to repay loans, thereby reducing the NPL ratio. This finding is consistent with the results of Klein (2013). Conversely, a GDP shock in the USA has a minimal immediate positive impact on the NPL in Bangladesh. However, both of the effects include zero intermittently making the overall effect less significant.

An inflation shock creates a short-run negative response in non-performing loans, consistent with the traditional belief. This could be because inflation reduces non-performing loans by making it easier for borrowers to repay their debts with diminished real value. This effect, however, is also insignificant because its confidence interval includes zero throughout the period.

In sum, foreign direct investment, unemployment, and non-performing loan shocks had a significant effect on non-performing loans lasting only for the first period, becoming less significant over time. On the other hand, while inflation and GDP in Bangladesh showed expected behavior on non-performing loans, their impact remained insignificant throughout the entire period.

6.3 Variance Decomposition

Variance Decomposition is a crucial analytical tool used to understand the percentage of forecast error variance of a variable over time due to a specific shock. Specifically, by applying Cholesky Decomposition it provides insight into how much of the variability in the dependent variable is explained by its own shocks versus shocks from other variables in the model. This decomposition is invaluable in highlighting how the relative importance of these shocks evolves over time. For instance, certain shocks may have negligible effects in the short term but can lead to significant fluctuations in the long term.

Figure 4 illustrates the variance structure of the dependent variable non-performing loan over a prediction horizon of 8 years. Each column in the variance decomposition analysis represents one prediction period, which, in our study, corresponds to a year. These columns are segmented into six color-coded sections, as indicated by the legend. Each section of a column answers a critical question: What percentage of the variance in the dependent variable, NPL, is explained by each of the independent variables in a given year after an initial shock?

The variance decomposition diagram illustrates that in the initial period, the most sig-

nificant influence comes from the GDP of the USA which remains significant until the final period, contributing approximately 26% to the NPL variance.

The second largest influence comes from non-performing loans themselves in the initial stages, with their impact diminishing over time and ultimately contributing about 9% to the changes in non-performing loans by the end of the eighth period.

Unemployment had a moderate influence in the beginning, which increased over time, accounting for the highest change ($\approx 27\%$) in the variance of non-performing loans by the end of the eighth period. Initially, inflation and the GDP of Bangladesh had minimal impact on NPL variance. However, their influence stabilized at around 6% and 22%, respectively, by the end of the eighth period. It also indicates an increasing influence of the GDP of Bangladesh on the non-performing loans over time.

Interestingly, Foreign Direct Investment maintained a consistent moderate influence over all periods. With little fluctuation, FDI's contribution stabilized at around 9% by the end.

6.4 Stability Test

Ensuring the stability of a VAR (Vector Autoregressive) system is essential to maintain the reliability and validity of its results. A stable VAR system prevents shocks or disturbances from causing explosive or erratic behavior in the variables, thereby preserving stationarity over time. The stability condition is verified by checking that all the inverse roots of the characteristic AR polynomial have absolute values less than one and lie within the unit circle on the complex plane. If the VAR model is unstable, the results of various tests conducted on the model may be compromised or invalid due to unreliable predictions and erratic behavior in variable responses. Therefore, confirming the stability of the VAR model, as indicated by the results in Table 8, ensures that the analyses and conclusions drawn from it are robust and trustworthy.

6.5 Autocorrelation Test

Testing for residual autocorrelation using the Lagrange Multiplier (LM) test is crucial to validate the reliability of regression model results. Autocorrelation in residuals indicates systematic patterns or relationships among errors, which can bias statistical inference. Finding no evidence to reject the null hypothesis (H_0: no autocorrelation) suggests that the residuals are independent over time, ensuring the robustness of the model's estimates and the validity of conclusions drawn from the analysis (results are shown in the Table 9). Thus, confirming the absence of autocorrelation enhances confidence in the accuracy of the regression findings.

7 Discussion

The results align with several previous studies on the relationship between non-performing loans and foreign direct investment, confirming the similarity of their nature across different economies and countries.

Notably, the Granger causality test did not show any causality from foreign direct investment to non-performing loans; instead, it identified unemployment as the sole variable causing fluctuations in non-performing loans. Surprisingly, the Granger causality suggested a unidirectional causal relationship from non-performing loans to foreign direct investment.

Delving deeper, the Impulse Response Function (IRF) analysis provided further insights into the dynamics of non-performing loans. While the GDP of Bangladesh and inflation showed anticipated influences, these effects were statistically less significant throughout, indicating no lasting impact on non-performing loans. Shocks to foreign direct investment and the GDP of USA have a positive impact on non-performing loans. Conversely, non-performing loans exhibit a positive short-term effect on themselves, suggesting a self-reinforcing cycle of loan defaults. Interestingly, the IRF shows that the significant effects of foreign direct investment, the USA's GDP growth rate, and non-performing loans on non-performing loans only last until the first period. After that, the results are not statistically significant, meaning the immediate impact of these factors diminishes over time. The lack of long-term significance could be attributed to the limited historical data and data frequency, which may affect the reliability of the results beyond the short run.

Summarizing the variance decomposition results reveals the dynamic factors influencing changes in non-performing loan variance due to shocks. Initially, non-performing loans dominate NPL variance, with their influence gradually decreasing over time. The GDP growth rate of the USA is a consistently significant factor and emerges as a dominant factor towards the end of the observation period, indicating a persistent impact of the US economy on the health of Bangladesh's banking sector. Additionally, unemployment gradually emerges as a dominant factor, despite its minimal effect initially. In contrast, foreign direct investment and inflation exhibit minimal effects consistently. Notably, the GDP of Bangladesh has become increasingly significant over time, underscoring the growing influence of domestic economic growth on non-performing loans.

In sum, the impact of foreign direct investment on non-performing loans mirrors findings from Salko, Mamo, and Mustaqe (2024), indicating a minimal significant positive effect in the short term. Despite bringing in capital, technology, and expertise that stimulate economic growth and employment, the immediate benefits may not translate into improved loan repayment capacity for businesses. A possible reason could be the timing and specifics of FDI projects, such as their sectoral focus and scale, vary widely and influence their impact on local economic conditions and financial stability. Moreover, the effectiveness of foreign di-

rect investment in reducing non-performing loans hinges on broader economic factors such as regulatory frameworks, political stability, and institutional quality. These factors can either facilitate or hinder the positive effects of foreign investment on loan performance. It might also be a reason that, although a significant portion of FDI is invested in manufacturing and banking, a major share also goes to less risky sectors like power, energy, and telecom (The distribution is illustrated in Figure 5 for FY 2023). This distribution may limit the overall impact of FDI on reducing NPLs. While FDI in manufacturing and banking could potentially stimulate economic growth and improve loan repayment capacities, the substantial investment in stable, low-risk sectors suggests that the overall effect on reducing NPLs across the economy might not be significant. Consequently, high NPL levels could persist in riskier sectors, which may be less influenced by the influx of FDI.

Findings by Ozili, Salman, and Ali (2020) underscore this complexity, highlighting that while a direct significant effect of foreign direct investment alone on non-performing loans may not be evident, increased bank efficiency coupled with greater foreign direct investment inflows can reduce non-performing loan sizes. Koju, Abbas, and Wang (2018) also observe a positive relationship between non-performing loans and foreign direct investment in high-income countries, concluding that substantial FDI inflows significantly enhance liquidity and expand loan availability. This surge in credit growth, however, often leads to lower credit standards and an increase in default loans within the banking sector. Furthermore, causality tests revealing FDI's significant influence on inflation and unemployment suggest its indirect role in NPL dynamics. This indirect causal relationship underscores foreign direct investment's role in shaping economic conditions that influence non-performing loan levels over time.

Considering all the test findings together, unemployment emerges as the primary determinant of non-performing loans. This finding aligns with Klein (2013), Vogiazas and Nikolaidou (2011) underscoring unemployment's positive relationship with non-performing loan levels. Research works by Bofondi and Ropele (2011) in Italian banks and Louzis, Vouldis, and Metaxas (2012) in the Greek banking system indicate that unemployment leads to decreased firm production, ultimately reducing revenue and impairing the ability to make payments. Impulse response analysis reinforces this conclusion, highlighting the crucial role of managing unemployment in maintaining robust banking performance in a country's economy.

In addition to unemployment, the GDP growth rate of the USA and Bangladesh also shows a significant effect on non-performing loans. One plausible explanation for the influence of the USA's GDP is that local businesses might be tempted to expand aggressively or invest in riskier ventures, anticipating benefits from the positive global environment while strong consumer spending in the US could divert demand away from Bangladeshi exports, potentially weakening the financial health of export-oriented industries and leading to in-

creased incidence of non-performing loans as businesses contend with lower revenue. However, a clearer understanding of the long-term effects of these variables could provide more insight into the results. The lack of sufficient data frequency may have hindered a comprehensive analysis of their sustained impacts over time.

8 Conclusion

This comprehensive analysis examines the intricate dynamics influencing non-performing loans in Bangladesh from 1991 to 2022, using VAR modeling to scrutinize key macroeconomic variables. Initially, a stationarity test was conducted, and variables were transformed using log differences to address non-stationarity. Based on the FPE, AIC, and HQIC criteria, a lag length of two was selected. The stability test confirmed the model's robustness by ensuring all inverse roots of the AR polynomial are within the unit circle. The absence of autocorrelation further validates the reliability of the regression results. These findings confirm that the model is both stable and accurate.

The Granger causality test revealed no causal relationship from foreign direct investment to non-performing loans. However, the impulse response functions (IRF) showed that a foreign direct investment shock has an immediate positive effect on non-performing loans in the short run. This finding is further supported by the variance decomposition results, which indicate a moderate effect of foreign direct investment on non-performing loans, ranging from 5% to 9% over eight periods.

In summary, while the relationship between non-performing loans and foreign direct investment is not straightforward, the positive and significant effect of foreign direct investment on non-performing loans aligns with findings by Salko, Mamo, and Mustaqe (2024). The duration and extent of this effect suggest that the relationship is weaker and short-term compared to other macroeconomic variables. Additionally, foreign direct investment contributes to unemployment, which is a significant determinant of non-performing loans, implying an indirect effect of foreign direct investment on non-performing loans through unemployment.

This underscores that while foreign direct investment has an immediate impact on non-performing loans, its role is minimal and complex. Despite the challenges, foreign direct investment remains crucial for Bangladesh's development due to its significant influence on inflation and unemployment. Creating a favorable investment climate can attract more foreign direct investment, which boosts economic activity and improves borrowers' ability to repay loans. Strengthening banking regulations and fostering economic resilience are also essential for mitigating non-performing loans and ensuring financial stability in Bangladesh. The effective interplay among these macroeconomic variables, coupled with stringent banking regulations, can reduce non-performing loans and foster a healthier economic environment.

As an extension to the paper, a situational analysis of non-performing loan dependency on foreign direct investment, particularly considering the impact of the COVID-19 pandemic in Bangladesh, can provide deeper insights. By comparing changes due to the crisis, policy-makers can better understand the dynamics at play and develop more robust strategies to combat non-performing loans during times of economic turmoil.

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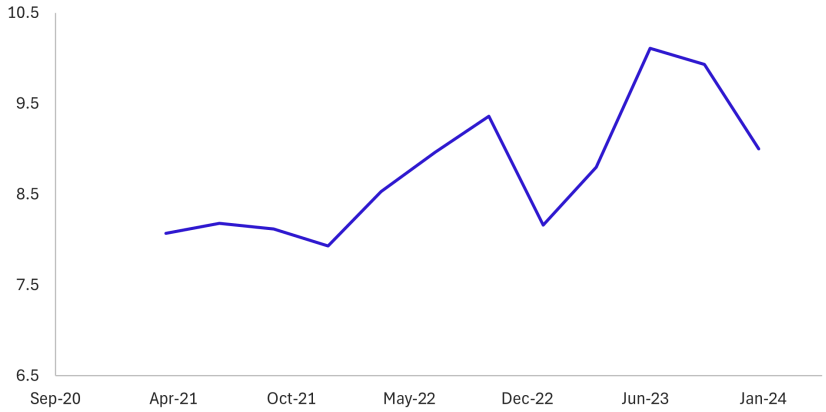
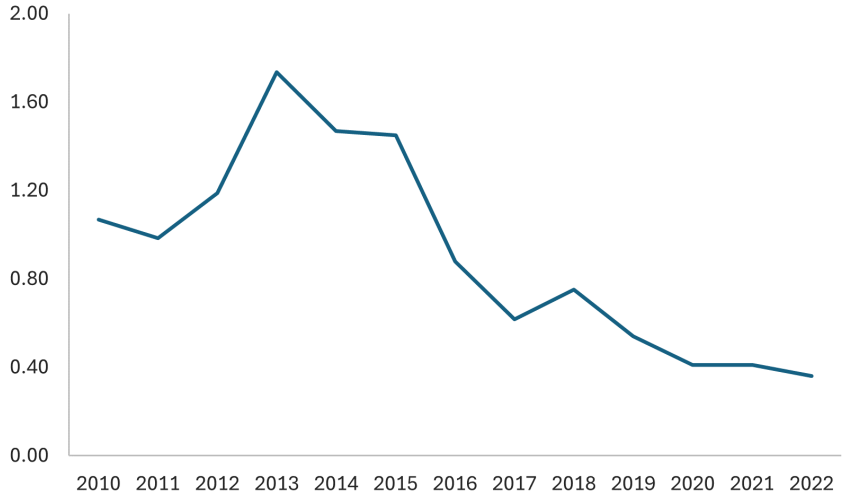
Appendix

Figure 1: Non-Performing Loan Ratios in Bangladesh from 2021 to 2024



Note: Based on data collected from the Bangladesh Bank.

Figure 2: FDI, net inflow (% of GDP) in Bangladesh (2010-2023)



Note: Based on data collected from the World Bank.

Figure 3: Impulse Response Functions of Non-Performing Loan

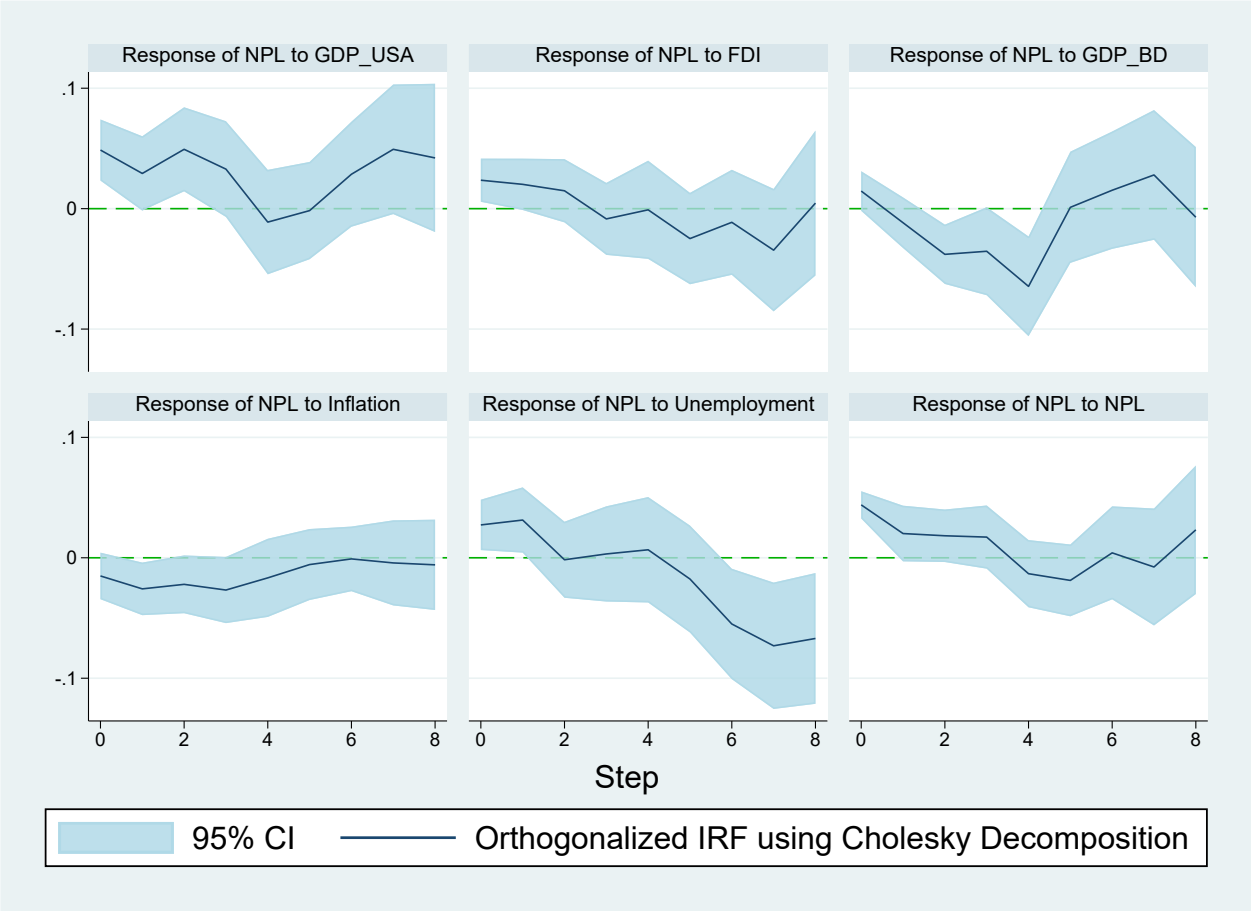


Figure 4: Variance Decomposition of NPL

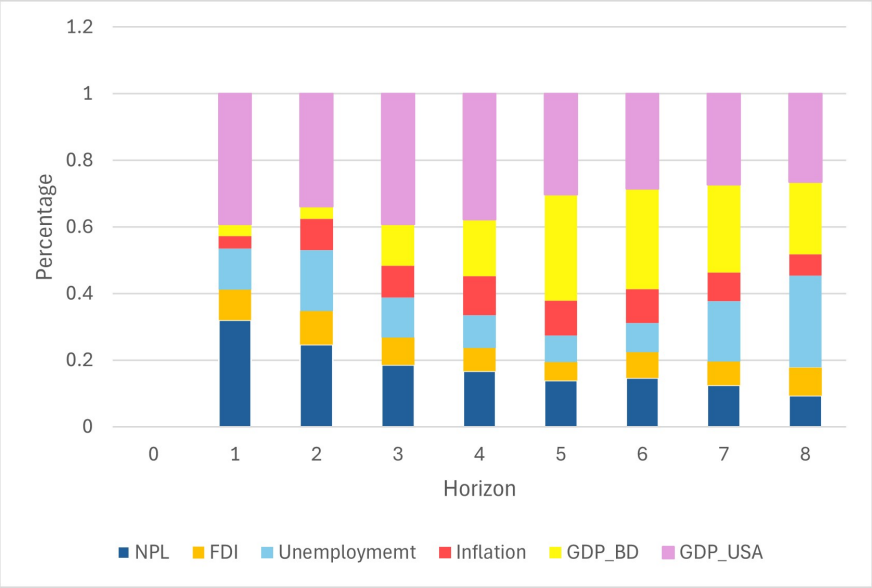
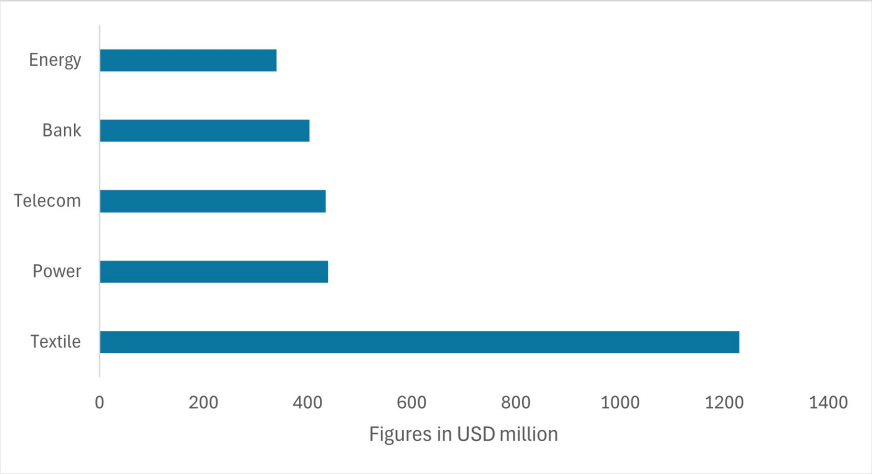


Figure 5: Gross FDI Inflow in Top Five Sectors in Bangladesh for FY 2023



Note: Based on data collected from the Bangladesh Bank.

Table 1: Variables Definition

Variable	**Definition**	**Source**
NPL	Ratio of Non Performing Loan to Gross Loan (%)	Annual Report by Bangladesh Bank
FDI	Foreign direct investment, net inflows (% of GDP)	World Bank Database
UNM	Unemployment rate	World Bank Database
INF	Inflation Rate	World Bank Database
GDP_BD	Real Gross Domestic Product Growth Rate of Bangladesh	World Bank Database
GDP_USA	Real Gross Domestic Product Growth Rate of USA	World Bank Database

Table 2: Unit Root Test

Variable	**Original Data**		**Status**	**Differenced Logs**		**Status**
	t	**p**		**t**	**p**	
Non-Performing Loan	-0.438	0.9035	Non Stationary	-4.751	0.0001	Stationary
Foreign Direct Investment	-1.899	0.3327	Non Stationary	-4.918	0.0000	Stationary
Unemployment	-1.944	0.3116	Non Stationary	-5.447	0.0000	Stationary
Inflation	-4.019	0.0013	Stationary			
GDP growth rate of Bangladesh	-3.75	0.0035	Stationary			
GDP growth rate of USA	-5.217	0.0000	Stationary			

Table 3: Descriptive Statistics

	Log Diff of Non-performing loan	**Log Diff of Foreign direct investment**	**Log Diff of Unemployment**	**Inflation**	**GDP_BD**	**GDP_USA**
Obs	31	31	31	32	32	32
Mean	-.036	0.141	0.021	6.144	5.643	2.412
Maximum	0.494	2.299	0.194	11.4	7.88	5.95
Minimum	-0.258	-1.887	-0.392	2.01	3.45	-2.77
Std Deviation	0.161	0.831	0.109	2.225	1.188	1.862
Skewness	-1.043	0.379	-2.073	0.113	-0.119	-1.04
Kurtosis	4.637	4.082	8.357	2.969	2.076	4.636

Table 4: Pearson Correlation Matrix

	Non-Performing Loan	**Foreign Direct Investment**	**Unemployment**	**Inflation**	**GDP_BD**	**GDP_USA**
Non-Performing Loan	1.0000					
Foreign Direct Investment	0.1593	1.0000				
Unemployment	0.0660	0.0727	1.0000			
Inflation	-0.1901	-0.2405	-0.1481	1.0000		
GDP_BD	0.1513	-0.1897	-0.3287	0.3197	1.0000	
GDP_USA	0.2829	0.3315	-0.2766	-0.0871	0.1762	1.0000

Table 5: Lag Length Selection Criterion

Lag	**LR**	**FPE**	**AIC**	**HQIC**	**SBIC**
0	NA	0.003042	11.231	11.3204*	11.5147*
1	71.037	0.003333	11.265	11.8852	13.2452
2	122.41*	0.000834*	9.526*	10.3783*	13.2041

Table 6: Granger Causality Test Result

Variable	Independent Variable					
	Non-Performing Loan	**Foreign Direct Investment**	**Unemployment**	**Inflation**	**GDP_BD**	**GDP_USA**
Non-Performing Loan	-	χ^2=0.42 p =0.809	χ^2=21.65 p =0.000***	χ^2=2.98 p =0.225	χ^2=2.18 p =0.337	χ^2=1.82 p =0.404
Foreign Direct Investment	χ^2=7.22 p =0.028**	-	χ^2=1.92 p =0.384	χ^2=9.56 p =0.008***	χ^2=5.86 p =0.054*	χ^2=4.38 p =0.112
Unemployment	χ^2=1.89 p =0.389	χ^2=7.25 p = 0.026**	-	χ^2=6.88 p =0.032**	χ^2=5.61 p =0.060*	χ^2=17.19 p =0.000***
Inflation	χ^2=1.94 p =0.379	χ^2=16.39 p =0.000***	χ^2=5.14 p =0.076*	-	χ^2=1.34 p =0.512	χ^2=17.32 p =0.000***
GDP_BD	χ^2=3.73 p =0.155	χ^2=0.19 p =0.909	χ^2=0.34 p =0.842	χ^2=1.44 p =0.489	-	χ^2=5.4283 p =0.066*

Note: ***, **, and * indicate statistically significant at the 1%, 5%, and 10% levels, respectively.

Table 7: Variance Decomposition of Non-Performing Loan

Time	**Non-performing loan**	**Foreign Direct Investment**	**Unemployment**	**Inflation**	**GDP_BD**	**GDP_USA**
0	0.000	0.000	0.000	0.000	0.000	0.000
1	31.968	9.228	12.337	3.753	3.539	39.176
2	24.622	10.159	18.211	9.394	3.687	33.927
3	18.556	8.227	12.024	9.561	12.413	39.219
4	16.652	7.055	9.773	11.741	17.043	37.737
5	13.897	5.566	7.903	10.483	31.846	30.305
6	14.603	7.842	8.769	10.038	30.100	28.649
7	12.476	7.125	18.176	8.537	26.424	27.262
8	9.404	8.413	27.534	6.377	21.658	26.615

Table 8: Eigenvalue Stability Condition

Eigenvalue stability condition

Eigenvalue	Modulus
-.09747541 + .7898818i	.795874
-.09747541 - .7898818i	.795874
-.5158859 + .5892959i	.783204
-.5158859 - .5892959i	.783204
.1889088 + .7599013i	.78303
.1889088 - .7599013i	.78303
.7719114 + .1254056i	.782032
.7719114 - .1254056i	.782032
-.7022098 + .2242382i	.737144
-.7022098 - .2242382i	.737144
.379846 + .473055i	.606683
.379846 - .473055i	.606683

All the eigenvalues lie inside the unit circle.
VAR satisfies stability condition.

Table 9: Lagrange-Multiplier Test

Lagrange-multiplier test

lag	chi2	df	Prob > chi2
1	54.0881	36	0.02689
2	40.7185	36	0.27049

H0: no autocorrelation at lag order