

Macroeconomic Determinants of Economic Growth in Bangladesh: An Empirical Analysis

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Abstract

This study explores the macroeconomic determinants of economic growth in Bangladesh by examining the dynamic interrelationships among key variables, including budget deficit, interest rate, inflation rate, exchange rate, investment rate, labor force growth, and GDP growth. Using annual time-series data from 1980 to 2024, the analysis employs advanced econometric techniques such as the Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests, ARDL bounds testing for cointegration, the Error Correction Model (ECM), and Granger causality tests. The findings confirm a stable long-run equilibrium relationship with a significant speed of adjustment, indicated by a negative and highly significant error correction term. Investment rate and exchange rate emerged as the most influential drivers of GDP growth in both the short and long run. Specifically, 1% depreciation in the exchange rate reduces GDP growth by 0.062% in the short run and 0.056% in the long run, while a 1% increase in investment boosts GDP growth by 0.41% and 0.37%, respectively. Surprisingly, labor force growth exhibits a negative impact on GDP growth, suggesting issues such as underemployment, low productivity, and skill mismatch. Interest rate shows a mixed effect where positively impacting GDP growth in the short run but exerting a marginally negative influence in the long run. Inflation and budget deficit are found to have no significant direct impact on GDP growth. Budget deficit has no significant impact on GDP growth but higher GDP growth inspires to increase the budget deficit. The model demonstrates strong diagnostic properties with no serial correlation, heteroscedasticity, or specification error, residual is normally distributed and explains 62% of the variation in GDP growth. Maintaining exchange rate stability, promoting productive investment, enhancing labor productivity, and implementing structural reforms to support sustained and inclusive economic growth in Bangladesh.

Keywords: Budget Deficit, Exchange Rate, Labor Force Growth Rate, GDP Growth Rate, Autoregressive Distributed Lag Model, Inclusive Economic Growth.

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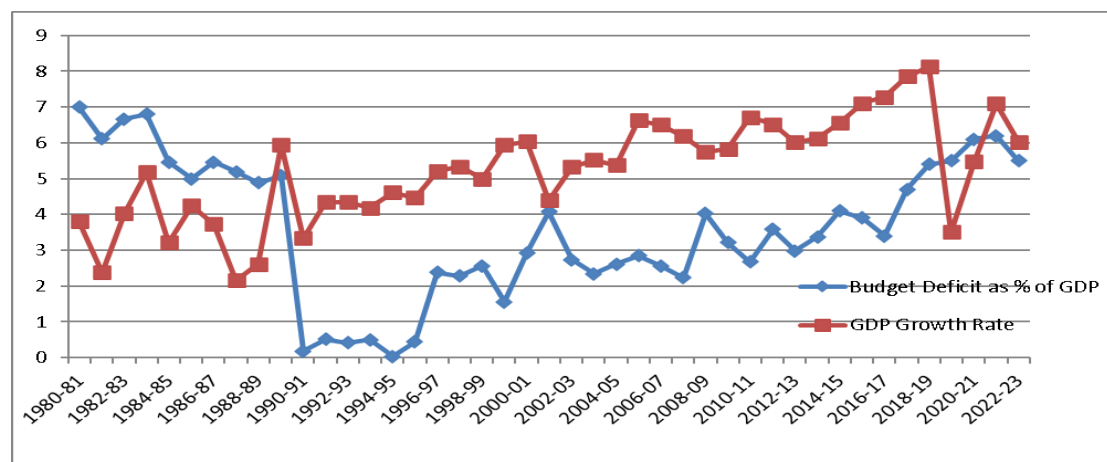
1.1 Introduction

Economic growth is a principal objective of overall development reflecting the overall health and progress of a country's economy. There are many determinants in an economy which influence GDP growth rate. Stable political government, proper socio-economic policies, perfection in project selection and implementation, honesty and accountability of respective authorities can support the determinants to improve the economic growth and conversely it can be declined if indiscipline and anarchy raised. Bangladesh has achieved global attraction in rigorous economic development and persistent GDP growth except 2020-21 for covid-19 deterioration and recent political turmoil. Bangladesh achieved Millennium Development Goals in 2015 and on the way to achieve SDGs by 2030. It achieved LMIC (Lower Middle-Income Countries in 2015), on the way to achieve UMIC (Upper Middle-Income Countries by 2030) and is graduating over LDCs by 2026. Despite these achievements, the country still faces some structural and macroeconomic challenges that impact its growth trajectory like Myanmar forced Rohingya crisis, persistent unfavorable balance of payment, increased local and foreign public debt, increased debt servicing payment, inflationary pressure, limited diversification in exportable goods and services, natural calamities and climatic change, inequality and corruption, lack of practical education, gender discrimination, and unemployment. In this context, understanding the key macroeconomic factors that drive or hinder economic growth becomes essential for effective policy formulation and strategic planning. This

thesis aims to empirically investigate the macroeconomic determinants that influence economic growth in Bangladesh. By analyzing data by applying appropriate econometric models, the study seeks to identify the most significant variables affecting GDP growth and provide insights that can inform policy decisions.

1.1.1 Trends in GDP Growth Rate and Budget Deficit in Bangladesh

Macroeconomic performance or health of macroeconomics can be measured in many ways but budget deficits and its effect on GDP growth rate is most important of them. This index also contains inflation rate, exchange rate, interest rate, debt to GDP ratio, external debt to GDP ratio, export-import, trade openness index etc. Budget deficit as percent of GDP and GDP growth rate is discussed below:



Source: ERD, MoF, Bangladesh; BBS, Bangladesh Bank, World Bank Data and author's computation.

Figure: 1.1 Trends in Budget Deficit as Percent of GDP and GDP Growth Rate

Budget deficits effects GDP growth rate positively in most of fiscal years and have few mixed effects also found in data series. Change of GDP growth is much higher than budget deficit as percent of GDP in 1989-90 fiscal year is observed then suddenly budget deficit got very lower percent and GDP growth rate also lower but smaller change. Sudden increase of budget deficit decreases growth rate in 2001-02 fiscal year and lower budget deficit provided greater GDP growth rate in 2007-08 fiscal year also observed. Bangladesh observed gradually increasing GDP growth rate from 2010-11 to 2018-19 and budget deficit also taken as fluctuating moves but GDP growth rate collapsed in 2019-20 fiscal year because of Covid-19 global economic downturn and it slowly improves but global war situation causes again slows economic growth from 2022-23 fiscal year.

1.2 Statement of the Problem

Despite Bangladesh's notable economic progress over the past two decades, the country continues to face persistent challenges in maintaining stable and inclusive growth. While several macroeconomic variables such as budget deficit, inflation, investment, exchange rate, interest rate, labor force growth rate are widely believed to influence GDP growth. The central problem this study seeks to address, which macroeconomic variables significantly influence economic growth in Bangladesh, and how strong and consistent are these relationships over time? Answering this question is vital for identifying effective policy measures that can be used to sustain and enhance economic growth in the country.

1.3 Significance of the Study

Bangladesh has experienced several notable milestones in Growth and development despite some problems and challenges. Bangladesh is an import-oriented country, national and international debt and deficit-based economy where debt servicing is a growing burden and trapped in a debt-deficit vicious cycle. Higher interest rates prevailing because of massive domestic debt in deficit financing, money laundering by corrupted peoples and overall monetary mismanagement causes decline private investment. Chronic higher inflation rate discourages exports and encourages imports and make balance of payment deficit. We have millions of working forces but majority are unskilled and mismatches in national and international job market. Importantly Bangladesh is a deficit budgeting country since its independence which directly affects public and private investment. These overall scenarios drive and hinder economic growth. So, empirical analysis based on time series data of such determinants is a situation demand to show how they affect economic growth.

1.4 Objectives of the Study

The general objective of this study is to **empirically examine the key macroeconomic determinants of economic growth in Bangladesh**. To fulfill the general objective the study seeks to achieve the following specific objectives:

- I. **To examine the short-run and long-run effects** of budget deficit, inflation, investment, exchange rate, interest rate, labor force growth rate on economic growth of Bangladesh economy
- II. To investigate the causal relationships among budget deficit, GDP growth rate and selected macroeconomic variables of Bangladesh economy
- III. To suggest policy recommendations based on empirical findings of the study

1.5 Review of Literature

A number of national and international studies have been investigated to observe the effect of key macroeconomic determinants as budget deficit, inflation rate, interest rate, exchange rate, investment rate and labor force growth rate on GDP growth rate empirically as follows:

Table 1. Review of Literature from National and International Perspective

Authors (Year)	Country	Study Period	Methodology	Main Findings
Khan et al. (2023)	Bangladesh	1991-2022	ARDL Model	Gross capital formation and government expenditure are strongly positive determinants of GDP growth in the long run.
Mukit (2021)	Bangladesh	1991-2020	ARDL Model	Exports have a positive relationship with GDP, though not always significant; imports sometimes have negative or ambiguous effects.
Akter (2024)	Bangladesh	2008-2023	ARDL Model	Budget deficits have a significant and positive long-run impact on inflation and exchange rate regime.
Alauddin (2023)	Bangladesh	1981-2019	ARDL Model	Positive relationship between budget deficit and economic growth.
Shahriar (2023)	Bangladesh	1982-2020	VECM Approach	Inverse relationship between budget deficit and economic growth.
Sadia (2013)	Bangladesh	1974-2010	ARDL Model	Fiscal deficits and exchange rate have inflationary effects in the long-run.
Hassan and Akther (2014)	Bangladesh	1977-2012	Johansen, VECM	GDP regressed with inflation rate, real interest rate, real effective exchange rate and budget deficit. They observed that budget deficit has significant negative effect on economic growth in Bangladesh economy.
Biplob (2019)	Bangladesh	1981-2017	ARDL Model	Budget deficit positively affects economic growth in both short-run and long-run where government expenditure leads to increase GDP in long-run

				only.
RK Mohanty (2011)	India	1971-2012	Johansen, VECM	Negative and significant relationship between fiscal deficit and economic growth in the long run.
Velnampy and Achchuthan (2013)	Sri Lanka	1970-2010	One-way ANOVAs (f-test)	There is no significant impact of fiscal deficit on the economic growth. It means that, economic growth is not contributed by the fiscal deficit significantly and economic growth is contributed by other factors significantly
Meryem Samirkaş (2014)	Turkiye	1980-2013	Johansen co-integration test, Granger causality	There was no significant long-term correlation between budget deficit and inflation, GDP, and interest rates but interest rates have a significant effect on budget deficits.
Osuka and Chioma (2014)	Nigeria	1981-2012	Johansen co-integration test, Granger causality	Presence of long-run relationship between budget deficits and selected macroeconomic variables GDP, interest rate, nominal exchange rate and inflation rate. The results agree with the Keynesian theory that budget deficits crowd-in investment.
Galodikwe & Mah (2023)	BRICS Countries	2005-2021	Panel (ARDL) technique, Pairwise Dumitrescu Hurlin panel causality	GDP, FDI, and debt service positively related to budget deficits in the long-run while current account and exchange rate relationships are negative.

Source: Author's Compilation

1.6 Methodology of the Study

This study examined the influence of key macroeconomic determinants on economic growth in Bangladesh. The research is based entirely on secondary data collected from various sources such as World Development Indicators, Bangladesh Bank, and multiple issues of the Bangladesh Economic Review. The data ranges from 1980 to 2024. The Augmented dickey-Fuller (ADF) and Phillips-Perron (PP) test is used to test the stationarity of the time-series data, the autoregressive distributed lag (ARDL) model is used to test the existence of the long-run relationship, the error correction model (ECM) is used to restore the deviated short-run situation to long-run equilibrium as fast as possible, Granger causality is used to show the direction of the relationship among the variables and diagnostic tests to show the strength and validity of the results of the study.

1.6.1 Concepts of Key Variables: Concepts of key variables include:

Budget Deficit (BDF):

Government cannot execute its huge expenditures from tax revenue and some other revenues from fines, fees, penalties and even from its own productive activities then deficit arises. Therefore, when government spends more than its revenues (i.e. $R < E$) then it is called budget deficit or fiscal deficit and it is financed from seignoraging and various national and international sources by borrowing.

Inflation Rate (INFR):

The inflation rate is the percentage change in the overall level of prices from one year to the next. The inflation rate calculation is just like the growth rate calculation above:

$$\text{Rate of inflation in year } t = \frac{CPI_t - CPI_{t-1}}{CPI_{t-1}} \times 100\%$$

CPI indicates Consumer price Index and it is the weighted average of market basket of a consumer in a given period of time.

Interest Rate (INTR):

Interest rate is the amount charged over and above the principal amount by the lender from the borrower. In terms of the receiver, a person who deposits money to any bank or financial institution also earns additional income considering the time value of money termed as interest received by the depositor.

Exchange Rate (EXR):

Exchange rate is the price of a nation's currency in terms of the currency of another nation or economic zones (or, a group of foreign currencies) and vice versa and nominally as so many taka or dollar is needed for one another. Say, \$1= Tk.120 is an example of bilateral nominal exchange rate between Bangladesh currency taka and US currency dollar for one another.

Investment Rate (INVR):

Investment rate typically refers to the ratio of investment to Gross Domestic Product (GDP) in an economy over a given period. It is a key indicator of how much of a country's output is being used for capital formation (i.e., creating assets that will generate future income or output). More formally: Investment Rate = (Gross Capital Formation / GDP) $\times$ 100%

Labor Force Growth Rate (LFGR):

The **labor force growth rate** is the **annual percentage change in the total labor force** of a country or region. It measures how quickly the number of people **available and willing to work** (either employed or actively looking for work) is increasing or decreasing over time.

GDP Growth Rate (GDPGR):

The annual percentage change of the real GDP for a given national economy during a specified time. Shortly, the growth rate of the economy is the rate at which real GDP is changing.

The GDP growth rate or economic growth rate is defined as % growth rate of real GDP in year t

$$= \frac{Real\ GDP_t - Real\ GDP_{t-1}}{Real\ GDP_{t-1}} \times 100\%$$

1.6.2 Model Formation

Following multivariate regression model has been formulated to achieve the specific objectives of the study as:

$$\text{Mathematically, } GDPGR = F(\text{BDF, INTR, EXR, INFR, INVR, LFGR}) \dots\dots\dots (1)$$

Where,

GDPGR = GDP Growth Rates which has been used as proxy variable of Bangladesh economy

BDF = Budget Deficits

INTR = Interest Rates taken as average lending interest rates

EXR = official Exchange Rates defined as Taka per US\$, Period average

INFR = Inflation Rates on consumer prices (annual %)

INVR = Investment Rates which has been used as proxy variable of gross fixed capital formation (% of GDP) and

LFGR = Labor Force Growth Rates which has been used as proxy variable of population growth rate (annual %).

Specified form of linear econometric model with log transformation of the data of variables:

$$GDPGR_t = \alpha_0 + \alpha_1 \ln BDF_t + \alpha_2 \ln INTR_t + \alpha_3 \ln EXR_t + \alpha_4 \ln INFR_t + \alpha_5 \ln INVR_t + \alpha_6 \ln LFGR_t + \mu_t \dots\dots (2)$$

Where α_0 is intercept term; $\alpha_1, \alpha_2, \alpha_3, \alpha_4, \alpha_5$ and α_6 are coefficients and μ is error term of the estimated equation.

Causes of log transformation of budget deficit and inflation rate: Skew value of dataset of budget deficit and inflation rate are higher than 1, so log transformation is required and renamed the symbol as $\ln bdf$ and $\ln infr$ and skew value of the rest of the variables lies between -0.5 and +0.5, so there is no need to use log transformation of that variables.

Data Analysis

Descriptive Statistics and Correlation Analysis

Table 2. Descriptive Statistics

Variables→	GDPGR	LNBDP	LNINFR	INTR	EXR	INVR	LFGR
Mean	5.161778	7.586553	1.894499	11.95556	56.20200	23.40000	1.564444
Median	5.340000	7.403061	1.944481	12.60000	57.44000	24.00000	1.500000
Maximum	8.130000	9.921180	2.933857	14.80000	115.6000	32.00000	2.700000
Minimum	0.820000	2.708050	0.662688	7.100000	15.49000	14.00000	0.800000
Std. Dev.	1.581704	1.551932	0.482751	2.035096	24.88372	5.836406	0.612059
Skewness	-0.47259	-0.77975	-0.53641	-0.68367	0.245599	-0.05635	0.292126
Kurtosis	2.968040	4.086531	3.270505	2.841875	2.237095	1.594348	1.810642
Jarque-Bera	1.676976	2.773578	2.295249	3.552394	1.543688	3.728550	3.292357
Probability	0.432364	0.133817	0.317390	0.169281	0.462160	0.155009	0.192785
Sum	232.2800	341.3949	85.25248	538.0000	2529.090	1053.000	70.40000
Sum Sq. Dev.	110.0787	105.9736	10.25414	182.2311	27244.78	1498.800	16.48311
Observations	45	45	45	45	45	45	45

Source: Author's Calculation

Descriptive statistics used 45 observations for seven key macroeconomic variables as GDP growth (GDPGR), log of budget deficit (LNBDP), log of inflation (LNINFR), exchange rate (EXR), interest rate (INTR), investment rate (INVR) and labor force growth (LFGR). The average GDP growth rate is around **5.16%**, with moderate variation suggesting fairly stable economic growth over the period. Inflation and interest rates have averages of **1.89** and **11.96** respectively, with relatively low variability. Both variables are slightly left-skewed but generally follow a normal distribution. The exchange rate shows the **highest variability** among all variables, with a wide range from **15.49 to 115.60**. This suggests considerable fluctuations in the exchange rate over time. Despite this, the distribution is close to symmetric. Investment and labor force growth are more stable. The investment rate averages **23.40%**, while labor force growth averages **1.56%**. Both show mild skewness and no extreme values. In summary, most variables are **fairly stable and normally distributed**. These findings are useful for guiding further empirical analysis and ensuring the reliability of statistical methods applied in the study.

Table 3. Correlation Analysis

Correlation Matrix							
	GDPGR	LNBDP	LNINFR	INTR	EXR	INVR	LFGR
GDPGR	1						
LNBDP	0.439448	1					
LNINFR	-0.33745	0.222894	1				
INTR	-0.29512	-0.66562	-0.17696	1			
EXR	0.680664	0.719254	-0.12552	-0.51519	1		
INVR	0.76349	0.768801	-0.17205	-0.58513	0.953219	1	
LFGR	-0.73786	-0.61607	0.22046	0.336437	-0.90615	-0.91527	1

Source: Author's Calculation

The correlation matrix reveals significant relationships among key macroeconomic variables. Investment rate (INVR) and exchange rate (EXR) exhibit a very strong positive correlation ($r = 0.95$), while both are negatively correlated with labor force growth (LFGR), suggesting potential trade-offs between capital-deepening and labor expansion. GDP growth (GDPGR) is positively related to investment and exchange rate strongly and with budget deficit mildly, but negatively associated with labor force growth strongly but with inflation and interest rate mildly.

1.6.3 Data Stationarity Testing in Formal Method

There are many test procedures to identify the stationarity of the variable. But the study used Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) Method for their superiority in time series data analysis. Null hypothesis and alternative hypothesis are considered to test the ADF method as follows:

Null Hypothesis H_0 : Variables are non-stationary
Alternative Hypothesis H_1 : Variables are stationary

Table 4. Result of ADF Test (with Intercept)

Variable	ADF Test Statistic	Critical Value			P-Value	Remarks
		1% Level	5% Level	10% Level		
LNBDP	-1.530823	-3.588509	-2.929734	-2.603064	0.5089	Non-stationary I(0)
D(LNBDP)	-8.172351	-3.592462	-2.931404	-2.603944	0.0000	Stationary I(1)
GDPGR	-2.347733	-3.596616	-2.933158	-2.604867	0.1625	Non-stationary I(0)
D(GDPGR)	-8.142880	-3.596616	-2.933158	-2.604867	0.0000	Stationary I(1)
LNINFR	-3.788715	-3.588509	-2.929734	-2.603064	0.0058	Stationary I(0)
INTR	-2.434836	-3.592462	-2.931404	-2.603944	0.1385	Non-stationary I(0)
D(INTR)	-3.480225	-3.592462	-2.931404	-2.603944	0.0134	Stationary I(1)
EXR	1.249502	-3.596616	-2.933158	-2.604867	0.9980	Non-stationary I(0)
D(EXR)	-4.396275	-3.596616	-2.933158	-2.604867	0.0011	Stationary I(1)
INVR	-0.969569	-3.588509	-2.929734	-2.603064	0.7559	Non-stationary I(0)
D(INVR)	-7.314161	-3.592462	-2.931404	-2.603944	0.0000	Stationary I(1)
LFGR	-2.100340	-3.592462	-2.931404	-2.603944	0.2456	Non-stationary I(0)
D(LFGR)	-4.539736	-3.592462	-2.931404	-2.603944	0.0007	Stationary I(1)

Note: D indicates first difference, I (0) indicate response in level and I (1) indicate response in first difference.

Source: Author's Calculation

Only inflation rate (LNINFR) is evident stationary at level and rests of the variables are non-stationary at level but attained stationary after first difference. Finally data of variables are mixed order of integration of I (0) and I (1).

Table 5. Results of Phillips-Perron Unit Root Test (With Intercept)

Variable	Phillips-Perron Test Statistic	Test Critical Value			P-Value	Remarks
		1% Level	5% Level	10% Level		
LNBDP	-1.37	-3.59	-2.93	-2.60	0.5875	Non-stationary I(0)
D(LNBDP)	-8.21	-3.59	-2.93	-2.60	0.0000	Stationary I(1)
GDPGR	-4.14	-3.59	-2.93	-2.60	0.0022	Stationary I(0)
LNINFR	-3.78	-3.59	-2.93	-2.60	0.0060	Stationary I(0)
INTR	-1.50	-3.59	-2.93	-2.60	0.5218	Non-stationary I(0)
D(INTR)	-3.62	-3.59	-2.93	-2.60	0.0092	Stationary I(1)
EXR	1.35	-3.59	-2.93	-2.60	0.9985	Non-stationary I(0)
D(EXR)	-3.37	-3.59	-2.93	-2.60	0.0179	Stationary I(1)
INVR	-0.97	-3.59	-2.93	-2.60	0.7563	Non-stationary I(0)
D(INVR)	-7.27	-3.59	-2.93	-2.60	0.0000	Stationary I(1)
LFGR	-1.24	-3.59	-2.93	-2.60	0.6477	Non-stationary I(0)
D(LFGR)	-4.50	-3.59	-2.93	-2.60	0.0008	Stationary I(1)

Note: D indicates first difference, I (0) indicate response in level and I (1) indicate response in first difference.

Source: Author's Calculation

There is mixed order of integration of I (0) and I (1) are also evident in PP test like ADF test. In the above table, GDPGR and LNINFR are stationary at level and rests of the variables are non-stationary at level but after first difference they are converted into stationary.

1.6.4 Optimum Lag Selection

The optimal lag is that which has the minimum value as reported by each criterion, when VAR statistics are used.

Table 6. VAR Lag Order Selection Criteria

Endogenous Variables: GDPGR, LNBDF, LNINFR, INTR, EXR, INVR, LFGR					
Exogenous Variables: C					
Lag	DRC (dof adj.)	DRC	Log L	AIC	SIC
1	0.000261	6.40E-05	-224.5856	12.754	14.025*
2	8.53E-05	4.23E-06	-161.0860	12.376	16.677
3	1.32E-05	7.31E-08	-72.11015	10.767	17.139
4	2.59E-07	4.77E-11	-79.96249	6.002*	14.486
* indicates selected lag order (at 5% level of significance)					
DRC (dof adj.): Determinant Resid Covariance (dof adj.)					
DRC: Determinant Resid Covariance					
Log L: Log Likelihood					
AIC: Akaike Information Criterion					
SIC: Schwarz Information Criterion					

Source: Author's Calculation

From the above output table, the asterisk sign (*) shows the optimal lag order that has suggested. The basic rule of the selection criterion is the lower the value, the better the model. The study adopt SIC criterion with the optimal lag length for the model is 1 because of its lowest value. Now, the study performs ARDL model (because of its mixed order of I(0) and I(1)) to justify the objectives of the study.

1.6.4 The Autoregressive Distributed Lag (ARDL) Model of Cointegration Test or Bound Test for Cointegration

Table 7. The ARDL Bound Cointegration Test (F-test):

F-Bound Test			Null Hypothesis: No long-run relationships exist		
Test Statistic	Value	Significant level	Lower Bound I(0)	Upper Bound I(1)	Decision
F-statistic	10.023	10%	2.12	3.23	Cointegration
K	6	5%	2.45	3.61	
		2.50%	2.75	3.99	
		1%	3.15	4.43	

2 Notes: The critical values for the F-statistics are from Pesaran, Shin and Smith (2001)

Source: Author's Calculation

F statistic value of this model is 10.02301 **which is greater than I (1) upper bound** at all conventional significance levels 10%, 5%, 2.5%, and 1%. This is a very strong result. Since the F-statistic significantly exceeds even the highest critical bound, our model likely captures a stable and meaningful long-run relationship. So null hypothesis is rejected and established strong evidence of a long-run relationship (Cointegration) among the variables in our model at all conventional significance levels. Evidence of cointegration is proved in the first step and now the study moves to the next step of estimating and interpreting the long-run coefficients of ARDL model.

Table 8. The Long-run Model

ARDL (1, 0, 0, 1, 0, 0, 0) Selected Based on Schwarz Information Criterion (SIC)

With Automatic Lag 1

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
GDPGR (-1)	-0.099620	0.144405	-0.689863	0.4948
LNBDF	-0.278215	0.179466	-1.550239	0.1301
LNINFR	-0.225208	0.376808	-0.597674	0.5539
INTR	0.366100	0.205641	1.780291	0.0837
INTR(-1)	-0.411753	0.221800	-1.856411	0.0718
EXR	-0.061571	0.021911	-2.810052	0.0081
INVR	0.406395	0.129392	3.140808	0.0034
LFGR	-1.186471	0.832481	-1.425224	0.1629
C	4.618209	4.967280	0.929726	0.3589
R-squared	0.688567	F-statistic		9.672975
Adjusted R-squared	0.617383	Prob(F-statistic)		0.000001
		Durbin-Watson stat		2.116888
*Note: p-values and any subsequent tests do not account for model selection.				

Source: Author's Calculation

Coefficient and p-value of lagged dependent variable GDPGR (-1) indicates an insignificant status which means about 1% increase in last year's GDP growth rate reduces 0.0996% of current year's GDP growth though insignificantly or past GDP growth doesn't significantly predict current growth. Coefficient and p-value of budget deficit indicate negative and insignificant status which means higher budget deficit (in logs) has no clear long-term effect on GDP growth rate. Coefficient and p-value of inflation rate (in logs) indicate negative and insignificant status which means inflation may have a negative effect on GDP growth rate but it's not statistically clear. Coefficient and p-value of current interest rate and past or lagged interest rate have mixed effects on economic growth. The current interest rate is marginally significant and positively associated with GDP growth which potentially reflecting short-term investor confidence by monetary tightening to control inflation or capital injects in economy. However, its lagged effect is marginally significant and has negative effect indicating that past high interest rates may reduce growth through reduced credit availability in private sector and aggregate demand. Coefficient and p-value of exchange rate indicate negative effects and highly significant status which means higher exchange rate (depreciation) reduces GDP growth potentially due to higher import costs, higher debt servicing, inflationary pressures, or external imbalances. Coefficient and p-value of investment rate indicate positive effects and highly significant status which means investment strongly and positively affects GDP growth. Investment emerges as a **strong and statistically significant positive driver** of GDP growth through capital accumulation in both public and private sector in Bangladesh. Coefficient and p-value of labor force growth rate indicate negative relationship with GDP growth rate reasonably through underemployment and inefficiency effects but it is statistically insignificant. Coefficient and p-value of constant term indicate positive status which implies a desired base level of growth when regressors are zero but it is statistically insignificant. Model diagnostics explains from the test of R-squared and adjusted R-squared about 69% meaning the model explains 69% of the variation in GDPGR and 62% respectively expresses a decent fit. The Durbin-Watson statistic 2.12 suggests the absence of serial correlation in the residuals, supporting the model's robustness. F-statistic value 9.672975 and respective p value less than 5% indicates that the overall model is highly statistically significant and independent variables has strong joint impact on GDP growth rate. The model is **statistically strong overall in the view of considered diagnostics**.

1.6.5 Error Correction Model

When variables have a long-run cointegrated relationship, they might deviate temporarily from that relationship in the short run. The ECM captures the speed and direction of adjustment back to the long-run equilibrium.

Table 9. Cointegrating (Short-run) Form and Long-run Coefficients based on ARDL Results

Cointegrating Form (Short-run) and Error Correction Representation				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(LNBDF)	-0.278215	0.179466	-1.550239	0.1301
D(LNINFR)	-0.225208	0.376808	-0.597674	0.5539
D(INTR)	0.366100	0.205641	1.780291	0.0837
D(EXR)	-0.061571	0.021911	-2.810052	0.0081
D(INVR)	0.406395	0.129392	3.140808	0.0034
D(LFGR)	-1.186471	0.832481	-1.425224	0.0491
CointEq(-1)	-1.099620	0.144405	-7.614839	0.0000
Cointeq = GDPGR - (-0.2530*LNBDF -0.2048*LNINFR -0.0415*INTR -0.0560*EXR + 0.3696*INVR -1.0790*LFGR + 4.1998)				
Long Run Coefficients				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNBDF	-0.253010	0.165888	-1.525186	0.1362
LNINFR	-0.204805	0.344748	-0.594074	0.5563
INTR	-0.041516	0.121206	-0.342528	0.7340
EXR	-0.055993	0.021643	-2.587114	0.0140
INVR	0.369577	0.116490	3.172610	0.0031
LFGR	-1.078983	0.766479	-1.407714	0.1680
C	4.199825	4.579057	0.917181	0.3653

Source: Author's Calculation

Cointegrating Form (Short-run Dynamics): The short-run dynamics indicate that exchange rate and investment rate significantly influence GDP growth. Specifically, exchange rate depreciation has a negative and statistically significant impact where 1% increase in exchange rate reduces GDP growth by 0.062% in the short-run. In contrast, investment rate positively and significantly affects growth where 1% increases in investment inspires GDP growth by 0.41% reinforcing the importance of capital formation. Interest rate approaches positive

and marginal significance suggesting short-run positive impact on GDP growth rate where 1% increase in interest rate increases GDP growth rate by 0.37% in the short-run. 1% increase in labor force growth rate reduces GDP growth by 1.19% in the short-run significantly. Budget deficit and inflation rate has expected signs but highly insignificant. **Coefficient and p-value of Coint Eq (-1) indicates** the error correction term is negative and highly significant, confirming the presence of a stable long-run relationship and indicating that deviations from equilibrium are corrected relatively quickly. The relatively large magnitude suggests a fast speed of adjustment approximately 109.9% of the disequilibrium or any deviation from the long-run equilibrium is corrected within a year. Other variables, including labor force growth rate, inflation, and budget deficit, are statistically insignificant in the short run.

Error Correction Term (CointEq (-1)): Cointegration equation appears to be derived from an error correction model (ECM) which reflects how GDP growth (GDPGR) relates to other macroeconomic variables over the long run. This cointegration equation confirms that GDP growth is driven in the long run by investment and exchange rate stability, while fiscal deficits, inflation, and labor dynamics may exert negative pressures, though insignificantly in this specification. The equation serves as the basis for the error correction mechanism, helping quantify how quickly the economy adjusts back to equilibrium following short-run shocks.

$$\text{Cointeq} = \text{GDPGR} - (-0.2530 \cdot \text{LNBDF} - 0.2048 \cdot \text{LNINFR} - 0.0415 \cdot \text{INTR} - 0.0560 \cdot \text{EXR} + 0.3696 \cdot \text{INVR} - 1.0790 \cdot \text{LFGR} + 4.1998)$$

From above cointegration equation, it is seen that LNBDF (-0.2530): 1% increase in the budget deficit (in log form) is associated with a 0.253 percentage point decrease in GDP growth in the long run, suggesting fiscal imbalances are detrimental to growth. However, this effect is statistically insignificant in the long-run regression. LNINFR (-0.2048): 1% increase in inflation reduces GDP growth by approximately 0.20 percentage, consistent with the theory that inflation erodes purchasing power and deters investment. This is also statistically insignificant, implying weak or unstable inflation-growth dynamics in the dataset. INTR (-0.0415): The interest rate has a mild negative long-run effect on GDP growth indicates higher interest rates can discourage borrowing and investment. However, this effect is both small in magnitude and statistically insignificant. EXR (-0.0560): 1% increase in the exchange rate (home currency depreciation) reduces GDP growth by 0.056 percentages, a statistically significant and important finding. Persistent depreciation likely increases import costs and macroeconomic instability, hindering growth. INVR (0.3696): The investment rate has a strong positive effect on GDP growth. 1% increase in investment rate is associated with a 0.37% point increase in GDP growth. This is both statistically significant and economically meaningful, reinforcing the critical role of investment in long-term development. LFGR (-1.0790): Labor force growth surprisingly shows a large negative effect on GDP growth though it seems statistically insignificant. 1% increase in labor force growth decreases GDP growth rate by 1.08% reflects underemployment, low productivity, or low skill and high labor force growth without matching job creation causes lower per capita output and growth. Constant (4.1998): This is the intercept term representing the baseline GDP growth when all other variables are zero. It adjusts the level of the cointegration equation.

1.6.6 Causality Test

Granger causality developed by Engle and Granger (1987), based on error correction model, and enables us to explain the direction of the relationship between the variables. The study used the Granger causality test for explaining the direction of the relationship among the selected macroeconomic variables of the study.

Table 10. Pairwise Granger Causality Tests

Sample: 1980 2024

Lags: 1

Null Hypothesis(H ₀)	Obs	F-Statistic	Prob.	Status of H ₀	Direction of the Relationship
LNBDF does not Granger Cause GDPGR	44	3.85073	0.0565	Fail to reject (marginal)	LNBDF weekly → GDPGR
GDPGR does not Granger Cause LNBDF		6.37886	0.0155	Reject	GDPGR strongly → LNBDF
LNINFR does not Granger Cause GDPGR	44	0.00329	0.9545	Fail to reject	-
GDPGR does not Granger Cause LNINFR		0.45529	0.5036	Fail to reject	-
INTR does not Granger Cause GDPGR	44	1.34898	0.2522	Fail to reject	-
GDPGR does not Granger Cause INTR		1.85136	0.1811	Fail to reject	-

EXR does not Granger Cause GDPGR	44	10.8380	0.0021	Reject	EXR→ GDPGR
GDPGR does not Granger Cause EXR		0.00630	0.9371	Fail to reject	-
INVR does not Granger Cause GDPGR	44	20.2603	0.0001	Reject	INVR→ GDPGR
GDPGR does not Granger Cause INVR		0.73388	0.3966	Fail to reject	-
LFGR does not Granger Cause GDPGR	44	20.4536	0.0032	Reject	LFGR strongly→ GDPGR
GDPGR does not Granger Cause LFGR		3.18931	0.0815	Fail to reject (marginal)	GDPGR weekly→ LFGR
LNINFR does not Granger Cause LNBDF	44	0.01343	0.9083	Fail to reject	-
LNBDF does not Granger Cause LNINFR		0.00447	0.9470	Fail to reject	-
INTR does not Granger Cause LNBDF	44	4.10890	0.0492	Reject	INTR→ LNBDF
LNBDF does not Granger Cause INTR		0.80731	0.3742	Fail to reject	-
EXR does not Granger Cause LNBDF	44	5.63031	0.0224	Reject	EXR→ LNBDF
LNBDF does not Granger Cause EXR		1.09127	0.3023	Fail to reject	-
INVR does not Granger Cause LNBDF	44	8.92103	0.0047	Reject	INVR→ LNBDF
LNBDF does not Granger Cause INVR		2.02660	0.1621	Fail to reject	-
LFGR does not Granger Cause LNBDF	44	3.47432	0.0695	Fail to reject (marginal)	LFGR weekly→ LNBDF
LNBDF does not Granger Cause LFGR		0.93322	0.3397	Fail to reject	-
INTR does not Granger Cause LNINFR	44	2.80002	0.1019	Fail to reject	-
LNINFR does not Granger Cause INTR		5.15097	0.0286	Reject	LNINFR→ INTR
EXR does not Granger Cause LNINFR	44	0.08623	0.7705	Fail to reject	-
LNINFR does not Granger Cause EXR		0.79559	0.3776	Fail to reject	-
INVR does not Granger Cause LNINFR	44	0.04059	0.8413	Fail to reject	-
LNINFR does not Granger Cause INVR		0.07570	0.7846	Fail to reject	-
LFGR does not Granger Cause LNINFR	44	6.9E-05	0.9934	Fail to reject	-
LNINFR does not Granger Cause LFGR		2.41794	0.1276	Fail to reject	-
EXR does not Granger Cause INTR	44	2.64827	0.1113	Fail to reject	-
INTR does not Granger Cause EXR		12.4241	0.0011	Reject	INTR→ EXR
INVR does not Granger Cause INTR	44	6.34678	0.0158	Reject	INVR→ INTR
INTR does not Granger Cause INVR		0.19765	0.6590	Fail to reject	-
LFGR does not Granger Cause INTR	44	4.84676	0.0334	Reject	LFGR→ INTR

INTR does not Granger Cause LFGR		4.49830	0.0400	Reject	INTR→ LFGR
INVR does not Granger Cause EXR	44	0.05078	0.8228	Fail to reject	-
EXR does not Granger Cause INVR		0.11649	0.7346	Fail to reject	-
LFGR does not Granger Cause EXR	44	12.3728	0.0011	Reject	LFGR→ EXR
EXR does not Granger Cause LFGR		0.04900	0.8259	Fail to reject	-
LFGR does not Granger Cause INVR	44	4.98184	0.0311	Reject	LFGR→ INVR
INVR does not Granger Cause LFGR		0.01968	0.8891	Fail to reject	-

Source: Author's Calculation

GDP growth rate is strongly influenced by exchange rate, investment, and labor force growth rate. GDP growth rate is also weekly influenced by budget deficit but causality from GDP Growth rate to budget deficit is very strong and significant indicates economic growth drives credit expansion and motivates to increase budget deficit. Budget deficit is strongly influenced by interest rate, exchange rate and investment rate. LFGR Granger causes GDPGR, EXR, INVR and INTR where LFGR and INTR have bidirectional causality indicating GDP growth rate, exchange rate, investment rate and interest rate are influenced by labor force growth rate. Interest rate is strongly Granger cause exchange rate meaning exchange rate is strongly influenced by interest rate which indicates strong monetary policy link.

1.6.7 Diagnostic Tests

Diagnostic tests, such as serial correlation, heteroscedasticity, test of normality and stability test have been performed to ensure the strength of the result's reliability and validity.

Table 11. Diagnostics Test Result

Test Type	Null Hypothesis	Statistic	Probability	Inference
Jarque-Bera test	Residuals are normally distributed	J-B statistic = 0.794625	Probability = 0.102310	Fail to reject H_0
Breusch-Godfrey Serial Correlation Test	No serial correlation in residuals	F-statistic = 0.835625 Obs*R-squared = 1.0554	Prob. F (1,34) = 0.3671 Prob. Chi-Square (1) = 0.3043	Fail to reject H_0
Heteroscedasticity Test	Variance of the residuals is constant or homoscedastic	F-statistic = 1.174713 Obs*R-squared = 9.3135 Scaled explained SS=11.53	Prob. F (8,35) = 0.3416 Prob. Chi-Square (8) = 0.3165 Prob. Chi-Square (8) = 0.1734	Fail to reject H_0
Stability Diagnostics: Ramsey RESET Test	Regression model does not suffer from functional form misspecification	t-statistic=1.659569 F-statistic=2.754170	Prob.=0.1062 Prob.=0.1062	Fail to reject H_0

Source: Author's Calculation

Probability values of above test results are higher than conventional significance level 5% or 0.05. So, null hypotheses are accepted in all the cases and proved that the model is free from heteroscedasticity, misspecification, serial correlation and obviously model is normally distributed.

1.7 Findings, Recommendations and Conclusions

This chapter summarizes the study findings that were made on the basis of the objectives of this research. Recommendations and conclusions have been suggested based on these outcomes.

1.7.1 Research Findings

- ❖ The ARDL bound test has evaluated and confirmed the strong evidence of the existence of a long-run

- relationship (cointegration) between the dependent variable (GDPGR) and the independent variables (LNBDP, LNINFR, INTR, EXR, INVR and LFGR) evidenced by F statistic value of this model is 10.02301 which is much greater than I (1) upper bound at all conventional significance levels 10%, 5%, 2.5%, and 1%.
- ❖ The Error Correction Term (ECT) is highly significant and negative, confirming the existence of a stable long-run equilibrium relationship and indicating a rapid adjustment speed to restore equilibrium (approx. 109.9% correction per year).
 - ❖ It is seen that the investment rate and exchange rate are the most powerful and consistent driver of GDP growth in both the short and long run. Interest rate has a mixed effect in both short-term and long-term. Labor force growth, while theoretically important for all time but it is evidenced that negatively affects short-run growth significantly but insignificantly in the long-run. Budget deficit and inflation have expected negative signs but lack statistical significance for both the time periods. Causality tests confirm mainly, that GDP growth rate is strongly influenced by exchange rate, investment, and labor force growth rate. GDP growth rate is also weakly influenced by budget deficit but causality from GDP Growth rate to budget deficit is very strong and significant indicates economic growth drives credit expansion and motivates to increase budget deficit. Budget deficit is strongly influenced by interest rate, exchange rate and investment rate.

1.7.2 Policy Recommendations

Following recommendations have been made in view of the core extracts from research findings:

- Promote Investment to Sustain Long-term Growth: Public and private investment should be prioritized parallelly as a core strategy for sustaining economic growth. Government should strengthen infrastructure investment particularly in transport, energy and digital connectivity to reduce production costs and improve productivity. One stop service should be introduced to reduce bureaucratic inefficiencies, ensuring regulatory stability, and protecting investor rights to attract both domestic and foreign direct investment (FDI).
- Maintain Exchange Rate Stability: Currency depreciation though encourages exports but Bangladesh is an import-oriented country, so it costs more than earn. Therefore, adopt an optimum exchange rate regime that prevents excessive volatility, maintaining export competitiveness and obviously comforts in imports and debt servicing.
- Interest Rate Management: Governments should use balanced interest rate policy cautiously that controls inflation, considering the fiscal burden of debt servicing, vicious cycle of debt and crowding-out private investment while supporting credit flow to productive sectors. Government can reduce overall public and private loan pressure from banking channel by establishing an effective alternative source of funding namely, capital market.
- Improve Labor Force Productivity and Skills: Government should invest in human capital through expanded education, vocational training, and re-skilling programs that align with labor market demands. Encourage labor-intensive and technology-based industries simultaneously that can absorb a growing labor force productively in Bangladesh otherwise huge populations will become burden of the economy.
- Manage Inflation through Coordinated Macroeconomic Policies: Inflation shows a negative impact on growth but highly statistically insignificant in both short-run and long-run. However, theoretical and regional evidence suggest that high or volatile inflation disrupt long-term economic growth through exchange rate depreciation. So, coordinated monetary and fiscal policies needed to maintain price stability. Consider supply-side interventions to address inflationary pressures without overly tight monetary policy and obviously break down the platform of oligopolistic cartel of artificial crisis of goods and services to ensure the continuity of supply.
- Fiscal Discipline: Bangladesh government may need to enhance revenue mobilization, rationalize spending, or reform subsidies and transfers to make deficits more responsive to growth. Internal resource mobilization is needed by overcome weak tax buoyancy, improving tax policy and tax administration to improve tax-GDP ratio and minimize tax gaps. Ensure budget deficits are directed towards productive public investments (e.g., infrastructure) and promote private investment parallelly to enhance long-term growth.

1.7.3 Conclusions

Prior to conducting the analysis, I held a strong hypothesis that the budget deficit significantly contributed to the GDP growth rate of the Bangladeshi economy. However, the research findings revealed a more authentic reality of other than budget deficit factors such as the investment rate, exchange rate, interest rate, and labor force

growth rate found to have a more substantial impact on GDP growth. Among these, the investment rate exhibited a positive relationship with economic growth, while both the exchange rate and labor force growth rate demonstrated a negative effect and interest rate have mixed effects. Interestingly, the analysis also uncovered a reverse causality as GDP growth appears to encourage an expansion of the budget deficit through optimism in economic expectations.

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