DOES BUDGET DEFICIT IMPEDE ECONOMIC GROWTH? EVIDENCE FROM BANGLADESH

Md. Nurul Kabir Biplob

Begum Rokeya University, Rangpur, Bangladesh

http://doi.org/10.31039/jomeino.2019.3.2.5

Received 12 April 2019

Revised 25 April 2019

Accepted 02 May 2019

Corresponding author:
nkbiplob@brur.ac.bd

Abstract

The purpose of this study is to investigate the impacts of budget deficit on economic growth in Bangladesh over the period of 1981-2017. This study employed the autoregressive distributed lag (ARDL) model to capture long-run cointegration along with long-run and short-run elasticity of the explanatory variables. Moreover, directional causalities between the variables used in this study have been checked using vector error correction model (VECM). The results of the analysis under ARDL model revealed that in case of Bangladesh, budget deficit positively affects economic growth both in long-run and short-run while government total expenditures lead to increase GDP only in long-run. These findings support the Keynesian proposition that budget deficits crowd-in private investments resulting economic growth. Furthermore, directional causality tests conducted using VECM explored unidirectional causality running from budget deficit to economic growth while feedback causality has been found between governments total expenditures and economic growth. For policy implications, this research provides evidence that in an emerging economy like Bangladesh, government spending through deficit financing can drive positively in the level of economic growth. Bangladesh, however, should not have the luxury of forgetting about the bad consequences of consistent and gradually increasing budget deficit at all.

Keywords: *Budget Deficit, Autoregressive Distributed Lag Model, Vector Error Correction Model, Economic Growth, Government Expenditure, Bangladesh.*

1. Introduction

What should be the country's fiscal policies? Should the government meet all its expenditures from tax revenues or by together deficits financing and tax revenues? Are the impacts of deficit financing positive, negative or irrelevant over macroeconomic conditions? Yet, the answers of these sorts of question are still inconclusive. Economists, researchers and policy makers have provided mixed opinions and outcomes regarding the effects of budget deficit on economy. For instance, Keynesian economists highlight the crowding-in effects of budget deficit on the economy. This implies that investing with deficit financing in public infrastructure such as roads, airports, and railway networks as well as social welfare and education programs can stimulate a country's domestic production and private investment (Van & Sudhipongpracha 2015). On the contrary, neoclassical economists focus on the effects of permanent deficit rather temporary deficit. They argue that budget deficit has very little crowding-in effects in short-run but increases current aggregate demand and declines national savings which in turn cause higher interest rate. The higher interest rate then reduces private investment which is referred to as crowding-out effect of budget deficit (Van & Sudhipongpracha 2015). Meanwhile, Ricardian equivalence theory postulates that economic growth does not depend upon fiscal deficit financing. Now a day, the efficient management of government expenditures is considered as prerequisite for sustainable economic growth and social stability in almost all of the developed and developing countries. Therefore, extensive empirical studies have been conducted to investigate the relationship between budget deficit and economic growth all over the world but very few in Bangladesh. (see, for example, Van & Sudhipongpracha 2015; Abdullah et al. 2018; Hussain & Haque 2017; Barro 1991; Ahmed and Miller 2000;)

In recent time, Qimiao Fan, World Bank country director for Bangladesh, Bhutan, and Nepal said that Bangladesh has become one of the 10 fastest growing economies owing to success of its efforts in reducing poverty and developing human capital[1]. According to World Bank statement on Bangladesh economy-"Progress was underpinned by 6 percent plus growth over the decade and reaching to 7.9 percent in 2017/2018, according to official estimates"[2]. Though, Bangladesh has gained immense attention from all over the world because of its rising economy, it has been experiencing shortfall in national budget since when it has emerged as an independent country. Recent repot of Bangladesh Economic Review[3] states that In FY2017-18, the country's budget deficit stood at 5% of its GDP which is identical over three consecutive financial years starting from FY 2014-2015 to FY 2016-2017. Bangladesh has been financing most of its fiscal deficit by borrowing domestically for last seven or eight years before that deficit financing was heavily

[1] Source: http://www.worldbank.org/en/news/press-release/2018/10/02/economic-reforms-can-make-bangladesh-grow-faster
[2] http://www.worldbank.org/en/country/bangladesh/overview Accessed on January 25, 2019.
[3] Bangladesh Economic Review-2018, Published by Finance Division, Ministry of Finance, Bangladesh. Source: https://mof.gov.bd/site/page/44e399b3-d378-41aa-86ff-8c4277eb0990/BangladeshEconomicReview

depended on international borrowings. Thus, according to standard view [4](Tas 1992) of budget deficit, these economic scenarios of Bangladesh create an scope to investigate the effects of budget deficit and/or government expenditures on economic growth. This study endeavors to satisfy this gap by considering most recent data of budget deficits, economic growth and other macroeconomic variables of Bangladesh covering the periods of 1981 to 2017.

The fundamental ideal as well as the purpose of this study is to analyze the impact of budget deficit which is considered as a magnitude of government spending on economic growth while considering some macroeconomic variables. However, one could claim that economic growth may perhaps stimulate budget deficit financing. This direction of causality from economic growth to budget deficit seems less appealing to the researches, economists and policymakers as it is implausible that economic growth could deteriorate the capability of government spending. Based on the extant literature, to see whether the emerging economy, like Bangladesh, follows Neoclassical or Keynesian or Ricardian paradigm of budget deficit, this study employ Autoregressive Distributed Lag(ARDL) model and Granger Causality test under Vector Error Correction Model(VECM) framework. Furthermore, this study investigates the relationship between government total expenditure and economic growth with the intention of making more robust inference on the fundamental idea of this research.

The need for conducting this research on the relationship of budget deficit and economic growth in Bangladesh is justified under the following reasons: First of all, the study will help the policy makers of Bangladesh in formulating effective tax policy. Second, this study will lend support in measuring the country's threshold level of government debt-taxation ratio. Third, Policy makers of Bangladesh will find the results of this study interesting and informative as the study considered other influential macroeconomic variables namely government total expenditure, money supply, inflation, real effective exchange rate, real interest rate and gross capital formation. Finally, the author is not aware of any study on this issue for Bangladesh (Abosedra et al. 2015) using autoregressive distributed lag (ARDL) model as it is more privileged, sophisticated and empirically appealing econometric model in capturing long-run co-integration over other cointegration models. Moreover, this study used vector error correction model (VECM) to examine the directional causality between the variables.

The remaining sections of this paper is structured by following manners: section 2 presents theoretical views as well as previous empirical studies on the nexus between budget deficit and economic performance; section 3 describes the data and methodology used in this study; empirical results are discussed in section 4; finally, section 5 presents conclusion and policy recommendations on the results discussed in section 4 of this paper.

[4] in an open economy, the country's budget deficit would affect real interest rate only if it is large enough to influence international capital market or else deficit financing only leads to increase borrowing from abroad leaving behind real interest rate unaffected which also indicate, in contrast that country's with substantial borrowing from domestic market might have faced crowding-out or crowding-in effects in its economy.

2. Literature Review

Not surprisingly, for a long period of time, the economic effects of budget deficit have become the most debated issue among researches, economists and policy makers in both developed and developing counties. Yet, unanimous proposition has not been developed on this issue due to mixed empirical results produced by the researchers. This study presents a brief review of theoretical and empirical studies that attempted to investigate the effects of budget deficit on economic performance.

2.1. Budget Deficit and Economic Growth nexus in Theory

Theoretically, there are three distinct schools of thought concerning the relationship between budget deficit and macroeconomic variables: Neoclassical, Keynesian, and Ricardian. Bernheim (1989) provides a brief summary of the basic structure and implications of each of the three paradigms. The Neoclassical paradigm imagines farsighted individuals scheduling consumption over their own life cycles. By shifting taxes to following generation, budget deficit rises current consumption. Under the assumption of full employment of economic resources, neoclassical school argues that increased aggregate consumer demand leads to decline national saving and eventually interest rate must increase in order to restore the equality between desired national savings and investment demand. The higher interest rates then cause lower private sector spending which, in turns, appears in the long run as a smaller stock of production. Concisely, persistent deficits "crowd out" private capital allocation.

In contrast to crowding out effect, Keynesians claim that budget deficits have beneficial consequences to the economy. They argue that increased debt finance government spending can boost economic activities which create an opportunity to private sectors to expand their operations towards profitability. This is known as the "Crowding-in" effect. It is worth mentioning here that the conventional Keynesian view contrasts from the standard neoclassical paradigm in two fundamental ways. First, it permits that there is a likelihood of being unused in some economic resources. Second, it assumes that there is significant number of individuals with constrained liquidity. Based on the second assumption, one could conclude that change in disposal income can considerably influence aggregate consumption. Many traditional Keynesians argue that deficits have negligible crowding out effects on economy. Eisner (1989) is an example of this group, who recommends that increased in current national consumption enhances the profitability as well as the level of private investments at any given rate of interest. Therefore, deficits may excite aggregate saving and private investment notwithstanding the fact that they cause higher interest rates. He concludes that deficits have crowded-in investment rather been crowding-out".

Meanwhile, based on the assumption of successive generations linking through voluntary, altruistically motivated resource transfers, Ricardian equivalence theory put forward that government deficit policy has no impact on economic performance. Barro (1989), an advocate of the Ricardian equivalence paradigm, who contends that an expansion in budget deficits, state because of an expansion in government spending, must be paid for either now or later, with the

aggregate present value of receipts settled by the aggregate present value of spending. In this manner, a cut in the present taxes must be matched by an expansion in future taxes, leaving financing costs, and accordingly private investment, unchanged.

In summary, Neoclassicists believe that budget deficit is negatively related with economic growth while Keynesians claim that there is a positive relationship between budget deficit and economic growth. On the contrary, Ricardians argue that deficit policy is a matter of indifference (Rahman 2012). Like different school of thoughts, researchers have found mixed results on the relationship between budget deficit and macroeconomic variables (such as interest rate, inflation, exchange rate, trade deficit, economic growth and so on.)

2.2. Review of Empirical Studies

Extensive empirical studies have been conducted to examine the effects of public expenditure or investment on private investment and economic growth mostly because of the crowding out[5](e.g. Chhibber and Wijenbergen 1988; Landau 1983, Barro 1991, Ghali 1998; Buiter 1977; David and Scadding 1974; Yellen 1989; among others) or "crowd-in[6] (Ghali and Al-Shamsi 1997; Bahmani 1999, Aschauer, 1989a 1989b; Eisner 1989; Heng 1997; Ramirez 1994; among others) effects of public spending.

Chhibber and Wijenbergen (1988) carried out a research on the relationship between public policy and private investment. Based on the Turkish data, they found that deficit financing from domestic capital markets induces in higher interest rate causing lower private investment. Barro (1991) in his study, found a negative relation between government consumption expenditure and economic growth based on the cross country (98) analysis during the period 1960-1985. In a cross country (100) study Landau (1983) revealed evidence of crowding out effects of government expenditures which eventually declines the growth rate of real per capita of GDP. Following Barro's (1990), based on annual data of 1960-1996 Ghali (1997) conducted a research on the relationship between public spending and economic growth in Saudi Arabia and found no strong evidence between them. To examine long-run effects of public investment on private capital formation Ghali (1998) used vector error correction on Tunisian data from 1963 to 1993 and found negative impact of public investment on economic growth and private investment.

Bahmani (1999) used Johansen-Juselius cointegration technique on quarterly data covering period from 1947:1 to 1992:2 of US federal to examine the long-run association between U.S. federal real budget deficits and real fixed investment. Empirical results of this study pointed out Keynesians paradigm of budget deficit meaning that budget deficits crowd-in private investment. Ramirez (1994) and Ouattara (2004) in their individual study revealed the expansionary or crowding-in effects of budget deficit on economic growth in Mexico and Senegal respectively. Using error correction model on quarterly data over the period 1970:1-1991:4 of Australia, UK and USA

[5] Crowding-out is a situation when increasing public sector spending lower or even get rid of private sector spending
[6] Crowding-in, opposite of Crowding-out, means the positive impact of public investment through borrowings on the private sector investment, hence economic growth.

Monadjemi and Huh (1998) found negligible negative effect of government expenditure on private investment.

Aschauer (1989b) examined the impact of public expenditure on private investment using annual time series data of US covering the period from1953 to 1986 and the empirical results indicated positive link running from public investment to private investment thus crowding-in effects. In their study, Ahmed and Miller (2000) applied OLS, fixed-effect and random-effect methods on the cross country data of 39 including developed and developing countries to investigate the influences of disaggregated government expenditure on investment. They found that government expenditure on transport and communication affects private investment positively in developing countries while social security and welfare expenditure of government hinder investment in both developed and developing countries. Nkrumah et al. (2016) conducted a study on the relationship between budget deficit and economic growth of Ghana. Based on their trend analysis as well as econometric models they found negative impacts of budget deficit on economic growth.

In the context of Bangladesh economy Abdullah et al. 2018 tried to explore the optimum level of budget deficit as well as its effects on economic growth by using Johansen cointegration procedure and VECM. The findings of their study indicated long-run positive association running from budget deficit to economic growth. They also revealed the threshold budget deficit for Bangladesh ranging from 4.55 to 5.0 percent of GDP in their study.

Hussain and Haque (2017) studied the relationship between fiscal deficit and economic growth of Bangladesh. Using two datasets from two different sources (BBS & WB)[7], they provided two opposite results. Based on BBS data covering period of 1993-94 to 2015-2016, they revealed expansionary effects of fiscal deficit on economic growth while WB data over the period 2001-2014 provided negative and significant impacts of budget deficit on economic growth. With the help of econometric tools such as unit root test, cointegration test, error correction model Majumder (2007) tried to explore whether government borrowing crowd-out private invest in case of Bangladeh. The findings of their study indicate crowding-in effects of budget deficit on economic growth meaning that deficit financing is driving forces to increase economic growth in Bangladesh.

Based on the quarterly data over the period 2000-2012, Haider et al. (2016) examined the relationship between budget deficit and economic growth in the context of Bangladesh. Using various econometrics techniques, they found negative impact of budget deficit on economic growth. Using various econometric techniques such as Augmented Dickey-Fuller test, Johansen co-integration test, Vector Error Correction Model (VECM) to investigate budget deficit and economic growth nexus of Bangladesh, Hassan and Akhter (2014) carried out a study following the model developed by shojai (1999). The results of their study support the neoclassical proposition that deficit financing affects economic growth negatively.

[7] BBS stands for Bangladesh Bureau of Statistics; WB stands for World Bank.

3. Data and Methodology

3.1. Data Description and Sources

This study is cried out based on annual time series data covering time period from 1981 to 2017. Data are extracted and transformed from various sources namely World Development Indicators (WDI)[8] produced by World Bank, World Economic Outlook (WEO)[9] published by the IMF, Bangladesh Economic Review (BER)[10] published by the Ministry of Finance and Bruegel datasets[11]. Meanwhile, data of budget deficit form1981 to 1993 are collected from Benson and Clay (2002)[12] published by World Bank.

This study made an attempt to investigate the causal impact of budget deficit on economic growth, thus economic growth has considered as dependent variable. Gross Domestic Product (GDP) was considered as the economic growth indicator. It has been widely assumed and acknowledge by the policy makers as well as economic practitioners that an increasing trend in GDP over the selected period of time indicates the growth of an economy.

The study examined the causal relationship between budget deficit, magnitude of government spending, and economic growth at which budget deficit was considered as independent variable. Moreover, Government total expenditure was also used as an independent variable in an alternate model specification to create more robustness on the findings of the study.

In order to create robustness in the model and to isolate the relation of budget deficit with economic growth as well as the relation of government expenditure with economic growth, this study used five control variables. The first control variable is the M2, broad money, with proxy of money supply in the economy (for example Nguyen 2015, Chaitip et al. 2015; Biplob & Halder 2018; Qamruzzaman & Wei 2018). The Monetarists Claim that monetary policy influences prices, but not economic growth or unemployment while Keynesians, with an efficient monetary policy, believe that changes in money supply cause to change in real GDP and prices. The study expects a positive impact of M2 on GDP.

Inflation (INF) measured in annual percentage changes in the consumer price index (CPI) used as a second control variable and expected to negatively affect economic growth in this study. Researchers have found mixed results on the relation of inflation with economic growth (see for example, Wai 1959; Bhatia 1960; Evans & Lewis1995; De Gregorio 1992; Nell 2000; Ahmed & Mortaza 2005).

The third control variable used in this study is real effective exchange rate (REER) and expected to positively/negatively affect economic growth. Economists often argued that a high real

[8] Data set is available at https://data.worldbank.org/country/bangladesh
[9] Data set is available at https://www.imf.org/external/pubs/ft/weo/2018/02/weodata/index.aspx
[10] Data set is available at https://mof.gov.bd/site/page/44e399b3-d378-41aa-86ff-8c4277eb0990/BangladeshEconomicReview
[11] Data set is available at http://bruegel.org/publications/datasets/real-effective-exchange-rates-for-178-countries-a-new-database/
[12]Data set is available at http://lib.riskreductionafrica.org/bitstream/handle/123456789/388/3671.Bangladesh.%20Disasters%20and%20Public%20Finance.pdf?sequence=1

exchange rate (devaluation of the currency) excite economic growth, particularly in developing countries. (For instance, see, Ito et al. 1999; Eichengreen 2007; Razzaque et al. 2017; Rodrik 2008)

With the mechanism of low inflation expectations, economy's attractiveness to foreign investors, the technological transfer effect, the accumulation of domestic savings, economist believe that high nominal and real interest rates may not worsen economic growth (Drobyshevsky 2016; Lee and Werner 2018). while some economist found an inverse relationship between interest rate and economic growth (Babalola et al. 2015). Thus, the study also included real interest rate (RIR) as a fourth control variable and expected either positive or negative effect on economic growth.

The fifth control variable of this study is gross capital formation (GCF) as a percentage of GDP, with proxy of investment in the economy. (Biplob & Halder 2018; Qamruzzaman & Wei 2018). According to World Bank (2018), GCF refers to the change in the level of fixed asset and inventories in the economy.

For the purpose of analysis and applying empirical model, this study used natural log of all the variables. The statistical data analysis package Eviews 10.0 was used for every estimation and diagnostic tests of this paper. Table 1 exhibits the summary of research variables, their sources, units, scale and expected sign in the individual coefficient.

Table 1: Summary of Research Variables, Sources and Expected Impact

Variable	Measurement	Units	Scale	Epithet	Expected Sign	Sources
Dependent	Gross Domestic Product	National Currency	Billions	GDP		WDI
Independent	Budget Deficit	National Currency	Billions	BDF	Positive/ Negative	BER; Benson and Clay (2002)[13].
	Government Total Expenditure	National Currency	Billions	GTEX	Positive/ Negative	WEO
Control	Broad Money	National Currency	Billions	M2	Positive	WDI
	Inflation, average consumer prices index	Percent change		INF	Negative	WEO
	Real Effective Exchange Rate	Index		REER	Positive/ Negative	Bruegel datasets[14]
	Real Interest Rate	Percentage		RIR	Negative	WDI
	Gross Capital Formation	Percentage of GDP		GCF	Positive	WDI

[13] Data set is available at http://lib.riskreductionafrica.org/bitstream/handle/123456789/388/3671.Bangladesh.%20Disasters%20and%20Public%20Finance.pdf?sequence=1

[14] Data set is available at http://bruegel.org/publications/datasets/real-effective-exchange-rates-for-178-countries-a-new-database/

3.2. Empirical Methodology

The main objective of this is to investigate the impact of budget deficit on economic growth. With the intention of examining the link between budget deficit and economic growth formally, this study consider the following log-linear empirical model [Model-1]

$$LnGDP = \delta + \mu_1 LnBDF + \mu_2 LnM2 + \mu_3 LnINF + \mu_4 LnREER + \mu_5 LnRIR + \mu_6 LnGCF + \varepsilon_t \quad [1]$$

Where, δ for the constant, ε_t is the error term assumed to be normally, identically and independently distributed, while $\mu_1, \mu_2, \mu_3, \mu_4, \mu_5, \mu_6$ are respective unbiased coefficients.GDP for gross domestic product, BDF for budget deficit, GTEX for government total expenditure, M2 for money supply (broad money), INF for inflation, REER for real effective exchange rate, RIR for real interest rate, and GCF for gross capital formation.

Furthermore, in order to make the results generated from equation (1) more robust this study also developed the following log-linear model [Model-2][15]

$$LnGDP = \delta + \mu_1 LnGTEX + \mu_2 LnM2 + \mu_3 LnINF + \mu_4 LnREER + \mu_5 LnRIR + \mu_6 LnGCF + \varepsilon_t \quad [2]$$

Where, GTEX is used as an independent variable instead of Budget Deficit and stands for Government Total Expenditure.

3.2.1. Unit Root Tests

For analyzing cointegration or long-run equilibrium relationship between the time series variables, it is necessary to check the order of integration in the variables. A time series is said to be stationary or integrated of order zero; ***I (0),*** if it has not found unit root at level or else it is referred to as non-stationary; for instance, integrated of first order difference or second order difference; ***I (1)/I (2).***

Thus, with the purpose of determining order of integration, this study applied Augmented Dickey-Fuller (ADF), Phillips-Perron (PP) tests with null hypothesis of non-stationarity and Kwiatkowski–Phillips–Schmidt–Shin (KPSS) test with null hypothesis of stationarity. This research conducted tests of two opposite null hypothesis because of making more strong conclusion on stationarity issue of the time series under consideration.

3.2.2. The Autoregressive Distributed Lag (ARDL) Model

Researchers often try to examine long-run equilibrium relationship or cointegration between the variables. The extant econometric literatures provide several cointegration techniques which can be applied to identify the long-run associations between the variables such as residual based Engle and Granger (1987) test, the maximum likelihood-based Johansen (1991,1995); and Johansen and Juselius (1990) tests. These cointegration tests are not appropriate when the sample size is small and variables are integrated at different order (Shahbaz et al. 2015). On the other hand, first of all, the Autoregressive Distributed Lag (ARDL) model proposed by Pesaran et al. (2001) allows small

[15] The purpose of formulating model [2] is to check whether the results of model (1) are compatible with the results of model (2). More specifically, to find out the answer of the following question: "Is the impact of budget deficit, a magnitude of government expenditures, on economic growth compatible with the impact of government total expenditures on economic growth?"

or finite sample size with different order of integration of the variables; *I(0) / I (1).* Second, it is easy to explain ARDL model because of its single equation framework (Pan & Mishra 2018). Third, ARDL model allows to take sufficient number of lags in order to modeling from general to specific (Pesaran et al. 2001). Finally, The ARDL model can estimate both long-run cointegrations and short-run dynamics simultaneously (Pesaran et al. 2001). Considering these benefits over other cointegration methods, this study preferred ARDL approach.

Thus, this study specifies the following unrestricted error correction model (UECM) under ARDL bounds testing approach to contigration.

$$\begin{aligned}\Delta lnGDP_t = {} & \alpha_0 + \sum_{i=1}^{k} \beta_{1i} \Delta lnGDP_{t-i} + \sum_{i=0}^{k} \beta_{2i} \Delta lnBDF_{t-i} + \sum_{i=0}^{k} \beta_{3i} \Delta lnM2_{t-i} \\ & + \sum_{i=0}^{k} \beta_{4i} \Delta lnINF_{t-i} + \sum_{i=0}^{k} \beta_{5i} \Delta lnREER_{t-i} + \sum_{i=0}^{k} \beta_{6i} \Delta lnRIR_{t-i} \\ & + \sum_{i=0}^{k} \beta_{7i} \Delta lnGCF_{t-i} + \delta_1 lnGDP_{t-1} + \delta_2 lnBDF_{t-1} + \delta_3 lnM2_{t-1} \\ & + \delta_4 lnINF_{t-1} + \delta_5 lnREER_{t-1} + \delta_6 lnRIR_{t-1} + \delta_7 lnGCF_{t-1} + \varepsilon_t \end{aligned} \quad [3]$$

Where, Δ is the difference operator, α_0 represent constant term, $\beta_1 \, to \, \beta_7$ represents short-run dynamics, $\delta_1 \, to \, \delta_7$ represents long-run associations and ε_t is the error term. To identify the presence of long-run equilibrium relationship between the variables of interest the bounds test proposed by Pesaran et al. (2001) requires conducting *F*-test with the null hypothesis that H_0: $\delta_1 = \delta_2 = \delta_3 = \delta_4 = \delta_5 = \delta_6 = \delta_7 = 0$ in equation (3).
Pesaran et al. (2001) proposed the following decision criteria to accept or rejectH_0;

i. If *F*-Statistic is smaller than the lower bound of critical value, accept H_0 and there is no long-run association between the variables.
ii. If *F*-Statistic is greater than the upper bound of critical value, reject H_0 and there exists long-run association between the variables.
iii. If *F*-Statistic falls between the lower and upper bound of critical value, the decision about the presence of cointegration is inconclusive.

If long-run association is identified among the variables of interest, one could estimate long-run and short-run coefficients using following procedures. For long-run coefficients the ARDL model specified in this study as;

$$lnGDP_t = \mu_0 + \sum_{i=0}^{k} \theta_{1i}\, lnGDP_{t-i} + \sum_{i=0}^{m} \theta_{2i}\, lnBDF_{t-i} + \sum_{i=0}^{n} \theta_{3i}\, lnM2_{t-i} + \sum_{i=0}^{p} \theta_{4i}\, lnINF_{t-i} + \sum_{i=0}^{q} \theta_{5i}\, lnREER_{t-i} + \sum_{i=0}^{x} \theta_{6i}\, lnRIR_{t-i} + \sum_{i=0}^{z} \theta_{7i}\, lnGCF_{t-i} + \vartheta_t \quad [4]$$

Where; k, m, n, p, q, x and z represent the lag length of the variables. Schwarz Bayesian criterion (SIC) has been used to select optimal lag length because of its superior properties and efficient results over other information criterion such as Akaike information criterion (AIC), Hannan-Quinn criterion (HQ).

For short-run dynamics, restricted error correction model (ECM) under ARDL approach is formulated as;

$$\Delta lnGDP_t = \partial_0 + \sum_{i=1}^{k} \gamma_{1i} \Delta lnGDP_{t-i} + \sum_{i=0}^{k} \gamma_{2i}\, \Delta lnBDF_{t-i} + \sum_{i=0}^{k} \gamma_{3i}\, \Delta lnM2_{t-i} + \sum_{i=0}^{k} \gamma_{4i}\, \Delta lnINF_{t-i} + \sum_{i=0}^{k} \gamma_{5i}\, \Delta lnREER_{t-i} + \sum_{i=0}^{k} \gamma_{6i}\, \Delta lnRIR_{t-i} + \sum_{i=0}^{k} \gamma_{7i}\, \Delta lnGCF_{t-i} + \varphi ECT_{t-1} + \varepsilon_t \quad [5]$$

Where, ε_t is white noise error, ECT stands for Error Correction Term, φ indicates the proportional disequilibrium among the dependent and explanatory variables which is corrected in the short-run so as to converge back to the long-run equilibrium path.

Error Correction Term (ECT_t) can be expressed as;

$$ECT_t = lnGDP_t - \mu_0 - \sum_{i=0}^{k} \theta_{1i}\, lnGDP_{t-i} - \sum_{i=0}^{m} \theta_{2i}\, lnBDF_{t-i} - \sum_{i=0}^{n} \theta_{3i}\, lnM2_{t-i} - \sum_{i=0}^{p} \theta_{4i}\, lnINF_{t-i} - \sum_{i=0}^{q} \theta_{5i}\, lnREER_{t-i} - \sum_{i=0}^{x} \theta_{6i}\, lnRIR_{t-i} - \sum_{i=0}^{z} \theta_{7i}\, lnGCF_{t-i} \quad [6]$$

3.2.3 Granger Causality Test under VECM Framework

Based on the findings of cointegrating equations among the variables, one could investigate both long-run causality and short-run dynamics by applying Granger Causality test under Vector Error Correction Model (VECM) framework. The VECM can be specified as[16];

$$\begin{bmatrix} \Delta lnGDP_t \\ \Delta lnBDF_t \\ \Delta lnM2_t \\ \Delta lnINF_t \\ \Delta lnREER_t \\ \Delta lnRIR_t \\ \Delta lnGCF_t \end{bmatrix} = \begin{bmatrix} \mu_1 \\ \mu_2 \\ \mu_3 \\ \mu_4 \\ \mu_5 \\ \mu_6 \\ \mu_7 \end{bmatrix} + \sum_{i=1}^{p} \begin{bmatrix} \beta_{11i}\,\beta_{12i}\,\beta_{13i}\,\beta_{14i}\,\beta_{15i}\,\beta_{16i}\,\beta_{17i} \\ \beta_{21i}\,\beta_{22i}\,\beta_{23i}\,\beta_{24i}\,\beta_{25i}\,\beta_{26i}\,\beta_{27i} \\ \beta_{31i}\,\beta_{32i}\,\beta_{33i}\,\beta_{34i}\,\beta_{35i}\,\beta_{36i}\,\beta_{37i} \\ \beta_{41i}\,\beta_{42i}\,\beta_{43i}\,\beta_{44i}\,\beta_{45i}\,\beta_{46i}\,\beta_{47i} \\ \beta_{51i}\,\beta_{52i}\,\beta_{53i}\,\beta_{54i}\,\beta_{55i}\,\beta_{56i}\,\beta_{57i} \\ \beta_{61i}\,\beta_{62i}\,\beta_{63i}\,\beta_{64i}\,\beta_{65i}\,\beta_{66i}\,\beta_{67i} \\ \beta_{71i}\,\beta_{72i}\,\beta_{73i}\,\beta_{74i}\,\beta_{75i}\,\beta_{76i}\,\beta_{77i} \end{bmatrix} \times \begin{bmatrix} \Delta lnGDP_{t-i} \\ \Delta lnBDF_{t-i} \\ \Delta lnM2_{t-i} \\ \Delta lnINF_{t-i} \\ \Delta lnREER_{t-i} \\ \Delta lnRIR_{t-i} \\ \Delta lnGCF_{t-i} \end{bmatrix} + \begin{bmatrix} \sigma_1 \\ \sigma_2 \\ \sigma_3 \\ \sigma_4 \\ \sigma_5 \\ \sigma_6 \\ \sigma_7 \end{bmatrix} ECT_{t-1} + \begin{bmatrix} \omega_1 \\ \omega_2 \\ \omega_3 \\ \omega_4 \\ \omega_5 \\ \omega_6 \\ \omega_7 \end{bmatrix} \quad [7]$$

Where, Δ is the difference operator**,** $\mu_1\ to\ \mu_7$ represents constant term; $\beta_{11}\ to\ \beta_{77}$ indicate short-run coefficients and $\sigma_1\ to\ \sigma_7$ indicate the coefficient of error correction term (ECT_{t-1}) and use to describe long run causality between the variables; $\omega_1\ to\ \omega_7$ are white nose of error correction term.[17]

4. Results and Discussions

4.1. Descriptive Statistics

Descriptive statistics of variables used in this research are reported in Table-2. It reveals that most of the variables have changed noticeably over the period of time [see Panel A]. For instance, Gross Domestic Product (GDP) ranges from a low value of Tk. 330.88 billion up to Tk. 19758.20 billion. Similarly, budget deficit (BDF) ranges from 56.80 billion to Tk. 986.74 billion. Meanwhile, the findings of the study have confirmed a moderate level of variability within the variables. For example; a control variable of lnM2 has a mean of 6.73 with 1.65 standard deviation. [see Panel B].

[16] In case of findings no cointegrating equation, the directional causality test is performed excluding error correction term (ECT).

[17] This study has employed the same empirical methodology describe above on Model(2) Where, Government Total Expenditure(GTEX) is used as an independent variable instead of Budget Deficit.

Table 2: Descriptive Statistics

Panel-A: Original Value for the period (1981-2017)

	GDP National Currency (Billions)	BDF National Currency (Billions)	GTEX National Currency (Billions)	M2 National Currency (Billions)	INF (Consumer Price Index)	REER	RIR	GCF (% of GDP)
Mean	4617.38	213.44	611.81	2516.62	7.47	120.45	5.34	22.19
Median	2465.09	100.10	266.96	687.39	7.04	117.49	4.96	22.72
Maximum	19758.20	986.74	2679.12	13223.33	14.55	160.22	11.67	30.51
Minimum	330.88	56.80	45.35	46.56	1.91	98.34	-2.22	15.47
Std. Dev.	5164.32	241.55	715.85	3498.16	3.04	14.69	3.27	4.93

Panel B Natural Log Value for the period (1981-2017)

	lnGDP	lnBDF	lnGTEX	lnM2	lnINF	lnREER	lnRIR	lnGCF
Mean	7.82	4.92	5.76	6.73	1.91	1.74	1.52	3.08
Median	7.81	4.61	5.59	6.53	1.95	1.61	1.60	3.12
Maximum	9.90	6.89	7.89	9.49	2.68	2.93	2.46	3.42
Minimum	5.81	4.04	3.81	3.84	0.65	1.16	0.00	2.74
Std. Dev.	1.18	0.88	1.19	1.65	0.49	0.47	0.66	0.23

Note: GDP for gross domestic product, BDF for budget deficit, GTEX for government total expenditure, M2 for money supply (broad money), INF for inflation, REER for real effective exchange rate, RIR for real interest rate, and GCF for gross capital formation. Numerical values are rounded to the nearest ten.

Table 3: Correlations of the Variables

Correlation	GDP	BD	GTEX	M2	INF	REER	RIRCPI	GCF
GDP	1							
BD	0.98	1						
GTEX	0.99	0.98	1					
M2	0.99	0.99	0.99	1				
INF	-0.21	-0.17	-0.19	-0.17	1			
REER	0.49	0.59	0.49	0.53	0.11	1		
RIR	-0.053	-0.08	-0.06	-0.09	-0.88	-0.27	1	
GCF	0.85	0.77	0.84	0.81	-0.38	0.12	0.06	1

Note: GDP for gross domestic product, BDF for budget deficit, GTEX for government total expenditure, M2 for money supply (broad money), INF for inflation, REER for real effective exchange rate, RIR for real interest rate, and GCF for gross capital formation. Numerical values are rounded to the nearest ten.

4.2. Correlation Matrix

Table 3 provides very low value of correlation coefficient between most of the variables specified in the right side of the research models used in this study. These findings eventually suggest ignoring the multi-colinearity problems between the explanatory variables. It can also be seen that there is a strong positive relation between GDP and Budget Deficit; also GDP and Government Total Expenditure which indicate a good sign for further analysis in both two models[18] specified in this study.

4.3. Unit Root Test

The pre-condition of unbiased[19] co-integrating relationship between the time series variables requires identifying the appropriate order of integration in each of the variables. Thus, this study investigated order of integration of variable first. The results of unit root test with null hypothesis of non-stationarity [ADF & PP] and null hypothesis of stationarity [KPSS] are reported in Table 3 & Table 4 respectively. Table 3 & 4, together, show that variables used in this research are not integrated at the same order. Some variables are integrated at I(0) while others at I(1). ADF and PP test confirm that only inflation (lnINF) is stationary at level and the remaining variables become stationary after the first difference. Unlike these, the results also revealed that Real Effective Exchange Rate (lnREER) and Real Interest Rate (lnRIR) are stationary at level while assuming only intercept in the test equations.

On the other hand, the results of Table 4 [KPSS] show that Gross Domestic Product (lnGDP) Money Supply M2 (lnM2) and Gross Capital Formation (lnGCF) are stationary at level while rest of the variables become stationary after first difference.

One of the important findings revealed in both Table [3&4] is that no variable is integrated at I(2), which, in turn leads to perform Autoregressive Distributed Lag Model (ARDL) bounds testing approach (Pesaran et al. 2001) to capture long-run equilibrium relationship between the variables.

[18] See equation [1] & Equation [2]
[19] Biased, opposite of unbiased, relationship between the variables states that non-stationary variables (dependent or independent) may produce misleading or spurious outcomes. One could observe strong relationship between two non-stationary variables even if no causality exists between them.

Table 4: ADF and PP Unit Root Test

Variables		At level		First Difference		Remarks
		ADF	PP	ADF	PP	*I(d)*
lnGDP	υ_i	0.4206	0.3066	-4.2162***	-4.1931***	I(1)
	υ_t	-1.0089	-1.4595	-4.1809**	-4.2215**	I(1)
lnBDF	υ_i	1.1773	4.0173	-6.7049***	-6.7116***	I(1)
	υ_t	-1.2660	-0.6479	-7.5143***	-19.3529***	I(1)
lnGTEX	υ_i	0.6949	0.8211	-6.9308***	-7.0409***	I(1)
	υ_t	-1.4130	-1.2637	-7.0552***	-7.0552***	I(1)
lnM2	υ_i	-0.7930	-0.7930	-4.6303***	-4.6874***	I(1)
	υ_t	-2.3052	-2.4661	-4.6574***	-4.6574***	I(1)
lnINF	υ_i	-3.4137**	-3.2648**			I(0)
	υ_t	-3.4889*	-3.261925*			I(0)
lnREER	υ_i	-2.5819	-3.4005**	-6.8649***		I(0)
	υ_t	-2.0034	-1.5733	-6.9183***	-20.48734***	I(1)
lnRIR	υ_i	-3.3454**	-3.306729**			I(0)
	υ_t	-3.1194	-3.0652	-7.9782***	-9.2289***	I(1)
lnGCF	υ_i	-0.5399	0.1845	-4.0106***	-3.929772***	I(1)
	υ_t	-2.8634	-2.4643	-6.1365***	-4.184245**	I(1)

Note 1: GDP for gross domestic product, BDF for budget deficit, GTEX for government total expenditure, M2 for money supply (broad money), INF for inflation, REER for real effective exchange rate, RIR for real interest rate, and GCF for gross capital formation. Note 2: ***/**/* indicate rejection of null hypothesis of having unit root at the 1%, 5% and 10% level respectively. Note 3: *I(d)* denotes order of integration. Note 4: all the variables are in the natural log form. Note 5: ADF for Augmented Dickey-Fuller, PP for Phillips-Perron. Note 6: υ_i for intercept only and υ_t for intercept and trend**.** Note 7: Numerical values are rounded to the nearest ten.

Table 5: KPSS Unit Root Test

Variables		At level	First Difference	Remarks
				I(d)
lnGDP	υ_t	0.125		I(0)
lnBDF	υ_t	0.2182***	0.0698	I(1)
lnGTEX	υ_t	0.2050***	0.1021	I(1)
lnM2	υ_t	0.1111		I(0)
lnINF	υ_t	0.1888**	0.0815	I(1)
lnREER	υ_t	0.2342***	0.0574	I(1)
lnRIR	υ_t	0.2010**	0.0810	I(1)
lnGCF	υ_t	0.1128		I(0)

Note: ***/**/* indicate rejection of null hypothesis that the variable is stationary at the 1%, 5% and 10% level respectively; Numerical values are rounded to the nearest ten.

4.4. ARDL Bounds Testing for Cointegration

This study employed ARDL Bounds test to investigate whether cointegration relationship exists between Budget Deficits (BDF) and Economic Growth (GDP) [Model 1] as well as Government Total Expenditure (GTEX) and Economic Growth (GDP)) [Model 2][20]. Since ARDL bounds testing approach is highly sensitive to lag length selections , this study choose ARDL(3, 2, 3, 3, 2, 3, 3) for Model 1 and ARDL(3, 1, 0, 1, 1, 1, 2) for Model 2 based on Schwarz information criterion (SIC) as benchmark specifications. The results of the ARDL bounds testing for cointegration reveal (see Table 5) that, in all two models F-statistics exceeds from upper critical bound at 1% level of significance. Thus, according to decision criteria[21], this study confirms existence of long-run cointegration in both model 1 and 2.

Table 5: ARDL bounds testing result for long-run co-integration

	Lag: SIC	***F*-Statistics**	**Result**
Model-1: Budget deficit			
F_{LNGDP}(LNGDP | LNBDF,LNM2,LNINF,LNREER,LNRIR,LNGCF)	ARDL(3, 2, 3, 3, 2, 3, 3)	7.61	Cointegration
Model-2: Government Total Expenditure			
F_{LNGDP}(LNGDP | LNGTEX,LNM2,LNINF,LNREER,LNRIR,LNGCF)	ARDL(3, 1, 0, 1, 1, 1, 2)	6.43	Cointegration
Critical value Pesaran et al. (2001)	**K**	**1%**	**5%**	**10%**
I(0) Bound	6	3.15	2.45	2.12
I(1) Bound	6	4.43	3.61	3.23

Note 1: GDP for gross domestic product, BDF for budget deficit, GTEX for government total expenditure, M2 for money supply (broad money), INF for inflation, REER for real effective exchange rate, RIR for real interest rate, and GCF for gross capital formation. Note 2: SIC=Schwarz information criterion. Note 3: all the variables are in the natural log form. Note 4: Numerical values are rounded to the nearest ten.

Table 6: ARDL long-run coefficient (1981-2017)

	Model	**Lag**	**lnBDF**	**lnGTEX**	**lnM2**	**lnINF**	**lnREER**	**lnRIR**	**lnGCF**
1	ARDL(3, 2, 3, 3, 2, 3, 3)	**SIC**	0.77*** [10.23] (0.000)	–	0.17** [2.49] (0.037)	-0.21** [-3.17] (0.013)	-0.72*** [-7.91] (0.000)	-0.009 [-0.22] (0.832)	-0.18 [-0.60] (0.562)
2	ARDL(3, 1, 0, 1, 1, 1, 2)	**SIC**	–	0.69** [3.54] (0.002)	0.20 [1.25] (0.227)	-0.06 [-0.79] (0.442)	-0.12 [-1.49] (0.153)	-0.14* [-1.79] (0.090)	-0.065 [-0.20] (0.846)

Note 1: t-statistics in [] and p-values in (). Note 2: ***/**/* indicate significance at the 1%, 5% and 10% level respectively. Note 3: GDP for gross domestic product, BDF for budget deficit, GTEX for government total expenditure, M2 for money supply (broad money), INF for inflation, REER for real effective exchange rate, RIR for real interest rate, and GCF for gross capital formation. Note 4: SIC=Schwarz information criterion. Note 5: all the variables are in the natural log form Note 6: Numerical values are rounded to the nearest ten.

[20] See Table 5: ARDL bounds testing result for long-run co-integration
[21] See Section 3.2.2 The Autoregressive Distributed Lag Model

4.5. Long run and ECM Short-run Coefficient Estimation under ARDL

4.5.1. Long-run Estimate

ARDL bounds testing approaches of this study suggest estimating the long-run coefficient of budget deficit [Model 1], government total expenditure [Model 2] and control variables where GDP is considered as dependent variable in both Model 1 and 2. The long-run elasticity results are reported in Table-6.

In Row 2 Table 6, the coefficients of budget deficit (lnBDF) and Money supply M2(lnM2) are positive and statistically significant at the level of 1% and 5% respectively while remaining coefficients of variables are negative. Among all the estimated negative coefficients, only Inflation(lnINF) and Real Effective exchange rate (lnREER) are statistically significant. These results of Model 1 imply that a 1% increase in budget deficit and money supply increases the growth of the economy by 0 .77% and 0.17% respectively in the long-run. In contrast, a 1% increase in inflation and real effective exchange rate would decrease the growth of economy by 0.21% and 0.72% respectively in the long-run.

It can also be seen from Row 3 Table 6 that the long-run coefficient of government total expenditure (lnGTEX) is positive and statistically significant at the level of 5% while long-run coefficient of real Interest rate (RIR) is negative and statistically significant at the level of 10% These results of Model 2 indicate that a 1% increase in government total expenditure increases the growth of economy by 0.69%. In contrast a 1% increase in real interest rate decreases the growth of economy by 0.14%.

It can be concluded from the overall results of Table-6 that all variables act in the direction of economic growth as anticipated as economic theory and empirical studies elucidated with the exception of gross capital formation in both two models. However, GCF is found insignificant in Both Model 1 and Model 2. The outcomes of this study are consistent with prior studies (Abdullah et al. 2018; Hussain & Haque 2017; Majumder 2007) which have also revealed the positive impact of budget deficit and government total expenditure on economic growth.

4.5.2. ECM Short-run Estimate

The short-run coefficients of all two model specifications as well as the coefficient of error correction term, *ECT (-1)*, under ECM-ARDL [see equation-5] model are presented in Table-7. The negative and statistically significant coefficients of lagged one period *ECT* in all two model specifications indicate that any short-run disequilibrium is corrected each year in convergence towards long-run equilibrium with the speed of 67% and 38% respectively.

In Column 2 Table 7, the short-run coefficient of budget deficit (lnBDF) is positive and statistically significant at the level of 1% indicating that expenditure decision of government with deficit financing has immediate effect on the growth of economy. On the other hand, the short-run coefficient of government total expenditure (lnGTEX) [see Column 5 Table 7] has found positive and insignificant relation with GDP. From Table 7, both indicators of government spendings

(lnBDF & lnGTEX) confirm their positive effects on economic growth (lnGDP) in Bangladesh. For instance, a 1% increase in budget deficit would increase more than 80% in the level of economic growth in short-run. Meanwhile, the significant short-run coefficients of Inflation (lnINF) and Real interest rate (lnRIR), in all two models indicate a negative association of them with economic growth (lnGDP). The study also revealed significant short-run relationship between GDP and GCF; REER and GDP at the level of 1% in Model 1 [see Column 2 Table 7]. Surprisingly in Model 2 [see Column 5 Table 7] the coefficients of government total expenditure, money supply M2, real effective exchange rate, and gross capital formation are found to be insignificant.

From the overall results of Table 7, one could conclude that in short-run, budget deficit as well as government actions regarding expenditure lead to a boost in the level of economic growth of Bangladesh.

Table 7: ARDL Short-run Dynamics (1981-2017)

	Model 1 ARDL(3, 2, 3, 3, 2, 3, 3) Lag: SIC			**Model 2** ARDL(3, 1, 0, 1, 1, 1, 2) Lag: SIC		
	Coefficient	***T*-Statistics**	***P*-value**	**Coefficient**	***T*-Statistics**	***P*-value**
ECM(-1)	-0.67***	-9.65	0.000	-0.38***	-7.75	0.000
ΔlnBDF	0.86***	10.31	0.000	–	–	–
ΔlnGTEX	–	–	–	0.02	0.43	0.688
ΔlnM2	0.07	1.75	0.119	0.09	068	0.506
ΔlnINF	-0.04***	-4.34	0.002	-0.06***	-4.76	0.000
ΔlnREER	-0.77***	-9.89	0.000	0.02	1.01	0.32
ΔlnRIR	-0.03***	-4.99	0.001	-0.06***	-4.53	0.000
ΔlnGCF	0.73***	4.57	0.002	-0.16	-0.78	0.445
Diagnostic tests						
Adjusted R-squared	0.94			0.71		
Durbin-Watson stat	2.55			1.73		
F-statistic	25.44(0.00)			9.78(0.00)		
χ^2 Normality()	0.92(0.64)			0.40(0.82)		
χ^2 Serial	2.22 (0.14)			0.49(0.70)		
χ^2ARCH	0.05 (0.83)			0.14(0.93)		
χ^2 Remsay	0.497(0.504)			0.041 (0.842)		

Note 1: *p*-values in (). ***Note 2:*** ***/**/* indicate significance at the 1%, 5% and 10% level respectively. ***Note 3:*** GDP for gross domestic product, BDF for budget deficit, GTEX for government total expenditure, M2 for money supply (broad money), INF for inflation, REER for real effective exchange rate, RIR for real interest rate, and GCF for gross capital formation. ***Note 4:*** SIC=Schwarz information criterion. ***Note 5:*** all the variables are in the natural log form. ***Note 6:*** χ2 Normality for Jarque-Bera normality test, χ2 Serial for Breusch-Godfrey Serial Correlation LM Test, χ2 ARCH for autoregressive conditional heteroskedasticity Test and χ2 Remsay for Remsay RESET test. ***Note 6:*** Numerical values are rounded to the nearest ten.

Diagnostic test results reported in Table 7 provide adequate evidence to support the models robustness. It shows that each of the alternate model specification is normally distributed and is free of serial correlation as well as heteroskedasticity problems. Remsay RESET (Regression Equation Specification Error Test) proposed by (Pegan et al. 1983) also confirmed that both, ECM-Short-run, Model 1 and 2 (see Table 7) are functionally well specified.

The stability of long-run and short-run in each alternate specification is examined by using cumulative sum (CUSUM) and cumulative sum of squares. The test lines in Figure 1-4 of CUSUM and CUSUMsq lie within the 5% critical bounds which confirm the robustness in both Model 1 and 2 along with stable long run and short run parameters (Qamruzzaman and Wei 2018)

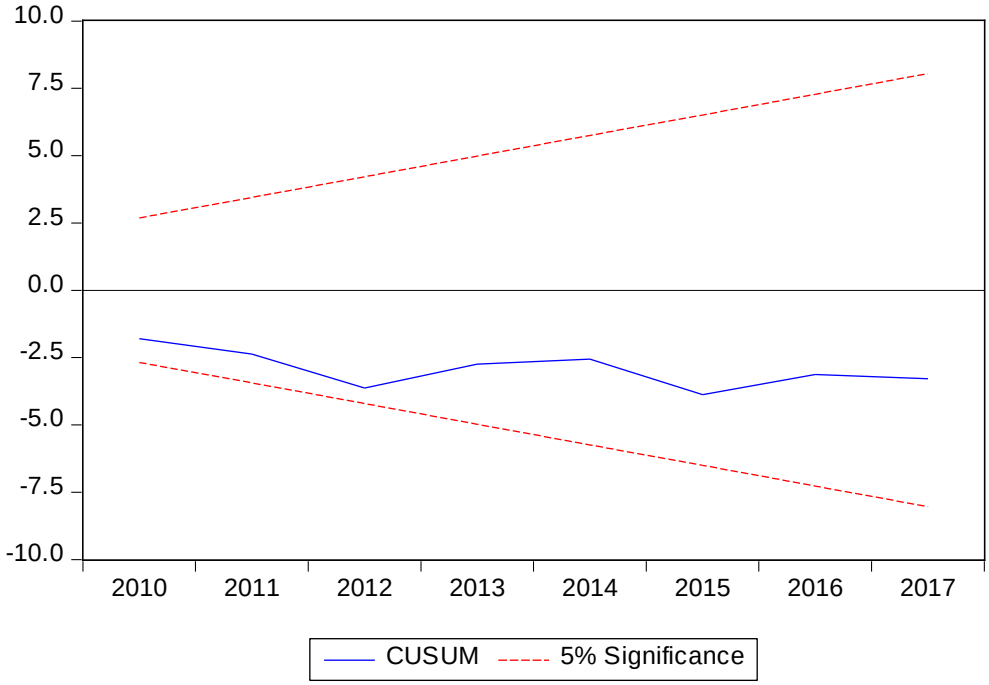

Figure 1. Plot of cumulative sum of recursive residuals for Model1(Budget Deficit)

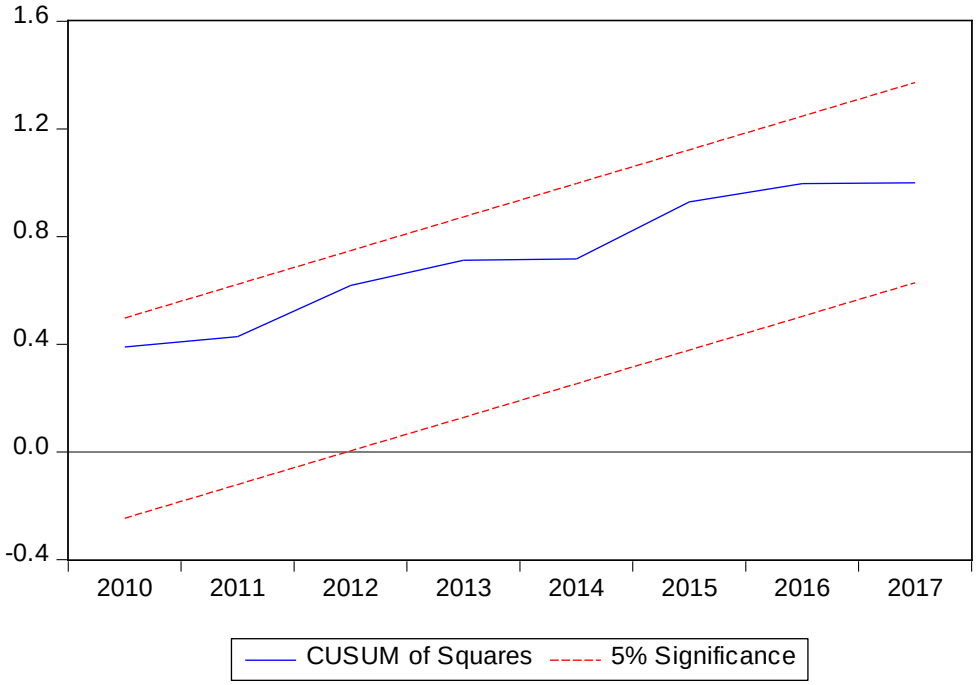

Figure 2. Plot of cumulative sum of squares of recursive residuals for Model1(Budget defict)

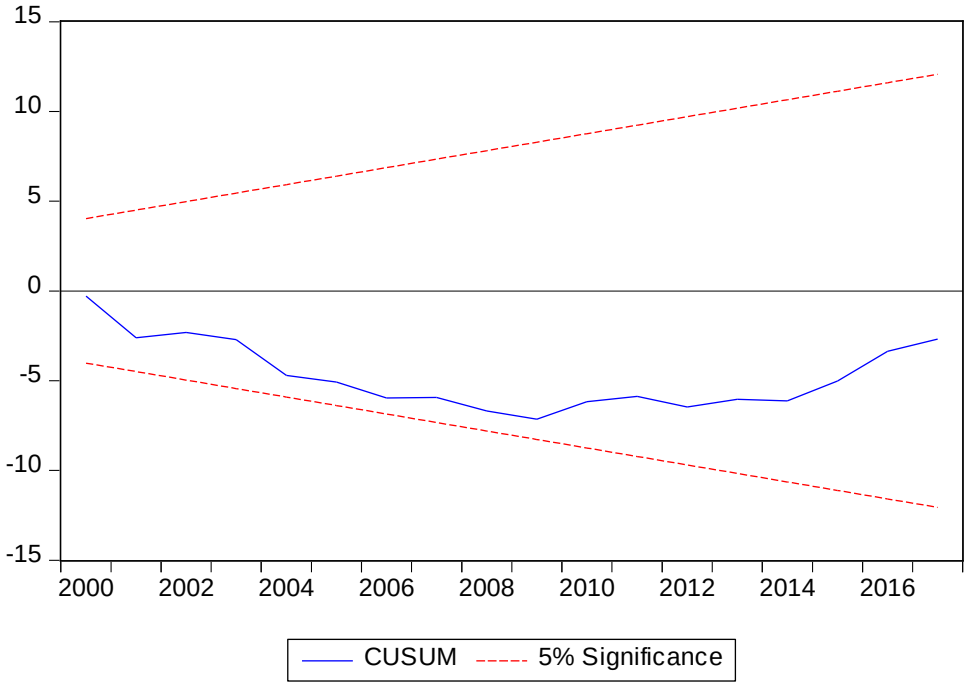

Figure 3. Plot of cumulative sum of recursive residuals for Model 2(Government Total Expenditure)

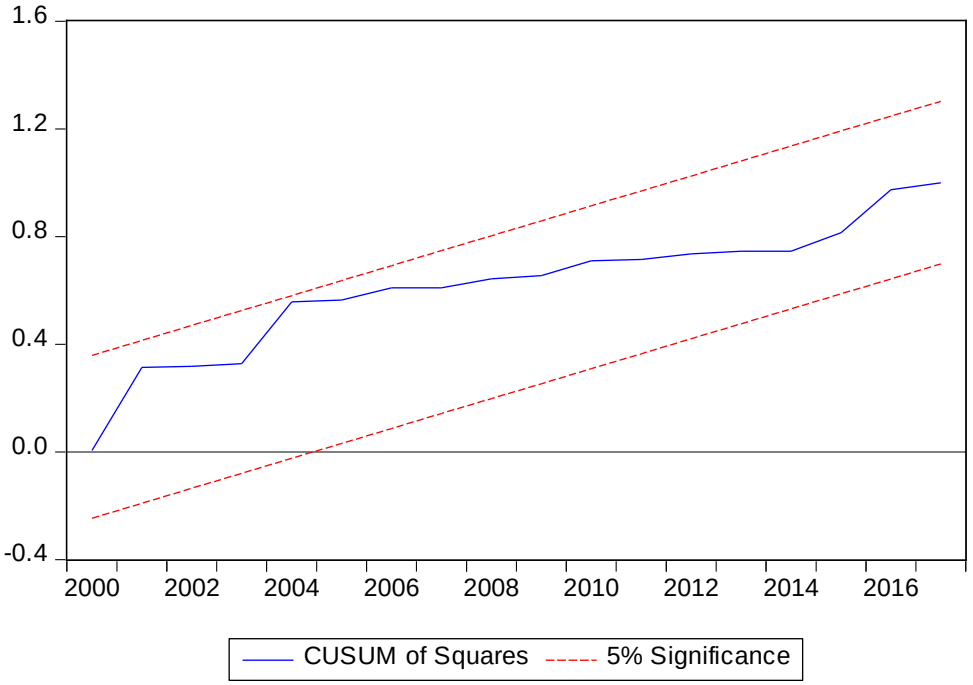

Figure 4. Plot of cumulative sum of squares of recursive residuals for Model 2 (Government Total Expenditure)

4.6. VECM Granger Causality

It is well established in econometric literatures that vector error correction model (VECM) is one of the most useful techniques for investigating directional causality between the variables in both short-run and long-run. To verify the existence of unidirectional or feedback causality between the variables, this study employed granger causality test under VECM framework. The results of the VECM are reported in Table-8. This study found unidirectional causality running from budget deficit to economic growth (see Model 1) in long-run by observing negative and significant coefficient of *ECT (-1).* This implies that economic growth depends upon government decisions relating to financing either domestically or internationally for making up shortfall in fiscal budget. Thus, it will impossible to gain or retain sustainable economic growth by adopting inappropriate policies of fiscal deficit financing.

To examine the directional causalities between government total expenditure and economic growth, this study also applied VECM on Model 2 [see equation 2]. Table 8 model 2 shows that government total expenditure (GTEX) granger causes economic growth and vice versa which also ensure the dependence of economic growth on financing and spending policies of government in Bangladesh.

This research, in all two models has found bilateral or feedback causality between money supply (M2) to economic growth (GDP); real interest rate (RIR) to economic growth (GDP); inflation

(INF) to economic growth (GDP) in the long-run. Furthermore, in long-run model 1 represents two ways causality between gross capital formation (GCF) and economic growth (GDP) while model 2 represents one way, causality between them running from GCF. Meanwhile, Table 8 model 2 reports bidirectional causality between real effective exchange rate (REER) and economic growth (GDP) while model 1 suggests unidirectional causality between them running from REER.

In short-run, no causality found between budget deficit (BDF) and economic growth (GDP)[22]. Nevertheless, Table 8 shows the bidirectional positive causality between government expenditure (GTEX) and economic growth (GDP)[23] in short-run. Therefore, one could conclude that any change in government expenditure would positively affect economic growth in short-run and vice versa.

This study also revealed a great extant to short-run causality between economic growth and control variables considered for this research. Table 8 shows that there is bidirectional causality between economic growth (GDP) to money supply (M2); money supply (M2) to inflation (INF); economic growth (GDP) to inflation (INF); economic growth (GDP) to real interest rate (RIR); government expenditure (GTEX) to real effective exchange rate (REER); inflation (INF) to real interest rate (RIR); inflation (INF) to gross capital formation (GCF); real interest rate (RIR to gross capital formation (GCF).Summary of findings of short-run granger causality between the variables are reported in Table 9.

[22] See Table 8, Model 1, Column 1 and 2.
[23] See Table 8, Model 2, Column 1 and 2.

Table 8: Granger Causality Test under VECM Framework

Model -1
Dependent Variables

		ΔlnGDP	**ΔlnBDF**	**ΔlnM2**	**ΔlnINF**	**ΔlnREER**	**ΔlnRIR**	**ΔlnGCF**
Short-run	**ΔlnGDP**		-1.25 [-0.99]	-0.69** [-2.23]	3.20 [1.08]	-1.52 [-1.17]	1.58 [0.44]	0.16 [1.19]
	ΔlnBDF	0.07 [0.43]		-0.18 [-0.62]	-0.61 [-0.22]	0.45 [0.37]	0.17 [0.05]	0.034 [0.27]
	ΔlnM2	0.19** [2.22]	-1.12* [-1.90]		2.53* [1.84]	-1.31** [-2.16]	-2.69 [-1.62]	-0.07 [-1.15]
	ΔlnINF	0.02 [1.32]	-0.08 [-0.67]	-0.09*** [-3.07]		-0.11 [-0.87]	-0.51 [-1.43]	-0.005 [-0.36]
	ΔlnREER	-0.11 [-0.67]	-0.69 [-0.61]	0.21 [0.79]	0.25 [0.097]		-0.05 [-0.02]	0.002 [0.01]
	ΔlnRIR	-0.002 [-0.16]	-0.083 [-0.87]	-0.019 [-0.81]	0.38* [1.71]	-0.09 [-0.94]		-0.02** [-2.20]
	ΔlnGCF	0.48** [1.99]	0.22 [0.14]	-0.37 [-0.94]	0.94 [0.25]	-0.24 [-0.14]	0.35 [0.076]	
Long-run	**ECT_{t-1}**	-0.022** [-2.36]	-0.091 [-1.44]	-0.07*** [-4.40]	0.36** [2.46]	-0.064 [-0.99]	-0.38** [-2.16]	0.03*** [3.69]

Model - 2
Dependent Variables

		ΔlnGDP	**ΔlnGTEX**	**ΔlnM2**	**ΔlnINF**	**ΔlnREER**	**ΔlnRIR**	**ΔlnGCF**
Short-run	**ΔlnGDP**		1.22** [2.36]	0.34 [0.74]	-3.94*** [-3.39]	-0.57 [-0.35]	-4.04** [-2.51]	-0.23 [-1.29]
	ΔlnGTEX	0.13** [2.05]		0.24 [1.38]	0.05 [0.09]	1.03* [1.88]	-0.57 [-0.82]	-0.03 [-0.38]
	ΔlnM2	0.05 [0.59]	0.17 [0.74]		-0.32 [-0.50]	0.22 [0.30]	-0.30 [-0.36]	-0.08 [-0.80]
	ΔlnINF	-0.07*** [-4.22]	0.09 [1.58]	0.02 [0.32]		-0.09 [-0.51]	-1.07*** [-10.70]	-0.04*** [-2.21]
	ΔlnREER	0.0004 [0.02]	0.12* [1.92]	-0.03 [-0.42]	0.16 [0.89]		0.12 [0.51]	0.01 [0.56]
	ΔlnRIR	-0.03** [-2.27]	0.03 [0.57]	0.01 [0.32]	-0.71*** [-11.11]	-0.03 [-0.21]		-0.03* [-1.95]
	ΔlnGCF	-0.31 [-1.53]	0.58 [0.96]	-0.85* [-1.82]	-4.66*** [-3.11]	-1.82 [-0.92]	-4.43** [-2.29]	
Long-run	**ECT_{t-1}**	-0.32*** [-2.95]	-0.68*** [-2.86]	-0.27** [-2.16]	-0.93*** [-4.61]	-0.63** [-2.28]	-1.05*** [-4.34]	-0.20 [-1.62]

Note 1: t-values in [ ]. Note 2: ***/**/* indicate significance at the 1%, 5% and 10% level respectively. Note 3: GDP for gross domestic product, BDF for budget deficit, GTEX for government total expenditure, M2 for money supply (broad money), INF for inflation, REER for real effective exchange rate, RIR for real interest rate, and GCF for gross capital formation. Note 4: Numerical values are rounded to the nearest ten.

Table 9: List of Findings of Short- run Granger Causality between the Variables[24]

Model 1		**Model 2**	
Direction of Causality	Remarks	Direction of Causality	Remarks
GDP ←→M2	Feedback, or bilateral causality	GDP←→GTEX	Feedback, or bilateral causality
GDP ←GCF	Unidirectional causality	GDP←→ INF	Feedback, or bilateral causality
BDF ←M2	Unidirectional causality	GDP←→RIR	Feedback, or bilateral causality
M2 ←→INF	Feedback, or bilateral causality	GTEX←→REER	Feedback, or bilateral causality
M2 →REER	Unidirectional causality	M2← GCF	Unidirectional causality
INF ←RIR	Unidirectional causality	INF ←→RIR	Feedback, or bilateral causality
RIR →GCF	Unidirectional causality	INF ←→ GCF	Feedback, or bilateral causality
		RIR ←→ GCF	Feedback, or bilateral causality

Concluding Remarks

This study investigated the relationship between budget deficit and economic growth in Bangladesh for the period of 1981-2017. Creating robustness on findings generated from the investigation of relationship between budget deficit and economic growth plus extracting intrinsic effects of public spending on economic performance, this study also examined the relationship between government expenditure and economic growth in Bangladesh for the same time period. Data of research variables used in this study are collected from various sources[25]. A number of researches have been carried out on the relationship between budget deficit and economic growth but very few of that in Bangladesh. (see Hussain and Haque 2017; Majumder 2007; Haider et al. 2016; Hassan and Akhter 2014; Abdullah et al. 2018). Among them in Bangladesh, however, the author has not found any of the studies used autoregressive distributed lag (ARDL) model which is, by and large, a very sophisticated and privileged econometric technique for empirical investigation over other cointegration techniques. By considering this research gap, therefore, this study used ARDL model to capture both the long-run relationships of budget deficit and government total expenditures with economic growth in Bangladesh. In addition, this study examined directional causalities between the variables by performing granger causality test under vector error correction model (VECM) framework.

Results from ARDL bounds testing revealed that long-run cointegration relationships exist in both two model specifications at 1% level of significance. Further analysis of long-run and short-run

[24] Table 9 is prepared from Table 8: *Granger Causality Test under VECM* Framework
[25] See Table 1: Summary of research variables, sources and expected impact.

coefficients under ARDL model also revealed that budget deficits positively affect GDP both in long-run and short-run at 1% level of significance while government total expenditures lead to increase GDP only in long-run at 5% significance level. These results support the Keynesian proposition that budget deficits crowd-in private investments resulting economic growth. The study also revealed that money supply positively affects GDP in long-run while real effective exchange rate; inflation and real interest rate negatively influence GDP both in long-run and short-run. Furthermore, in the long run, directional causality tests conducted by VECM explored unidirectional causality running from budget deficit to economic growth while feedback causality has been found between governments total expenditures and economic growth. In short-run, results from granger causality test under VECM mechanism also exposed some significant directional causality[26] between the variables used in this study.

For policy implications, this research provides evidence that in an emerging economy like Bangladesh, government spending through deficit financing can drive positively in the level of economic growth. Bangladesh, however, should not have the luxury of forgetting about the bad consequences of consistent and gradually increasing budget deficit at all. Based on the findings, this study emphasizes that policymakers, government high officials and other concerned authorities should focus on setting expenditure priorities with available capital resources, formulating equitable and efficient tax policy, imposing good governance, reducing corruption, condensing lengthiness in project implementation particularly in public projects, assisting to new industries, introducing contemporary techniques and technologies and so on.

Upon considering limitations inherent in this study such as data unavailability of some control variables, further research could be performed on the issue of budget deficit-economic growth nexus in Bangladesh by incorporating trade openness, foreign direct investment (FDI) as control variables and a dummy variable for capturing the effects of financial reform between before and after period of 1990.

Conflict of Interest

The Corresponding author states that there is no conflict of interest.

[26] See Table 9: List of Findings of Short- run Granger Causality between the variable.

References

Abdullah, S. M., Azad, A. K., & Siddiqua, S. (2018). Budget deficit and growth: In search of ceiling for Bangladesh. *Business and Economic Horizons*, *14*(4), 743-765.

Ahmed, H., & Miller, S. M. (2000). Crowding-out and crowding-in effects of the components of government expenditure. *Contemporary Economic Policy*, *18*(1), 124-133

Ahmed, S., & Mortaza, M. G. (2005). Inflation and growth in Bangladesh: 1981-2005. *Policy Analysis Unit, Working Paper Series: WP, 604*. https://ideas.repec.org/p/ess/wpaper/id3033.html Accessed 23 December 2018.

Aschauer, D.A., (1989a). Is public expenditure productive?. *Journal of Monetary Economics*, *23*(2), pp.177-200.

Aschauer, D.A., (1989b). Does public capital crowd out private capital?. *Journal of Monetary Economics*, *24*(2), pp.171-188.

Bahmani-Oskooee, M., (1999). Do federal budget deficits crowd out or crowd in private investment?. *Journal of Policy Modeling*, *21*(5), pp.633-640.

Babalola, o. O., danladi, j. D., akomolafe, k. J., & ajiboye, o. P. (2015). Inflation, interest rates and economic growth in Nigeria. *European Journal of Business and Management*, *7*(30), 91-102.

Barro, R. J. (1989). The Ricardian approach to budget deficits. *Journal of Economic Perspectives*, *3*(2), 37-54.

Barro, R.J., (1990). Government spending in a simple model of endogeneous growth. *Journal of Political Economy*, *98*(5, Part 2), S103-S125.

Barro, R.J., (199)1. Economic growth in a cross section of countries. *The Quarterly Journal of Economics*, *106*(2), 407-443.

Benson, C., & Clay, E. (2002). Bangladesh: Disasters and Public Finance. *Working Paper Series* No. 6, the World Bank, Washington, D.C. https://www.odi.org/sites/odi.org.uk/files/odi-assets/publications-opinion-files/4794.pdf Accessed 15 December 2018.

Bernheim, B. D. (1989). A neoclassical perspective on budget deficits. *Journal of Economic Perspectives*, *3*(2), 55-72.

Bhatia, R. J. (1960). Inflation, deflation, and economic development. *Staff Papers*, *8*(1), 101-114.

Biplob, M. N. K., & Halder, P. (2018). Financial sector development and economic growth: Empirical evidence from Bangladesh. *Asian Economic and Financial Review*, *8*(6), 799-814.

Buiter, W.H. (1977). 'Crowding out'and the effectiveness of fiscal policy. *Journal of Public Economics*, *7*(3), 309-328.

Chaitip, P., Chokethaworn, K., Chaiboonsri, C., & Khounkhalax, M. (2015). Money supply influencing on economic growth-wide phenomena of AEC open region. *Procedia Economics and Finance*, *24*, 108-115.

Chhibber, A., Wijnbergen, S. V., (1988). Public policy and private investment in Turkey. Policy Research Working Paper Series 120, The World Bank. https://ideas.repec.org/p/wbk/wbrwps/120.html Accessed on 15 December 2018.

David, P.A. and Scadding, J.L. (1974). Private savings: ultrarationality, aggregation, and 'Denison's Law'. *Journal of Political Economy*, *82*(2, Part 1), 225-249.

De Gregorio, J. (1992). The effects of inflation on economic growth: lessons from Latin America. *European Economic Review*, *36*(2-3), 417-425.

Drobyshevsky, S., Trunin, P. V., Bogachkova, A. V., & Sinelnikova-Muryleva, E. V. (2016). The effect of interest rates on economic growth. *Money and Credit*, (9), 29-40.

Engle, R. F., & Granger, C. W. (1987). Co-integration and error correction: representation, estimation, and testing. *Econometrica: Journal of the Econometric Society*, *55*(2), 251-276.

Eichengreen, B. (2007). The real exchange rate and economic growth. *Social and Economic Studies, 56*(4),7-22

Eisner, R. (1989). Budget deficits: rhetoric and reality. *Journal of Economic Perspectives*, *3*(2), 73-93.

Evans, M. D., & Lewis, K. K. (1995). Do expected shifts in inflation affect estimates of the long-run Fisher relation?. *The Journal of Finance*, *50*(1), 225-253.

Ghali, K. H. (1997). Government spending and economic growth in Saudi Arabia. *Journal of Development Economics*, *22*(2), 165-72.

Ghali, K. H. (1998). Public investment and private capital formation in a vector error-correction model of growth. *Applied Economics*, *30*(6), 837-844.

Ghali, K. and Al-Shamsi, F. (1997). Fiscal policy and economic growth: A study relating to the United Arab Emirates. *Economia Internazional*, *50*(4), 519-533.

Haider, ASM S., Sabrina F. S., & M. Rezaul K. (2016). Impact of Budget Deficit on Growth: An Empirical Case Study on Bangladesh. https://www.researchgate.net/publication/298971557 Accessed on 15 December 2018.

Hassan, M. H., & Ayesha A. (2014). Budget deficit and economic growth of Bangladesh: A VAR-VECM approach. *Janata Bank Journal of Money, Finance and Development*. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2661754 Accessed on 15 December 2018.

Heng, T.K. (1997). Public capital and crowding in. *The Singapore Economic Review*, *42*(2), 1-10.

Hussain, M. E., & Haque, M. (2017). Fiscal deficit and its impact on economic growth: Evidence from Bangladesh. *Economies*, *5*(4), 37.

Ito, T., Isard, P., & Symansky, S. (1999). Economic growth and real exchange rate: an overview of the Balassa-Samuelson hypothesis in Asia. In *Changes in Exchange Rates in Rapidly Developing Countries: Theory, Practice, and Policy Issues NBER-EASE Volume 7*, 109-132. University of Chicago Press.

Johansen, S., & Juselius, K. (1990). Maximum likelihood estimation and inference on cointegration—with applications to the demand for money. *Oxford Bulletin of Economics and Statistics*, *52*(2), 169-210.

Johansen, S. (1991). Estimation and hypothesis testing of cointegration vectors in Gaussian vector autoregressive models. *Econometrica: Journal of the Econometric Society*, *59*(6), 1551-1580.

Johansen, S. (1995). Likelihood-Based Inference in Cointegrated Vector Autoregressive Models. *Oxford: Oxford University Press*.

Landau, D. (1983). Government expenditure and economic growth: a cross-country study. *Southern Economic Journal*, *49*(3), 783-792.

Lee, K. S., & Werner, R. A. (2018). Reconsidering monetary policy: An empirical examination of the relationship between interest rates and nominal GDP growth in the US, UK, Germany and Japan. *Ecological Economics*, *146*(C), 26-34.

Monadjemi, M.S. and Huh, H. (1998). Private and government investment: A study of three OECD countries. *International Economic Journal*, *12*(2), 93-104.

Nell, K. S. (2000). Is low inflation and precondition for faster growth? The case of South Africa (No. 00, 11). Department of Economics Discussion Paper, University of Kent. *Working Paper No. 7*.

Nguyen, V. B. (2015). Effects of fiscal deficit and money M2 supply on inflation: Evidence from selected economies of Asia. *Journal of Economics, Finance and Administrative Science*, *20*(38), 49-53

Nkrumah, K.O., Orkoh, E., & Owusu, A.M. (2016). Exploring the budget deficit-economic growth nexus: new evidence from Ghana. *Journal for the Advancement of Developing Economies, 5*(1), 36-50.

Ouattara, B. (2004). Modelling the long run determinants of private investment in Senegal, No. 04/05. *Credit Research Paper*, The University of Manchester.

Pagan, A.R. & Hall, A.D. (1983). Diagnostic tests as residual analysis. *Econometric Reviews, 2*(2), 159-218.

Pan, L., & Mishra, V. (2018). Stock market development and economic growth: Empirical evidence from China. *Economic Modelling*, *68*(C), 661-673.

Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationships. *Journal of Applied Econometrics*, *16*(3), 289-326.

Qamruzzaman, M., & Wei, J. (2018). Financial innovation, stock market development, and economic growth: An application of ARDL model. *International Journal of Financial Studies*, *6*(3), 69.

Ramirez, M.D. (1994). Public and private investment in Mexico, 1950-90: An empirical analysis. *Southern Economic Journal*, *61*(1), 1-17.

Rana, E.A. &Wahid, A.N. (2017). Fiscal deficit and economic growth in Bangladesh: A time-series analysis. *The American Economist*, *62*(1), 31-42.

Razzaque, M. A., Bidisha, S. H., & Khondker, B. H. (2017). Exchange rate and economic growth: An empirical assessment for Bangladesh. *Journal of South Asian Development*, *12*(1), 42-64.

Rodrik, D. (2008). The real exchange rate and economic growth. *Brookings Papers on Economic Activity*, *2008*(2), 365-412.

Shahbaz, M., Rehman, I. U., & Muzaffar, A. T. (2015). Re-Visiting financial development and economic growth nexus: The role of capitalization in Bangladesh. *South African Journal of Economics*, *83*(3), 452-471.

Shojai, S. (1999). Budget Deficits and Debt: A Global Perspective. New York: Praeger

Taş, R. (1992). Theoretical and empirical aspects of budget deficits. *Ankara Üniversitesi SBF Dergisi*, *47*(3), 327-341.

Toda, H. Y., & Yamamoto, T. (1995). Statistical inference in vector autoregressions with possibly integrated processes. *Journal of Econometrics*, *66*(1-2), 225-250.

Van, V. B., & Sudhipongpracha, T. (2015). Exploring government budget deficit and economic growth: Evidence from Vietnam's economic miracle. *Asian Affairs: An American Review*, *42*(3), 127-148.

Wai, U. T. (1959). The relation between inflation and economic development: a statistical inductive study. *Staff Papers*, *7*(2), 302-317.

World Bank. (2018). World Development Indicators. Available online: https://datacatalog.worldbank.org/dataset/world-development-indicators Accessed on 1st December 2018.

Yellen, J.L. (1989). Symposium on the budget deficit. *Journal of Economic Perspectives*, *3*(2), 17-21.