

The Macroeconomic Determinants of Economic Growth in Bangladesh: An ARDL Approach

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ABSTRACT

The study aims to explore the impact of major macroeconomic variables (Capital, Government Expenditure, Net Trade and Domestic Credit) on Gross Domestic Products (GDP) of Bangladesh. In this study we have employed Autoregressive Distributive Lag (ARDL) mode to the short run as well as long run relationship between major macroeconomic variables and GDP of Bangladesh. The findings of the study is that in the short run capital and domestic credit have showed negative relationship at lag 1, while the remaining variables have showed positive relationship with GDP. However, the error correction mechanism shows that disequilibrium in the short run converges to equilibrium at a rate of 34%. Capital, Government Expenditure, Net Trade and Domestic Credit all are positively associated with GDP in the long run. Gross capital formation and government expenditure have strong positive effects on GDP of Bangladesh.

JEL Classification Code: C320, E010, E1

Keywords: Autoregressive Distributive Lag Model, Macroeconomic Variables, Gross Domestic Products, Error Correction Mechanism.

*The views expressed here are the author's own and do not necessarily reflect that of Bangladesh Bank.

INTRODUCTION

Can we quantify the factors that influence economic growth? Economists have tried to figure out the determinants of economic growth of an economy. Analyzing the macroeconomic factors, which are empirically tested, allows one to gauge the health of an economy. Various international studies have shown that this factor differs from time to time, country to country and region to region. Notwithstanding, in a sample of 98 cross country, income per capita which is the outcome of economic growth, has depicted a dynamic positive reference to saving rate and negative reference to population growth (Mankiw Gregory et al., 1992). In reality, economic growth is influenced directly or indirectly by export and consumption (Paksi 2020), trade liberalization and FDI (Ali and Saif 2017), population and gross capital formation (Hashim et al. 2018), money supply and employment (Biswas and Saha 2014), exchange rate and development of human capital (Sharma et al. 2018).

For many nations, rapid economic expansion is a top priority. But negative effects of economic growth include the loss of natural resources and widening gaps between the rich and the poor (Tinh, 2012). Additionally, unpredictable gross domestic product (GDP) growth causes poverty to increase and a nation's progress in health and education to stagnate (Aziz and Azmi, 2017). Bangladesh is a developing country. It has amazing natural attributes. Our natural resources could not be used properly due to a lack of proper planning of natural resources and modern technology. As a result, we are forced to rely on international trade to acquire industrial goods and raw materials in order to meet our domestic demands and exports.

Increasing employment possibilities and reducing poverty depend mostly on economic growth (Ainajjar, 2002). The fight against unemployment and poverty has not yet been accelerated by Bangladesh's economic growth. Since gaining independence, more recent issues have been added to older ones, which have hampered Bangladesh's economic development. Due to a lack of resources, political upheaval, poor governance, and pervasive corruption at all levels of society, the nation has been unable to realize its long-cherished development aspirations. If economic growth factors are reckonable or not, is an issue that macroeconomists have long considered. Analyzing empirically, macroeconomic determinants can be used to measure an economy's strength. These dimensions may differ from country to country and occasionally, according to a number of worldwide researches. In fact, factors including population increase, technological improvement, the accumulating of human and physical capital (Maria & Strykowski, 2009; Sahoo, 2012), and a nation's export-import strategy have all had a direct or indirect impact on economic growth (Rodriguez & Rodrik, 1999).

The impact of these criteria, however, may be brittle over time due to a nation's structural and economic circumstances. Fischer (1993) discovered that repairing the budget deficit and controlling inflation have assisted in supporting economic growth in the region utilizing evidence from Latin America, Chile, and Mexico using cross-sectional and panel data. In a similar vein, Manmohan and Woo (2010) discovered an inversely correlated association between debt levels and economic development in both rich and developing nations.

Evidently, creating an all-encompassing framework for policy that promotes economic growth has always been difficult. These empirical studies are region-specific, so they might not be applicable to other nations. In actuality, it is challenging to identify the critical variables and how they interact in a way that affects economic growth in an economy both in the short- and long-run. In this backdrop, a through empirical analysis is required to determine the key factors influencing Bangladesh's economic growth between 1991 and 2020. Using Pesaran, Shin, and Smith's (2001) autoregressive distributed lag (ARDL) bounds test estimation; it is possible to determine the short- and long-run relationship between certain variables and GDP growth in Bangladesh. The ARDL model, which is derived from the ordinary least square OLS model, is suitable for mixed order integration and provides sufficient delays for accurate estimate (Shrestha MB et al., 2018).

Objectives of the study

The study is focused on identifying the macroeconomic determinants that have contribution on the economic growth of Bangladesh. Various macroeconomic variables that influence the economic growth of Bangladesh. It is not possible to cover all the macroeconomic variables that impact the economic growth of Bangladesh. In this backdrop, this study aims to identify the main macroeconomic determinants of economic growth of Bangladesh.

Organization of the Study

The rest of the study is organized in the following way: Section 2 shows review of previous studies, section 3 provides data and methodology while section 4 illustrates result and discussion and finally sections 5 outlines conclusion and policy implications.

REVIEW OF PREVIOUS STUDIES

Economic growth refers to the expansion of the output of goods and services within an economy. Economic growth is often quantified by assessing the rise in the combined market value of final products and services generated; using estimations such as Gross Domestic Product (GDP). In this empirical study, we considered major macroeconomic variables as determinants of GDP of Bangladesh. This section provides previous studies on the impact of macro variables on economic growth. As GDP is the key indicator of a country's economic development, many researchers have shown their interest on this topic and conducted various studies to find out the main determinants of GDP. We have divided this section of review of previous studies in two ways; (i) previous studies in Bangladesh on this topic, (ii) previous studies in rest of the world on this topic. Currency

rate, Gross Fixed Capital Formation, and imports all had a substantial impact on Nepal's economic growth, although export, FDI, and inflation did not (Ghimire et al. 2020). In Malaysia Consumption spending, government spending, export, the exchange rate, and foreign direct investment were the determining factors in explaining economic growth (Kogid et al. 2010). They also demonstrated that there were numerous short-run causal links as well as long-run co-integration between economic growth and the determinant factors. Ali and Saif (2017) illustrate that trade liberalization; FDI, energy consumption, and agriculture rate all positively affected the GDP of Pakistan. Paksi (2020) assesses the variables that affected Indonesia's economic growth from 1991 to 2019. Export and household consumption growth had a beneficial impact on economic growth, according to the OLS method's findings. The attempts to combat unemployment and poverty had not been accelerated by Indonesia's economic progress, according to Adityara Revan (2020). The results were consistent with economic theory, which was based on both the aggregate supply side and aggregate demand side. In India economic growth was adversely impacted by exchange rates and the development of human capital in the long run, but positively affected by foreign aid, government final consumption spending, and foreign direct investment in the short run (Sharma et al. 2018).

Manoj Kumar DAS 2020 combined a time series technique with an empirical model to better understand the growth process quarterly observations 1996–1997 to 2017–18 was used in this study to examine the effects of macroeconomic variable on growth process. It was found that trade openness favorably influences GDP, but trade openness negatively impacted by GDP, and FDI inflow to India positively affected trade openness.

In a study by BASUKI et al. 2020 that sought to examine how macroeconomic factors, public spending, and BPK¹ opinion all affected economic growth. According to the study's outcomes, regional economic growth was influenced by population in the short term, but in the long term, it was influenced by the population, the poor, the General Allocation Fund, the health budget, foreign investment, and BPK opinion.

Yuliadi 2020 reported that regional gross domestic product was positively and significantly impacted by foreign investment, domestic investment, regional spending, exchange rates, the Human Development Index, and the length of the road.

Mohey-Ud-Din & Siddiqui 2016 intended to find the factors that affect GDP by using macro panel approach in a panel of five south Asian countries and discovered that assistance dependence (AIDGDP), trade openness (OPEN), pricing volatility (PRIVOL), dependence on agriculture (AGRGDP), and political stability (POLSTB) are the key factors of the GDP variations.

In a study Mukit 2021 demonstrated that Bangladesh's Gross Domestic Product (GDP) had a causal relationship with exports, imports, and inflation as well as there was a slight but favorable link between exports and GDP.

Hashim et al. 2018 introduced yearly time series data from 1987 to 2016 to find the interaction between macro variables and GDP growth in Malaysia. According to their findings population and gross capital formation are positively allied to GDP.

Biswas and Saha 2014 reported on his estimation of the macroeconomic factors driving India's economic growth in the short and long-run in a study that used time series analysis. According to the results, money supply, employment, exports, foreign direct investment, and gross domestic capital formation all had a positive impact on India's GDP growth.

Based on the previous studies it is clear that to figure out the main determinants of economic growth of a country is important. In continuation of previous studies we have tried to figure out the determinants of economic growth of Bangladesh by taking yearly data from 1991 to 2022. As time series shows mixed order of integration that is integration order of zero $I(0)$ and one $I(1)$, so we have used Autoregressive Distributed Lag (ARDL) model to investigate the short run as well as long run relationship between macro variables and

¹ The Supreme Audit Board of Bank of Indonesia

economic growth of Bangladesh. The main advantage of using ARDL model is that it is appropriate for mixed order of integration and captures adequate lags for appropriate estimation (Shrestha and Bhatta 2018).

DATA AND METHODOLOGY

Data

To discover the dependency of major macroeconomic variables (capital, government expenditure, net trade and domestic credit) on economic growth rate, we have taken GDP as the proxy variable of economic growth. The yearly time series data (1990 to 2020) of the dependent and independent variables of World Development Indicators (WDI) Data form World Bank data are used to analyze the relationship of the parameters. For analyzing the time series data Eviews-9 software is used and for modeling the equations of the study log of the variables are implied.

Methodology

Testing Stationary:

Unit Root test is nothing but an alternative to correlogram for testing stationary (Maddala G. S. & Kim In-Moo, Unit Roots, cointegration and structural change). Augmented Dickey-Fuller (ADF), Phillips-Perron (PP) test, Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test and Dickey-Fuller (DF) GLS test are the some tests for testing stationary.

a) Augmented Dickey-Fuller (ADF) test

The most commonly used test for checking stationary for a time series is ADF test which is the augmented version of Dickey-Fuller test with higher-order lags to capture the higher-order autocorrelation with a loss of degree of freedom and structural change (Jalil Abdul, Rao Nasir Hamid, 2019).

According to Dickey and Fuller (1981) ΔGDP_{t-1} can be added as the lagged difference form for adopting serial autocorrelation. Followings are the models for ADF test.

$$\Delta GDP_t = \alpha_0 + \alpha_1 GDP_{t-1} + \alpha_2 t + \sum_{i=1}^n \beta_i \Delta GDP_{t-i} + \epsilon_t \dots \dots (i)$$

$$\Delta K_t = \alpha_0 + \alpha_1 K_{t-1} + \alpha_2 t + \sum_{i=1}^n \beta_i \Delta K_{t-i} + \epsilon_t \dots \dots (ii)$$

$$\Delta G_t = \alpha_0 + \alpha_1 G_{t-1} + \alpha_2 t + \sum_{i=1}^n \beta_i \Delta G_{t-i} + \epsilon_t \dots \dots (iii)$$

$$\Delta NT_t = \alpha_0 + \alpha_1 NT_{t-1} + \alpha_2 t + \sum_{i=1}^n \beta_i \Delta NT_{t-i} + \epsilon_t \Delta \dots \dots (iv)$$

$$\Delta DC_t = \alpha_0 + \alpha_1 DC_{t-1} + \alpha_2 t + \sum_{i=1}^n \beta_i \Delta DC_{t-i} + \epsilon_t \dots \dots (v)$$

As the data series for all the exogenous and endogenous variable shows the evidence of both trend and intercept, the equations are drawn for both trend and intercept (Harris RID, 1992).

Where, ϵ_t is the white noise error term for all the ADF models for the current study; ΔGDP_t , ΔK_t , ΔG_t , ΔNT_t and ΔDC_t are first difference for GDP growth rate, capital, government expenditure, net trade (export –import), FDI and personal remittances respectively.

b) Phillips-Perron (PP) test

A nonparametric technique of unit root test to check whether the data series is integrated of order 1 or not, was developed by Phillips Perron (1998). PP test generate good results in case of unspecified higher order autocorrelation which may lose degrees of freedom and heteroscedasticity (Jalil Abdul, Rao Nasir Hamid,

2019). But according to Davidson and MacKinnon (2004) the result of PP test is not robust in case of finite samples. Symbolically-

$$GDP_t = \alpha_0 + \alpha_1 GDP_{t-1} + \epsilon_t \quad \epsilon_t \dots \dots (vi)$$

$$K_t = \alpha_0 + \alpha_1 K_{t-1} + \epsilon_t \quad \epsilon_t \dots \dots (vii)$$

$$G_t = \alpha_0 + \alpha_1 G_{t-1} + \epsilon_t \quad \epsilon_t \dots \dots (viii)$$

$$NT_t = \alpha_0 + \alpha_1 NT_{t-1} + \epsilon_t \quad \epsilon_t \dots \dots (ix)$$

$$DC_t = \alpha_0 + \alpha_1 DC_{t-1} + \epsilon_t \quad \epsilon_t \dots \dots (x)$$

where, $E\epsilon_t=0$, that is, no serial correlation is not an obligatory requirement for Phillips-Perron test (Enders Walter, Third Edition).

VAR model for Lag selection:

Lag length selection is crucial for the autoregressive time series model (Liew, Venus Khim–Sen, 2004). Aikake’s information criterion (AIC) (Akaike 1973), final prediction error (FPE) (Akaike 1969), Hannan-Quinn criterion (HQC) (Hannan and Quinn 1978) and Schwarz information criterion (SIC) (Schwarz 1978) are some of the most popular criterion which are applied for this study. The simple dimension for lag selection with the dependent and independent variables can be expressed as following:

$$GDP_t = f(K_t, G_t, NT_t, DC_t) \quad \epsilon_t \dots \dots (xi)$$

Where, the regressor GDP growth rate (GDP_t) is depended on the regressands capital (K_t), government expenditure (G_t), net trade (NT_t) and domestic credit (DC_t).

Autoregressive Distributed Lag (ARDL) Model:

Autoregressive Distributed Lag (ARDL) model, based on ordinary least square OLS) model, is appropriate for mixed order of integration and captures adequate lags for appropriate estimation (Shrestha MB et al., 2018). For small sample size ARDL model is an appropriate tool for understanding the long-run and short-run relationships in Bangladesh (Samantha NPG et al., 2016).

$$\Delta \ln GDP_t = \alpha_0 + \beta_i \Delta \ln GDP_{t-i} + \lambda_i \Delta \ln K_{t-i} + \gamma_i \Delta \ln G_{t-i} + \delta_i \Delta \ln NT_{t-i} + \rho_i \Delta \ln DC_{t-i} + \epsilon_t \dots \dots (xii)$$

Where, $i = 1,2$ which is the maximum lag order selection for the model and ϵ_t is the white noise error term. For understanding the long run relationship between the dependent variable and independent variables an extra bound test with F-statistic and t-statistic at $I(0)$ and $I(1)$ is applied (Sam et al. 2019). If the absolute calculated value of F-statistic and t-statistic is greater than the critical value of $I(1)$ upper bound test, the null hypothesis of no long run relationship is rejected at different significance level (Pesaran et al., 2001).

For assessing the short-run dynamics, an Error Correction Regression is applied. The model will be as equation (xiii).

$$\Delta \ln GDP_t = \alpha_0 + \sum_{i=1}^n \alpha_{1i} \Delta \ln GDP_{t-i} + \sum_{i=0}^n \alpha_{2i} \Delta \ln K_{t-i} + \sum_{i=0}^n \alpha_{3i} \Delta \ln G_{t-i} + \sum_{i=0}^n \alpha_{4i} \Delta \ln NT_{t-i} + \sum_{i=0}^n \alpha_{5i} \Delta \ln DC_{t-i} + \beta_1 GDP_{t-1} + \beta_2 K_{t-1} + \beta_3 G_{t-1} + \beta_4 NT_{t-1} + \beta_5 DC_{t-1} + \epsilon_t \dots \dots xiii$$

Equation (xiv) compress for short run as well as long run relationships and indicates short run coefficients as $\alpha_1 \dots \dots \alpha_5$ and long run coefficients as $\beta_1 \dots \dots \beta_5$. ϵ_t is the residual term, α_0 is used for intercept and Δ illustrates the difference.

$$\Delta \text{Ln GDP}_t = \alpha_0 + \alpha_1 \Delta \text{Ln GDP}_{t-1} + \alpha_2 \Delta \text{Ln K}_{t-1} + \alpha_3 \Delta \text{Ln G}_{t-1} + \alpha_4 \Delta \text{Ln NT}_{t-1} + \alpha_5 \Delta \text{Ln DC}_{t-1} + \mu_1 \text{ECM}_{t-1} + \epsilon_t \dots \dots (xiv)$$

In equation (xiv), μ_1 is the coefficient of error correction regression model, bears the evidence of short run dynamics speed and $\alpha_1 \dots \dots \alpha_5$ indicates short run coefficients. ϵ_t is the residual terms and α_0 is used intercepts and Δ indicates change. The assumption of the null hypothesis is that in the short $\alpha_1 = \alpha_2 = \alpha_3 = \alpha_4 = \alpha_5 = 0$ which displays that in the short run there is no relationship between dependent and independent variables.

RESULT AND DISCUSSION

Stationarity Testing

Unit root test (Augmented Dickey-Fuller test and Phillips-Perron test) is applied by taking log and first difference for testing stationarity of the GDP, K, G, DC and NT yearly data series. ADF test results from Table 1 shows that all the variables stationary at level data and log transformation. PP test also shows stationarity of the data at level and log transformation.

Table 1: Unit Root Test Result

Variable	Augmented Dickey-Fuller			Phillips-Perron		
	Level	1 st Diff.	Decision	Level	1 st Diff.	Decision
LNGDP	-1.1680	-3.6648**	I(1)	-1.2123	-6.3844***	I(1)
LNK	-3.0908	-3.4550*	I(1)	-4.0706**	-11.7532***	I(0)
LNG	-1.5715	-3.9901**	I(1)	-1.5226	-3.9213**	I(1)
LNDC	-1.7281	-4.9587***	I(1)	0.2870	-7.8859***	I(1)
LNNT	-4.2684**	-6.6394***	I(0)	-10.2027***	-7.0603***	I(0)

*, **, *** indicates significance at 10%, 5% and 1% levels respectively

Source: Authors' own calculation from World Development Indicators (WDI) Data.

Both the ADF and PP test results shows that LNGDP, LNK, LNG and LNDC is stationary at I(1), while only LNNT is stationary at I(0).

ARDL model is the best fitted model for this study to understand the impact of independent variables on dependent variables, as the variables are stationary at I(1) and I(0), that is, there are mixed order of integration.

VAR Lag Order Selection Criteria

The lag length criteria through VAR model is applied to find out the maximum lag for the ARDL model. Table 2 shows the result of VAR lag order selection.

Table 2: VAR Lag Order Selection

Lag	Log L	Log R	FPE	AIC	SC	HQ
0	144.19	NA	4.67e-11	-9.60	-9.36	-9.52
1	329.81	294.44	7.43e-16	-20.68	-19.26*	-20.23
2	367.32	46.56*	3.71e-16*	-21.54*	-18.95	-20.73*

LR: sequential modified LR test statistic (each test at 5% level), * indicates lag order selected by the criterion

Source: Authors’ own calculation from World Development Indicators (WDI) Data

According to FPE, AIC and HQ criteria the lag order is 2 for the ARDL model of the study, while the lag order is 1 for SC criteria. So the maximum lag order 2 is fitted for the ARDL model of GDP with the independent variables (K, G, DC and NT).

ARDL Results

AIC criteria are applied in the ARDL model of maximum 2 lags for all the series. Table 1 in Appendix portrayed that all of the coefficient are significant at different level of significance. The result displayed significant relationships of GDP with capital (K), government expenditure (G), net trade (NT) and domestic credit (DC) at different lag. Capital and domestic credit have showed negative relationship, while the remaining variables have showed positive relationship with GDP.

Long run bound testing

The results of this study reveal that all four variables have positive and significant effects on the economic growth of Bangladesh. Gross Capital formation is highly significant at 1 percent level and positively related to GDP. This result shows that one percent increase in capital will lead to a 0.57 percent increase in the GDP growth of Bangladesh. Government spending is another crucial determinant of economic growth of Bangladesh. According to our result, if government spending increased by 1% the economic growth, which is measured by GDP, will increase by 0.57%. Net trade and domestic credit are other important determinants of GDP in Bangladesh. This study shows that 1% increase in net trade and domestic credit will results in 0.15% and 0.19% increase in GDP of Bangladesh respectively (Table-3).

Table 3: Long run bound test relationship.

Variable	Coefficient	Std. Error	t-Statistic
LNK	0.58	0.1	6.02***
LNG	0.57	0.08	7.35***
LNNT	0.15	0.05	2.93***
LNDC	0.19	0.11	1.68*

Table 4: Long run bound Test results.

	F-Bounds Test		t-Bounds Test	
	I(0)	I(1)	I(0)	I(1)
1%	4.4	5.72	-3.96	-4.96
2.50%	3.89	5.07	-3.65	-4.62
5%	3.47	4.57	-3.41	-4.36
10%	3.03	4.06	-3.13	-4.04

*** indicates significance at 1% level

Source: Authors’ own calculation from World Development Indicators (WDI) Data.

Table 4 revealed the result of F-bound test and t-bound test of long run relationship with GDP and the independent variables. The absolute value of F bound test is 7.82 which have exceeded the upper bound critical value at 1%, 2.5%, 5% and 10% level of significance.

The absolute value of t-bound test (5.29) reported long run relationship with GDP, as the absolute value of t-bound test also exceeds the upper bound of the absolute critical values at 1%, 2.5%, 5% and 10% level of significance.

Therefore, all the test statistics confirmed the evidence of long run cointegration among the variables.

Short run error correction regression results

Table 5 shows the short run dynamic dependency between the dependent variable and the independent variables.

The values and signs of the coefficient of the first difference lagged variables; GDP, k and DC with their respective significant t-statistics bears the evidence of short-run dynamics. The other variables, government expenditure and net trade are not significant in the current study.

Table 5: Error Correction Regression short run results

Variable	Coefficient	Std. Error	t-Statistic
D(LNGDP(-1))	0.28	0.15	1.90*
D(LNK)	0.28	0.04	7.92***
D(LNK(-1))	-0.16	0.03	-5.12***
D(LNDC)	0.07	0.02	3.90***
D(LNDC(-1))	-0.08	0.02	-3.49***
ECM(-1)	-0.34	0.05	-6.95***

* and *** indicates significance at 10% and 1% levels respectively.

Source: Authors' own calculation from World Development Indicators (WDI) Data.

The Error Correction Model (ECM) value is -0.34 and this is highly significant at a one percent level of confidence. This significance is proof of the existence of the long-run relationship between the independent and dependent variables.

This -0.34 indicates 34 percent of disequilibrium in the short-run will be corrected in one year.

Co integration test results

Table 6 of co integration test results reports two types of statistics of unrestricted co integration rank test- trace statistics and maximum eigenvalue.

Trace test indicates 2 co integrating equation at the 0.05 level. Similarly, Max-eigenvalue test indicates 2 co integrating equation at the 0.05 level

Both of the statistics displayed similar result of number of cointegration relationship. However, the result of the two different statistics are relatively strong at 1% level of significance, therefore we reject the null hypothesis.

Table 6: Co integration relation results

Hypothesized No. of CE(s)	Eigen Value	Trace Statistics	0.05 Critical Value	Prob.	Hypothesized No. of CE(s)	Eigen Value	Maximum Eigenvalue Statistics	0.05 Critical Value	Prob.
None*	0.97	168.53	69.82	0	None*	0.97	97.43	33.88	0
At most 1**	0.82	71.1	47.86	0	At most 1**	0.82	48.14	27.58	0
At most 2	0.38	22.96	29.8	0.25	At most 2	0.38	13.44	21.13	0.41
At most 3	0.27	9.52	15.5	0.32	At most 3	0.27	8.87	14.26	0.3
At most 4	0.02	0.64	3.84	0.42	At most 4	0.02	0.64	3.84	

Diagnostic test results

Different tests of diagnostic results are displayed on table 7. For checking serial correlation Breusch-Godfrey Serial Correlation LM Test is used and the result reports that the value of F-statistic is 1.67 at 22 percent level of significance and the test result suggests for accepting the null hypothesis, that is, there is no correlation among the residuals obtained from the ARDL model.

Table 7: Diagnostic tests

Breusch-Godfrey Serial Correlation LM Test	Breusch-Pagan-Godfrey				
heteroscedasticity Test	Normality Test				
H0: No serial correlation at up to 2 lags	Ho: Homoscedasticity	Ho: Normally distributed			
F-statistic	1.67	F-statistic	0.42	Jarque-Bera	2.34
Prob. F(2,15)	0.22	Prob. F(2,15)	0.93	Probability	0.31

Breusch-Pagan-Godfrey heteroskedasticity Test is applied to check the homoscedasticity of the obtained residuals. The F-statistic of 0.42 with 93 percent level of significance implies that the null hypothesis of homoscedasticity is accepted, that is, the residuals are homoscedastic. The test value of Jarque-Bera (2.34) with a 31 percent level of significance suggests accepting the null hypothesis, therefore the residuals of the study is normally distributed.

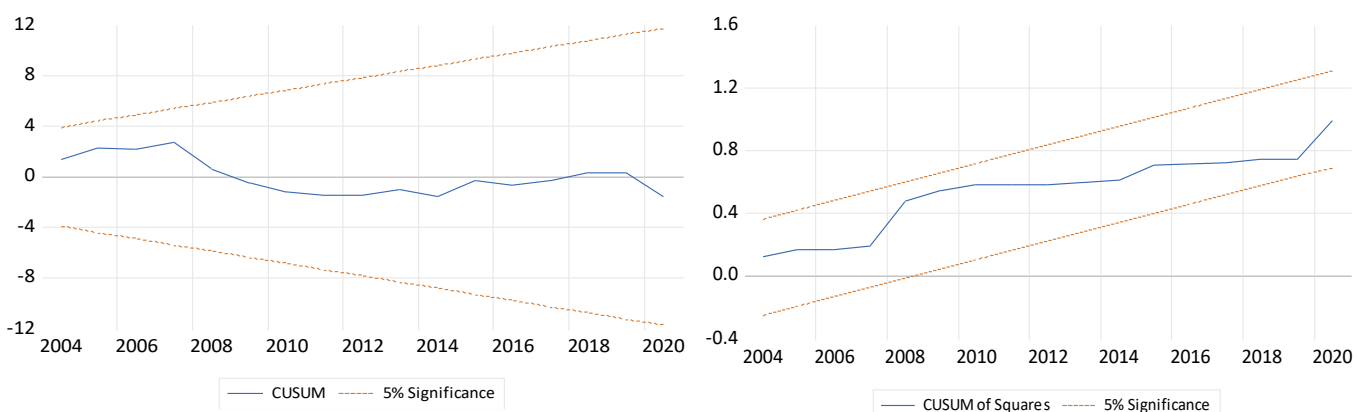


Figure 1: CUSUM and CUSUM squares

To ensure the stability of estimated model and long run relationship of the estimated results we employed CUSUM and CUSUM of squares test. From Figure 1 reveals that both the CUSUM and CUSUM of squares line are in 5 percent critical line boundary, so it clearly indicates that there are parameter stability in the data series.

CONCLUSION AND POLICY IMPLICATION

Economic growth is a much-discussed topic for developing countries like Bangladesh and in this study; we have attempted to detect the determinants of economic growth of Bangladesh. In this study, we have taken GDP growth as a proxy of economic growth. We have used yearly time series data spanning from 1990 to 2020 to discover the relationship between major macroeconomic variables namely capital, government expenditure, net trade and domestic credit and GDP growth of Bangladesh. We have used the ARDL model bound testing approach to find out the relationship between major macroeconomic variables and the economic growth of Bangladesh as the data series has mixed levels of integration. ARDL bound testing shows that there is a long-run relationship between major macroeconomic variables and the economic growth of Bangladesh. After doing the bound test we have done some diagnostics tests to ensure the model's accuracy. All the diagnostics tests show that the model is well-fitted and CUSUM and CUSUMSQ test show that the model is stable. According to our outcomes gross capital formation is the most important determinants of economic growth of Bangladesh. This finding is similar to that of Ghimire et al. 2020, Biswas and Saha 2014, Qamruzzaman & Jianguo, 2017 & Hashim et al. 2018 and the opposite of the findings of Sharma et al. 2018. Government spending is another important determinant of GDP growth in Bangladesh according to the outcomes of this study. This variable is highly statistically significant at one percent level and positively allied with GDP growth. The intensity of this variable to affect the GDP growth of Bangladesh is also high and similar to that of gross capital formation. A study conducted for Malaysia by Kogid et al. 2010 also finds that government spending is an important determinant for GDP growth. Net trade is another determinant of GDP of a developing country and this variable is named trade openness in many studies. In our study, this variable has also positive impact on GDP growth of Bangladesh and is highly significant at one percent level. A wide number of researches considered net trade as a crucial determinant of GDP growth of a country which is similar to the study namely Mohey-Ud-Din & Siddiqui 2016, Qamruzzaman & Jianguo, 2017, Manoj Kumar DAS 2020 & Ali and Saif 2017. Our findings also show that one percent increase in net trade will increase our GDP growth by 0.15 percent which is supported by previous literature. Our last considered variable is domestic credit which is also an important variable that affects GDP growth. In this study, domestic credit is positively associated with GDP growth of Bangladesh which is similar to the study conducted by Qamruzzaman & Jianguo, 2017 & Biswas & Masuduzzaman, 2016 and contrary to the findings of Begum & Shawkatul Islam Aziz, 2019 for Bangladesh.

As a developing country, Bangladesh poses high emphasis on its economic growth, which is measured by GDP growth. Finding the major determinants of GDP growth of Bangladesh is a burning issue in recent times. Our study has attempted to distinguish the major determinants of GDP growth of Bangladesh. According to the ARDL model we have estimated in this study, gross capital formation, government spending, net trade, and domestic credit all have positive relationship with GDP growth. Therefore, to achieve the desired and sustained economic growth the Government of Bangladesh (GoB) should have to adopt a favorable policy for capital formation most importantly human capital.

At the same time, the GoB is consistently increasing the government spending in every budget, which supports its economic growth according to our study. In recent times, Bangladesh's trade volume with the trading partners is increasing but import is always more than export. Therefore, the GoB should prioritize export diversification product innovation and technological development along with incentives to the export-oriented industries to increase export, which will improve our net trade in future. Lastly, domestic credit should make easier by the policy of Bangladesh Bank so that easier credit can play a vital role to increase GDP growth of Bangladesh.

REFERENCE

1. Ali, A., & Saif, S. (2017). Determinants of Economic Growth in Pakistan: A Time Series Analysis (1976-2015). *European Online Journal of Natural and Social Sciences*, 6(4), 686–700.
2. BASUKI, A. T., PURWANINGSIH, Y., SOESILO, A. M., & MULYANTO, M. (2020). Determinants of Economic Growth in Indonesia: A Dynamic Panel Model. *The Journal of Asian Finance, Economics and Business*, 7(11), 147–156. <https://doi.org/10.13106/jafeb.2020.vol7.no11.147>
3. Begum, H., & Shawkatul Islam Aziz, M. (2019). Impact of Domestic Credit to Private Sector on Gross Domestic Product in Bangladesh. *IOSR Journal of Economics and Finance*, 10(1), 45–54. <https://doi.org/10.9790/5933-1001014554>
4. Biswas, B. P., & Masuduzzaman, M. (2016). Bank Credit and Economic Growth Nexus: Bangladesh Perspective. *BBTA Journal: Thoughts on Banking and Finance*, 5(2), 24–39. https://d1wqtxts1xzle7.cloudfront.net/58696714/1553450674549_bbta_journal_v5i2.pdf?1553451018=&response-content-disposition=inline%3B+filename%3DBank_Credit_and_Economic_Growth_Nexus_Ba.pdf&Expires=1609720244&Signature=Ykqs3gmKtYDjKbCh32rkMxq4RMwl9rWw7MTE
5. Biswas, S., & Saha, A. (2014). Macroeconomic Determinants of Economic Growth in India: A Time series Analysis. *SOP Transactions on Economic Research*, 1(2), 54–72. <https://doi.org/10.15764/er.2014.02006>
6. Das, M. K., & Das, T. (2020). Determinants of economic growth in India: A time series perspective Impact of Climate Change on Agricultural Productivity, Vulnerability and Adaptation Strategy of Farmers View project Determinants of economic growth in India: A time series perspective. *Theoretical and Applied Economics*, XXVII(2), 263–280.
7. Doan, Tinh; Stevens, Philip (2012) : Evolution of competition in Vietnam industries over the recent economic transition, *Economics: The Open-Access, OpenAssessment E-Journal*, ISSN 1864-6042, Kiel Institute for the World Economy (IfW), Kiel, Vol. 6, Iss. 2012-19, pp. 1-24. <https://doi.org/10.5018/economics-ejournal.ja.2012-19>
8. Di Maria, Corrado & Strykowski, Piotr. (2009). Migration, human capital accumulation and economic development. *Journal of Development Economics*. 90. 306-313. 10.1016/j.jdeveco.2008.06.008.
9. Fischer, S. (1993) The Role of Macroeconomic Factors in Growth. *Journal of Monetary Economics*, 32, 485-512. [http://dx.doi.org/10.1016/0304-3932\(93\)90027-d](http://dx.doi.org/10.1016/0304-3932(93)90027-d)
10. Francisco Rodriguez & Dani Rodrik, 1999. "Trade Policy and Economic Growth: A Skeptic's Guide to Cross-National Evidence," NBER Working Papers 7081, National Bureau of Economic Research, Inc.
11. Fouad K. Ainajjar, 2002. "Economic Freedom and Macroeconomic Determinants of Economic Growth: Cross-Country Evidence," *Review of Accounting and Finance*, Emerald Group Publishing Limited, vol. 1(3), pages 74-84, March
12. Ghimire, L., Kumar Shah, A., & Kumar Phuyal, R. (2020). Economic Growth in Nepal: Macroeconomic Determinants, Trends and Cross-Country Evidences. *Journal of World Economic Research*, 9(1), 76. <https://doi.org/10.11648/j.jwer.20200901.20>
13. Hasan, M. M., Hossain, B. M. S., & Sayem, M. A. (2022). Determining the Impact of Economic Factors to the Gross Domestic Product in Bangladesh. *International Journal of Economics and Financial Issues*, 12(1), 37–40. <https://doi.org/10.32479/ijefi.12686>
14. Hashim, E., Jalil, N. A., & Ron, N. W. (2018). Determinants of Real GDP in Malaysia. *The Journal of Social Sciences Research*, SPI 3, 97–103. <https://doi.org/10.32861/jssr.spi3.97.103>
15. Hussain, M. E., & Haque, M. (2016). Foreign direct investment, trade, and economic growth: An empirical analysis of bangladesh. *Economies*, 4(2), 1–14. <https://doi.org/10.3390/economies4020007>
16. Jacob, T., & Raphael, R. (2021). the Impact of Key Macroeconomic Factors on the Economic Growth of Bangladesh: an Auto Regressive Distributed Lag Bounds Testing Approach. *Journal of Smart Economic Growth*, 6(2), 101–119.
17. Kogid, M., Mulok, D., Beatrice, L. F. Y., & Mansur, K. (2010). Determinant factors of economic growth in Malaysia: Multivariate cointegration and causality analysis. *European Journal of Economics, Finance and Administrative Sciences*, 24, 123–137.
18. Kumar, Manmohan and Woo, Jaejoon, *Public Debt and Growth* (July 2010). IMF Working Paper No.

- 10/174, Available at SSRN: <https://ssrn.com/abstract=1653188>
19. Mankiw NG, Romer D, Weil D. A Contribution to the Empirics of Economic Growth. *Quarterly Journal of Economics*. 1992;107 (May) :407-437.
 20. Mohammad, S., & Anwar, H. (2015). Determinants of Growth in Bangladesh : An Economic Analysis . 171–186.
 21. Mohey-Ud-Din, G., & Siddiqui, M. W. (2016). Determinants of GDP fluctuations in selected south asian countries: A macro-panel study. *Pakistan Development Review*, 55(4), 483–497. <https://doi.org/10.30541/v55i4i-iipp.483-497>
 22. Mukit, M. M. H. (2021). An Econometric Analysis of the Macroeconomic Determinants Impact of Gross Domestic Product (GDP) in Bangladesh. *SSRN Electronic Journal*, November, 0–2. <https://doi.org/10.2139/ssrn.3767899>
 23. Paksi, R. (2020). Determinants of Economic Growth: Case of Indonesia. *Jdep*, 3(3), 157–171.
 24. Qamruzzaman, M., & Jianguo, W. (2017). Financial innovation and economic growth in Bangladesh. *Financial Innovation*, 3(1). <https://doi.org/10.1186/s40854-017-0070-0>
 25. Shahbaz, M., Ahmad, K., & Chaudhary, A. R. (2008). Economic growth and its determinants in Pakistan. *Pakistan Development Review*, 47(4), 471–486. <https://doi.org/10.30541/v47i4iipp.471-486>
 26. Sharma, R., Kautish, P., & Kumar, D. S. (2018). Impact of Selected Macroeconomic Determinants on Economic Growth in India: An Empirical Study. *Vision*, 22(4), 405–415. <https://doi.org/10.1177/0972262918803173>
 27. Syed, A. A. S. G., & Shaikh, F. M. (2013). Effects of Macroeconomic Variables on Gross Domestic Product (GDP) in Pakistan. *Procedia Economics and Finance*, 5(13), 703–711. [https://doi.org/10.1016/s2212-5671\(13\)00082-8](https://doi.org/10.1016/s2212-5671(13)00082-8)
 28. Yuliadi, I. (2020). Determinants of Regional Economic Growth in Indonesia. *Jurnal Ekonomi & Studi Pembangunan*, 21(1). <https://doi.org/10.18196/jesp.21.1.5035>

APPENDIX

Table 1: Descriptive Statistics

	GDPG (%)	K (in crore BDT)	G (in crore BDT)	NT (in crore BDT)	DC (in crore BDT)
Mean	5.674678	199640.6	391987.0	-645.4386	456971.8
Median	5.507237	103053.7	342271.1	-387.5592	222480.2
Maximum	8.152684	802669.5	753902.5	-151.5339	1791524.
Minimum	3.485228	17110.20	216108.5	-2145.717	22953.40
Std. Dev.	1.179646	217730.7	158562.2	555.0713	519995.2
Skewness	0.209397	1.389235	0.765161	-1.285269	1.252039
Kurtosis	2.393182	3.917404	2.477225	3.761467	3.420384

Source: Authors' own calculation from World Development Indicators (WDI) Data

Table 2: Autoregressive Distributed Lag (ARDL) results

Variable	Coefficient	t-statistic
Constant	0.22	0.3
log GDP(-1)	0.94	5.01***
log K	0.28	5.53***
log K(-1)	-0.24	-4.87***
log K(-2)	0.16	4.89***
log G	0.19	4.44***
log NT	0.05	2.60***
log DC	0.07	2.57**
log DC(-1)	-0.08	-2.15**
log DC(-2)	0.08	4.37**