Causal Relationship between Economic Growth and Government Spending in Bangladesh: Using Co-Integration and Error-Correction Models

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Abstract: This study examines the relationship between government spending and economic growth in Bangladesh from 1996-2022. The research uses time series data from mentioned period of the country, focusing on the government's significant allocation of its annual budget towards infrastructure. Augmented Dickey Fuller test is applied to check data stationary of the taken variables. The Granger causality Wald test is used to confirm the significant impact of government spending on GDP growth. However, the study uses co-integration and error-correction modeling, along with Hsiao's Granger causality approach, to identify a causal relationship. The study found no co-integration between government spending and economic growth using the Johansen co-integration test. The Granger Causality Test results do not support the effect of economic growth on government spending, but government spending significantly influences economic growth. This supports the Keynesian economic system, where government spending is used as a policy instrument to stimulate economic growth.

Keywords: Government Spending; Consumption; Investment, Causality; Economic Growth.

INTRODUCTION

Bangladesh's economy has made considerable progress since independence in 1971. Economists consider GDP as a tool of growth to evaluate the performance of the economy. Bangladesh has achieved growth in GDP at an average rate of 6.3% over the past decade (Yasmin & Karim, 2023). The relationship between economic growth and government spending has been a topic for research in public finance and macroeconomic modeling (Kolluri et al., 2000). In public finance the research studies have concentrated on indulgent the causes of growth of the public sector. While, the macroeconomic modeling has been on examining the short and long term influence of government spending policies on economic growth and development. Knowing the effect of government spending on economic growth provides a perception into the conceivable effect of fiscal adjustment policies on correction the fiscal deficit.

The studies aim to evaluate the impact of government services on private decision making and the effects of government spending on long-term economic growth. Especially, the Keynesian theory suggest that government spending hasten the economic growth of a country. Theoretical models are reviewed to understand their relevance in explaining the impact of fiscal adjustment policies on economic growth. According to the Keynesian model, government spending is autonomous and exogenous (Branson, 1979; Levacic & Rebmann, 1991).

Government spending is a policy tool that influences economic growth and short-term output fluctuations. The Keynesian model suggests that cuts in government spending or fiscal deficits lead to a decline in aggregate demand and income, affecting aggregate demand through the negative multiplier effect, resulting in economic growth decline and increased unemployment. Wagner's law emphasizes economic growth as the fundamental determinant of public sector growth, as explored in other studies.

According to Wagner, there are three reasons for increased government spending importance in an economy include industrialization, the increasing complexity of economic life and urbanization, and the high income elasticity of demand for government services. As per capita income increases, demand for government services increases rapidly, raising the share of public sector expenditure in GDP. Additionally, technological change and growing firm scale may create monopolies, which the state must offset to maintain law and order. As a result, the state's role in maintaining law and order and economic regulation is likely to become more pronounced.

Policymakers often focus on demand management policies and supply side policies to stimulate growth. Demand management policies manage money supply and government expenditures, affecting financial market liquidity and private spending. Changes in government spending directly affect aggregate demand in the economy.

OBJECTIVES OF THE STUDY

The main objective of this paper is to find out the long-run relationship between government spending and economic growth in Bangladesh. Besides this we also aim to:

1. To find the causal relation between government spending and economic growth.

2. To estimate the tendency of these two variables in future.

DATA AND METHODOLOGY

The analysis uses secondary data and a time frame of 1996-2022. Secondary sources include Bangladesh Economic Review which is issued by the Ministry of Finance, the government of the People's Republic of Bangladesh. Government spending (GE), GDP (Y), investment (INV), and export (EXP) are taken for this study. Multiple modeling issues are used to confirm dynamic linkages among variables. The study utilized the Augmented Dickey Fuller (ADF) test to identify unit-root problems in a data set, followed by the Johansen co-integration test to examine long-run relationships among variables and error correction models, and the Granger causality test to show the causality among the variables using STATA 12.

REVIEW OF THE LITERATURES

The discussion on the link between government spending and economic growth is complex, with numerous theoretical and empirical studies examining the validity of Wagner's or Keynesian public expenditure laws. Some studies favor Wagner's law, while others support the Keynesian hypothesis. Some studies also show causality between government spending and economic growth.

1. The studies by Bagdigen and Cetintas (2004), Rauf et al. (2012), and Ray and Ray (2012) have all found no causal relationship between national income and public expenditure in Turkey, Pakistan, or India, thereby rejecting Wagner's law or the Keynesian hypothesis. These findings highlight the need for further research and understanding of economic growth and government spending.

2. Ram (1986) conducted empirical research indicating a positive correlation between growth and government spending.

3. Grier and Tullock's 1989 study found a negative correlation between economic growth and the government share of GDP, suggesting that a rise in government size hinders economic growth, as evidenced by the proportion of government spending to GDP, based on five-year averaged data from 113 nations.

4. Kalam and Aziz (2009) and Rahman et al. (2010) found a causal relationship between national income and public spending in Bangladesh and Pakistan, following Wagner's law.

5. Ifa and Guetat's 2018 study on the impact of government spending on education on Tunisia and Morocco's GDP per capita from 1980-2015, using the Auto-Regressive Distributive Lags (ARDL) approach, found that education spending positively and significantly influenced both countries, with Morocco showing a more intensive impact.

6. Miller and Russek (1997) found that increased government spending through debt financing slowed down growth.

7. Al-Shatti (2014) a Jordanian study using a multiple regression approach found that government spending, both short and long term, did not significantly impact economic growth between 1993-2013.

8. Magazzino's 2010 study in Italy confirms the Keynesian hypothesis for government spending, while Ayo et al.'s 2011 study in Nigeria demonstrates a two-way causal relationship between government spending and economic growth in both short and long terms.

9. Islam and Nazemzadeh (2001) examined the correlation between government spending and economic growth using US data, revealing a causal relationship between relative government spending and economic development.

10. Srinivasan's 2013 study, conducted using 1973-2012 data, analyzed the causal relationship between government spending and economic growth in India using a co-integration approach and error correction model. The results showed a long-term equilibrium relationship between public spending and economic growth, confirming Wagner's law.

11. P. K. Mishra (2011) conducted a study on the dynamic relationship between real consumption expenditure and economic growth in India from 1950 to 2009 using the cointegration test.

12. Yasmin and Karim (2023) found there is a unidirectional causal relationship between consumption expenditure and economic growth in Bangladesh. They detected there is a causality of consumption to economic growth using Hsiao's version of the Granger causality method with the aid of co-integration and error-correction modelling.

13. Yasmin and Karim, (2022) showed the causal relationship with investment and economic growth in Bangladesh. Their study found that there exists bidirectional causality between investment and economic growth.

14. Abu-Bader and Abu-Qarn's 2003 study reveals a bidirectional causality between government expenditures and economic growth in Egypt, Israel, and Syria, with a negative long-run relationship in Israel and Syria and a unidirectional negative short-run causality in Egypt.

EMPIRICAL ANALYSIS

To identify the causal relationship between government expenditure and economic growth in Bangladesh the data are analyzed according to the following estimation procedures:

UNIT ROOT TEST

The unit root test is used to determine the stationarity of time series data before conducting co-integration and causality tests. The PP test, proposed by Phillips and Perron (1988), determines the existence of a unit root of each series. If two variables are non-stationary in level but stationary in first differences, a co-integration test can be performed. The theory of co-integration is discussed by Engle and Granger (1987), which determines if the linear combination of these variables is stationary. Davidson and MacKinnon (1993) provide critical values for unit root and co-integration tests. If more than two variables are in the equation, the Johansen co-integration test is appropriate. If co-integration is not present, unit root tests can be used for causality tests. Hafer and Kutan (1977) suggest that stationary variables are necessary for the standard Granger causality test. The ordinary least square method also requires stationary variables in the estimated equation.

GRANGER CAUSALITY TEST

The Granger causality test is performed by the following two equations:

$$x_t=\alpha_0+\sum_{i=1}^{\kappa}\alpha_i y_{t-i}+\sum_{i=1}^{\kappa}\beta_i x_{t-i}+\varepsilon_t \quad (1)$$

and

$$y_t=\gamma_0+\sum_{i=1}^{\kappa}\gamma_i x_{t-i}+\sum_{i=1}^{\kappa}\delta_i y_{t-i}+\nu_t \quad (2)$$

In Eq.(1)

H_O:α_i=0 for$i$=1,2,….k, and H_a:$\alpha_i\neq0$ for at least one i. ForEq.(2)

H0: i 0 for i=1,2,….,k, and Ha: i 0 for at least one i. The variable x Granger causes variable y if the null hypothesis (Ho) in Eq.(1) is rejected. Similarly, the variable y Granger causes variable x if the null hypothesis in Eq.(2) is rejected.

The Granger causality test, developed by Granger (1980), is a widely used method to determine if past changes in one variable explain current changes in other variables. It uses equations (1) and (2) to test whether y Granger causes x and x Granger causes y. The bi-variate Granger causality test requires two variables to be stationary, even if they are not integrated of the same order. However, economic variables are non-stationary in level, and the test can be applied even when one variable is stationary in level and the other in different order. The more sophisticated test is the co-integration and error-correction mechanism test.

MODEL SPECIFICATION

To investigate the association between government spending and economic growth of Bangladesh our study adapts the concept of Granger causality within a bivariate vector auto-regression (VAR) framework. The model is based on the following regression

$$LGE_t = \beta_0+\sum\beta_i LGE_{t-0}+\sum\alpha_i LGDP_{t-0}+\sum\pi_i LIVT_{t-0}+\sum\mu_i LEXP_{t-o}+\varepsilon_t \quad \text{-----(3)}$$
$$i=1 \quad i=1 \quad i=1 \quad i=1$$

$$LGDP_t = \alpha_0+\sum\beta_i LGE_{t-0}+\sum\alpha_i LGDP_{t-0}+\sum\pi_i LIVT_{t-0}+\sum\mu_i LEXP_{t-o}+\nu_t \quad \text{------(4)}$$
$$i=1 \quad i=1 \quad i=1 \quad i=1$$

Where, βo and αo are the intercept; LGE is the government expenditure; LGDP is the nominal GDP; LIVT is the investment and LEXP is the export. It is assumed that the disturbances εt and νt are uncorrelated. All variables are in real and natural logarithm form.

Equation (3) suggests that current government expenditure can be better explained by present and lagged GDP values, rather than past values, assuming LGE and LGDP are stationary. Equation (4) similarly suggests that GE causes GDP, indicating unidirectional causality from GDP to GE. Government expenditure causes GDP if $\sum\alpha i=0$ and $\sum\beta i\neq 0$, while bilateral causality occurs if the sets of LGDP and LGE coefficients are statistically significantly different from zero in both regressions.

Empirical work using time series data assumes the underlying time series is stationary, and regression models are often used for forecasting. If the time series is not stationary (Gujrati, 2003), nonsense regression would arise, making forecasting invalid. The Causality test of Granger assumes the time series is stationary, while the Augmented Dicky-Fuller test is a common statistical test used to determine if the data is stationary.

$$\Delta LGE_t=\beta_1+\beta_2 t+\delta LGE_{t-1}+\alpha_i\sum_{i=1}^{m}\Delta LGE_{t-i}+\varepsilon_t \quad \text{--------(5)}$$

$$\Delta LIVT_t=\beta_1+\beta_2 t+\delta LIVT_{t-1}+\alpha_i\sum_{i=1}^{m}\Delta LIVT_{t-i}+\varepsilon_t \quad \text{------(6)}$$

$$\Delta LEXP_t=\beta_1+\beta_2 t+\delta LEXP_{t-1}+\alpha_i\sum_{i=1}^{m}\Delta LEXP_{t-i}+\varepsilon_t \quad \text{-------(7)}$$

$$\Delta LGDP_t=\beta_1+\beta_2 t+\delta LGDP_{t-1}+\alpha_i\sum_{i=1}^{m}\Delta LGDP_{t-i}+\varepsilon_t \quad \text{-------(8)}$$

Where, εt is the white noise error term assuming serially uncorrelated, ΔLGEt=(LGEt-LGEt-1).m is the number of lags in the dependent variable chosen by Schwarz criterion

The outcome of the unit root test is shown in Table 1. Since all test statistics for the variables except LINV (is not stationary at 1%) are bigger than the 1%, 5%, and 10% critical values, LGDP, LGE, LIVT, and LEXP are stationary at their current level.

Table 1: Unit Root Test (ADF)

Variables	**Test Statistics**	**1% critical**	**5% critical**	**10% Critical**
LGDP	1.497	-0.380	-0.620	-0.240
LGE	1.188	-0.962	-0.562	0.246
LIVT	2.813	-2.989	-2.621	-0.348
LEXP	-1.339	-1.280	-0.985	-0.242

Table 2: Johansen tests for co-integration

Maximum Rank	**Parms**	**LL**	**Eigenvalue**	**Trace Statistic**	**5% critical value**
0	21	-526.89903		46.5100	48.23
1	26	-509.15441	0.83449	27.0208	28.69
2	33	-487.97416	0.46128	12.6603	16.42
3	34	-484.28475	0.31247	2.2915	3.79
Maximum Rank	**Parms**	**LL**	**Eigenvalue**	**Max Statistic**	**5% critical value**
0	21	-526.89903		27.4892	28.07
1	26	-509.15441	0.83449	15.3605	21.97
2	33	-487.97416	0.46128	9.3688	15.07
3	34	-484.28475	0.31247	2.3815	3.77

Table 2 shows the results of the Johansen co-integration test. We observe that the trace statistics are less than the threshold value of 5%, indicating the presence of no long-term link among the variables.

RESULTS OF CAUSALITY TEST

With no long-run relationship between government expenditures (G) and economic growth (y), the standard Granger causality test is performed using G variable at level and first difference of Y variable. The optimal lag length for the causality test is determined by a vector autoregressive (VAR) form. When G and y are endogenous variables in an unrestricted VAR, the optimal lag length using Akaike information criterion (AIC) is four. The standard Granger causality test results between government expenditure and growth rate are reported in Table 3.The null hypothesis of government spending (G) does not Granger cause economic growth (y) is rejected at the 1 percent level of significance.

Given that there is no long-term correlation between government spending (G) and economic growth (y), the typical Granger causality test is done with the G variable at level and the Y variable's initial difference. For the causality test, a vector autoregressive (VAR) form yields the ideal lag length. Using the Akaike information criterion (AIC), four is the ideal lag time when G and y are endogenous variables in an unconstrained VAR. Table 3 presents the findings of the typical Granger causality test between growth rate and government spending. At the one percent significance level, the null hypothesis—that government expenditure (G) does not impact economic growth (y)—is rejected. Therefore, there is a unidirectional causal relationship between government spending (G) and

economic growth (y). Conversely, the null hypothesis of economic development implies that government spending do not follow a causal relationship with economic growth.

Table 3: Results of Causality Test

Direction of Causation	F Statistic	P-value
Ho:*G* does not cause y	5.768	0.005
Ho:y does not cause *G*	0.254	0.812

The null hypothesis is rejected for G does not cause y (growth rate).

CONCLUSION AND POLICY IMPLICATIONS

This study investigates the relationship between government expenditures and economic growth. Using the Granger causality test, the results show that aggregate government expenditures cause economic growth, but economic growth does not cause expenditures to expand. A unidirectional causality exists between government expenditures and economic growth. The least square method confirms this causality. The study's limitation is the lack of disaggregate data for military and non-military spending, making comparison between impacts impossible. However, the positive impact of government expenditures on economic growth is confirmed, supporting the Keynesian approach, which suggests causality runs from government spending to economic growth. Therefore, as a tool for fiscal policy, government expenditure must be implemented in a way that is sustainable, effective, and efficient. The stability of domestic and regional economic growth may then be sustained by it. As a result, it will affect how economic advantages are distributed both nationally and among regions.

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