



MACROECONOMIC DETERMINANTS OF BUDGET DEFICIT IN BANGLADESH: EVIDENCE FROM WORLD BANK DATA

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Abstract

This study examines the macroeconomic determinants of budget deficit in Bangladesh using annual data from World Bank spanning the fiscal years 1980–2024. The study employed the Augmented Dickey–Fuller unit root test, ARDL bounds testing approach to cointegration, Error Correction Model and pairwise Granger causality analysis to find comprehensive insights into the dynamic interactions between the budget deficit and key macroeconomic variables including investment, trade deficit, external debt stock, interest rate, inflation, exchange rate and trade openness. The long-run coefficients reveal that trade deficit, external debt stock and investment

have highly statistically significant effects on the budget deficit. In the long run, higher investment reduces the budget deficit while higher trade deficit and external debt stock increase it. Other variables such as interest rate, inflation, exchange rate and trade openness are not statistically significant in the long run but their sign is positive which aligns theoretical concepts. Investment emerges as the most powerful variable in the model where 1 unit increases in investment decline budget deficit by 0.99 units and 0.56 units immediately and in one lag in the short-run as well as 0.65 units in the long-run. Trade deficit positively impacts budget deficit in the long-run where 1 unit increase in trade deficit increases budget deficit by 0.38 units which aligns twin deficit hypothesis. External debt stock also positively impacts budget deficit in both the short-run and long-run with highly significance where 1 unit increase in external debt stock increases budget deficit by 5.61 units in the long-run. Causal relationships reveal that budget deficit and investment, budget deficit and external debt stock as well as budget deficit and trade deficit are bi directionally associated. Diagnostic tests confirm that the model is statistically sound and robust. The findings suggest that sustainable budget deficit reduction in Bangladesh requires a policy framework centered on productive investment, trade deficit containment, prudent external debt management and coordinated fiscal, monetary and exchange rate policies.

Keywords: Budget Deficit, Trade Deficit, ARDL Bounds Testing, Twin Deficit, Investment, External debt Stock

INTRODUCTION

Bangladesh has pursued deficit budgeting since its independence and has faced persistent capital deficiency from its born. Both theoretical and empirical evidence suggest that deficit budgeting can be more growth-enhancing than balanced or surplus budgets. Consequently, most countries worldwide including developed nations, OECD members, G-7 countries, developing economies and least developed countries (LDCs) have adopted deficit budgeting as a fiscal policy tool. Classical, Keynesian and neo-classical economists argued for and against deficit budget in the question of economic growth. Classical and neo-classical economists always pleaded against budget deficit that it reduces economic growth through higher interest rate and crowding-out effect. On the other hand, Keynesian economists pleaded for deficit budget especially in the case of recession that it increases economic growth at any interest rate through crowding-in effect. Moreover, academicians, researchers, politicians, and policymakers frequently examine the impact of budget deficits and related macroeconomic variables on economic growth across countries to assess whether deficit budgeting is a growth-friendly mechanism or not. However, an important question remains unanswered in the context of

Bangladesh that whether the current level of budget deficit relative to GDP is appropriate and which relevant economic variables most strongly influence policymakers' decisions in maintaining the existing budget deficit. Despite the significance of this issue, only a limited number of studies have addressed it so far. This study examines the impact of key factors specially trade deficit influencing the budget deficit in the context of Bangladesh.

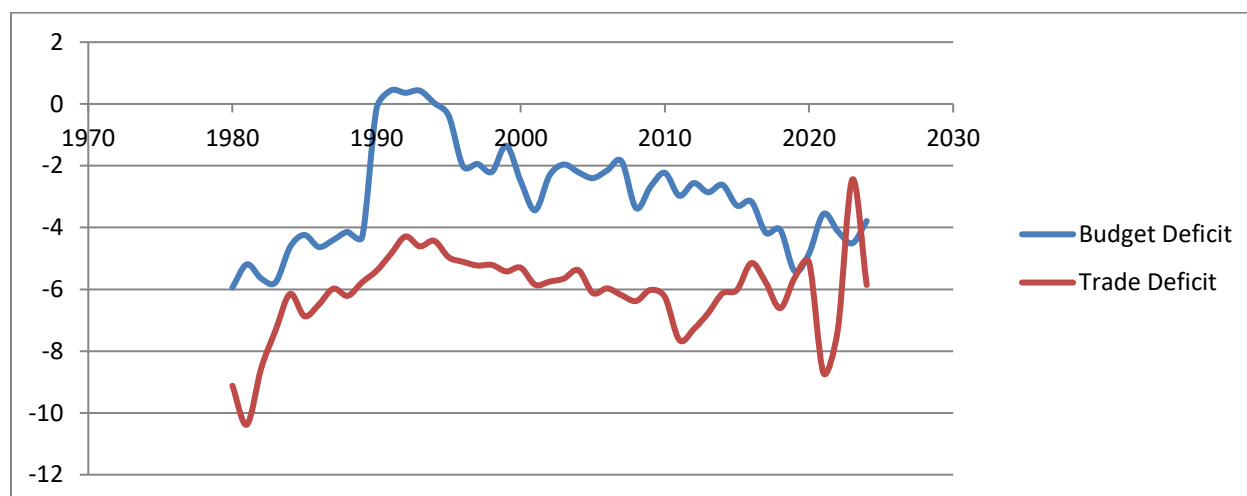


Figure 1: Trend of budget deficit and trade deficit in Bangladesh during the research data period

Source: World Development Indicators (World Bank Data), Author's Compilation

Upper blue line indicates budget deficit and lower red line indicates trade deficit where both are indicating negative or deficit status including little surplus budget in 1990-94 fiscal years. A larger volatility of trade deficit expressed in 2020-2024 due to paying huge debt servicing and imports of capital goods and drastic import reduction of capital goods in 2024. The data broadly support a “twin deficits” pattern because of their similar direction in deficit status.

Significance of the Study

This study is significant for Bangladesh because the country has consistently relied on deficit budgeting since its independence while simultaneously facing chronic capital scarcity. Bangladesh is getting opportunity of foreign loan with lower interest rate in the category of LDCs which is another cause of budget deficit and accumulated external debt with debt servicing make deficit more. Trade deficit is also a major problem in Bangladesh. So, normally it raises a question that, is twin deficit hypothesis prevails in Bangladesh economy? Is Budget deficit size taken as per willingness of policy makers or its size is depend on various factors like trade deficit, exchange rate, interest rate, inflation rate, investment rate, trade openness or external debt stock? This study tries to get the answer of these concerns and provides the resolving techniques.

Objectives of the Study

The general objective of the study is to show the macroeconomic determinants of fiscal deficit in Bangladesh economy empirically with the evidence from World Bank data. To fulfill the general objective the specific objectives are as follows:

Specific Objectives

- i. To examine the long-run effects of the macroeconomic determinants like interest rate, inflation rate, exchange rate, trade deficit, trade openness, investment and external debt stock on budget deficit in Bangladesh economy
- ii. To analyze the short-run dynamics of the selected macroeconomic determinants in relation to the budget deficit of Bangladesh economy
- iii. To investigate whether the twin deficit hypothesis (the relationship between budget deficit and trade deficit) exists in the context of the Bangladesh economy
- iv. To investigate the causal relationships among the selected macroeconomic variables of Bangladesh economy
- v. To suggest policy recommendations based on empirical findings of the study

LITERATURE REVIEW

Asrafuzzaman et al. (2013) employed Vector Autoregression (VAR) and Granger causality tests following successful PP, ADF unit root tests, and cointegration rank tests to test the twin deficit hypothesis and the causal alliance between the fiscal deficit and trade deficit in Bangladesh during the fiscal years 1972–73 to 2011–12. The study found evidence of bidirectional Granger causality between the fiscal deficit and trade deficit; this long-term relationship was found to depend on broader macroeconomic conditions and the performance of related variables. The authors recommended reducing the budget deficit as a strategy to improve the trade balance.

Alam, Sadekin, and Saha (2022) employed a VECM, Granger Causality test, and Johansen's cointegration method to analyze the effect of key macroeconomic indicators including the GDP, real effective exchange rate (REER), inflation (INF), money supply (M2), and trade volume (TR) on the budget deficit (BD) in Bangladesh for the fiscal years 1980–2018. Johansen's cointegration test revealed a positive long-run alliance between the budget deficit and REER, trade volume, inflation, and money supply, whereas GDP showed an inverse long-run association. In the short run, VECM results indicated that GDP, money supply and inflation exert an inverse effect on the budget deficit.

Osuka and Chioma (2014) investigated the long-run relationship between budget deficits and key macroeconomic variables in Nigeria over the period 1981–2012. Using the Johansen

cointegration test, they confirmed the presence of a long-run relationship among the variables budget deficit, GDP, nominal exchange rate, interest rate, and inflation rate. The findings lend support to the Keynesian perspective that budget deficits can crowd in investment and suggested based on these results to emphasis on capital expenditure to amplify its positive impact on GDP and foster broader economic growth and development.

Alenoghena et al. (2023) applied Pairwise Granger Causality and the Two Stage Least Squares (2SLS) approaches to examine the macroeconomic factors determining the massive growth of fiscal deficit financing in Nigeria from 1981 to 2020. Their research results showed that economic growth positively impact on domestic deficit financing significantly and inflation and exchange rates also positively but insignificantly. On the other hand, financial development, debt service and trade openness are negative and significant in affecting fiscal deficit financing. The research study recommends earning more from taxation and prudent utilization of the funds from domestic deficit financing on productive projects to the economy.

Meno et al. (2025) utilized ARDL and ECM to analyze the macroeconomic determinants of fiscal deficits from 1980/81 to 2023/24 in Ethiopia. The long-run findings indicated that grants, capital expenditures and relative income negatively related with fiscal deficit conversely inflation, interest rates and dependency ratio positively related. Granger causality tests revealed bidirectional short-run causality between fiscal deficits and capital expenditures, as well as current account deficits but unidirectional causality for other variables. The study recommends policies to improve domestic revenue mobilization, reduce current account deficits and foster macroeconomic stability.

Alam (2025) utilized 2-state regime-switching model to examine the fiscal sustainability in response to deficit budgeting strategy in Bangladesh from 1983 to 2022. The research study found that the government's fiscal response to rising public debt was stabilizing during 1989-1995 and 2002-2014 with 84% probability (sustainable) while the response was insignificant during 1983-1989, 1996-2001, and 2015-2020 with 80% probability (unsustainable). The main reason for fiscal unsustainability appears to be the rising interest rates due to changes in budget financing mixes, higher interest payments, and persistent expansionary fiscal policy without major fiscal reforms.

Kasongo (2023) used the Bayesian vector autoregressive estimation with the Minestor prior and the findings are analyzed using the impulse response function and variance decomposition to examine empirically the factors influencing South Africa's fiscal deficit from 1975 to 2021. The findings revealed that government debt, GDP growth, money supply, and interest rate as determinants of the fiscal deficit. Impulse response functions showed positive and significant impacts of government debt on the fiscal deficit; negative and significant impacts of

economic growth, money supply, and interest rate on fiscal deficits. The variance decomposition showed that economic growth and national debt explained the variations in fiscal deficit in the long run.

Das et al. (2020) applied Johansen Co-integration test and Pair-wise Granger Causality test to trace relationship of fiscal deficit with the recent surge in GDP growth, inflation, Money supply etc. in the context of Bangladesh from 1990 to 2019. The study found a unidirectional causal relationship in the form of GDP to budget deficit. As well as it also found a unidirectional causal relationship between CPI and money supply and deficit for the case of BD economy.

Research Gap

Various national and international research papers have studied and reviewed to search knowledge to add something with existing research. Most of the research examined the impact of trade deficit on budget deficit to explain twin deficit hypothesis. In this journey, they used relevant factors like interest rate, inflation rate, money supply and GDP growth as influencing variables but ignored more effective factors like exchange rate, external debt stock, investment rate and trade openness. Moreover, they examined their research with domestic source or mixed source of data. In this study, these are identified as research gap and tried to overcome by including the entire possible effective influencing variables with homogenous World Bank data.

THEORETICAL AND CONCEPTUAL FRAMEWORK

Theoretical Framework of Twin Deficits

Keynesian macroeconomic framework of national income identity in open economy is,
 $Y \equiv C + I + G + (X-M) \dots\dots\dots (1)$

Where, X-M= net export or trade balance, NX. Y= National Income, C = consumption expenditure, I = investment, G= government purchases of goods and services, X= export, M= import.

Next, we turn to the derivation of the very important relation between output and disposable income. Now we have to recognize that part of income is spent on taxes (TA) and that the private sector receives net transfers (TR) in addition to national income. Disposable income (YD) is thus equal to income plus transfers less taxes.

$YD \equiv Y+TR-TA \dots\dots\dots (2)$

Disposable income, in turn, is allocated to consumption and saving.

$YD \equiv C + S \dots\dots\dots (3)$

Combining identities (2) and (3) allows us to write consumption as the difference between incomes, plus transfers minus taxes, and saving.

$C + S \equiv YD \equiv Y+TR-TA \dots\dots\dots (4)$

$$\text{Or, } C \equiv YD - S \equiv Y + TR - TA - S \dots \dots \dots (5)$$

Last identity says that consumption is disposable income less savings or alternatively, that consumption is equal to income plus transfers less taxes and saving. Now we use the right-hand side of equation (5) to substitute for C in identity (1). With some rearrangement we obtain.

$$S - I \equiv (G + TR - TA) + (X - M) \dots \dots \dots (6)$$

And rearranging again we get

$$(X - M) \equiv (S - I) + (TA - G - TR) \dots \dots \dots (7)$$

In words, equation (7) states that the trade account surplus is equal to budget surplus plus saving investment balance. Assuming that government fixes spending (G), and cuts taxes (T), thereby creating a deficits. Equation (7) indicates that, as a result, either the trade deficit (X-M) must take place or the saving investment balance will distort, or both. Note that this conclusion follows directly from accounting and does not depend on any behavioral theories. Whether the impact of budget deficits falls on (X-M) or (S-I) is an open question.

It can be explained shortly as,

In a Keynesian open-economy framework:

$$Y = C + I + G + (X - M) \dots \dots \dots (8)$$

Rearranging to highlight deficits, we can subtract consumption and taxes from both sides

$$Y - C - T = I + (G - T) + (X - M) \dots \dots \dots (9)$$

Since Private saving $S = Y - C - T$

We get,

$$S = I + (G - T) + (X - M) \dots \dots \dots (10)$$

$$\text{Rearranging, } (X - M) = (S - I) - (G - T) \dots \dots \dots (11)$$

Where (G-T) indicates budget deficit (if positive), (X-M) indicates trade balance (trade deficit if negative) and (S-I) indicates private sector saving-investment balance. Economists trained in the traditional Keynesian theory have pointed to the budget deficits as the major cause of the trade deficits.

Inflation Rate

The inflation rate represents the percentage change in the overall price level from one year to the next. Its calculation follows the same method used for determining the growth rate, as described above.

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

Interest Rate

The interest rate is the percentage imposed by a lender to a borrower in addition to the main amount. From the perspective of the receiver, an individual who deposits money in a bank or financial institution earns additional income over time known as interest reflecting the time value of money.

Exchange Rate

An exchange rate is the price of a country's currency in terms of the currency of another country or economic zone (or, a group of foreign currencies) or vice versa. There are two types of foreign exchange rates, as floating exchange rate and fixed exchange rate.

Twin Deficit Hypothesis

A twin deficit occurs when budget deficit and trade deficit exist in an economy simultaneously. Trade deficit or current account deficit occurs when import expenditure is more than export earnings. Budget deficit occurs when government expenditures is more than its earning. Government borrows from international sources to meet the gap between expenditures and earnings. Borrowing foreign currencies contribute to excess supply of foreign currencies make appreciation of domestic currencies. As a result, exports become more expensive for foreigners resulting exports and remittance fall and imports become cheaper for domestic consumers resulting imports rise and creates a big gap between export earnings and import costs. Such a way, budget deficit creates trade deficit and exists togetherly. Moreover, Bangladesh is an import oriented country where import expensive capital goods with high salaried foreigners even import huge food grains for vast population through budget deficit. As a result import costs always higher than export earnings and make a trade deficit. By this way both the budget deficit and trade deficit exists in Bangladesh simultaneously.

Budget Deficit

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 then it is called budget deficit or fiscal deficit and it is financed from various national and international sources by borrowing. The accumulation of such borrowing is the government debt or public debt.

External Debt Stock

External debt stock refers to the total outstanding amount of a country's external debt at a specific point in time.

Trade Deficit

The trade deficit is the negative balance of trade, calculated as: Trade Balance=Exports–Imports. When imports are greater than exports, the trade balance is negative, indicating a trade deficit.

Trade Openness

Trade openness is a measure of how strongly an economy is integrated into the global trading system, reflecting the extent to which a country engages in international trade. Trade openness is commonly defined as the ratio of a country's total trade to its economic output, calculated as:

$$\text{Trade Openness} = \frac{\text{Exports} + \text{Imports}}{\text{GDP}}$$

METHODOLOGY

To resolve the research problem the study conducted on secondary data and the objectives of the study being examined by using time series data covering period of 1980-2024 fiscal years. The study period 1980–2024 was selected because it captures the post-independence fiscal and macroeconomic evolution of Bangladesh, including major policy reforms, trade liberalization, exchange rate adjustments, external debt expansion and recent post-pandemic fiscal developments. Moreover, the longtime-series provides sufficient observations for reliable ARDL estimation and robust long-run econometric analysis.

Research Model

In order to analyze the research problem through short-run dynamics and long-run relationship and to examine the causal direction between the variables, following econometric model is employed:

$$\text{BDF}_t = \alpha_0 + \alpha_1 \text{TD}_t + \alpha_2 \text{LNTR}_t + \alpha_3 \text{EXR}_t + \alpha_4 \text{LNFR}_t + \alpha_5 \text{LNVR}_t + \alpha_6 \text{LNTRDOP}_t + \alpha_7 \text{LNEDS}_t + \mu_t \dots \dots (1)$$

Where,

α_0 = intercept term;

$\alpha_1 - \alpha_7$ = coefficients

μ = error term

BDF = Budget Deficits used as % of GDP

TD = Trade Deficit as negative value of exports – imports of goods and services in Billion US\$

INTR = Interest Rates taken as average lending interest rates

EXR = Exchange Rates defined as Taka per US\$

INFR = Inflation Rates on consumer prices (annual %)

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

TRDOP = Trade openness as export plus import as a share of GDP

EDS = External debt stock in Billion US\$

Econometric Estimation Techniques

This research is analyzed by using econometric techniques such as unit root test to check data stationarity, Autoregressive Distributed Lag (ARDL) model of cointegration test to identify long-run relationships, Error Correction Model (ECM) to examine the adjustment toward long-run equilibrium and Granger Causality Test to analyze cause-and-effect relationships.

Diagnostic tests including heteroscedasticity, R² and adjusted R², serial correlation, normality, and stability tests are also performed to ensure the robustness of the chosen model.

ADF unit root test rule follow this procedure as

$$\Delta Y_t = \alpha + \beta_t + \gamma Y_{t-1} + \sum_{i=1}^p \beta_i \Delta^2 Y_{t-i} + \varepsilon_t \dots \dots \dots (2)$$

ARDL model follow this rule for multivariate regression model as

$$y_t = a_0 + a_1 t + \sum_{i=1}^p \psi_i y_{t-i} - i + \sum_{j=1}^k w_j \sum_{l=j}^q \beta_{jl} x_{t-l} + \varepsilon_t \dots \dots \dots (3)$$

Error Correction Model for this study can be written as

$$\Delta \ln BDF_t = \alpha_0 + \alpha_1 \Delta \ln TD_t + \alpha_2 \Delta \ln INTR_t + \alpha_3 \Delta \ln EXR_t + \alpha_4 \Delta \ln INFR_t + \alpha_5 \Delta \ln INVR_t + \alpha_6 \Delta \ln TRDOP_t + \alpha_7 \Delta \ln EDS_t + \alpha_7 ECT_{t-1} + u_t \dots \dots \dots (4)$$

Granger causality tests is measured by this rule as

Eviews then performs bivariate regressions of the following form:

$$y_t = \alpha_0 + \alpha_1 \cdot y_{t-1} + \alpha_2 \cdot y_{t-2} + \dots + \alpha_p \cdot y_{t-p} + \beta_1 \cdot x_{t-1} + \dots + \beta_p \cdot x_{t-p} + \varepsilon_t \dots \dots \dots (5)$$

Next, the Eq. (1) is augmented by including lagged values of the variable X:

$$x_t = \alpha_0 + \alpha_1 \cdot x_{t-1} + \alpha_2 \cdot x_{t-2} + \dots + \alpha_p \cdot x_{t-p} + \beta_1 \cdot y_{t-1} + \dots + \beta_p \cdot y_{t-p} + u_t \dots \dots \dots (6)$$

EMPIRICAL ANALYSIS AND RESULTS

Descriptive Analysis

Table 1: Descriptive Statistics

	BDF	INTR	INFR	EXR	INVR	LNTRDOP	TD	LNEDS
Mean	-2.99378	12.29822	7.471111	56.97333	23.40000	3.321477	-7.43667	2.980017
Median	-2.97	12.64000	7.200000	57.89000	24.00000	3.332205	-3.14	2.814810
Maximum	0.440000	16.00000	14.90000	115.6000	32.00000	3.871201	-1.4	4.649091
Minimum	-5.94	7.120000	1.800000	15.45000	14.00000	2.833213	-36.01	1.335001
Std. Dev.	1.698599	2.267133	2.791189	24.68217	5.836406	0.309275	8.397767	0.857665
Skewness	0.357234	-0.47178	0.216289	0.227482	-0.05635	0.038314	-1.83212	0.198638
Kurtosis	2.520067	2.869065	3.149744	2.212963	1.594348	2.000198	5.970049	2.562160
Jarque-Bera	1.389003	1.701442	0.392901	1.549537	3.728550	1.885268	41.71466	0.655374
Probability	0.499323	0.427107	0.821642	0.460810	0.155009	0.389600	0.000000	0.720589
Sum	-134.72	553.4200	336.2000	2563.800	1053.000	149.4664	-334.65	134.1008
Sum Sq. Dev.	126.9505	226.1553	342.7924	26805.22	1498.800	4.208650	3102.989	32.36591
Observations	45	45	45	45	45	45	45	45

The descriptive statistics reveal that most variables demonstrate stable central tendencies, as evidenced by the close proximity of their mean and median values where exchange rate (EXR) and trade deficit (TD) shows substantial fluctuations and trade openness (LNTRDOP) is comparatively stable over the study period. The skewness and kurtosis statistics suggest that most of the variables are normally distributed supported by the Jarque–Bera test results. Overall, the distributional properties of the variables are largely suitable for econometric analysis.

Correlation Matrix

Table 2: Correlation Analysis

	BDF	INTR	INFR	EXR	INVR	LNTRDOP	TD	LNEDS
BDF	1	0.460689	-0.37352	-0.041971	-0.10791	0.112517	0.281696	0.027347
INTR	0.460689	1	0.158601	-0.6248186	-0.70379	-0.303482	0.750004	-0.61678
INFR	-0.37352	0.158601	1	-0.3446436	-0.40665	-0.360018	0.185478	-0.3981
EXR	-0.04197	-0.62482	-0.34464	1	0.956008	0.729945	-0.77135	0.95743
INVR	-0.10791	-0.70379	-0.40665	0.9560083	1	0.776412	-0.7792	0.916357

LNTRDOP	0.112517	-0.30348	-0.36002	0.7299448	0.776412	1	-0.40319	0.605366
TD	0.281696	0.750004	0.185478	-0.7713518	-0.7792	-0.403194	1	-0.84066
LNEDS	0.027347	-0.61678	-0.3981	0.9574296	0.916357	0.605366	-0.84066	1

The correlation matrix indicates degrees of association among the study variables. Budget deficit shows a moderate positive relationship with interest rate and trade deficit, while its correlation with other variables is relatively weak. Interest rate is strongly positively correlated with trade deficit and negatively associated with exchange rate, investment and external debt stock. Exchange rate exhibits very strong positive correlations with investment, external debt stock and trade openness, but a strong negative association with trade deficit.

Result of Unit Root Test

Table 3: Result of ADF Test (with Intercept)

Variable	ADF Test	Critical Value			P-Value	Remarks
	Statistic	1% Level	5% Level	10% Level		
BDF	-2.289	-3.588509	-2.929734	-2.603064	0.179	Non-stationary I(0)
D(BDF)	-6.78	-3.592462	-2.931404	-2.603944	0.0000	Stationary I(1)
TD	3.03	-3.596616	-2.933158	-2.604867	0.9890	Non-stationary I(0)
D(TD)	-3.65	-3.596616	-2.933158	-2.604867	0.0087	Stationary I(1)
INFR	-2.887	-3.588509	-2.929734	-2.603064	0.0450	Stationary I(0)
INTR	-1.888	-3.592462	-2.931404	-2.603944	0.3346	Non-stationary I(0)
D(INTR)	-4.16	-3.592462	-2.931404	-2.603944	0.0021	Stationary I(1)
EXR	1.16	-3.596616	-2.933158	-2.604867	0.997	Non-stationary I(0)
D(EXR)	-4.08	-3.596616	-2.933158	-2.604867	0.0027	Stationary I(1)
LNTRDOP	-1.25	-3.596616	-2.933158	-2.604867	0.6434	Non-stationary I(0)
D(LNTRDOP)	-6.45	-3.596616	-2.933158	-2.604867	0.0000	Stationary I(1)
INVR	-0.97	-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)
LNEDS	-0.279	-3.592462	-2.931404	-2.603944	0.9195	Non-stationary I(0)
D(LNEDS)	-4.318	-3.592462	-2.931404	-2.603944	0.0013	Stationary I(1)

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

The Augmented Dickey–Fuller unit root test results indicate most of the variables are non-stationary at level, with the exception of inflation rate. However, all non-stationary variables

become stationary after first difference implying that they are integrated of order one, $I(1)$. The mixture of $I(0)$ and $I(1)$ variables show the appropriateness of using the ARDL modeling framework for empirical analysis.

Result of Cointegration Test

Table 4: 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	10.46177	10%	2.03	3.13	Cointegration
K	7	5%	2.32	3.5	
		2.50%	2.6	3.84	
		1%	2.96	4.26	

ARDL bound test result where computed F-statistic (10.46) is substantially higher than the upper bound critical values at all conventional significance levels (10%, 5%, 2.5%, and 1%) reject the null hypothesis and confirm the existence of a stable long-run equilibrium relationship between the budget deficit and its explanatory variables. This result justifies the estimation and interpretation of both long-run relationship and short-run dynamics through ARDL approach and associated error correction model (ECM).

Table 5: The Long-run Model

Dependent Variable: BDF					
Method: ARDL					
Selected Model: ARDL(1, 3, 1, 3, 2, 0, 3, 3)					
Variable	Coefficient	Std. Error	t-Statistic	Prob.*	
BDF(-1)	0.225302	0.132992	1.694097	0.1075	
INTR	-0.438419	0.151065	-2.902180	0.0095	
INTR(-1)	0.022968	0.192939	0.119040	0.9066	
INTR(-2)	0.063693	0.205550	0.309868	0.7602	
INTR(-3)	0.577474	0.170388	3.389165	0.0033	
INFR	-0.038342	0.058855	-0.651462	0.5230	
INFR(-1)	0.164953	0.056388	2.925295	0.0090	
EXR	0.126394	0.056884	2.221946	0.0393	
EXR(-1)	-0.017649	0.081221	-0.217297	0.8304	
EXR(-2)	0.106216	0.075824	1.400822	0.1783	

EXR(-3)	-0.169981	0.058930	-2.884451	0.0099
INVR	-0.996468	0.190260	-5.237407	0.0001
INVR(-1)	-0.074938	0.246897	-0.303519	0.7650
INVR(-2)	0.567836	0.213460	2.660155	0.0159
LNTRDOP	0.666735	1.387113	0.480664	0.6365
TD	0.005887	0.050943	0.115554	0.9093
TD(-1)	0.037560	0.041337	0.908632	0.3756
TD(-2)	0.099078	0.061205	1.618780	0.1229
TD(-3)	0.154393	0.059824	2.580770	0.0188
LNEDS	-0.290939	2.543417	-0.114389	0.9102
LNEDS(-1)	5.578371	2.809308	1.985674	0.0625
LNEDS(-2)	-9.817198	2.885799	-3.401900	0.0032
LNEDS(-3)	8.879690	2.253375	3.940618	0.0010
C	-9.648987	5.087530	-1.896596	0.0740
R-squared	0.963923	Prob(F-statistic)	0.000000	
Adjusted R-squared	0.917824	Durbin-Watson stat	2.656317	
F-statistic	20.91001			

The table presents that interest rate, exchange rate, investment, trade deficit, and external debt stock significantly influence the budget deficit and even their effects occur at different lag lengths. The lagged budget deficit, BDF (-1), is positive but statistically insignificant indicating limited persistence in the budget deficit continuously. Lower interest rates (INTR) increases budget deficit but increased interest rate increases budget deficit highly significantly in longer lags. Inflation rate (INFR) shows mixed effects where the contemporaneous or immediate effect is insignificant, whereas the first lag is positive and highly significant, implying that past inflationary pressures contribute to higher budget deficits. Exchange rate (EXR) positively significantly affects budget deficit immediately. If exchange rate increase or home currency depreciation occurs then it increases export competitiveness and make the import expensive at the same time. Since Bangladesh is an import oriented and foreign loan based budgetary country, so such expenses increase budget deficit. Exchange rate impact budget deficit negatively with highly significance in the longer lags due to increase exchange rate or home currency depreciation earn higher tax and VAT from export competitiveness and costly imports without any expenditure which improve the status of budget deficit. Investment (INVR) expresses a strong and very highly significant negative immediate effect on the budget deficit, indicating that increased investment improves employment, export and various taxes and VAT for government which improve the status of budget deficit. Increased investment raises the

budget deficit in lag two when it is debt-financed, inefficient, or characterized by long gestation periods. Bangladesh has faced massive public investment for last fifteen years which are foreign loan based and currency depreciation increases debt servicing which ultimately increase the budget deficit. Trade openness (LNTRDOP) does not significantly affect the budget deficit in the short run. Trade Deficit (TD) impacts the budget deficit only at the third lag, where it is positive and statistically significant, indicating that persistent trade deficits eventually worsen fiscal balances and lower export earnings reduce income and corporate tax revenues as compare to GDP resulting a higher budget deficit. This result supports the “twin deficits hypothesis” which suggests that sustained trade deficits can retreat economy into higher budget deficits over time. External debt (LNEDS) does not affect budget deficit immediately but highly significantly affect in the longer lags positively indicating increased external debt and higher debt servicing cost through increased exchange rate increase the budget deficit. Overall results indicate that macroeconomic variables affect the budget deficit through both immediate and lagged channels. The selected ARDL (1, 3, 1, 3, 2, 0, 3, 3) model demonstrates strong explanatory power as indicated by a high R-squared (0.96) and an adjusted R-squared (0.92) with the F-statistic significant at the 1 percent level while the Durbin–Watson statistic suggests the absence of serial correlation. The overall model is statistically significant with combined effect.

Table 6: Cointegrating (Short-run) Form and Long-run Coefficients based on ARDL Results through Error Correction Model (ECM)

ARDL Cointegrating And Long Run Form				
Dependent Variable: BDF				
Cointegrating (Short-run) Form				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(INTR)	-0.438419	0.151065	-2.902180	0.0095
D(INTR(-1))	-0.063693	0.205550	-0.309868	0.7602
D(INTR(-2))	-0.577474	0.170388	-3.389165	0.0033
D(INFR)	-0.038342	0.058855	-0.651462	0.5230
D(EXR)	0.126394	0.056884	2.221946	0.0393
D(EXR(-1))	-0.106216	0.075824	-1.400822	0.1783
D(EXR(-2))	0.169981	0.058930	2.884451	0.0099
D(INVR)	-0.996468	0.190260	-5.237407	0.0001
D(INVR(-1))	-0.567836	0.213460	-2.660155	0.0159
D(LNTRDOP)	0.666735	1.387113	0.480664	0.6365
D(TD)	0.005887	0.050943	0.115554	0.9093

D(TD(-1))	-0.099078	0.061205	-1.618780	0.1229
D(TD(-2))	-0.154393	0.059824	-2.580770	0.0188
D(LNEDS)	-0.290939	2.543417	-0.114389	0.9102
D(LNEDS(-1))	9.817198	2.885799	3.401900	0.0032
D(LNEDS(-2))	-8.879690	2.253375	-3.940618	0.0010
CointEq(-1)	-0.774698	0.132992	-5.825137	0.0000
Cointeq = BDF - (0.2914*INTR + 0.1634*INFR + 0.0581*EXR -0.6500*INVR + 0.8606*LNTRDOP + 0.3833*TD + 5.6150*LNEDS -12.4552)				
Long Run Coefficients				
Variable	Coefficient	Std. Error	t-Statistic	Prob.
INTR	0.291359	0.218864	1.331236	0.1997
INFR	0.163432	0.100149	1.631892	0.1201
EXR	0.058060	0.061865	0.938506	0.3604
INVR	-0.650021	0.169984	-3.824019	0.0012
LNTRDOP	0.860639	1.702133	0.505624	0.6193
TD	0.383268	0.080867	4.739479	0.0002
LNEDS	5.614991	1.267772	4.429023	0.0003
C	-12.455155	6.067142	-2.052887	0.0549

Explanation of Short-run Dynamics and Long-run Relationship

after Error Correction Presentation:

Short-run Dynamics

The coefficient of the error correction term, CointEq(-1) = -0.7747 is negative and highly statistically significant at the 1% level which confirming the existence of a stable long-run equilibrium and indicating that about 77% of any short-run deviation from the long-run equilibrium is corrected within one period. In the short run, significant variables include interest rate (INTR) and investment (INVR) affects budget deficit negatively while exchange rate (EXR), Trade Deficit (TD) and external debt stock (LNEDS) affect budget deficit positively at various lags.

Long-run Relationships

The long-run coefficients reveal that trade deficit (TD), external debt stock (LNEDS) and investment (INVR) have highly statistically significant effects on the budget deficit. In the long run, investment reduces the budget deficit while trade deficit and external debt stock increase it. Other variables such as interest rate, inflation, exchange rate and trade openness are not statistically significant in the long run but their sign is positive which aligns theoretical concepts. Investment

emerges as the most powerful variable in the model where 1 unit increases in investment decline budget deficit by 0.99 units and 0.56 units immediately and in one lag in the short-run as well as 0.65 units in the long-run. Trade deficit positively impacts budget deficit in the long-run where 1 unit increase in trade deficit increases budget deficit by 0.38 units which aligns twin deficit hypothesis. External debt stock also positively impacts budget deficit in both the short-run and long-run with highly significance where 1 unit increase in external debt stock increases budget deficit by 5.61 units in the long-run.

Granger Causality Tests

Table 7: Pairwise Granger Causality Tests

Null Hypothesis(H ₀)	Obs.	F-Statistic	Prob.	Status of H ₀	Direction of the Relationship
INTR does not Granger Cause BDF	42	2.60995	0.0668	Reject (marginal)	INTR weekly→ BDF
BDF does not Granger Cause EXR	42	2.27414	0.0971	Reject (marginal)	BDF weekly→ EXR
INVR does not Granger Cause BDF	42	2.64317	0.0044	Reject	INVR→ BDF
BDF does not Granger Cause INVR	42	4.44185	0.0095	Reject	BDF→ INVR
LNEDS does not Granger Cause BDF	42	3.00060	0.0436	Reject	LNEDS→ BDF
BDF does not Granger Cause LNEDS	42	3.31216	0.0311	Reject	BDF→ LNEDS
TD does not Granger Cause BDF	42	3.00432	0.0125	Reject	TD→BDF
BDF does not Granger Cause TD	42	2.51884	0.0121	Reject	BDF→TD
EXR does not Granger Cause INTR	42	4.75031	0.0070	Reject	EXR→ INTR
INTR does not Granger Cause EXR	42	3.52149	0.0249	Reject	INTR→ EXR
INVR does not Granger Cause INTR	42	2.63134	0.0653	Reject (marginal)	INVR weekly → INTR

INTR does not Granger Cause INVR	42	5.55135	0.0032	Reject	INTR → INVR
INFR does not Granger Cause INVR	42	3.06474	0.0406	Reject	INFR → INVR
INFR does not Granger Cause LNEDS	42	3.26347	0.0328	Reject	INFR → LNEDS
EXR does not Granger Cause INVR	42	2.25510	0.0991	Reject (marginal)	EXR weekly → INVR
LNTRDOP does not Granger Cause EXR	42	3.20561	0.0349	Reject	LNTRDOP → EXR
TD does not Granger Cause EXR	42	3.60263	0.0228	Reject	TD → EXR
LNEDS does not Granger Cause EXR	42	2.94464	0.0463	Reject	LNEDS → EXR
LNTRDOP does not Granger Cause INVR	42	2.43607	0.0810	Reject (marginal)	LNTRDOP weekly → INVR
TD does not Granger Cause INVR	42	2.73261	0.0584	Reject	TD → INVR
LNEDS does not Granger Cause INVR	42	2.60893	0.0669	Reject (marginal)	LNEDS weekly → INVR
TD does not Granger Cause LNTRDOP	42	3.13094	0.0378	Reject	TD → LNTRDOP
LNEDS does not Granger Cause TD	42	2.31179	0.0931	Reject (marginal)	LNEDS weekly → TD

Budget deficit is strongly influenced by investment, external debt stock and trade deficit where budget deficit and investment, budget deficit and external debt stock as well as budget deficit and trade deficit are bi directionally associated. Twin deficit hypothesis is also proved in Bangladesh through the bidirectional causal relationship between budget deficit and trade deficit. Budget deficit is weekly influenced by interest rate. Investment is strongly influenced by interest rate, inflation rate and trade deficit where weekly influenced by exchange rate, trade openness and external debt stock. Exchange rate and interest rate is bi directionally associated with one another. Exchange rate is influenced by budget deficit weekly but by trade openness, trade deficit and external debt stock strongly. Trade openness is strongly influenced by trade deficit but trade deficit is weekly influenced by external debt stock.

Diagnostics Test

Table 8: Diagnostics Test Result

Test Type	Null Hypothesis	Statistic	Probability	Inference
Jarque-Bera test	Residuals are normally distributed	J-B statistic = 1.545088	Probability = 0.461837	Fail to reject H_0
Breusch-Godfrey Serial Correlation Test	No serial correlation in residuals	F-statistic = 0.859399 Obs*R-squared = 1.77149	Prob. F(2,16)= 0.2934 Prob. Chi-Square(2)= 0.3046	Fail to reject H_0
Heteroscedasticity Test	Variance of the residuals is constant or homoscedastic	F-statistic = 1.509836 Obs*R-squared = 27.66179 Scaled explained SS=4.594938	Prob. F(23,18)= 0.1879 Prob. Chi-Square(23)= 0.2288 Prob. Chi-Square(23)= 1.0000	Fail to reject H_0
Stability Diagnostics: Ramsey RESET Test	Regression model does not suffer from functional form misspecification	t-statistic=0.052545 F-statistic=0.002761	Prob.= 0.9587 Prob.= 0.9587	Fail to reject H_0

The diagnostic tests indicate that the regression model satisfies the key classical linear regression assumptions. The Jarque–Bera test shows that the residuals are normally distributed, as the null hypothesis of normality cannot be rejected. The Breusch–Godfrey serial correlation test provides no evidence of autocorrelation in the residuals, confirming error independence. The heteroscedasticity test suggests that the variance of the residuals is constant, indicating homoscedasticity. Finally, the Ramsey RESET test reveals no signs of functional form misspecification, implying that the model is correctly specified. Overall, these results suggest that the estimated model is statistically sound and that the coefficient estimates and inference drawn from the regression are reliable.

POLICY RECOMMENDATIONS

Investment is the most powerful tool for reducing the budget deficit in both the short run and the long run in this study. The study recommend that government should reset fiscal policy toward productive private and public investment particularly in infrastructure and human capital

rather than recurrent expenditure through improving the business climate, strengthening financial intermediation and overall accountability.

The long-run results and bidirectional Granger causality confirm the twin deficit hypothesis in Bangladesh. Export-promoting policies should be strengthened through diversification of export products and markets. Reduce import dependence by encouraging domestic production of import-substituting goods particularly intermediate and capital goods. Exchange rate management should focus on maintaining external competitiveness, given the strong causal links between exchange rate, trade deficit and budget deficit.

External debt stock has a large and highly significant positive impact on the budget deficit especially in the long run and exhibits bidirectional causality with the budget deficit. Government should limit excessive reliance on external borrowing for budget financing particularly non-concessional debt. External borrowing should be strictly applied to high-return investment projects that generate future fiscal revenues. Strengthening debt sustainability frameworks and improving debt monitoring and transparency are essential to avoid debt-deficit spirals.

Since higher interest rates affect investment negatively in this study, so coordination between fiscal and monetary policy is crucial to be supportive of investment growth rather than purely focused on deficit reduction.

Exchange rate policy should be carefully managed to avoid excessive volatility which can worsen trade deficits and debt servicing costs and to enhance the trade openness must be accompanied by export competitiveness measures. Inflation rate also be reduced to reduce the budget deficit of Bangladesh economy.

CONCLUSION

The study has provided a comprehensive econometric analysis of the effect of selected macroeconomic variables including trade deficit, external debt stock, trade openness, inflation rate, interest rate, exchange rate and investment rate on budget deficit from 1980 to 2024 fiscal years in Bangladesh economy. Applying rigorous statistical methods such as Augmented Dicky-Fuller method of unit root test, ARDL bound cointegration test, Error Correction Model and Granger causality analysis to show comprehensive insights into both the long-run and short-run relationship. The long-run results identify investment, trade deficit, and external debt stock as the key drivers of Bangladesh's budget deficit. Investment emerges as the most influential factor, significantly reducing the deficit in both the short run and the long run. In contrast, trade deficit and external debt stock significantly increase the budget deficit in the long run. The positive and significant relationship between trade deficit and budget deficit supported by bidirectional Granger causality confirms the validity of the twin deficit hypothesis in Bangladesh. Diagnostic tests

confirm that the estimated model is statistically sound and the results are robust. Overall, the findings suggest that sustainable budget deficit reduction in Bangladesh requires a policy framework centered on productive public and private investment. Coordinated fiscal, monetary, external debt and exchange rate policies are required to control budget deficit and trade deficit in Bangladesh.

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