Journal of Economics, Finance and Management Studies

ISSN (print): 2644-0490, ISSN (online): 2644-0504

Volume 08 Issue 12 December 2025

Article DOI: 10.47191/jefms/v8-i12-15, Impact Factor: 8.317

Page No: 7722-7732

An Empirical Analysis of the Dynamic Nexus Between Key Macroeconomic Factors and Sustainable GDP Growth in Bangladesh

Mithila Tanzil[1], Shahed Ahmed[2]*

[1] Assistant Professor, Department of Economics, Islamic University, Kushtia-7003, Bangladesh

[2] Professor, Department of Economics, Islamic University, Kushtia-7003, Bangladesh

*Corresponding author's Name: Shahed Ahmed

ABSTRACT: The study examines the economic growth of Bangladesh by analyzing the interactions of GDP with key macroeconomic factors such as Remittances (REM), Foreign Direct Investment (FDI), Gross capital Formation (GCF), and Annual Net National Income (ANNI) covering the time period from 1980 to 2024 using the Vector Error Correction Model (VECM) framework. The Johansen Cointrgration test confirms the existence of long-run cointegration relationship and highlights short-run stability, with particular relevance to the post pandemic context. The findings reveal that GDP acts as the sole endogenous stabilizer, adjusting 19.13% to restore equilibrium annually, while FDI, GCF, and ANNI remain weakly exogenous and showing minimal responsiveness to domestic shocks. On the other hand, REM destabilizes the system in the short run. The result suggests that the stability of Bangladesh's economy cannot rely on external or weakly exogenous variables. Policy implications underscore the need to strengthen GDP's internal corrective capacity through targeted domestic investment while mitigating volatility from external remittance inflows.

KEYWORDS: GDP, Remittances, FDI, GCF, ANNI, VECM.

1 INTRODUCTION

Bangladesh's economic growth depends on how its main macroeconomic factors work together, and understanding this relationship is important for making good policies. Over the last four decades, the country has changed a lot, moving from a low-income economy to a lower-middle-income one. Real GDP growth averaged about 6.3% between 2010 and 2023, driven by structural change, rising investment, export expansion, and improvements in human development. The poverty rate fell from 14.7% in 2010 to 5.9% in 2022, reflecting broad-based progress, yet the economy has also shown growing vulnerability to short-term shocks. However, the economy has also faced ups and downs. For example, growth dropped to 3.45% in 2020 during the COVID-19 pandemic, then rose to 6.94% in 2021 and 7.10% in 2022, before slowing to around 5.78% in 2023 and about 5.82% in 2023–24. These changes show that the economy can grow strongly but is also sensitive to shocks. Therefore, it is important to study how factors like Remittances (REM), Foreign Direct Investment (FDI), Gross capital Formation (GCF) and Annual Net National Income (ANNI) affect GDP growth both in the long run and the short run. A clearer empirical understanding of these interactions is essential for designing policies that promote stable, resilient, and sustainable economic growth in Bangladesh.

1.1 Background of the Study:

The journey of Bangladesh's economic growth has been shaped by several important domestic and external macroeconomic factors. Remittances remain one of the strongest pillars of the economy, with inflows reaching around **USD 21–24 billion in recent years**, helping stabilize foreign currency reserves and supporting household income and consumption. Foreign Direct Investment (FDI), although still modest compared to peer economies, has generally ranged between **USD 1.5–3 billion annually**, contributing to the transfer of technology, managerial skills, and capital needed for industrial growth. Gross Capital Formation (GCF), which reflects domestic investment, has consistently remained high at around **30% of GDP**, showing strong efforts to build productive capacity. Meanwhile, Annual Net National Income (ANNI) has kept rising steadily along with economic growth, reflecting the country's expanding ability to generate income. Despite this progress, the long-term stability and structural consistency of these growth drivers remain uncertain, especially given fluctuations in remittances, investment, and external economic conditions.

Therefore, this study aims to go beyond simple correlations and examine how these key macroeconomic factors are structurally connected to Bangladesh's sustainable GDP growth.

1.2 Statement of the Problem:

Despite maintaining an average GDP growth rate above 6 percent for more than a decade, Bangladesh's macroeconomic structure continues to exhibit signs of fragility, reflected in recurring external imbalances, fluctuating investment inflows, and periodic pressure on foreign exchange reserves. For example, while annual remittance inflows have remained strong—often exceeding USD 20 billion—FDI inflows have remained comparatively low, generally fluctuating between USD 1.5 and 3 billion per year, raising questions about the actual contribution of foreign investment to long-term growth. Similarly, although Gross Capital Formation has consistently hovered around 28–31 percent of GDP, the efficiency and stability of this investment in sustaining future growth remain uncertain. These inconsistencies highlight a deeper structural issue: the long-run equilibrium among key macroeconomic variables remains unclear, making it difficult to determine whether components such as FDI, remittances, and domestic investment act as stabilizing forces or potential sources of volatility.

In the absence of clear empirical evidence on which variables anchor long-run stability, which respond passively to shocks, and which may destabilize the system, policymakers face significant challenges in designing policies that ensure sustainable economic growth. To address this gap, the present study employs a Vector Error Correction Model (VECM) to examine both the long-term structural relationships and the short-run dynamic adjustments among the selected macroeconomic indicators. This approach is expected to offer a more rigorous understanding of the mechanisms through which these variables influence sustainable GDP growth, thereby providing a stronger foundation for evidence-based economic planning and policy formulation.

1.3 Rationale of the study:

This study is essential because it provides a comprehensive, up-to-date, and structurally grounded assessment of Bangladesh's macroeconomic environment. First, it incorporates a broad set of domestic and external variables—such as remittances, FDI, Gross Capital Formation, and national income—into a unified analytical framework to capture the interconnected nature of the economy. Second, it applies rigorous econometric techniques, including unit root tests, the Johansen Cointegration approach, and the Vector Error Correction Model (VECM), enabling a clear distinction between short-run adjustments and long-run equilibrium relationships. Third, the study employs the most recent data available up to 2024, covering both the pre-pandemic period and the post-pandemic recovery phase, a period marked by notable volatility in GDP growth, remittance inflows, external balances, and investment patterns. By integrating these methodological strengths and contemporary data trends, the study provides timely, evidence-based insights that can guide policymakers in strengthening macroeconomic stability, managing external vulnerabilities, and promoting sustainable economic growth.

1.4 Objectives of the study:

- To analyze the historical trends and structural volatility of GDP and selected macroeconomic indicators in Bangladesh.
- To examine the short-run dynamics and long-run equilibrium relationships between GDP and key macroeconomic variables.
- To identify the weakly exogenous macroeconomic variables that influence the growth system.

1.5 Research Questions:

1. How have GDP and key macroeconomic variables (REM, FDI, GCF, ANNI) historically evolved?
2. What are the short-run dynamic and long-run equilibrium relationship between GDP and these macroeconomic variables?
3. Which macroeconomic variables operate as weakly exogenous component within Bangladesh's growth system?

1.6 Hypotheses:

H_1: A long-run cointegrating relationship exists among the variables

H_2: At least one of the macroeconomic variables significantly influence GDP in the short-run

H_3: At least one of the macroeconomic variables is weakly exogenous within the VECM framework, meaning it does not respond to deviation from long-run equilibrium

2.0 LITERATURE REVIEW

2.1 Theoretical Background:

Economic growth is a fundamental indicator of a country's economic performance and is shaped by a range of domestic and external macroeconomic factors. Identifying the most effective determinants of sustainable growth is particularly important for

developing economies such as Bangladesh, where structural transformation and external vulnerability coexist. This study draws on several classical and modern economic growth theories to establish its analytical foundation.

Gross Capital Formation, a key variable in this study, aligns with the **Solow–Swan neoclassical growth model**, which emphasizes capital accumulation as a driver of productive capacity and long-run output. Foreign Direct Investment (FDI), which introduces capital, advanced technology, and managerial skills, is supported by **endogenous growth theory**, where external knowledge spillovers and innovation contribute to sustained economic expansion. Insights from **open-economy growth theory** further clarify how trade openness enhances efficiency, broadens market access, and encourages technological progress in developing economies. According to **Keynesian theory**, remittances play a countercyclical role by raising household income, consumption, and investment, thereby stimulating aggregate demand. Additionally, the inclusion of Annual Net National Income (ANNI) is grounded in **aggregate income theory**, which links overall economic activity and national income generation to GDP growth.

By integrating these theoretical perspectives, the study develops a comprehensive framework to examine the dynamic nexus between domestic and external macroeconomic determinants and their contribution to sustainable economic growth in Bangladesh.

2.2 Review of Literature

The literature review has been systematically organized in a table format, summarizing key studies, their objectives, methodologies, variables, and main findings to provide a clear and comparative overview of existing research on macroeconomic determinants of economic growth.

Author(s) & Year	Country/Period	Variables Examined	Methodology	Key Findings
Anuno et al. (2025)	Timor-Leste, 2006–2023	FDI, Remittance, GCF, GDP	ARDL	FDI positive in short run, insignificant in long run; GCF positive in long run; remittance insignificant; FDI Granger causes GDP
Bikorimana et al. (2021)	East African Community, 1970–2017	FDI, Capital Formation, Inflation, Population Growth, Consumption, Trade, GDP	VECM, Granger causality	FDI & capital formation positive; inflation, population growth, consumption negative; trade negative; GDP & population growth bidirectional causality
Poudel & Giri (2025)	Nepal, 1975–2023	Export, Import, Remittance, GFCF, GDP	VAR, Johansen Cointegration	Remittance positive; export & GFCF insignificant; import, investment, remittance affected by GDP shocks; export unaffected
Akhter (2022)	Bangladesh, last 20 years	FDI, Remittance, External Debt, GDP	Granger causality	FDI insignificant on GDP; external debt unidirectional relation with FDI & remittance; FDI Granger causes ED, ED causes remittance
Nath & Begum (2021)	Bangladesh, 1996–2018	Exchange rate, Inflation, FDI, Remittance, Trade, GDP	ADF, Cointegration, VECM, Granger causality	Remittance positive; FDI negative impact on GDP
Jacob & Raphael (2021)	Bangladesh, 1990–2020	Inflation, Exchange rate, Trade openness, FDI, GDP	ARDL bounds testing	FDI negative; inflation, exchange rate, trade openness positive & significant
Khan et al. (2024)	Bangladesh	Capital, Domestic Credit, GCF, Government Expenditure, Net Trade, GDP	ARDL	Short run: capital & credit negative, government expenditure & net trade positive; long run: GCF & government expenditure strongly positive

Haque et al. (2023)	Bangladesh, 1980–2022	Inflation, Real Interest Rate, Exchange Rate, GDP	VAR, Johansen Cointegration, VECM	Inflation insignificant; interest rate negative; exchange rate positive; long-run causality present; short-run effects weak
Hasan et al. (2022)	Bangladesh	Import, Export, Inflation, GDP	Multiple regression	Import & export positive; inflation negative
Chowdhury & Rahman (2020)	Bangladesh, 1972–2018	Official Exchange Rate, External Debt, Terms of Trade, GDP	VECM	Exchange rate & external debt positive long-run effect; terms of trade negative; unidirectional causality to GDP
Hao Wu (2020)	Bangladesh, 1980–2018	Investment, Labor, Technology, GDP	Neoclassical growth framework	Investment strongest determinant; suggested diversification beyond garment sector
Chowdhury et al. (2019)	Bangladesh, 1987–2015	Inflation, Exchange Rate, Interest Rate, Household Consumption, GDP	Correlation, Multiple Regression	Inflation, exchange rate, consumption positive; interest rate negative; significant relationships overall

In conclusion, the reviewed literature highlights that macroeconomic factors such as investment, trade, and government expenditure are key drivers of economic growth, while the impact of FDI and remittances is mixed and context-dependent. This highlights the need for a comprehensive analysis to understand their dynamic interactions and inform policies for sustainable economic growth in Bangladesh.

2.3 Research Gap:

Although numerous studies have explored macroeconomic influences on economic growth, notable gap persists in the concerning literature of Bangladesh. Bangladesh specific literature such as Khan et al., 2024; Haque et al., 2023; Nath and Begum, 2021; Chowdhury and Rahman, 2020) used data before 2020, consequently failing to capture post covid phase. Even the studies with recent time coverage (e.g., Anuono et al., 2025; Poudel and Giri, 2025) mostly situated within global and regional framework and often restrict its scope to few selected variables such as FDI, remittance, or capital formation. Thus the literature remains incomplete, as to overlooks the combined influence external and domestic factors on growth, which this study systematically incorporates a unified framework including remittance, FDI, trade in the external sides and Annual Net National Income along with gross capital formation on the domestic side. Moreover, while most of the existing studied applied simple VAR and ARDL methods, this study utilized advanced and complete econometric techniques such as unit root, Johansen cointegration and VECM. This underscores a clear gap that necessitates a more robust and methodologically rigorous empirical assessment.

3.1 METHODOLOGY

This chapter describes about the type and sources of data, mention set of variables, and the methodological approaches that have been adopted to estimate the objectives of this research.

3.2 Sources of Data:

This study uses time series data covering the time period from 1980 to 2024. Most of the data of selected macroeconomic variables for this study have been collected from World Development Indicator (WDI) and World Bank (WB). For cross checking and confirming the reliability some other sources like Bangladesh Bank, Bangladesh Bureau of Statistics (BBS) and other online journals and articles have been used.

3.3 Key Variables:

The study aims to investigate the short-run dynamic and long run equilibrium between selected macroeconomic variables and economic growth of Bangladesh. The main key variables are Remittances (REM), Foreign Direct Investment (FDI), Gross Capital Formation (GCF) and Annual Net National Income (ANNI), which have significant impact on Gross Domestic Product (GDP). Here GDP is considered as dependent and others as independent variables.

3.4 Model Specification:

Since this study deals with time series data of 44 years long, this can be often nonstationary in nature, which cause their mean and variance to change over time. Therefore, the variables must be tested for stationarity to avoid the spurious results.

3.4.1 Model Specification and Estimation

The empirical analysis utilized the **Vector Error Correction Model (VECM)** to investigate the dynamic relationships between five-time series variables: Gross Domestic Product (GDP), Remittances (REM), Foreign Direct Investment (FDI), Gross Capital Formation (GCF), and Annual Net National Income (ANNI).

3.4.2 Unit Root and Cointegration Tests

Before estimating VECM estimation, the time series properties of the variables were examined, assuming all variables are integrated of order one, I(1) (non-stationary).

The following steps were followed:

1. Unit root testing ADF
2. Lag selection through VAR
3. Johansen Cointegration Test
4. VECM estimation

3.4.3 Augmented Dickey–Fuller (ADF) Test Specification

The stationarity of the variables was confirmed using the Augmented Dickey-Fuller (ADF) test. The test generally employed the specification including both a constant (α) and a linear trend (βt):

$$\Delta Y_t = \alpha + \beta_t + \gamma Y_{t-1} + \sum_{i=1}^{p} \delta_i \Delta Y_{t-1} + \varepsilon_t$$

Where,

ΔYt = The first difference of the time series variables at time t .

Y_{t-1} = The lagged level of time series variables

γ = The key coefficient. The null hypothesis is $H_0 : \gamma = 0$ (Unit root)

$\sum_{i=1}^{p} \delta i \Delta Y_{t-1}$ = A sum of lagged difference term included to correct autocorrelation.

ϵ_t = The white-noise error term.

H_0: $\gamma = 0$ (Unit root); Result confirms all variables are I(1).

3.4.4 Optimal Lag Selection

The analysis began with an unrestricted Vector Autoregression (VAR) model to determine the optimal lag structure. Based on the majority of criteria (LR, FPE, and AIC), an optimal lag length of p = 2 was selected. This choice determines the number of lagged difference terms (p-1=1) used in the subsequent VECM.

3.4.5 Johansen Cointegration Test Specification and Results

The Johansen Cointegration Test was performed to confirm the existence of a long-run relationship The model is specified as:

$$\Delta X_t = \Pi X_t + \sum \Gamma_i \Delta X_{t-1} + \varepsilon_t$$

$\Pi = \alpha\beta'$ contains long-run equilibrium (β) and adjustment coefficients (α)

The cointegration rank (r) is tested using two likelihood ratio statistics: The **Trace Test** and the **Max-eigenvalue Test**.

Two cointegrating vectors found (r=2).

3.4.6 Long-Run Cointegration Equation

$$GDP_t = \beta_0 + \beta_1 REM_t + \beta_2 FDI_t + \beta_3 CGF_t + \beta_4 ANNI_t + \varepsilon_t$$

3.4.7 VECM Equation

The estimated VECM model utilizes a rank of r=2 and p-1 = 1 lagged difference, given the optimal lag selection. The general form of the VECM is:

$$\Delta X_t = \alpha\beta' X_{t-1} + \sum \Gamma_i \Delta X_{t-1} + \varepsilon_t$$

Where,

$\alpha\beta' X_{t-1}$ = The Error Correction Term (ECT). Represents the system's deviation from the long- run equilibrium in the previous period.

β' = The Cointegrating Vector (Long-Run Relationship).

α = The Adjustment Vector.

$\Gamma_1 \Delta X_{t-1}$ = The Short-Run Dynamics Component.

ΔX_t = Vector of the first differences of the variables.

3.4.8 Error Correction Term:

Normalization on GDP sets GDP coefficient=1

Thus, ECT appears with reverse signs:

$ECT_{t-1} = GDP_{t-1} - (\beta_0 + \beta_1 REM_{t-1} + \beta_2 FDI_{t-1} + \beta_3 GCF_{t-1} + \beta_4 ANNI_{t-1})$

3.4.9 Diagnostic Checking

The estimated VECM model (rank 2, 1 lagged difference) was validated using residual tests.

- **Model Stability:** The underlying VAR(2) model is **stable** , as the Inverse Roots of the AR Characteristic Polynomial all lie **inside the unit circle**. This is essential for valid analysis.
- **Residual Serial Correlation (LM Test):** This test confirms the model is correctly specified by checking if residuals are white noise.
    - **Null Hypothesis (H_0):** No serial correlation.

3.4.10 Identification of Weakly Exogenous Variables

To identify the weakly exogenous variables in the system, follows the standard VECM approach through Error Correction Term (ECT), the two variable form of VECM formulated as,

$$\Delta Y_t = \alpha_Y ECT_{t-1} + \sum \Gamma_i \Delta Z_{t-1} + \varepsilon_{Yt}$$

$$\Delta X_t = \alpha_X ECT_{t-1} + \sum \Gamma_i \Delta Z_{t-1} + \varepsilon_{Xt}$$

ECT_{t-1}= captures the deviation from long-run equilibrium

αy, αx measure how strongly each variable adjust to recover equilibrium

$\Gamma_i \Delta Z_{t-1}$ represents short-run effects from lagged differences

Applying this structure in this study

$Y_t = GDP_t$

$X_t = REM_t, FDI_t, GCF_t, ANNI_t$

4.0 RESULT AND DISCUSSION

4.1 Objective 01: Analyzing the historical trends and structural volatility of GDP and selected macroeconomic factors (REM, FDI, GCF, ANNI) in Bangladesh.

This objective tends to investigate the historical trend and structural volatility of GDP and selected macroeconomic variables such as remittances, foreign direct investment, gross capital formation and annual net national income in the context of Bangladesh. A sample of 44 observations covering the time period 1980 to 2024 have been selected to analyze how variables behave over the long period of time. By utilizing descriptive statistic which includes Mean, Median, Maximum, Minimum and Standard Deviation to provide essential insights in understanding the traditional pattern and instability of economic growth and other selected key macroeconomic variables priory mentioned.

Table: 1 Descriptive Statistics for key Macroeconomic Indicators

Statistic	GDP (Gross Domestic Product)	REM (Remittances)	FDI (Foreign Direct Investment)	GCF (Gross Capital Formation)	ANNI
Mean	803.4882	4.980352	0.458681	23.47668	20.55375
Median	396.6707	4.596677	0.350304	24.34142	16.92402
Maximum	2716.486	10.59151	1.735320	32.21373	39.17621
Minimum	184.7068	1.867162	-0.029894	14.43939	10.96872
Std. Dev.	780.6227	2.534164	0.492685	5.793651	7.620551

Source: Author's calculation based on data from the World Development Indicators (WDI), World Bank.

This descriptive statistic shows trend as well as volatility between economic growth and selected macroeconomic variables. Over the sample period from 1980 to 2024, the trend of GDP is strongly raising, indicated by the high Maximum value (2716.486) compared to Minimum (184.7068). The upward trend of GDP is also confirmed by the huge gap between Mean (803.48) and

Median (396.67). Despite that, high volatility is also observed in this trend, reflecting by its very large standard deviation (780.6227), indicating notable instability in the overall economic growth.

On the other hand, remittances found to remain consistent over the past years since the Mean (4.98) and Median (4.60) provides very close values with a moderate Standard deviation (2.53), which reflects comparatively stable trend. Although FDI maintains a low Mean (0.46) and minimal dispersion (0.49), the negative Minimum value (-0.028894) reveals a period of net disinvestment, suggesting even if the fluctuations are limited, yet it caused instability.

While gross capital formation exhibits a relatively stable investment trend which shows manageably moderate volatility in domestic investment, ANNI presents a upward trend moving between Maximum of 39.18 and Minimum of 10.97, showing income growth with periodic fluctuation. Overall, the result from this analysis suggest that, although the economic growth of Bangladesh has a sharply upward trend, it also faces volatility. It is also found that, in compare to FDI inflows which exhibits inconsistent nature, domestic investment and remittances display better stability.

Table: 2 Descriptive Statistics of Distributional Properties for Macroeconomic Variables

Statistic	GDP	REM	FDI	GCF	ANNI
Skewness	1.348480 (Right-Skewed)	0.820119 (Right-Skewed)	0.929778 (Right-Skewed)	-0.043727 (Symmetric)	1.176980 (Right-Skewed)
Kurtosis	3.361037 (Slightly Leptokurtic)	2.460079 (Platykurtic)	2.829890 (Platykurtic)	1.574328 (Platykurtic)	3.092477 (Slightly Leptokurtic)
Jarque-Bera	13.88239	5.591060	6.537910	3.825354	10.40564
Probability	0.000967	0.061083	0.038046	0.147685	0.005501

Source: Author's calculation based on data from the World Development Indicators (WDI), World Bank.

This above distributional table shows GDP, REM and ANNI are all right skewed, indicating long right tails, whereas, CGF is nearly symmetric.

On the other hand, the values of Kurtosis suggest that, GDP and ANNI are slightly platykurtic, indicating a little heavier tail, whereas, REM, FDI, GCF are playkurtic, indicating flatter distribution. The Jarque-Bera test confirms that GDP, FDI and ANNI significantly driven from normality, but REM and CGF do not reject normality at 5% level.

4.2 Objective 2: Examining short run dynamic and long run equilibrium between key macroeconomic variables and economic growth.

This objective estimates both short run adjustment and long run equilibrium between economic growth as Gross Domestic Product (GDP) and the major macroeconomic variables such as remittance (REM), Foreign Direct Investment (FDI), Gross Capital Formation (GCF) and Annual Net National Income (ANNI) applying Vector Error Correction Model (VECM).

4.2.1 Long-run equilibrium:

to analyze long run equilibrium between GDP and key macroeconomic variables let's start with generating long-run regression equation considering GDP as dependent variable and REM, FDI, GCF and ANNI as independent variables;

Long-rum regression equation:

$GDP = \beta_0 + \beta_1 REM + \beta_2 FDI + \beta_3 CGF + \beta_4 ANNI$…… (1)

Long-run econometric equation with error term,

$GDP_t = \beta_0 + \beta_1 REM_t + \beta_2 FDI_t + \beta_3 CGF_t + \beta_4 ANNI_t + \varepsilon_t$…… (2)

Where, $€_t$ = Error term; capturing all missing factors

Subscript t = Time dimension

Long-run estimated equation with error term:

$GDP_t = -2737.1 + 5.29REMt - 14.56FDI_t + 999.24CGF_t + 1480.99ANNI_t + \varepsilon_t$……(3)

Table: 3 Johansen Cointegration Test (Summary)

Test	Result	Notes

Rank (r)	r = 2	Maximum Eigenvalue test suggested two cointegrating vectors; supports long run linkage

Source: Author's calculation based on data from the World Development Indicators (WDI), World Bank.

The Johansen Cointegration Test identifies the number of long-run equilibrium relationships among the variables. In Table 3, the test results indicate a cointegration rank of **r = 2**, meaning there are two distinct long-run relationships among GDP, REM, FDI, GCF, and ANNI. The Maximum Eigenvalue test confirms the presence of these two cointegrating vectors, which supports the existence of stable, long-term linkages between the selected macroeconomic variables in Bangladesh. This result justifies the use of the VECM framework to analyze both short-run dynamics and long-run equilibrium.

Table: 4 Long-Run Cointegration Coefficients:

Variable	Coefficient	t-statistic
REM	5.29	6.504
FDI	-14.56	-2.859
GCF	999.24	__
ANNI	1480.99	__

Source: Author's calculation based on data from the World Development Indicators (WDI), World Bank.

From above table, it is observed that, most of the estimated long run coefficients among the selected, have positive and significant impact on economic growth except FDI. Starting with remittance, the value of this coefficient is 5.29, which means 1% increase in remittance is associate with 5.29% increase in GDP growth in the long run. For gross capital formation the coefficient is 999.24 which indicates a very strong positive contribution to long term GDP growth. Moreover, the coefficient for annual net national income 1480.99 which also confirms a strong and positive contribution. However, the coefficient of FDI is negative with -14.56, which thus suggests, in long run FDI has a limited or inverse effect on GDP growth.

4.2.2 Short-Run Dynamics:

To evaluate the short-run dynamics the Vector Error Correction (VECM) has been utilized. This model includes Error Correction Term (ECT),

General form of ETC (Lagged),

$ECT_{t-1} = GDPt\text{-}1 - (\beta_0 + \beta_1 REM_{t-1} + \beta_2 FDI_{t-1} + \beta_3 GCF_{t-1} + \beta_4 ANNI_{t-1})$…….(4)

The estimated form of ECT,

$ECT_{t-1} = GDP_{t-1} + 2737.1 - 5.29\ REM_{t-1} + 14.56\ FDI_{t-1} - 999.24\ GCF_{t-1} - 1480.99\ ANNI_{t-1}$…(5)

VECM specification of GDP using ECT,

$\Delta GDP_t = \alpha GDP \times ECT_{t-1} + \Sigma\gamma_i \Delta X_{t-i} + \varepsilon_t$……(6)

Estimated VECM equation of GDP,

$\Delta GDP\_t = -0.19133 \times ECT_{t-1} + (\text{short-run lagged } \Delta \text{ terms}) + \varepsilon_t$…….(7)

Interpretation: -0.19133 indicates negative but significant value which means GDP corrects 19.13% disequilibrium each year previously occurred. This quantifies speed of adjustment.

Table: 5 Error Correction Term (ECT) coefficients

Variable	ECT Coefficient (α)	t-Statistic
GDP	-0.19133	-3.19133
REM	0.002930	2.96409
FDI	__	1.44584
GCF	__	__
ANNI	__	__

Source: Author's calculation based on data from the World Development Indicators (WDI), World Bank.

From the above table it is observed that, the ECT coefficient for GDP is negative and statistically significant with -0.19133, which implies approximately 19.13% disequilibrium has been corrected each year, reflecting adjustment happen in a moderate speed. Remittance showing a significant but positive coefficient which suggest that remittance appears to push the system further from equilibrium rather than guiding it back towards stability. Since the adjustment coefficients of remaining variables such as FDI, GCF

and ANNI are not statistically significant, they can be considered as weakly exogenous. Because they fail to adjust long-run disequilibrium, shocks related to GDP do not meaningfully influence their short run dynamics. Since GDP is the only variable exhibiting a significant adjustment coefficient, the short run correction towards equilibrium is predominantly driven by change in GDP, rather than change in other variables.

4.3 Objective 3: Identifying weakly exogenous variables in the growth system

The third and last objective is to find out the weakly exogenous variables within the GDP growth system. Weak exogeneity refers to the variables that do not adjust in the short-run and to deviations from the long-run variables. When evaluating through VECM model, a weakly exogenous variable has no error correction term variable.

Mathematically,

The general VECM format for two integrated variables can be presented as,

$\Delta Y_t = \alpha_Y ECT_{t-1} + \sum \Gamma_i \Delta Z_{t-1} + \varepsilon_{Yt}$.....(8)

$\Delta X_t = \alpha_X ECT_{t-1} + \sum \Gamma_i \Delta Z_{t-1} + \varepsilon_{Xt}$.....(9)

The estimated long run ECT derived from the cointegrating vector is:

$ECT_{t-1} = GDP_{t-1} - (273701 - 5.29REM_{t-1} + 14.56FDI_{t-1} - 999.24CGF_{t-1} - 1480.99ANNI_{t-1})$.....(10)

The significance of the coefficient of the ECT model determines whether a variable adjust to long-run disequilibrium.

Identification of weakly exogenous variables:

1. Gross Domestic Product (GDP): GDP has a negative and significant adjustment coefficient, which means GDP is the endogenous variable in the adjustment process.
2. Remittances (REM): Remittance has a significant and positive adjustment coefficient, which means remittance respond to disequilibrium but in a disruptive direction. Remittance is neither weakly exogenous nor a stabilizer.
3. FDI, CGF and ANNI: These variables have statistically significant adjustment coefficient, which means they do not respond to disequilibrium. Therefore, they considered as weakly exogenous variables.

Table: 6 Error Correction Term (ECT) Coefficients (α vector)

Variable	ECT Coefficient (α)	t-Statistic	Interpretation
GDP	-0.19133	-3.19133	Significant; adjusts to restore equilibrium (19.13%)
REM	0.002930	2.96409	Significant positive; tends to move system away
FDI	Not significant	1.44584	Weakly exogenous
GCF	Not significant	—	Weakly exogenous
ANNI	Not significant	—	Weakly exogenous

Source: Author's calculation based on data from the World Development Indicators (WDI), World Bank.

The finding showed in the table indicates a clear definite hierarchy for how the economic variables work together to stabilize the economy, and it is found that GDP is the single stabilizer mechanism which is statistically significant adjustment coefficient with a negative sign. This finding establishes GDP as an endogenous adjustment factor, which automatically adjust to correct the imbalance and restore the stability to ensure sustainable economic growth. On the contrary, the remaining factors such as Foreign Direct Investment and capital formation found to be weakly exogenous since they show no significant coefficient, which means they are not responsive to the error and also not concerned in fixing long term imbalance. This result is consistent with Bangladesh economy, suggesting that, the movement of FDI and Capital formation are governed by external forces rather than adjusting to domestic adjustment issues. Remittances exhibit different outcome. Positive value of the coefficient indicates they push the economy away from equilibrium and possibly amplify short-run instability. However, remittances are neither stabilizer nor weakly exogenous, they introduce short-run volatility because their flow is highly sensitive to external labor market and domestic households. The structural analysis of the VECM exposes a clear overview of long-run economic sustainability in Bangladesh. GDP is the key internal force that fixes the economy. On contrary, FDI, Gross Capital Formation, and National Income are weakly exogenous and externally driven; they fail to adjust to the long-run error. Furthermore, Remittances remain insignificant in correcting error in long-run rather boosts volatility in short run. Hence, government policies should focus directly stimulate GDP to control the fluctuation arising from remittance inflows.

4.4 Diagnosis Tests:

The estimated VECM model successfully passed all key diagnostic tests, including model stability (inverse roots within the unit circle), absence of serial correlation in residuals (LM test), and acceptable distributional properties as indicated by the Jarque–Bera normality results. These outcomes confirm that the model is correctly specified and the reported long-run and short-run results are statistically reliable.

4.5 Conclusion:

This result and discussion chapter highlighted three objectives provides in-depth structural review of the economy of Bangladesh through descriptive statistics and Vector Error Correction Model (VECM). Objective one focuses on historical trends and volatility between economic growth and selected macroeconomic factors namely, Remittance (REM), Foreign Direct Investment (FDI), Gross Capital Formation (CGF) and Annual Net National Income (ANNI). GDP showed a sharply upward trend but also reflects high volatility measured by high standard deviation. Similarly, ANNI showed positive upward trend with periodic fluctuations. On the contrary, although having low dispersion, FDI possess instability due to a period of net disinvestment. Whereas, remittance presents relatively stable trend. Objective two evaluates short-run dynamic and long-run equilibrium through the application of Vector Error Correction model. The findings confirmed short run and ling run relations among the factors. All the factors such as REM, GCF and ANNI have significantly positive impact on GDP growth accept FDI which exhibits negative impact on economic growth in the long run. The VECM result revealed a short run negative and significant ECT coefficient for GDP, which means GDP restore 19.13% of previous year imbalances. Objective three finally confirmed GDP is the only stabilizer that identified as endogenous variables which restores economic disequilibrium in the context of Bangladesh. FDI, GCF and ANNI are found to be weakly exogenous since their ECT coefficient shows insignificant values. However, Remittances are neither a stabilizer nor a weakly exogenous, but it's significant positive coefficient indicates it contribute to diverging equilibrium and intensify short run instability. Therefore, policy makers should emphasize on promoting GDP to reduce the fluctuations occurs from remittance inflows.

5.0 CONCLUSION AND POLICY RECOMMENDATION

5.1 Conclusion:

This study empirically explains Bangladesh's growth pattern by investigating long-run equilibrium and short run dynamics and identifying the weakly exogenous variables within the economic system. In response to first research question, trend analysis between GDP and selected macroeconomic factors confirmed an upward but volatile GDP trajectory. Since Remittance (REM) and Foreign Direct Investment (FDI) exhibits significant instability. This result reflects the post pandemic shocks. This finding validates the relevance of first objective. Addressing second research question, the application of cointegration analysis and VECM model verified long-run relationship among core macroeconomic variables, thereby supporting hypothesis one. In addition, the significant Error Correction term (ECT) for GDP illustrates that the economy adjust itself back to restore long-run equilibrium. This outcome validates hypothesis two and provides a measurable rate of adjustment which helps to assess how the economy recovering after the pandemic. Finally, to answer third research question, the weak erogeneity test identified two variables such as remittance and foreign direct investment as exogenous variables, which indicates they are unable to correct long-run disequilibrium, which thus confirms hypothesis two. The findings reveal that in the post COVID context, Bangladesh has limited domestic control over key financial inflows, which are still vulnerable to outside shocks.

In summary, according to the findings of this study, Bangladesh's growth is driven by internal variables that respond to changes and external factors that do not correct long-run imbalance. It is essential to stabilize domestic investment, attract FDI and manage remittance flows to reduce the volatility of the post pandemic era. Through the integration of recent data and application of the VECM model, this study provides clear insights for policymakers to formulate sustainable economic growth.

5.2 Policy Recommendations:

Considering the above findings, where GDP is emerged as the only stabilizing force in Bangladesh's economy, while key external components such as FDI and remittances though traditionally regarded as engines of economic strengthening, fail to respond positively and instead generate additional volatility. So it becomes essential to place greater emphasis on policy making to reduce these instabilities and ensure sustainable economic growth of Bangladesh.

1. Enhance the internal capacity of GDP:

Since GDP is the single variable correcting long-run disequilibrium, policies should be formulated with foremost priority to make GDP more structurally resilient through human capital, productivity driven infrastructure and modern digitalization.

2. Reduce Short-run Remittance volatility:

Since remittances undermine short-run stability, the government should develop financial tools that can smooth or absorb sudden fluctuations in inflows.

3. Directing FDI to support structural alignment:

Instead general policies that attract FDI, the government should prioritize investments that build local linkages, promote technology transfer, and support high value added manufacturing.

4 Reduce dependence on external force:

Since GCF and ANNI are influenced by external factors and do to adjust automatically, policies should prioritize streteghning domestic finance and diversifying exports to reduce risks from volatile inflows.

REFERENCES

1) Akhter, A. (2022). Foreign capital inflows and economic growth of Bangladesh. Journal of Financial Markets and Governance,1(2). https://www.researchgate.net/publication/ 363038179
2) Anuno, F., Reis, C., Jesus, B., & Céu, F. (2025). Impact of remittances, foreign direct investment and gross capital formation on economic growth in timor-leste: strategies for sustainable development. Asian Journal of Economic Modelling, 13(3), 402-418.
3) Bikorimana, G., Rutikanga, C., Butare, G. W., Safari, K., & Bahizi, M. (2021). Empirical analysis of foreign direct investment on economic growth: Evidence from the East African Community. International Review of Economics and Management, 9(2), 114–135.
4) Chowdhury, M. E. R., & Rahman, M. M. (2020). Investigating the impact of external factors on economic growth: A VEC model approach for Bangladesh. Journal of Economics and Financial Modeling, 1(2), 65–85.
5) Chowdhury, S. A., Zaman, S., & Jahan, S. (2019). Impact of macroeconomic variables on economic growth in Bangladesh. International Journal of Accounting and Financial Reporting, 9(3), 101–114. https://doi.org/10.5296/ijafr.v9i3.15170
6) Haque, A., Rana, M. S., Soni, M. S. M., Uddin, M. K., Hossain, M. S., & Molla, M. M. R. (2023). Quantifying the Interconnection of Economic Growth and Key Macroeconomic Factors Using the VECM: Perspective of Bangladesh. European Journal of Statistics and Probability, 11(1), 39–53.
7) Hasan, M. M., Hossain, B. S., & Sayem, M. A. (2022). Determining the impact of economic factors to the gross domestic product in Bangladesh. International Journal of Economics and Financial Issues, 12(1), 37–40. https://doi.org/10.32479/ijefi.12686
8) Jacob, T., & Raphael, R. (2021). The impact of key macroeconomic factors on the economic growth of Bangladesh: An autoregressive distributed lag bounds testing approach. Journal of Smart Economic Growth, 6(2), 102–111. https://jseg.ro/index.php/jseg/article/down load/144/106/
9) Khan, M. M., Das, S. R., & Ahmed, A. (2024). The macroeconomic determinants of economic growth in Bangladesh: An ARDL approach. International Journal of Research and Innovation in Social Science, 8(6), 1433–1445.
10) Nath, S., & Begum, M. (2021). VECM for Measuring the Impact of Macroeconomic Variables on GDP. Journal of Science and Engineering, 8(1), 404–416.
11) Poudel, A. and Giri, S. (2025). Dynamic interactions between real gdp and macroeconomic variables in nepal. SAIM Journal, 2(1), 43-63. https://doi.org/10.70320/sacm.2025. v02i01.004
12) Sattar, S. A. (2025). The impact of macroeconomic indicators on GDP Growth: An empirical analysis. International Journal of Science and Research Archive, 16(02), 1277–1282.
13) Wu, H. (2024). How can developing countries in asia achieve economic growth? taking bangladesh as an example. SHS Web of Conferences, 188, 02008. https://doi.org/10.1051/ shsconf/202418802008