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Export, Exchange Rate, Inflation, FDI, and Economic Growth in Bangladesh

A Time Series Analysis

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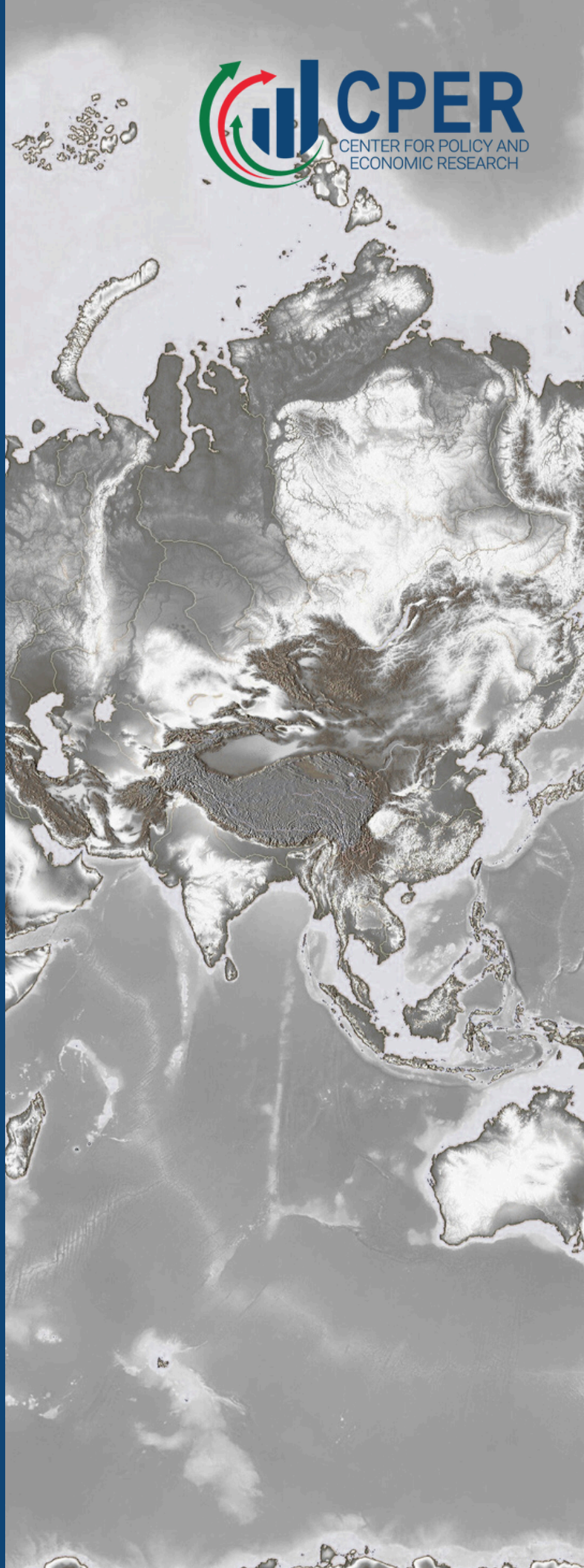

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Abstract

This study examines the impact of internal and external factors on Bangladesh's long-term economic growth, with a focus on inflation, exchange rates, foreign direct investment (FDI), and exports. Understanding these relationships is crucial for policymakers, particularly in light of the country's ongoing economic transformations and external pressures. The research utilizes annual data from 1986 to 2022 and employs the Autoregressive Distributed Lag (ARDL) model to examine both short-term and long-term relationships. This model considers stationarity and cointegration among variables, ensuring reliable results. Diagnostic tests confirm the model's dependability. The study reveals that currency depreciation has a positive impact on economic growth by enhancing export competitiveness. Although inflation has a negative but statistically insignificant effect, and FDI shows a positive but statistically insignificant influence, these results suggest a need for more effective investment policies. Exports contribute to growth in the short term, though their long-term importance is limited, emphasizing the need for export diversification. The error correction model suggests a robust adjustment process that promotes long-term economic stability. However, the study's scope is limited by excluding key structural factors, such as labor market dynamics, technological progress, and institutional quality, which could further explain variations in growth. Additionally, using only annual data restricts the ability to capture short-term fluctuations and external shocks, such as political instability or global crises. Overall, this research adds to existing knowledge by thoroughly examining the internal and external factors affecting Bangladesh's economic growth through a robust econometric approach. The findings offer valuable insights for policymakers in developing economies seeking to strike a balance between currency stability, controlling inflation, promoting investment-driven growth, and encouraging export diversification.

Keywords: Exchange Rate, Inflation, FDI, Export, Economic Growth, ARDL

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Export, Exchange Rate, Inflation, FDI, and Economic Growth in Bangladesh: A Time Series Analysis

1. Introduction

Despite national and global uncertainties and natural disasters, including the COVID-19 pandemic, Bangladesh has made remarkable progress since its independence, transforming from one of the world's poorest nations to achieving lower-middle-income status in 2015. Bangladesh is also on track to graduate from the United Nations' List of Least Developed Countries (LDC) in 2026 (World Bank, 2024). Over the past decade, the country maintained an average annual GDP growth rate of 6.4% and made substantial strides in poverty reduction alongside improvements in key human development indicators (World Bank, 2024). However, challenges persist, including slowing real GDP growth (5.2% in FY24), elevated inflation, and vulnerabilities in the financial sector. To sustain economic growth and achieve upper-middle-income status, Bangladesh must focus on diversifying its exports, strengthening institutional frameworks, investing in infrastructure, enhancing human capital, and prioritizing sustainable and green development to ensure long-term resilience.

In an era marked by globalization and anti-globalization trends, understanding the determinants of economic growth remains a critical challenge for Bangladesh. Economic growth is influenced by many factors, reflecting its complex nature, as highlighted in the economic literature. Domestic determinants, such as human capital, savings, democracy, political stability, good governance, and robust macroeconomic policies, play a pivotal role in sustaining growth (Mamun & Arfanuzzaman, 2020; Narayan & Smyth, 2005; Roubini & Wachtel, 1999). Similarly, internal factors such as inflation, exports, and exchange rates, along with external factors like foreign direct investment (FDI), are crucial for driving sustainable growth in developing countries (Almfraji & Almsafir, 2014; Azman-Saini et al., 2010; Chen & Jayaraman, 2016). Sustainable economic growth is essential for addressing critical challenges, including reducing unemployment, enhancing access to quality education and healthcare, and improving living standards. A consistently growing economy fosters human development, the ultimate goal of worldwide economic activities (Nourzad & Powell, 2003). Consequently, prioritizing policies that ensure sustainable and inclusive growth is imperative for Bangladesh as it navigates its development trajectory.

This study investigates the influence of internal and external factors on economic growth, offering an empirical examination of how inflation, exports, exchange rates, and FDI impact Bangladesh's economic growth trajectory. The research utilizes annual data (1986–2022) on the yearly average exchange rate (LCU per USD), inflation rate (annual percentage), net inflow of FDI (as a percentage of GDP), exports of goods and services (as a percentage of GDP), and GDP growth (annual percentage). The study analyzes these relationships using the Autoregressive Distributed Lag (ARDL) model, a prominent time-series econometric technique.

Inflation in Bangladesh in 2024 reveals a concerning trend. General inflation has risen sharply, with food inflation increasing by approximately 45% year-on-year as of July 2024. Non-food inflation also surged, reaching 9.68% during the same period (United Nations, 2024). According to the Bangladesh Bank, inflation has shown a persistent upward trend, with the 12-month average inflation rate recorded at 6.97% in FY2024 (Bangladesh Bank, 2024). Inflationary pressures have been exacerbated during and in the aftermath of the COVID-19 pandemic. The inflation rate rose from 7.56% in FY22 to 9.02% in FY23 (Bangladesh Bank, 2024). The Consumer Price Index (CPI), measured on a 12-month average basis (Base: 2021–22 = 100), remained elevated at approximately 9.73% in FY24. Projections by the Asian Development Bank (ADB) indicate further inflationary increases, with estimates of 10.1% for FY2024–25 (ADB, 2024). These trends underscore the urgent need for effective monetary and fiscal measures to stabilize prices and mitigate the economic burden on consumers.

The Bangladeshi Taka (BDT) exchange rate against the US Dollar (USD) has been in continuous depreciation since the fiscal year 2010. The annual average exchange rate was BDT 69.18 per USD in FY 2010, rising to

BDT 86.30 in FY 2022, BDT 99.46 in FY 2023, and BDT 111.06 in FY 2024. By September FY2025, it climbed further to BDT 120 (Bangladesh Bank, 2024). Various factors, including inflation and interest rate differentials, current account deficits, public debt levels, political stability, economic performance, and speculative activities in the foreign exchange market, influence exchange rate fluctuations in Bangladesh. While currency devaluation has made Bangladeshi exports more competitive and boosted foreign exchange earnings, it has also had significant adverse effects. These include increased inflation, higher debt burdens, social unrest, economic uncertainty, and diminished investor confidence (Roy & Kar, 2023).

The Bangladeshi economy has recently struggled to attract significant foreign direct investment (FDI). According to data from Bangladesh Bank, FDI inflow stood at USD 913.02 million in FY2010, rising to USD 3,888.99 million in FY2019. However, it declined to USD 3,439.63 million in FY 2022 and USD 3,201.16 million in FY 2023 (Bangladesh Bank, 2024). This downturn reflects the broader economic crisis caused by the COVID-19 pandemic, which disrupted investment commitments and is likely to prolong the recovery of FDI inflows. Additional factors contributing to the decline include inadequate infrastructure, power and gas supply shortages, limited port facilities, bureaucratic inefficiencies, corruption, challenges in democratic governance, and issues with law and order. These challenges have collectively resulted in Bangladesh ranking 168th out of 190 countries in the World Bank's Ease of Doing Business index, significantly behind other South Asian nations except Afghanistan (World Bank, 2020).

On the other hand, exports play a crucial role in fostering sustainable economic growth. Since 2001, Bangladesh has recorded an average annual growth rate of 11% in exports, primarily driven by the ready-made garments (RMG) sector. In FY2019, total exports amounted to USD 45.99 billion; however, this figure dropped to USD 39.05 billion (a 15.09% decline) in FY2020, due to disruptions in global trade caused by the COVID-19 pandemic (Bangladesh Bank, 2021). Exports rebounded to USD 44.39 billion in FY2021, representing a 13.65% increase from the previous year. In FY2022, exports surged to USD 59.28 billion, representing a 33.54% year-over-year growth, and making Bangladesh the 52nd largest exporter globally. However, in FY2023, exports fell to USD 57.55 billion (equivalent to 13.16% of GDP), a 2.91% decrease from FY2022 (Macrotrends, 2024). Over the last five reported years, exports have grown from USD 40.73 billion in FY 2018 to USD 57.55 billion in FY 2023, reflecting an increase of USD 16.82 billion (Macrotrends, 2024). According to the World Bank, continued exports and domestic consumption growth are essential to sustaining Bangladesh's average annual growth rate of 6.4% (World Bank, 2024).

Despite the post-pandemic recovery in exports, the sector faces potential challenges due to geopolitical instability in the Middle East, the ongoing Russia-Ukraine war, and recent political changes in Bangladesh. These factors underscore the importance of examining the long-term relationships between inflation, exchange rates, FDI, exports, and economic growth. An in-depth analysis of these factors, considering both domestic and global contexts, can provide policymakers with valuable insights for devising strategies to address internal and external challenges that affect sustainable economic growth. Accordingly, this article aims to critically evaluate the influence of external factors (FDI) and internal factors (exchange rates, inflation, and exports) on sustainable economic growth, with a specific focus on the interplay among key economic variables. The specific objectives of this study are:

a. To examine the short- and long-term effects of exchange rates, inflation, FDI, and exports on Bangladesh's economic growth.
b. To assess the presence of a cointegrating relationship among these variables using the Autoregressive Distributed Lag (ARDL) model.
c. To evaluate the role of currency depreciation in enhancing export competitiveness and its potential destabilizing effects.
d. To analyze the structural constraints limiting FDI inflows and their implications for economic growth.
e. To provide evidence-based policy recommendations to enhance economic stability, promote export diversification, and attract FDI.

This article is organized into several sections. The second section reviews relevant literature, while the third section discusses the data sources and econometric model specifications. The fourth section presents the results and their interpretations. Finally, the fifth section concludes with policy recommendations.

2. Literature Review

Numerous studies establish a connection between economic growth and external (FDI) and internal (exchange rate, inflation, and exports) factors. Hausmann et al. (2005) identify a positive correlation between growth acceleration and depreciation of the real exchange rate. Ramoni-Perazzi and Romero (2022) observe a significant negative impact of exchange rate volatility on economic growth, noting that this effect is less pronounced in countries with high corruption. Barguellil et al. (2018) use a GARCH-based measure of exchange rate volatility to find that both nominal and real exchange rate volatility hinder economic growth, employing difference and system GMM estimators. Rodrik (2008) argues that currency undervaluation (a high real exchange rate) fosters growth, especially in developing countries, eventually leading to exchange rate appreciation.

Research on exchange rate regimes explores the implications of fixed versus floating exchange rates on long-term economic growth. Miles (2006) highlights the importance of this distinction, while Jakob (2016) concludes that fixed exchange rates foster economic stability and growth. MacDonald (2000) contends that although flexible rates are more volatile, they may support growth through enhanced trade and investment in the eurozone. Krugman et al. (2011) suggest that more rigid exchange rates increase economies' vulnerability to financial shocks due to limited flexibility and heightened sensitivity to capital flows. In contrast, Petreski (2009) demonstrates that exchange rate regimes have no significant impact on economic growth. Gabriel et al. (2016) emphasize that depreciation can enhance productivity by facilitating the production of tradable goods through technological advancements, thereby promoting economic growth. Conversely, Benigno et al. (2015) caution that currency appreciation may attract excessive capital inflows, redirecting investments to non-tradable or low-value-added sectors, which can lead to economic stagnation and reduced GDP growth.

Several studies have underscored the influence of exchange rates on economic growth in Bangladesh. Bristy (2014) demonstrates that exchange rate volatility negatively impacts Bangladesh's economic growth due to its underdeveloped financial market. Kabir Hassan and Tufte (1998) show that long-run export growth is positively influenced by global trade volume but negatively affected by exchange rate volatility. Razzaque et al. (2017) find that a 10% real depreciation leads to a 3.2% increase in output in the long run, but results in a 0.5% contraction of GDP in the short run. These findings highlight the potential for exchange rate policy as a development tool, as well as the associated inflationary risks that require careful consideration. Khan (2021) concludes that exchange rates and FDI have a positive and significant influence on Bangladesh's economic growth; however, unexpected events, such as the COVID-19 pandemic and natural disasters, have negatively impacted growth.

The relationship between inflation and economic growth is complex and widely studied in economics. Moderate inflation can promote economic growth by encouraging spending and investment as individuals and businesses anticipate rising prices (EconomicsOnline, 2021). High inflation hinders economic growth by creating uncertainty, eroding purchasing power, and driving up interest rates, which in turn discourages investment and spending (Agarwal & Baron, 2023). Ekinci et al. (2020) suggest a threshold level of inflation, below which it has minimal impact on growth but above which it significantly hampers economic growth. Hall (2023) states that, in the short term, inflation may boost growth by increasing demand; however, sustained high inflation leads to economic instability and slower long-term growth. Inflation can rise in tandem with GDP growth due to increased demand or reduced supply, necessitating a careful balance to prevent excessive inflation (Ellis, 2024). While some inflation is natural in a growing economy, maintaining moderate inflation is essential for sustainable growth (Wai, 1959).

Behera and Mishra (2017) investigate the threshold level of inflation and its implications for economic growth in India, analyzing both short- and long-term dynamics. Using spline regression, their study identifies a

significant structural break beyond which inflation has a detrimental impact on growth. The ARDL model reveals a long-run equilibrium relationship among economic growth, inflation, the exchange rate, and interest rates, indicating that inflation is positively correlated with long-term growth. At the same time, other variables exhibit no significant effects. Kusumatrisna et al. (2022) examine the linear and nonlinear effects of inflation on economic growth in Indonesia, using provincial data spanning the period from 1994 to 2019. Their linear model reveals a negative relationship between inflation and growth, while the nonlinear model confirms this effect beyond certain threshold inflation levels. Ahmed and Mortaza (2010) explore the relationship between inflation and economic growth in Bangladesh, analyzing annual GDP and CPI data from 1980 to 2005. Employing cointegration and error correction models, they identify the threshold level of inflation specific to Bangladesh and discuss its policy implications. Similarly, Uddin (2019) examines the relationship between inflation and economic growth in Bangladesh from 1987 to 2017, revealing a significant correlation between the two variables throughout the study period.

The impact of foreign direct investment (FDI) on economic growth has been widely studied, yielding mixed findings that depend on various factors. Tahir et al. (2015) analyze the effect of external factors on Pakistan's economic growth using data from 1977 to 2013. Their results highlight that FDI significantly boosts economic growth, prompting the recommendation that policymakers prioritize attracting more significant FDI to sustain long-term growth. Almfraji and Almsafir (2014) review studies from 1994 to 2012, concluding that FDI generally has a positive impact on economic growth but may sometimes yield neutral or adverse effects. The development of financial markets, human capital, interactions between domestic and foreign investment, trade openness, exchange rate policies, and legal frameworks influences these outcomes. Blonigen and Piger (2014) identify several determinants of FDI, including cultural ties, geographical distance, per capita GDP, labor availability, and regional trade agreements. They also emphasize the importance of trade openness, ease of doing business, infrastructure quality, financial development, and institutional quality in attracting FDI.

In Bangladesh, Mamun and Kabir (2023) investigated the influence of internal and external factors on economic growth from 1976 to 2019 using ARDL bounds testing. Their findings reveal that while remittances and exports positively contribute to growth, FDI has a negative impact. Similarly, other South Asian studies report a negative relationship between FDI and economic growth (Rehman, 2016; Saqib et al., 2013; Sarker & Khan, 2020a; Siddiqui & Iqbal, 2010). However, most studies from the region find that FDI has a positive impact on economic growth in both the short and long term (Choi & Baek, 2017; Hussain & Haque, 2016a; Khathlan, 2012; Shar & Malik, 2017).

The literature extensively acknowledges the substantial role of exports in driving economic growth in developing countries. The impact of exports, influenced by factors such as the number, quality, price, and volume of exported products, is a significant driver of economic growth (Hameed et al., 2012; Jordaan & Eita, 2007; Luo & Qu, 2023; Mishra, 2011; Sultanuzzaman et al., 2018).

Begum and Shamsuddin (1998) investigated the relationship between exports and economic growth in Bangladesh using a two-sector growth model and annual data from 1961 to 1992. Their findings reveal that increasing the share of investment in GDP significantly boosts GDP growth in typical years but has a negligible effect during abnormal periods (e.g., war, political turmoil, or natural disasters). Their study concludes that export growth significantly enhances economic growth by positively influencing total factor productivity. Similarly, Hossain and Dias Karunaratne (2004) found that total and manufacturing exports have positive and statistically significant long-term and short-term impacts, highlighting the role of exports as a primary driver of Bangladesh's export-led growth.

Mamun and Kabir (2023) employed the ARDL approach using annual data from 1976 to 2019 and found a significant long-term positive relationship between exports and economic growth in Bangladesh. Muhammad Adnan Hye (2012) used similar methods and found a comparable positive relationship in the context of China. Similar findings have been reported in studies on Malaysia, India, and the Southern African Customs Union (SACU) countries, where the same methodology was applied (Chiwira et al., 2023; Chowdhury, 2024; Chukari et al., 2024). In a recent study, Islam and Azad (2023) examined the effects of personal remittances and ready-made garment (RMG) export income on income inequality in Bangladesh from 1983 to 2018, employing the

ARDL and T-Y causality methods. Their findings indicate that remittances reduce income inequality, while RMG export income and economic growth exacerbate it. The study recommends that policymakers encourage international migration and increase the minimum wage for RMG workers to mitigate income disparities.

The literature on Bangladesh's economic growth presents mixed findings regarding the impact of external and internal determinants. While some studies identify positive influences, others report adverse effects, reflecting a lack of consensus in the existing research. Notably, no study has comprehensively examined the combined impact of these external (FDI) and internal (exchange rate, inflation, and exports) determinants on sustainable economic growth in Bangladesh. This inconsistency underscores the need for further empirical research to gain a deeper understanding of these relationships. In particular, the limited number of studies focusing on Bangladesh underscores the urgent need for updated research that accurately reflects the country's current economic conditions and the actual impact of these determinants on its growth trajectory.

3. Data and Methodology

3.1 Data and variables

Based on data availability, this study utilized 36 annual observations from 1986 to 2022. The data were collected from the World Bank's website (https://data.worldbank.org/country/BD, accessed June 11, 2024) and encompass the yearly average exchange rate (LCU per US$), inflation rate (annual %), net inflow of Foreign Direct Investment (FDI) (% of GDP), exports of goods and services (% of GDP), and GDP growth (annual %).

Table 1 presents the summary statistics for all selected variables. The average GDP growth from 1986 to 2022 was 5.423%, while the annual inflation rate averaged 6.280%. The yearly exchange rate averaged 60.499 LCU per US$. Another important variable in this study is the export of goods and services. The average annual export (% of GDP) was 12.508%, significantly higher than the net inflow of FDI, which averaged 0.552% of GDP. The graphical plots of these series are presented in Figure 1.

Table 1. Summary Statistics

Variable	Observations	Unit	Mean	SD
GDP	36	Annual %	5.423	1.351
Inflation	36	Annual %	6.280	2.193
Exchange rate	36	LCU per US$	60.499	18.849
FDI	36	% of GDP	0.552	0.505
Export	36	% of GDP	12.508	4.265

3.2 Model and Methodology

3.2.1 Model specification

The primary objective of this study is to investigate the influence of internal factors (inflation, exports, and exchange rate) and external factors (foreign direct investment) on economic growth in Bangladesh. The empirical analysis utilized 36 years of observations, spanning from 1986 to 2022. Based on data availability, the variables used in the analysis include inflation (annual percentage), exchange rate (LCU per US$), foreign direct investment (as a percentage of GDP), and exports of goods and services (as a percentage of GDP). The econometric analysis is based on the following specified model:

$$GDP_t = \alpha_0 + \beta_1 INFL_t + \beta_2 EXC\_RT_t + \beta_3 FDI_t + \beta_4 EXPT_t + e_t \quad (1)$$

where GDP represents the gross domestic product growth, INFL denotes the inflation rate, EXC_RT is the exchange rate, FDI is foreign direct investment, and EXPT represents exports. α and β are the intercepts and slope parameters, respectively, and e is the error term. In equation (1), GDP is a dependent variable, while inflation, exchange rate, FDI, and exports are the independent variables.

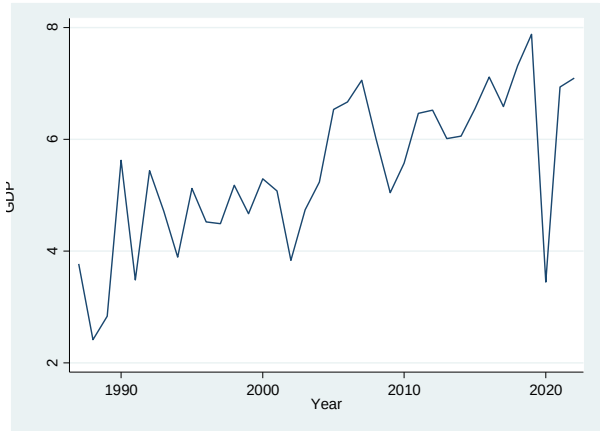

Figure 1a: GDP growth

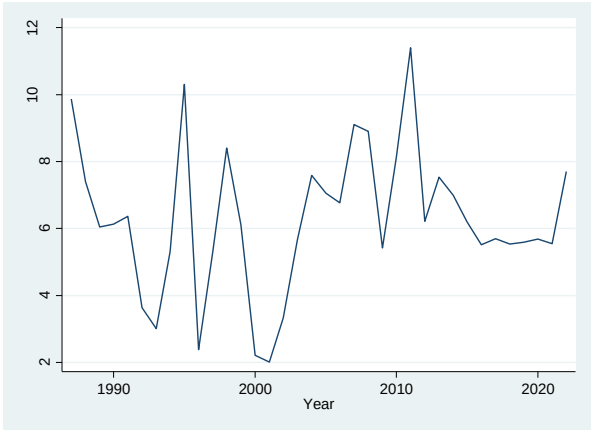

Figure 1b: Annual inflation rate

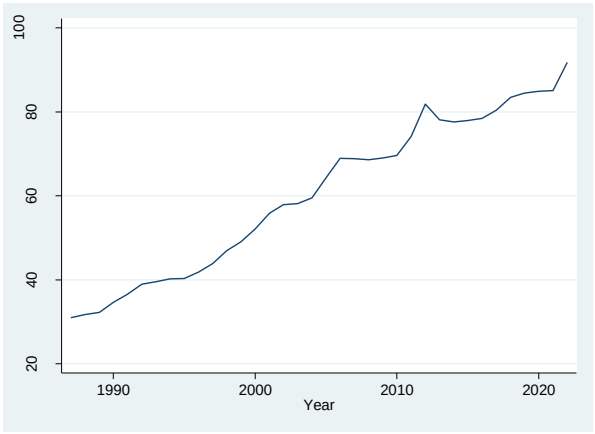

Figure 1c: Exchange rate (LCU per US$)

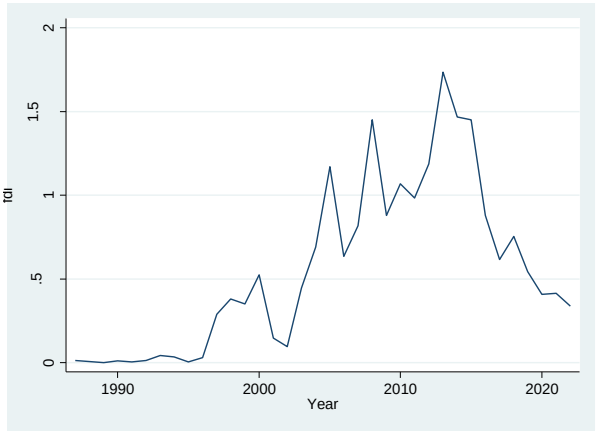

Figure 1d: FDI (% of GDP)

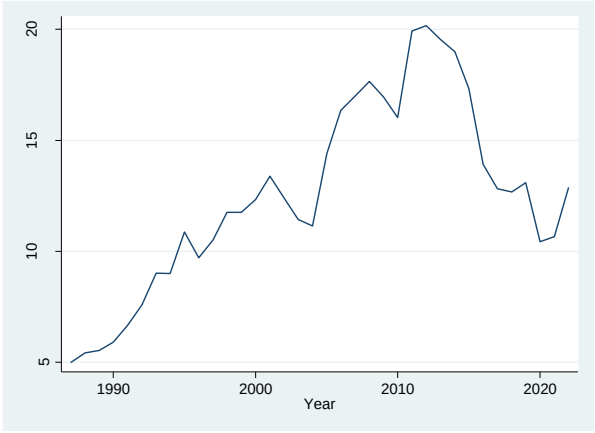

Figure 1e: Export of goods and services (% of GDP)

Figure 1. GDP growth, inflation rate, exchange rate, FDI, and export in Bangladesh from 1986 to 2022

3.2.2 Stationarity Testing and Model Selection Criteria

Identifying an appropriate model using time series data is crucial because such data requires special care before analysis. Generally, time series data contain unit roots and are often non-stationary. Therefore, it is essential to check for potential non-stationarity and determine the order of integration for each series. Failing to account for stationarity or unit root issues can lead to spurious regression. Gujarati et al. (2012) argued that series must be stationary to avoid inconsistencies in coefficient estimation. If the time series variables are non-stationary, the recommended procedure is to use cointegration techniques or to differentiate the data according to the order of integration and use the differenced data in the analysis rather than the original data (Tahir et al., 2015).

Before conducting stationarity tests, it is essential to pre-estimate the lag order, as selecting too many lags can lead to increased forecasting errors. In this study, three commonly used methods were selected: Schwarz's Bayesian Information Criterion (SBIC), Akaike's Information Criterion (AIC), and the Hannan-Quinn Information Criterion (HQIC), which assist in selecting the appropriate number of lags.[2] However, this study employed the Augmented Dickey-Fuller (ADF), Phillips-Perron (PP), and Kwiatkowski-Phillips-Schmidt-Shin (KPSS) unit root tests to address potential non-stationarity concerns.[3]

Several econometric methods are available for time series analysis, such as fully modified ordinary least squares (FMOLS), LSE-Hendry's General-to-Specific (GETS) approach, the Johansen maximum likelihood (JML) method, the Engle-Granger (EG) two-step method, the Johansen multivariate cointegration test, and the more recent Autoregressive Distributed Lag (ARDL) model (Makun, 2018; Tahir et al., 2015). Pesaran, Shin, and Smith (2001) developed the ARDL method, which is particularly effective because it can handle different orders of integration, correct for possible endogeneity, and is robust for both small and large sample sizes (Pesaran et al., 2001; Tahir et al., 2015).

On the other hand, Shrestha and Bhatta (2018) argue that if all the selected variables are stationary, methods such as ordinary least squares (OLS) or vector autoregressive (VAR) models can be used. However, if the variables are non-stationary, the Johansen test is more appropriate than OLS or VAR models. If some variables are stationary and others are not, the ARDL model is considered the most suitable. Therefore, this study prefers the ARDL approach to detect long-run relationships, mainly when the variables exhibit different levels of stationarity.

3.2.3 Cointegration Testing and ARDL Estimation Procedure

The ARDL approach to cointegration follows a step-by-step procedure. Pesaran, Shin, and Smith developed the bounds F-test approach for cointegration, also known as the ARDL approach, in 2001. The first step in this study is to examine the presence of long-run cointegration by rewriting equation (1) as an unrestricted error correction model (UECM) in the ARDL framework, as shown below:

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[2] The formulas for AIC, SBIC, and HQIC, as provided in Lütkepohl (2013), are: $AIC = -2\left(\frac{LL}{T}\right) + \frac{2\mathrm{t}_p}{T}$; $SBIC = -2\left(\frac{LL}{T}\right) + \frac{\ln(T)}{T}\mathrm{t}_p$; $and\ HQIC = -2\left(\frac{LL}{T}\right) + \frac{2ln\{\ln(T)\}}{T}\ \mathrm{t}_p$

[3] The equations for these tests, including the error term (e_t), are as follows: $ADF: \Delta y_t = \mu + \sigma y_{t-1} + \sum_{i=1}^{k} \beta_i \Delta y_{t-i} + e_t$; $PP: \Delta y_t = \sigma y_{t-1} + \beta_i R_{t-i} + e_t$; $and\ KPSS: Y_t = X_t + e_t$

$$\Delta GDP_t = \alpha_0 + \beta_1(GDP)_{t-1} + \beta_2(INFL)_{t-1} + \beta_3(EXC\_RT)_{t-1} + \beta_4(FDI)_{t-1} + \beta_5(EXPT)_{t-1} + \sum_{i=1}^{n} \beta_6 \Delta(GDP)_{t-1} + \sum_{i=1}^{n} \beta_7 \Delta(INFL)_{t-1} + \sum_{i=1}^{n} \beta_8 \Delta(EXC\_RT)_{t-1} + \sum_{i=1}^{n} \beta_9 \Delta(FDI)_{t-1} + \sum_{i=1}^{n} \beta_{10} \Delta(EXPT)_{t-1} + e_t \quad (2)$$

where (Δ) is the difference operator, indicating short-run dynamics, while the coefficients of the lagged variables represent long-run relationships. This study will test the null hypothesis of no long-run relationship ($H_0: \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = 0$) against the alternative hypothesis of the existence of a long-run relationship ($H_1: \beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq \beta_5 \neq 0$). If the null hypothesis is rejected, it indicates the establishment of a long-run cointegrating relationship; otherwise, the null hypothesis is accepted. The coefficients capture the short-run dynamics $\beta_6, \beta_7, \beta_8, \beta_9$, and β_{10}.

In 2001, Pesaran, Shin, and Smith generated critical values for the bounds F-test: lower bound critical values (I(0)) and upper bound critical values (I(1)). The F-test imposes restrictions on the long-run coefficients by using the Wald test, obtaining the Wald F-statistic, and comparing it with the lower and upper-bound critical values (Pesaran et al., 2001). There are three possible outcomes for the cointegration test:

1. If the calculated Wald F-statistic exceeds the upper bound I(1) critical value, there is evidence of cointegration, rejecting the null hypothesis and indicating the existence of a long-run association between the variables. The process then estimates the long-run error correction model (ECM).
2. If the calculated Wald F-statistic is below the lower bound I(0) critical value, the null hypothesis is accepted, suggesting no long-run relationship, and the short-run ARDL model is estimated instead.
3. The result is inconclusive if the F-statistic falls between the lower and upper bound values.

P. K. Narayan (2017) re-estimated the critical values for the ARDL approach for small samples (30 to 80 observations), arguing that the critical values developed by Pesaran, Shin, and Smith (2001) were designed for large sample sizes and could lead to misleading outcomes for smaller samples. However, since this study utilizes 36 years of data, the critical values from Narayan (2005) will be appropriate. Nevertheless, this study considers the critical values from P. K. Narayan (2017) and those from Pesaran, Shin, and Smith (2001) to observe and compare the outcomes. Accordingly, the estimated Wald F-statistic will be compared to both sets of critical values to determine the existence of a cointegrating relationship.

The second step involves estimating the short-run and long-run relationships using the ARDL model. Duasa (2007) argued that the ARDL approach allows for the possibility of selecting various optimal lag orders. The long-run coefficients can be derived from the ARDL unrestricted regression estimates by dividing the coefficient of each explanatory variable by the coefficient of the first lag of the response variable and multiplying by -1 (Khatun & Ahamad, 2012). Thus, the long-run coefficients for export, personal remittances, and foreign direct investment, including dummy variables, are calculated as $\left(\beta_2/\beta_1\right) - 1$, $\left(\beta_3/\beta_1\right) - 1$, $\left(\beta_4/\beta_1\right) - 1$, and $\left(\beta_5/\beta_1\right) - 1$, respectively.

Finally, the short-run error correction model is estimated, where the short-run dynamics identify and verify the robustness of the long-run coefficients. The error correction model is specified based on equation (2):

$$GDP_t = \alpha_0 + \sum_{i-1}^{n} \beta_6 \Delta(GDP)_{t-1} + \sum_{i-1}^{n} \beta_7 (INFL)_{t-1} + \sum_{i-1}^{n} \beta_8 \Delta(EXC\_RT)_{t-1} + \sum_{i-1}^{n} \beta_9 \Delta(FDI)_{t-1} + \sum_{i-1}^{n} \beta_{10} \Delta(EXPT)_{t-1} + (ECM)_{t-1} + e_t \quad (3)$$

Where ECM represents the error correction term derived from the long-run estimates in equation (2), the error correction term is expected to have a significant and adverse relationship with the dependent variable, indicating adjustment back to equilibrium.

4. Results and discussion

4.1 Lag length selection

Selecting the appropriate lag length is critical for stationarity tests. Too many lags can increase forecasting errors, while too few may omit relevant information (Stock & Watson, 2006). Determining the optimal lag length for the ARDL model is also necessary for performing the bounds cointegration test and evaluating the error correction model. While experience, theoretical understanding, and empirical knowledge are often employed to determine the required number of lags, information criteria provide a systematic and reliable approach to this determination.

Three commonly used information criteria for lag selection include Schwarz's Bayesian Information Criterion (SBIC), Akaike's Information Criterion (AIC), and Hannan and Quinn's Information Criterion (HQIC). When all three criteria suggest the same lag, the selection is straightforward. However, discrepancies between criteria may complicate the decision. According to a CEPR (2001) study, SBIC is recommended for quarterly and annual data of any sample size, while AIC is more accurate for monthly data; for quarterly data with a sample size exceeding 120, HQIC is preferred (Ivanov & Kilian, 2001). A general rule of thumb suggests maximum lags of 1–2 for annual data, 1–8 for quarterly data, and 6, 12, or 24 for monthly data.

Since this dataset comprises 36 annual observations, SBIC is deemed the most appropriate criterion, with a maximum lag of 2 for lag length selection. A standard unrestricted VAR was employed to identify the optimal lag length using the FPE, AIC, SBIC, and HQIC. Table 2 presents the lag-order selection statistics for vector autoregressions of order 1 with a maximum lag of 2. The results indicate that all criteria suggest an optimal lag length of 1 for further analysis. In alignment with CEPR (2001) guidelines, the SBIC criterion was followed for final lag selection.

Table 2. Obtain lag-order selection statistics (obtain optimal lag for each variable)

Lag	LL	LR	FPE	AIC	HQIC	SBIC
0	-342.97	NA	533.485	20.4687	20.5453	20.6932
1	-222.34	241.25	1.96007*	14.8437*	15.303*	**16.1905***
2	-202.93	38.826*	3.01472	15.1723	16.0144	17.6415

LR: Likelihood ratio, FPE: Final prediction error, AIC: Akaike information criterion, HQIC: Hannan and Quinn information criterion, and SBIC: Schwarz's Bayesian information criterion.
* Optimal lag length: Significant at 5 percent or lower level.

4.2 Stationarity Test

4.2.1 Graphically test for stationarity

The study conducted a graphical analysis of the time series data for five variables: GDP growth (annual %), inflation (annual %), exchange rate (LCU per US$, period average), foreign direct investment (FDI) (net inflows, % of GDP), and exports of goods and services (% of GDP). The plots revealed that the annual growth rates of these variables exhibited minor fluctuations over time, indicating non-stationarity at their levels (Figure 2). However, after taking the first differences, the variables displayed stationarity (Figure 3).

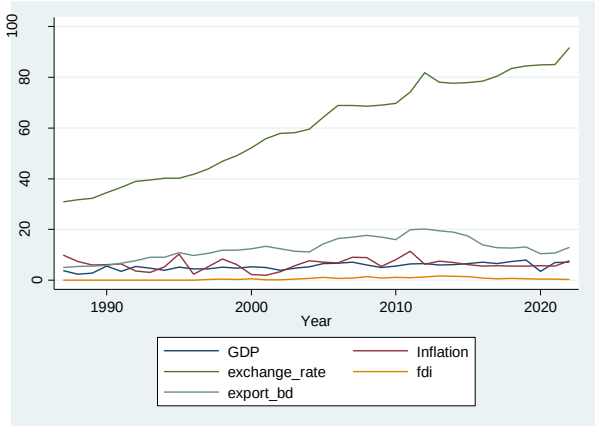

Figure 2. Time series plot of variables in levels

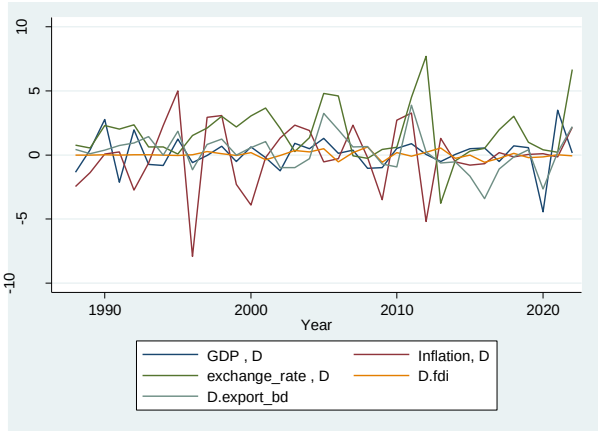

Figure 3. Time series plot of the first difference

4.2.2 Unit root test for stationarity

This study conducted unit root tests on the annual series of GDP, inflation, exchange rate, FDI, and export variables. The series was transformed using logarithmic first differences, with intercept-only models and models that included both trend and intercept. Three widely used test methods—Augmented Dickey-Fuller (ADF), Phillips-Perron (PP), and Kwiatkowski-Phillips-Schmidt-Shin (KPSS)—were employed to evaluate stationarity.

The Augmented Dickey-Fuller (ADF) test results indicate that all variables, except inflation, are non-stationary at their levels (Table 3). After taking the first differences, all variables become stationary. Additionally, none of the series is trend stationary in their levels, as they remain non-stationary even after incorporating time trends in the ADF test equation, except GDP and inflation, which are stationary at the 5% significance level. All non-stationary variables become stationary at the first difference when both trend and intercept are included.

The Phillips-Perron (PP) test confirms that all variables are stationary at the first difference at the 5% level (Table 4), consistent with the ADF test results. Before differencing, none of the series was stationary under intercept-only and trend-with-intercept models, except for GDP and inflation.

The KPSS test also shows that all series become stationary after taking the first difference, aligning with the ADF and PP results (Table 5). Before differencing, none of the series is stationary under intercept-only models except inflation. When the time trend is included, GDP, inflation, and exports become stationary. This finding is consistent with the ADF and PP tests, where GDP and inflation are stationary at the level when the time trend is included.

Although stationarity can be confirmed using any of these methods, inconsistent results may arise when variables are differenced and retested. It is crucial to carefully interpret results for variables that do not become stationary at the first difference or are near the decision threshold. Selecting repeated or consistent properties across tests is a prudent approach. Based on these results, this study observed mixed stationarity (some variables

were stationary at their levels) and determined that the ARDL model is suitable for further analysis (Shrestha & Bhatta, 2018).

Table 3. Augmented Dicky Fuller (ADF) test results

Variable	Intercept				Trend and Intercept			
	Level		First Difference		Level		First Difference	
	t-stat	p-value	t-stat	p-value	t-stat	p-value	t-stat	p-value
GDP	-2.647	0.0836	-7.108	0.0000	-4.656	0.0008	-7.211	0.0000
Inflation	-3.956	0.0017	-7.635	0.0000	-4.099	0.0063	-7.545	0.0000
Exchange rate	-0.228	0.9351	-5.164	0.0000	-3.086	0.1096	-5.059	0.0002
FDI	-1.580	0.4936	-4.804	0.0001	-1.204	0.9097	-4.979	0.0002
Export_BD	-1.908	0.3281	-3.777	0.0031	-1.483	0.8347	-4.131	0.0057

Note: The ADF test follows the null hypothesis (H_0) that a variable is non-stationary (contains a unit root) and the alternative hypothesis (H_1) that a variable is stationary (no unit root). If the absolute critical value exceeds the absolute value of the test statistic, the null hypothesis (H_0) is rejected, indicating that the data are stationary.

Table 4. Phillips-Perron (PP) test results

Variable	Intercept				Trend and Intercept			
	Level		First Difference		Level		First Difference	
	t-stat	p-value	t-stat	p-value	t-stat	p-value	t-stat	p-value
GDP	-3.2420	0.0177	-10.1410	0.0000	-5.9210	0.0000	-10.0340	0.0000
Inflation	-4.5020	0.0002	-7.4410	0.0000	-4.5490	0.0013	-7.4390	0.0000
Exchange rate	-0.1300	0.9463	-4.8180	0.0001	-2.7250	0.2266	-4.7170	0.0007
FDI	-1.7290	0.4162	-6.8380	0.0000	-1.5870	0.7974	-6.9220	0.0000
Export_BD	-1.8450	0.3583	-4.4890	0.0002	-1.1880	0.9130	-4.6370	0.0009

Note: In the PP test, the null hypothesis (H_0) assumes the presence of a unit root (non-stationary), while the alternative hypothesis (H_1) assumes stationarity. If the absolute critical value exceeds the absolute value of the test statistic, the variable is considered stationary.

Table 5. KPSS test results

Variable	LM Statistics KPSS test			
	Intercept		Trend and intercept	
	critical value @10%=0.347, 5%=0.463, 2.5%=0.574 & 1%=0.739		critical value @ 10%=0.119, 5%=0.146, 2.5%=0.176 & 1%=0.216	
	Level	First difference	Level	First difference
GDP	1.330	0.026	0.059	0.026
Inflation	0.148	0.069	0.102	0.039
Exchange rate	1.880	0.046	0.200	0.047
FDI	1.080	0.161	0.248	0.079
Export_BD	1.120	0.269	0.325	0.062

Note: In the KPSS test, the null hypothesis (H_0) assumes that the variable is either level stationary or trend stationary, while the alternative hypothesis (H_1) assumes non-stationarity. The variable is deemed non-stationary if the test statistic exceeds the critical value and vice versa.

4.3 ARDL Model Estimation

This study presents the estimation results of the ARDL model using the optimal lag length determined by the Schwarz-Bayesian Information Criterion (SBIC). The selected model, ARDL (1 0 0 0 1), incorporates a lagged value of GDP growth, along with contemporaneous values of inflation, exchange rate, foreign direct investment (FDI), and exports, with exports also lagged by one period (Table 6). The model does not include structural breaks or dummy variables.

The results suggest that GDP growth is influenced by its lagged value (t_{-1}). The coefficient for lagged GDP growth (L1.GDP Growth) is estimated at -0.112. Although this coefficient is not statistically significant, it implies that GDP growth in the current period is negatively affected by growth in the previous period. This may indicate an economic adjustment mechanism, where rapid growth in one period is often followed by slower growth in subsequent periods, particularly in response to external shocks like the COVID-19 pandemic.

This interpretation aligns with Bangladesh's economic performance during the pandemic. In 2019, GDP growth was robust at 7.88%, but it declined sharply to 3.45% in 2020 due to pandemic-related disruptions—a recovery followed in 2021, with growth rebounding to 6.94%. An exceptional growth rate of 7.81% was recorded in 2022. This pattern highlights how external shocks and fluctuations in economic performance can give rise to a mean-reverting process, where periods of high growth are frequently followed by slower growth or adjustments. The adverse lagged effect of -0.112, although not statistically significant, is consistent with the literature, which highlights short-term fluctuations in GDP as part of these adjustment processes (M. H. Pesaran et al., 2001b). Despite the lack of statistical significance, this lagged effect indicates that policymakers should consider the inertia in economic growth when forecasting future performance, particularly in the context of external shocks.

In the ARDL (1 0 0 0 1) model, inflation, exchange rate, and FDI are included without lags (t_{-0}), capturing their immediate impact on GDP growth. The export variable is included both at the current level and with a one-period lag. The positive and significant coefficient for the exchange rate underscores the pronounced and immediate impact of currency valuation changes on GDP growth. Additionally, while current exports positively affect GDP growth, lagged exports have a negative impact, suggesting a delayed effect on export dynamics. The ARDL (1 0 0 0 1) model will also be employed to test for cointegration using the bounds-testing approach. This will allow for the estimation of both long-run and short-run coefficients. Diagnostic tests will be conducted to validate the robustness of the model's findings.

4.4 ARDL Bound Test for Cointegration

This study examines the presence of cointegration among the variables using the ARDL bounds test approach, which is based on the error correction representation proposed by Pesaran et al. (2001). The bounds test relies on the joint F-statistic, whose asymptotic distribution is nonstandard under the null hypothesis (H_0) of no cointegration or no level relationship, against the alternative hypothesis (H_1) of a cointegrating relationship. The bounds test assumes that the model includes variables integrated at order zero (I(0)) and order one (I(1)), with critical values provided at two levels. At the first level, the calculation assumes that all variables in the ARDL model are integrated of order 0, denoted as I(0). At the second level, it assumes that the variables are integrated of order I(1). The estimation process involves approximating the equation using ordinary least squares (OLS) and assessing the collective significance of the lagged levels of the variables. The null hypothesis (H_0) of no cointegration is rejected if the calculated F-statistic exceeds the critical values of both the lower bound (I(0)) and the upper bound (I(1)). Otherwise, the null hypothesis is accepted (Belloumi, 2014).

The results of the ARDL bounds test are presented in Table 7. The F-statistic is 8.742, while the critical value range is 3.74 (lower bound, I(0)) and 5.06 (upper bound, I(1)) at a 1% level of significance. Since the F-statistic exceeds the upper critical value at the 1% significance level, the null hypothesis of no cointegration is rejected. This result confirms the existence of a long-run relationship between the dependent and independent variables

(Narayan, 2005). Thus, the study concludes that a long-term cointegrating relationship exists among GDP growth, inflation, the exchange rate, FDI, and exports in Bangladesh. The findings suggest that these variables collectively influence the country's long-run economic performance when normalized to economic growth.

Table 6. ARDL Model Estimation

Variables	ARDL Estimations
L1.GDP Growth	-0.112
	(0.175)
Inflation Rate	-0.066
	(0.087)
Exchange Rate	0.056***
	(0.014)
FDI Inflow	0.466
	(0.694)
Export	0.304*
	(0.124)
L1.Export	-0.302*
	(0.128)
Constant	2.659**
	(0.960)
N	35
R square	0.636
Adjusted R-squared	0.558
Root MSE	0.891

Note: Standard error in parentheses.
*P<0.05, **P<0.01, and ***P<0.001

Table 7. ARDL Bound Test for Cointegration

Significance level	Critical Value		Calculated F statistic
	Lower Band I(0)	Upper Band I(1)	
1.0%	3.74	5.06	8.742
2.5%	3.25	4.49	
5.0%	2.86	4.01	
10.0%	2.45	3.52	

Note: *The variables lag length (1 0 0 0 1).
* H_0 is accepted if F < critical value for I(0) regressors (Lower band); and reject if F > critical value for I(1) regressors (Upper band).

4.5 ARDL and ECM Results

This study examined the cointegration among variables in the preceding section and established that the selected variables are cointegrated in the long term. Subsequently, the ARDL error correction approach was applied to estimate the long-run relationships and short-run dynamics between the dependent variable (economic growth) and the explanatory variables (exchange rate, inflation, foreign direct investment (FDI), and export).

The long-run results for the relationship between economic growth (as the dependent variable) and its predictors in Bangladesh are presented in Table 8. The findings suggest that the exchange rate has a significant and positive impact on Bangladesh's economic growth. The estimated long-run coefficient for the exchange rate is 0.0507, which is statistically significant at the 1% level ($p = 0.000$). This suggests that a 1% depreciation in the exchange rate (indicating an increase in the domestic currency price of foreign currency) is associated with a 0.05% increase in GDP in the long run. This result aligns with the findings of Rodrik (2008) and Rapetti et al. (2012) and is consistent with theoretical expectations for export-driven economies, where currency depreciation enhances export competitiveness, thereby promoting economic growth (Bahmani-Oskooee & Rhee, 1997; Edwards, 1989).

However, while the exchange rate positively influences growth, it is crucial to note that excessive exchange rates can have destabilizing effects, as emphasized by Belloumi (2014). In Bangladesh, currency depreciation tends to boost economic growth, potentially due to the country's reliance on imports for industrial inputs and consumption. A weaker Bangladeshi Taka makes locally produced goods more competitive in international markets, stimulating exports. Additionally, depreciation attracts foreign investment, supports domestic industries by making imports less competitive, and helps maintain a balance in foreign currency flows. These factors collectively contribute to economic stability and growth.

In contrast, inflation exhibits a negative but statistically insignificant impact on economic growth. The coefficient for inflation is -0.0590, implying that a 1% increase in inflation could reduce GDP by 0.059% in the long run. However, the lack of statistical significance suggests that inflationary pressures in Bangladesh have not yet reached levels detrimental to long-term growth. Theoretically, inflation erodes purchasing power and hampers economic performance (Fischer, 1993). However, in Bangladesh's case, its limited impact may reflect effective monetary policies or the relatively moderate inflation rates observed during the study period.

This study found evidence of an insignificant positive relationship between FDI and economic growth in Bangladesh's economy in the long run. However, the impact of FDI on economic growth remains statistically insignificant, possibly due to the exclusion of human capital as a variable in this analysis. Human capital is considered a critical factor for enhancing the beneficial effects of FDI (Borensztein et al., 1998; Makun, 2018). The coefficient for FDI is 0.4194, which, although positive, lacks statistical significance.

Contrary to these findings, Adnan Hye and Islam (2013) and Mamun and Kabir (2023) reported a significant positive relationship between FDI and economic growth, while studies such as Hussain and Haque (2016), Adhikary (2010), and Sarker and Khan (2020) documented results that align with the present findings. While FDI is theoretically expected to promote growth by facilitating capital accumulation and technology transfer (Borensztein et al., 1998), its limited impact in Bangladesh may reflect structural challenges, including weak governance, insufficient infrastructure, or the relatively small scale of FDI inflows.

Nevertheless, FDI presents significant opportunities for the host country. For instance, attracting FDI from developed nations can enable Bangladesh to acquire and adopt efficient production systems and advanced technologies, aiding its transition from a low-income to a middle-income economy. To capitalize on these benefits, the government of Bangladesh should intensify efforts to attract FDI by implementing various incentives, such as:

1. Strengthening governance through improved law and order and political stability.
2. Legal reforms to provide better security for foreign investors.
3. Infrastructure development, including uninterrupted energy supplies and modernized transportation networks.
4. Energy investments to bridge the supply-demand gap.

Such measures would create an investment-friendly environment, significantly increasing FDI inflows and fostering sustainable economic growth, ultimately helping Bangladesh achieve its goal of becoming a middle-income country.

This study also provides robust evidence of a positive relationship between exports and economic growth in Bangladesh. The estimated coefficient of 0.0021 suggests that exports have a negligible long-run positive impact on economic growth, though the effect is statistically insignificant. This finding contradicts conventional growth theories that emphasize exports as a critical driver of economic development (Krueger, 1998). The insignificance may stem from Bangladesh's heavy reliance on ready-made garments (RMG), which makes the economy vulnerable to global demand shocks, such as those induced by the COVID-19 pandemic and the Russia-Ukraine war.

In contrast, recent research by Mamun and Kabir (2023) identified a significant positive relationship between exports and economic growth. Similarly, Begum & Shamsuddin (1998) and Al Mamun & Nath (2005) demonstrated that increasing exports significantly boosts economic growth in Bangladesh. Notably, the export sector's contribution to growth was particularly pronounced during the period from 1982 to 1990, a time marked by trade liberalization and economic deregulation.

However, export contributions were negligible during the politically turbulent years of 1990–1992, highlighting the importance of political stability for sustained growth (Begum & Shamsuddin, 1998). Bangladesh relies heavily on RMG exports to Europe and the United States, given its labor-intensive economy. The country should diversify its export-oriented production by leveraging its abundant, cost-effective labor force to enhance export contributions. A model worth emulating is China, where production is tailored to the specific demands of global markets.

To achieve such diversification, the government should:

1. Attract both domestic and foreign investors by offering a range of incentives.
2. Develop energy and infrastructure sectors to ensure smooth production and distribution.
3. Foster an investment-friendly environment that facilitates export-oriented industrial growth.

By addressing these challenges and pursuing export diversification, Bangladesh can significantly enhance its exports, achieve sustainable economic growth, and realize its vision of attaining higher middle-income status.

Table 8 presents the error correction term (denoted as adjustment, the first leg of GDP). A non-negative adjustment coefficient would imply no long-run convergence, suggesting that the model lacks equilibrium-restoring dynamics. In contrast, a negative coefficient indicates long-run convergence among the variables, signifying that past deviations are corrected in the current period.

The coefficient for GDP growth (-1.112) is statistically significant at the 1% level ($p = 0.000$), highlighting a rapid adjustment mechanism. The magnitude of this coefficient suggests that 111% of the disequilibrium from the previous period is corrected in the current period. This confirms a strong long-run relationship between GDP and the explanatory variables. The error correction term illustrates the speed of the adjustment process in restoring equilibrium after a disturbance to the long-run equilibrium relationship.

The statistically significant and negative coefficient validates the presence of a long-term equilibrium and reflects the efficiency of the adjustment mechanism. The relatively high error correction coefficient (in absolute terms) suggests a faster adjustment process than similar studies on developing economies such as India and Pakistan. For instance, Shahbaz et al. (2008) reported adjustment coefficients ranging between -0.4 and -0.8, highlighting that Bangladesh exhibits a swifter reversion to equilibrium conditions.

In the short run, the export coefficient (0.302) is both positive and statistically significant ($p = 0.026$), indicating that a 1% increase in exports contributes to a 0.3% rise in GDP. This finding underscores the immediate benefits of export growth, aligning with the export-led growth hypothesis (Balassa, 1978). However, the negligible long-run impact of exports presents a contrasting narrative. This discrepancy may arise due to structural bottlenecks, such as supply-side constraints, which limit the long-term sustainability of export-driven growth.

The R^2 value of 0.6501 and adjusted R^2 of 0.5751 indicate that the included variables explain approximately 57.5% of the variation in GDP growth. While respectable, the moderate explanatory power suggests the

potential presence of omitted variables, such as labor market dynamics, technological advancements, or institutional quality. The RMSE of 0.8907 reflects the average deviation of the observed GDP growth from the predicted values, indicating a reasonable model fit given the sample size (N = 35).

Table 8. Long-run elasticities and error correction result (predictand: GDP Growth) ARDL (1 0 0 0 1)

Variable	Estimated coefficient
Long-run estimates:	
Exchange Rate	0.051***
	(0.000)
Inflation	-0.059
	(0.457)
FDI	0.419
	(0.515)
Export	0.002
	(0.979)
Adjustment:	
L1.GDP	-1.112***
	(0.000)
Short-run estimates:	
D1.Export	0.302*
	(0.026)
Constant	2.659**
	(0.010)
N	35
R-squared	0.650
Adjusted R-squared	0.575
Root MSE	0.891

Note: Standard errors in parentheses
* p<0.05, ** p<0.01, & *** p<0.001

4.6 Diagnostic Test Result

The final step in this analysis involves assessing the goodness of fit and reliability of the ARDL-error correction model. To achieve this, a series of diagnostic and stability tests was conducted. Table 9 presents the results of these tests, demonstrating that the estimated ARDL model is robust and free from significant econometric issues. First, the Durbin-Watson statistic indicates the absence of serial correlation or autocorrelation problems, ensuring the validity of the model's residuals. Similarly, the Breusch-Godfrey statistic confirms that the model does not suffer from higher-order autocorrelation, further affirming its reliability. Second, the White test results suggest no evidence of heteroscedasticity, as the test statistic is statistically insignificant at the 5% level. This ensures that the variance of the residuals remains constant, a key assumption for the model's robustness. Third, the Ramsey RESET test confirms that the model has the correct functional form, indicating no significant specification errors. Furthermore, the Jarque-Bera normality test confirms that the residuals follow a normal distribution, validating the normality assumption. In conclusion, the diagnostic tests collectively establish the reliability of the estimated ARDL model. The absence of severe econometric issues ensures that the model provides a credible basis for analyzing the relationships between the variables.

Table 9. The results of the diagnostic tests

Specification	chi2	p-Value	Conclusion
Durbin-Watson statistic (autocorrelation)	1.833	1.913	No autocorrelation
Breusch-Godfrey statistic (autocorrelation)	0.514	0.474	No higher-order autocorrelation
Heteroscedasticity	32.85	0.202	No heteroscedasticity
Ramsey RESET test	1.430	0.257	No omitted variables
Jarque-Bera normality test	0.307	0.858	No omitted variables

Note: Significant at the 5 percent level, and the d-statistic used for Durbin-Watson.

4.7 Stability Checking

To evaluate the stability of the ARDL model, the cumulative sum (CUSUM) and cumulative sum of squares (CUSUM-square) tests were conducted. Figures 4 and 5 present the plots for these stability tests, respectively. The results indicate that the plotted lines for CUSUM and CUSUM-square remain within the critical boundaries at the 5% significance level. These findings confirm that the estimated model is both stable and reliable, satisfying the assumption of parameter constancy over the sample period. Consequently, the model can be confidently used for long-run and short-run inferences regarding the relationships among the variables.

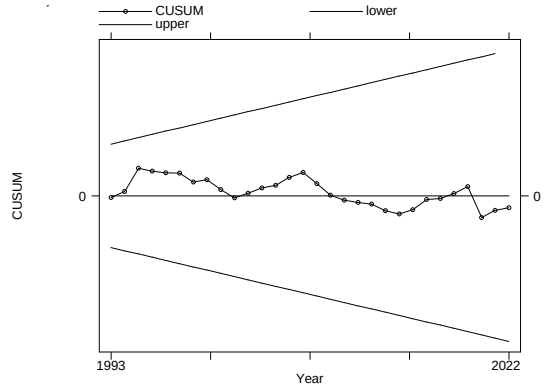

Figure 4. CUSUM Test

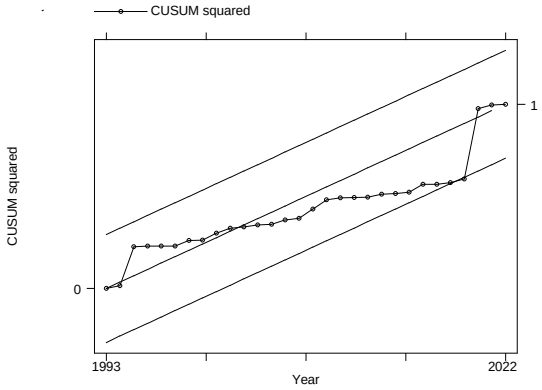

Figure 5. CUSUM-square Test

5. Conclusion and Policy Recommendations

The primary objective of this research was to investigate the impact of inflation, exchange rates, exports, and foreign direct investment (FDI) on Bangladesh's economic growth, utilizing the ARDL-ECM approach with annual data spanning the period from 1986 to 2022. The analysis aimed to understand how internal and external factors influence sustainable economic growth in Bangladesh, particularly in an economy facing inflationary pressures, low FDI, and interventionist exchange rates.

The findings of this study indicate that the exchange rate has a significant and positive impact on GDP growth. This suggests that the depreciation of the Bangladeshi Taka enhances export competitiveness, thereby fostering economic growth. In contrast, inflation was found to have a negative, but statistically insignificant, relationship with economic growth. This implies that, while inflation may present some challenges, it has not yet reached levels that significantly hamper long-term growth. Foreign direct investment (FDI) also showed an insignificant positive relationship with growth, suggesting that while FDI can benefit, its current impact in Bangladesh remains limited. This limitation may be attributed to structural issues, including governance and infrastructure. Although exports positively influenced GDP growth in the short term, they did not exhibit a significant long-

term impact. This is likely due to Bangladesh's reliance on the ready-made garments (RMG) sector, which is particularly vulnerable to shocks in global demand.

In the context of the research objectives, these findings suggest that while external factors, such as exchange rates, have long-term effects on economic growth, exports have immediate effects. The longer-term growth prospects of Bangladesh are more sensitive to structural factors, including governance, infrastructure, and the diversification of its export base. This study highlights the importance of currency depreciation in promoting economic growth, while cautioning against the destabilizing effects of excessive depreciation. Furthermore, the limited role of FDI highlights the need for targeted policy reforms to enhance the investment climate and attract more substantial foreign investment.

Given the positive impact of the exchange rate on GDP growth, it is recommended that the government adopt policies that carefully manage the depreciation of the Taka. While a weaker currency can boost exports, excessive depreciation may lead to higher inflation and erode investor confidence. The government should aim for a stable, competitive exchange rate to support export growth while preventing inflation. Although inflation did not significantly impact economic growth, its rising trend must be addressed. The government should implement robust monetary and fiscal policies to control inflation, particularly food inflation, which contributes to the rising cost of living. Effective inflation control will ensure a stable economic environment conducive to sustainable growth. The study suggests that the impact of FDI on growth is currently underwhelming. To boost FDI inflows, Bangladesh must improve its governance structures, ensure political stability, streamline bureaucratic processes, and address infrastructure deficiencies. Creating an investor-friendly environment through legal reforms, providing tax incentives, and simplifying the business environment will likely stimulate increased foreign investment. The study also found that exports contribute positively to economic growth in the short term; however, their long-term impact is limited due to an over-reliance on the RMG sector. To enhance the export sector's contribution, the government should focus on diversifying exports by investing in new industries and leveraging the country's low-cost labor for value-added products. Fostering export-oriented industries beyond garments, such as electronics and pharmaceuticals, will provide greater economic resilience against global market fluctuations. The findings suggest that for Bangladesh to achieve upper-middle-income status, it must focus on diversifying its economy, enhancing human capital, and strengthening its institutional frameworks. Comprehensive reforms in the education sector, infrastructure, and financial system will be crucial for maintaining long-term sustainable economic growth.

The limitations of this study include the exclusion of critical variables such as labor market dynamics, technological progress, and institutional quality, which could offer a more comprehensive understanding of the factors influencing economic growth. Additionally, the study relies on a relatively small sample size of 36 annual observations, which may limit the generalizability of the findings. The use of annual data also restricts the ability to capture short-term economic fluctuations and shocks. Moreover, the study does not account for potential structural breaks or external factors, such as political instability or global crises, which may influence the results.

Future research could further expand this analysis by examining the role of human capital, technological innovation, and labor market dynamics in enhancing the positive impact of foreign direct investment (FDI) on economic growth. Additionally, incorporating factors such as institutional quality and technological progress could provide deeper insights into the complexities of growth processes. Investigating the effects of geopolitical risks and external shocks, such as the aftershock of the COVID-19 pandemic, the unstable Middle East situation, the Israel-Palestine war, and the Russia-Ukraine war, would help assess Bangladesh's resilience to global crises. Moreover, a comprehensive study of the social and environmental impacts of economic growth, with a focus on inclusivity and sustainability, is essential for long-term policy development. By addressing these dimensions, future research can offer a more holistic framework to guide evidence-based policymaking in Bangladesh and other developing economies.

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