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Aggregate Consumption Expenditure and Economic Growth: Evidence from Bangladesh

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Aggregate Consumption Expenditure and Economic Growth: Evidence from Bangladesh

Sima Rani Dey [α] & Mohammed Tareque, Ph.D (Boston) [σ]

Abstract- This paper attempts to investigate the relationship between aggregate consumption expenditure and economic growth of Bangladesh using the ARDL Bounds Test approach. The study reveals that consumption expenditure and GDP have a significant impact on each other. Granger non-causality test also has been carried out, and the test reveals that unidirectional causal relationship is running from aggregate consumption expenditure to GDP. Bilateral causality exists between GDP and capital investment. The findings suggest that consumption enhancing fiscal and monetary policies can also boost the economic growth in the context of Bangladesh. That's because Bangladesh is still operating on the relatively flatter part of its long-run supply curve.

I. Introduction

Economic growth is believed to be encouraged when there is incentive to investment; technological frontier expands, human resources improve and fewer barriers for the entrepreneurs. Therefore, economic policies that focus on supply side should be encouraged. However, on the other hand, Keynesian economists believe that a fiscal stimulus to enhance consumption would lead to an increase in aggregate output. Whatever, the traditional Keynesian theory suggests that an increase in consumption expenditure would have the multiplier effect on the real GDP[1].

Paul Krugman (2015) opined that 'not only supply creates its own demand; experience since 2008 suggests, if anything, that the reverse is largely true - specifically, that inadequate demand destroys supply'. In fact, Yegorov (2015) emphasized on the contribution of population density in any economy which is a major source of demand in reality. So, economies with persistently weak demand (low population density) seem to suffer large declines in potential as well as actual output.

Over past decades, several studies have been carried out to examine the interrelation between consumption expenditure (mostly public expenditure) and economic growth. Few types of research also attempted to highlight their causal relationship in the short run and long run for Bangladesh (Amin, 2011; Mahmud and Ahmed, 2012; Nguyen, 2015). These studies might have importance on many grounds, but yet no study has been assessed the linkage between final consumption expenditure[2] and economic growth considering the effect of control variables as well as measured the short run and long run elasticities based on recent data of Bangladesh.

This paper tries to see the relationship mainly between final consumption expenditure and GDP within a multivariate model. But it also looks into the long run equilibrium relationship along with the causal relationship between these two variables and their elastic impact on each other. Also, two dummies are incorporated to capture the effect of two significant shocks as well such as 1988's and 1998's flood in Bangladesh as internal shock and 2008's Lehman Brothers worldwide recession shock as the external shock.

Thus this paper is organized as follows: starting with the introduction, Section 2 mentions the motivations of our study and Section 3 describes literature review. Section 4 focuses on econometric methodology, and Section 5 contains data description and their properties. Section 6 analyzes the empirical results, Section 7 concludes and, finally, Section 8 suggests policy implications of the study.

II. The Motivation for the Study

Bangladesh is the fastest growing economy in South-Asia and moving very fast towards middle-income country. Last 3-4 years GDP growth (6–7 percent per annum) as well as the growth of our last decade confirms the reflection of this phenomenon. To inspect the reason behind this high and stable economic growth, I feel motivated to study the influencing factors of our developing economy. In Bangladesh, final consumption expenditure comprises almost 70% of GDP[3], which is not common in other countries economy. So sustainability of consumption expenditure to induce the GDP growth seems very important. Bangladesh's population is about 160 million and, this population dividend helps to create massive demand of

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[1]Theoretically, it is already established that the multiplier effect depends on crowding effect of the expansionary fiscal policy.

[2] Sum of household final consumption expenditure and general government final consumption expenditure.

[3] According to World Bank collection of development indicators (2016).

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consumption. The author deployed sophisticated econometric tools to check the statistical significance of final consumption expenditure in driving GDP growth.

III. Literature Review

In the last decades, several empirical works have been undertaken on consumption expenditure and economic growth. Among them, most of the studies emphasized on the government consumption expenditure on GDP as well as energy consumption expenditure on GDP using time series data of a single country and panel data of cross countries. Ram (1986), Ahsan et al., (1989), Holmes and Hutton (1990a) observed that public expenditure expansion had a significant effect on national income growth. Similarly, Landau (1983, 1986) and Barth et al., (1990) concluded that public expenditure expansion had significant effect on national income growth for both developed and less developed countries. Kolluri et al., (2000) examines Wagner' s Law of Public Expenditure using time series data drawn from the G7 industrialized countries which provides evidence on both the short-run and long-run effects of growth in national income on government expenditure.

Samudram et al., (2009) investigates the Keynesian view and the Wagner's Law on the role of public expenditure on economic growth for Malaysia (1970–2004) using the Auto Regressive Distributed Lag (ARDL) model. Their result supports both Keynes view[4] and Wagner's Law[5]. Ebaidalla (2013) determined the nature and direction of causality between government expenditure and national income in Sudan using Granger causality test and supported the Keynesian proposition. Singh and Sahni (1984) neither confirm the Wagnerian nor the Keynesian view.

Mishra (2011) attempted to investigate the dynamics of the relationship between real consumption expenditure and economic growth in India and confirms the existence of unidirectional causal relationship which runs from real private consumption expenditure to economic growth in the long-run but no short-run causality. However, Amin (2011) revealed unidirectional causality from economic growth to consumption expenditure that indicates consumption is the result rather than the cause of growth for Bangladesh. The researcher used Johansen cointegration test and ARDL estimation technique to investigate the annual data of Bangladesh from 1976-2009.

Dogan and Tang (2006) aimed to find out the direction of causality between national income and government expenditures for Indonesia, Malaysia, Philippines, Singapore, and Thailand using Granger causality tests. Unidirectional causality evidence (running from government expenditure to national income) has been found only in the case of Philippines. But there is no evidence for this hypothesis and its reverse for other countries. Chimobi (2009) tested for the direction of causality between government expenditure and national income using annual data from 1970-2005 employing cointegration test and Granger causality test. The study also reveals no long-run relationship between the variables but unidirectional causality from government expenditure to national income in Nigeria.

Cheng and Lai (1997) attempted to determine the causality between government expenditure and economic growth along with money supply by applying VAR techniques to single country data from 1954-94. Their study finds bidirectional causality between government expenditures and economic growth in South Korea. Sakthivel and Yadav (2007) explored bidirectional causality between public expenditure and national income as well for India. From the above narrative, it appears that the number of research study so far conducted in particular, on this issue is very much scanty in context of Bangladesh.

IV. Model Specification

In an attempt to investigate the association between final consumption expenditure and economic growth of Bangladesh, our study adapts popular Keynes theory. According to the Keynesian model, consumption is a function of income which is as follows:

$$Consumption = f(GDP, Deposit\ Interest\ rate, Internal\ shock, External\ shock)$$

$$GDP = f(Consumption, Investment, Internal\ shock, External\ shock)$$

Since GDP is not a sole component to affect consumption so, consumption function also considered the influence of deposit interest rate. This study is also trying to look into the relationship of GDP with consumption expenditure and capital investment.

So, our targeted log-linear form of consumption expenditure and GDP equations can be expressed as

$$LCE_t = \alpha_0 + \alpha_1 LY_t + \alpha_2 LDR_t + \alpha_3 ID_t + \alpha_4 ED_t + \varepsilon_t \quad \cdots \quad (1)$$

$$LY_t = \alpha_0 + \alpha_1 LCE_t + \alpha_2 LI_t + \alpha_3 ID_t + \alpha_4 ED_t + \varepsilon_t \quad \cdots \quad (2)$$

[4] Public expenditure is seen as an exogenous factor, which can be used as a policy instrument to influence growth.

[5] And Public expenditure is seen as an endogenous factor or as an outcome, not a cause of growth in national income.

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Where, α_0 is the intercept; CE is the final consumption expenditure; Y is real GDP; CI is the capital investment; DR is the deposit interest rate; ID and ED are the two shocks; ε_t is error term. Expected signs of the equation variables are: $\alpha_1 > 0, \alpha_2 < 0$ (Eq.1); $\alpha_1 > 0, \alpha_2 > 0$ (Eq. 2); and $\alpha_3 < 0, \alpha_4 < 0$ (Eqs. 1-2). All variables are in real and natural logarithm form.

V. Econometric Methodology of the Study

Following econometric theory, firstly author conducted the stationarity test of the time series data[6]. The equation of ADF test can be formulated as follows:

$$\Delta y_t = \mu + \beta_t + \delta y_{t-1} + \sum_{j=1}^{k} \alpha_j \Delta y_{t-j} + \varepsilon_t$$

Where, Δ is the difference operator, t is the time trend, ε is the error term, y_t is the series and, k is the lag. PP test has the same null hypothesis as ADF, and its asymptotic distribution is the same as the ADF test statistic.

A multivariate framework is used in this paper to study the relationship between aggregate consumption expenditure and economic growth. Above two equations Eq. (1-2) are tested separately using modern cointegration based on Autoregressive Distributed Lag (ARDL) "Bound Test" approach introduced by Pesaran and Shin (1999) and Pesaran et al. (2001) to analyze long-run relationship[7]. Autoregressive Distributed Lag (ARDL) model is also helpful to identify the cointegrating vector(s) and if identified, then reparameterized into ECM that ECM result gives short-run dynamics. Appropriate modification of the orders of ARDL model is sufficient to simultaneously correct for residual serial correlation and problem of endogenous variables (Pesaran and Shin, 1999).

In ARDL cointegration technique, we determine the existence of long-run relationship between the variables at first. Then the short and long-run parameters are estimated in the next step. The bound test approach is merely based on an estimate of unrestricted error-correction model (UECM) by using ordinary least squares (OLS) estimation procedure. The UECM is a simple reparameterization of a general autoregressive distributed lag (ADL) model. The consumption Eq. (1) can be expressed in the UECM version of ARDL model as follows:

$$\Delta LCE_t = \alpha_{11} + \alpha_{12} LY_{t-1} + \alpha_{13} LDR_{t-1} + \alpha_{14} LCE_{t-1} + \sum_{i=0}^{n1} \beta_{1i} \Delta LY_{t-i} + \sum_{i=0}^{n2} \gamma_{1i} \Delta LDR_{t-i} + \sum_{i=1}^{n3} \delta_{1i} \Delta LCE_{t-i} + \alpha_{15} ID_t + \alpha_{16} ED_t + \varepsilon_{1t} \quad \cdots \quad \cdots \quad \cdots \quad \cdots \quad (3)$$

$$\Delta LY_t = \alpha_{11} + \alpha_{12} LY_{t-1} + \alpha_{13} LDR_{t-1} + \alpha_{14} LCE_{t-1} + \sum_{i=1}^{n1} \beta_{1i} \Delta LY_{t-i} + \sum_{i=0}^{n2} \gamma_{1i} \Delta LDR_{t-i} + \sum_{i=0}^{n3} \delta_{1i} \Delta LCE_{t-i} + \alpha_{15} ID_t + \alpha_{16} ED_t + \varepsilon_{2t} \quad \cdots \quad \cdots \quad \cdots \quad \cdots \quad (4)$$

$$\Delta LDR_t = \alpha_{11} + \alpha_{12} LY_{t-1} + \alpha_{13} LDR_{t-1} + \alpha_{14} LCE_{t-1} + \sum_{i=0}^{n1} \beta_{1i} \Delta LY_{t-i} + \sum_{i=1}^{n2} \gamma_{1i} \Delta LDR_{t-i} + \sum_{i=0}^{n3} \delta_{1i} \Delta LCE_{t-i} + \alpha_{15} ID_t + \alpha_{16} ED_t + \varepsilon_{3t} \quad \cdots \quad \cdots \quad \cdots \quad \cdots \quad (5)$$

Where, all variables are as previously defined in above. The current (time t) observation of each variable depends on its own lagged values and on the lagged values of each other variable. GDP Eq. (2) also can be written in the same manner.

Pesaran et al. (2001) proposed the bound test method using Wald test (F-statistic) to determine the long-run equilibrium relationship. A joint significance test is performed assuming the null hypothesis of no cointegration of all the one lagged level variables against the alternative hypothesis of having cointegration. Only the coefficients of the one lagged level variables included in the model for Wald test. In other words, is to perform a joint significance test (Wald test) setting $H_0: \alpha_{12} = \alpha_{13} = \alpha_{14} = 0$ against $H_A: \alpha_{12} \neq \alpha_{13} \neq \alpha_{14} \neq 0$ (Eq. 3). Decisions of the bound test are made by F-statistic value that helps to conclude[8] about the long-run relationship between the variables.

[6] Because it is well established that time series data are not statistically significant if they are not stationary. This stationarity decision can be verified using several tests such as Augmented Dickey-Fuller (ADF), Dickey-Fuller GLS, Kwiatkowski Phillips-Schmidt-Shin (KPSS), Philips-Perron (PP) or Ng-Perron. The null hypotheses as well as the asymptotic distribution of ADF and PP tests are same.

[7] ARDL approach has several advantages over other previous and traditional methods. The first is that it does not require all the variables under study to be integrated of the same order because it is applicable irrespective of whether the underlying variables are I(0), I(1) or a combination of both. The second is that ARDL test is relatively more proficient in case of small and finite sample data.

[8] If the F-statistic value is greater than the upper critical value bounds, then the variables are cointegrated and, if the F-statistic value is lower than the lower critical value bounds, then the variables are not cointegrated. Lastly, if the F-statistic value is between the upper critical value bounds and lower critical value bounds, then the decision is inconclusive.

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To ascertain the existence of the casual relationship between the series, we are using modified Wald test (MWALD) proposed by Toda and Yamamoto (1995)[9]. This approach involves VAR model with level variables (rather than the first differences, like Granger causality tests). Mainly, this approach artificially augments the correct VAR order, k, by the maximal order of integration, say d_{max}. Once this is done, a $(k + d_{max})^{th}$ order of VAR is estimated, and the coefficients of the last lagged d_{max} vector are ignored (see Caporale and Pittis, 1999; Rambaldi and Doran, 1996; Rambaldi, 1997; Zapata and Rambaldi, 1997). This TY procedure ensures that the usual test statistic for Granger causality which has the standard asymptotic distribution for making valid inferences.

Representations of consumption equation with GDP and deposit interest rate according to VAR system (GDP equation with consumption expenditure and capital investment can also be written in the following form), to conduct Toda and Yamamoto version of Granger non-causality models test is written as follows:

$$LCE_t = \alpha_0 + \sum_{i=1}^{k} \alpha_{1i} LCE_{t-i} + \sum_{j=k+1}^{d_{max}} \alpha_{2j} LCE_{t-j} + \sum_{i=1}^{n} \gamma_{1i} LY_{t-i} + \sum_{j=k+1}^{d_{max}} \gamma_{2j} LY_{t-j} + \sum_{i=1}^{k} \theta_{1i} LDR_{t-i} + \sum_{j=k+1}^{d_{max}} \theta_{2j} LDR_{t-j} + \varepsilon_{1t} \quad \cdots (6)$$

$$LY_t = \beta_0 + \sum_{i=1}^{k} \beta_{1i} LY_{t-i} + \sum_{j=k+1}^{d_{max}} \beta_{2j} LY_{t-j} + \sum_{i=1}^{n} \tau_{1i} LCE_{t-i} + \sum_{j=k+1}^{d_{max}} \tau_{2j} LCE_{t-j} + \sum_{i=1}^{k} \vartheta_{1i} LDR_{t-i} + \sum_{j=k+1}^{d_{max}} \vartheta_{2j} LDR_{t-j} + \varepsilon_{2t} \quad \cdots (7)$$

$$LDR_t = \mu_0 + \sum_{i=1}^{k} \mu_{1i} LDR_{t-i} + \sum_{j=k+1}^{d_{max}} \mu_{2j} LDR_{t-j} + \sum_{i=1}^{n} \varphi_{1i} LY_{t-i} + \sum_{j=k+1}^{d_{max}} \varphi_{2j} LY_{t-j} + \sum_{i=1}^{k} \omega_{1i} LCE_{t-i} + \sum_{j=k+1}^{d_{max}} \omega_{2j} LCE_{t-j} + \varepsilon_{3t} \quad \cdots (8)$$

The long-run elasticity can be derived from UECM that is the estimated coefficient of the one lagged explanatory variable (multiplied with a negative sign) divided by the estimated coefficient of the one lagged dependent variable (see Bardsen, 1989). The estimated coefficient of the first-differenced variable in UECM is short-run elasticity. The long-run value for the dummy variable is used directly from the estimated equation without dividing by the lag one level dependent variable (Choong, Law, Yusop, & Choo, 2005). Lastly, relevant diagnostic tests and stability tests are conducted for ensuring the goodness of fit of the model. The diagnostic tests consist of normality, serial correlation, heteroscedasticity, and structural stability tests associated with the model.

VI. Data Description and their Properties

Real GDP, gross fixed capital formation, deposit interest rate and final consumption expenditures are taken to estimate our targeted equations. Annual time series data[10] (1980-2016) were collected from the World Bank. Basic statistical information of the variables (Table 1) and the graphical presentation of our level data and stationary data (fig. 1-4) are described as well.

Table 1: Descriptive statistics, by logarithmic variable

Variable	Definition	Mean	Standard Deviation	Minimum	Maximum
LY	GDP (constant LCU[11])	1.21	0.524	0.410	2.18
LCE	Final consumption expenditure (constant LCU)	1.05	0.399	0.492	1.79
LCI	Gross fixed capital formation (constant LCU)	-0.37	0.819	-1.77	1.04
LDR	Deposit interest rate (%)	2.19	0.042	1.71	2.49
Observations	37				

[9] Toda and Yamamoto (TY) technique avoids the problems linked with standard Granger causality test that ignores any possible non-stationary or cointegration between series while testing for causality.

[10] It is to be noted that the presentation of the findings with quarterly data could be a more suitable way to accomplish such an exercise. So data availability is the limitations of the study.

[11] Local currency unit (LCU).

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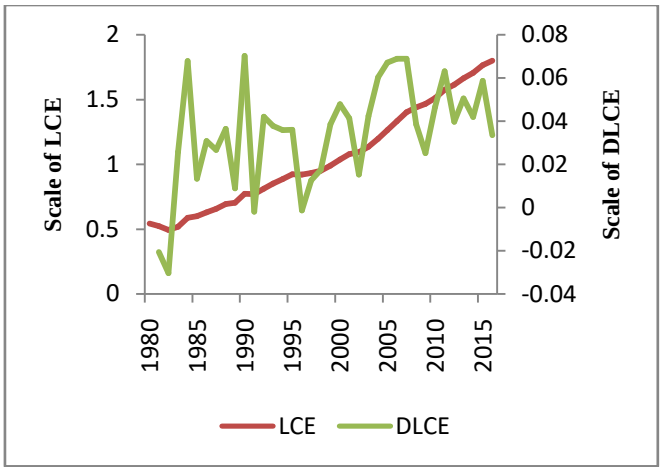

Fig. 1: Log of the level and first differenced series of CE

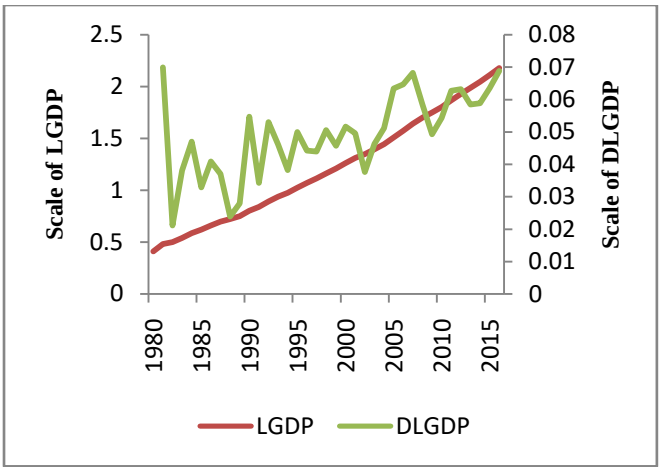

Fig. 2: Log of the level and first differenced series of GDP

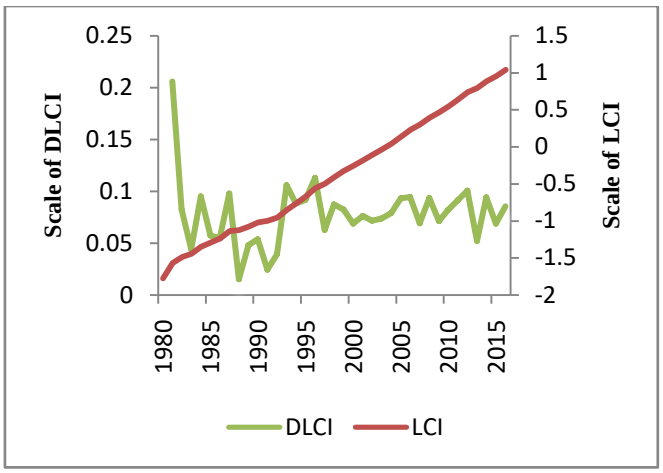

Fig. 3: Log of the level and first differenced series of CI

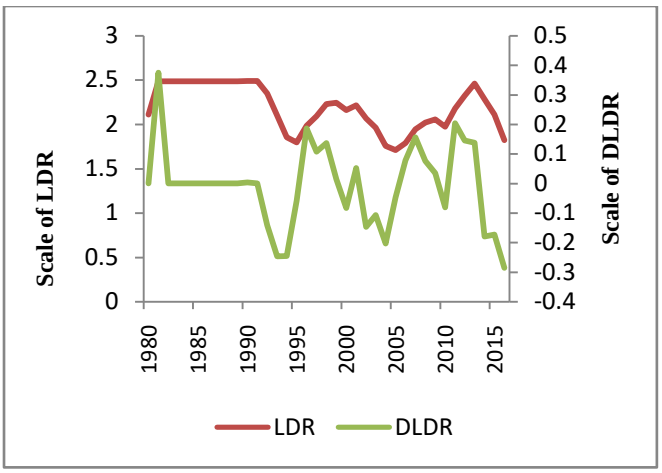

Fig. 4: Log of the level and first differenced series of DR

The figures show that both final consumption expenditure (LCE), capital investment (LCI), deposit interest rate (LDR) and GDP (LGDP) depict linear upward and deterministic trend. It also shows that the data are not stationary at level. Then we have taken their first difference to ensure their stationarity. The first differenced series of LCE, LGDP, LDR, and LCI are incorporated along with their level data in the above figures.

VII. Estimation and Empirical Results

a) *Unit Root Tests*

To transform our non-stationary series to stationary, we used Augmented Dickey-Fuller test (Dickey and Fuller 1979, 1981) and Philips-Perron (Philips and Perron, 1988) unit root tests. The reason behind for doing so has already been delineated in preceding paragraph.

Table 2: Unit root tests, by logarithmic variable

Variables	Augmented Dickey-Fuller Test				Phillips-Perron Test				Order of Integration
	Level		1st Difference		Level		1st Difference		
	Intercept	Intercept and trend	Intercept	Intercept and trend	Intercept	Intercept and trend	Intercept	Intercept and trend	
LY	5.113 (1.000)	0.5269 (0.9990)	-0.9193 (0.769)	-4.509* (0.0056)	5.113 (1.000)	0.5269 (0.9990)	-4.0509* (0.0034)	-9.9154* (0.0000)	I(1)
LCE	2.876 (1.000)	-2.110 (0.5228)	-4.537* (0.0009)	-5.335* (0.0006)	3.0758 (1.000)	-2.1046 (0.5259)	-4.7386* (0.0005)	-5.3882* (0.0005)	I(1)
LCI	0.060 (0.9580)	-1.556 (0.7902)	-7.489* (0.0000)	-7.8537* (0.0000)	0.0307 (0.9553)	-1.969 (0.6095)	-7.0138* (0.0000)	-7.8250* (0.0000)	I(1)
LDR	-2.589 (0.1046)	-3.203 (0.1002)	-3.913* (0.0051)	-3.775* (0.0309)	-1.728 (0.4087)	-2.249 (0.4492)	-3.752* (0.0074)	-3.674* (0.0377)	I(1)

Figures in ( ) represents probability-values respectively

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The stationarity tests were done at the level and first difference for both possibilities intercept as well as with intercept and trend. Both ADF and PP (Table 2) test results reveal that the variables are non-stationary at the level at 5% level of significance but they became stationary at first difference level. Thus, all the variables are integrated of order one i.e., I(1) respectively[12].

b) ARDL Bound Test Approach

Since our series are integrated of order one, so it's needed to find whether the variables are cointegrated or not. Autoregressive Distributed Lag model to cointegration and error correction is applied to investigate the relationship between final consumption expenditure and GDP.

Table 3: Bound Test Results

Dependent Variable	AIC Lags	F-Statistic	Decision
Consumption Eq.			
$F_{CE}(CE \setminus Y, DR)$	3	4.85	Cointegration
$F_{Y}(Y \setminus CE, DR)$		58.44	Cointegration
$F_{DR}(DR \setminus Y, CE)$		5.99	Cointegration
GDP Eq.			
$F_{Y}(Y \setminus CE, CI)$	4	5.27	Cointegration
$F_{CE}(CE \setminus Y, CI)$		1.86	No cointegration
$F_{CI}(CI \setminus CE, Y)$		4.55	No cointegration
Lower bound critical value at 1%		3.65	
upper bound critical value at 1%		4.66	

The ARDL bound test results to determine the presence of the long-run relationship between the variables in both consumption and GDP equation are presented in Table 3. The computed F-statistic of the estimated equations exceeded the upper bounds at 1% level of significance. As per the rule, the higher F-statistic value supports the rejection of the null hypothesis. So it leads us to argue that final consumption expenditure and GDP have the long-run association.

Table 4: ARDL Regression outputs

Dependent Variable: D(LCE)			Dependent Variable: D(LY)		
ARDL(1, 1, 2) selected based on AIC			ARDL(2, 4, 4) selected based on AIC		
Variable	Coefficient	Prob.*	Variable	Coefficient	Prob.*
C	-0.10603**	0.0078	C	0.473102**	0.0004
LCE(-1)	-0.208126*	0.0344	LY(-1)	-0.56840**	0.0008
LY(-1)	0.157696*	0.0341	LCE(-1)	0.326714**	0.0022
LD(-1)	0.041006**	0.0052	LCI(-1)	0.224546**	0.0005
D(LY)	1.457407**	0.0000	D(LY(-1))	0.713732**	0.0004
D(LD)	0.030569	0.2034	D(LCE)	0.307766**	0.0001
D(LD(-1))	-0.080384**	0.0012	D(LCE(-1))	-0.34182**	0.0017
ID	0.017227	0.1137	D(LCE(-2))	0.013170	0.8392
ED	-0.001626	0.9082	D(LCE(-3))	-0.130000	0.0538
			D(LCI)	0.223027**	0.0018
			D(LCI(-1))	-0.14775**	0.0198
			D(LCI(-2))	-0.013329	0.7932
			D(LCI(-3))	-0.076031	0.0779
			ID	-0.010022*	0.0454
			ED	-0.002331	0.7262
R-squared	0.999124		R-squared	0.999938	
F-statistic	3708.164 (0.00000)		F-statistic	20646.59 (0.00000)	
DW-statistic	1.967772		DW-statistic	2.501294	

*Figures in ( ) represents probability-values respectively, **Significance at 1% level and *Significance at 5% level*

Considering the selected lag length of AIC criterion, ARDL (1, 1, 2) model is selected as our appropriate model for consumption equation and ARDL(2, 4, 4) model for GDP equation. The results of the two models showed that a statistically significant association exists between final consumption expenditure and GDP (Table 4). Internal dummy

[12] A variable Y, is said to be integrated of order d, [I(d)] if it attains stationarity after differencing d times (Engle and Granger, 1987).

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(1988's flood and 1998's flood) is significant at 5% level though it reveals the positive impact on consumption function but negative impact on GDP. On the contrary, external dummy (2008's recession) was not significant at all for any models but negative for both equations. Intercept term of both equations became significant at 1% level of significance.

Table 5: Estimated ARDL long-run and short-run coefficients

Long-run coefficient estimates						
	Consumption Eq.			GDP Eq.		
	Constant	LY	LDR	Constant	LCE	LCI
	-0.509440 (0.1102)	0.757693 (0.0000)	0.197024 (0.0525)	0.832333 (0.0000)	0.574791 (0.0000)	0.395046 (0.0000)
Short-run coefficient estimates						
Lag order	0		1	2		3
Consumption Eq.						
ΔLY	1.457407 (0.0000)					
ΔLDR	0.030569 (0.1267)		-0.080384 (0.0002)			
ID	0.017227 (0.0687)					
ED	-0.001626 (0.9006)					
ECT_{t-1}	-0.208126 (0.0001)					
GDP Eq.						
ΔLY			0.713732 (0.0001)			
ΔLCE	0.307766 (0.0000)		-0.341818 (0.0005)	0.013170 (0.8196)		-0.130000 (0.0331)
ΔLCI	0.223027 (0.0005)		-0.147751 (0.0123)	-0.013329 (0.7604)		-0.076031 (0.0553)
ID	-0.010022 (0.0299)					
ED	-0.002331 (0.7035)					
ECT_{t-1}	-0.568405 (0.0001)					

Both short-run and long-run coefficients are providing strong evidence of having a significant association between consumption expenditure and GDP at 5% level of significance. The ECM coefficient value is negative as well as lying between 0 and 1. ECM value -0.208 and -0.57 in two equations suggest that the speed of adjustment to restore the equilibrium in the long run is 21% and 57%. It indicates that equations will restore their equilibriums by around five and two years respectively.

Table 6: Short-run diagnostic tests

Consumption Eq.		GDP Eq.	
Breusch-Godfrey Serial Correlation LM Test	[1] 0.020656 (0.8650); [2] 0.465804 (0.5200)	Breusch-Godfrey Serial Correlation LM Test	[1] 2.174534 (0.0530); [2] 1.463305 (0.0780)
Heteroskedasticity Test: ARCH	[1] 0.218446 (0.6311); [2] 0.660019 (0.4989)	Heteroskedasticity Test: ARCH	[1] 0.281664 (0.5854); [2] 0.123107 (0.8736)
Jarque-Bera normality test	0.568426 (0.752606)	Jarque-Bera normality test	1.198210 (0.549303)
Ramsey RESET test	0.163828 (0.6891)	Ramsey RESET test	0.00563 (0.9411)

Diagnostic tests results are based on F-statistic, and figures in ( ) represents probability-values respectively

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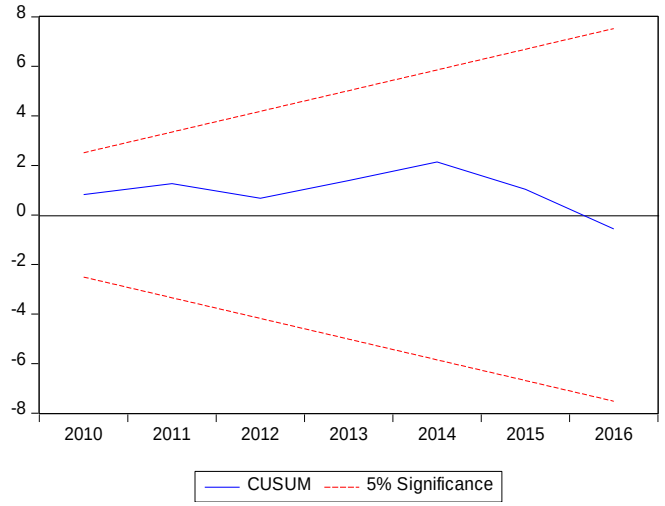

Fig. 5: Plot of CUSUM test of Consumption Eq.

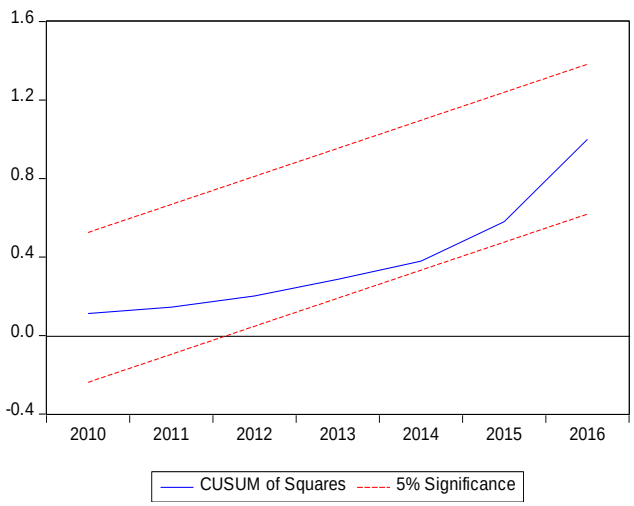

Fig. 6: Plot of CUSUM of sq. test of consumption Eq.

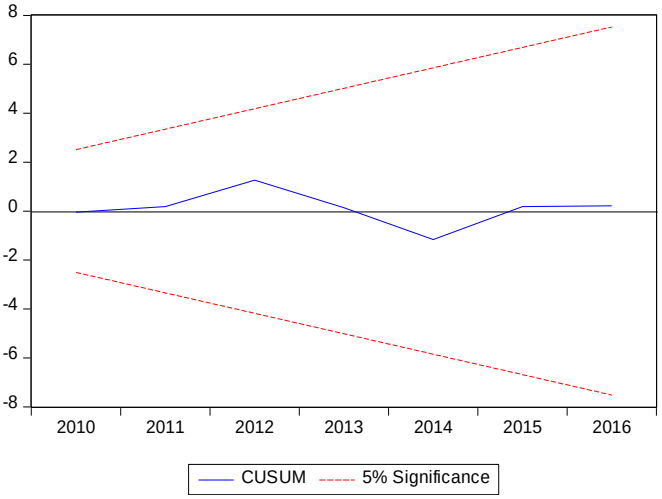

Fig. 7: Plot of CUSUM test of GDP Eq.

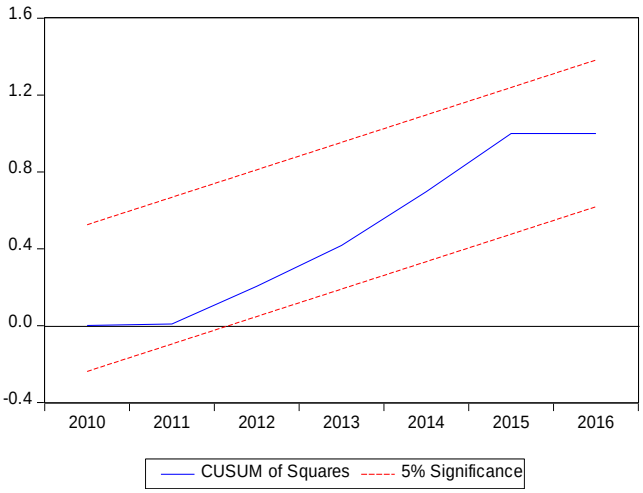

Fig. 8: Plot of CUSUM of Sq. test of GDP Eq.

Above model's ARDL equation validity is confirmed by conducting relevant diagnostic tests. It indicates that essential econometric properties are satisfied by both equations. The ARDL models are found to be robust against residual correlation, and the ARCH test confirms the homoskedasticity of the residuals in two equations. At the same time, Jarque-Bera normality test ensured that estimated residuals are normal. Ramsey RESET test, the CUSUM, and the CUSUM of Sq. test also confirmed the correct functional form of the equations.

c) Elasticity Calculation

The short run and log run elasticities of the two equations are presented in Table 8. It shows that GDP and the final consumption expenditure exert the positive impact on each other. GDP has an elastic impact on final consumption expenditure which implies that a 1% increase in real GDP could lead to an increase in the final consumption expenditure by .76% in the long run. Whereas, the short run increase in final consumption expenditure is 1.46% due to increase in GDP.

Table 7: Long run and short run elasticities

Variables	Dept. Variable D(LCE)		Variables	Dept. Variable D(LY)	
	Short run	Long run		Short run	Long run
LY(-1)	1.46**	0.76**	LCE(-1)	-0.15**	0.57**
LDR(-1)	-0.05*	0.20**	LCI(-1)	-0.02*	0.39**
ID	-	0.08	ID	-	-0.02
ED	-	-0.008	ED	-	-0.004

Besides, Final consumption expenditure has an elastic impact on GDP where 1% increase in final consumption expenditure could lead to an increase in the real GDP by 0.57% in the long run.

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d) Granger Non-Causality Test

Table 8: Granger non-causality test results

Consumption Eq.				GDP Eq.			
Dept. Variable	χ^2-Statistic			Dept. Variable	χ^2-Statistic		
	LCE	LY	LDR		LY	LCE	LCI
LCE	-	5.11	1.39	LY	-	22.6**	18.6**
LY	7.22*	-	4.32	LCE	4.10	-	11.4*
LDR	14.9**	17.2**	-	LCI	55.5**	51.0**	-
Direction of causality	CE→Y; CE→DR; Y→DR			Direction of causality	CE→Y; CE↔CI; Y↔CI		

The Granger non-causality results of Table 9 reveal that final consumption expenditure has the unidirectional causal relationship with GDP. Study results reveal new findings comparing the study of Amin (2011). Final consumption expenditure causes deposit interest rate in a unidirectional way as well. On the other hand, bidirectional causality exists between consumption expenditure and capital investment. Additionally, bidirectional causality is running between GDP and capital investment as well.

VIII. Conclusions

Long run association between final consumption expenditure and economic growth is confirmed by ARDL Bound test approach. It is evident from the findings that consumption expenditure as well as economic growth influences each other significantly. Even their estimated short and long-run coefficients are also consistent with that finding. But Granger non-causality test confirms the unidirectional relationship is running from final consumption expenditure to GDP. GDP and final consumption expenditure have the most elastic impact on each other in the long run whereas; GDP has the most elastic impact on final consumption expenditure in the short run. We didn't find any significant impact of both internal and external shocks on our economy.

IX. Policy Implication

Most of the economic researches generally suggest policies based on supply-side point of view for economic growth, but demand side is more powerful in case of Bangladesh. Since, theoretically, we are constraint by technology, infrastructure, and improved human resources. In fact, the findings show that final consumption expenditure and GDP influence each other significantly. So, higher production can provoke consumption by influencing economic growth.

On the other hand, our external income sources are stimulating our consumption behavior, such as quick cash flow like remittance mostly spent on consumption expenditure. Considering technology constraint and consumption pattern, in general, the government can take such monetary and fiscal policy that is consumption enhancing. Since our domestic market is quite large and we have the demand-driven economy, so a jump in domestic consumption can boost our production.

In Bangladesh context, fiscal and monetary policy inducing consumption will have a positive impact on growth. Demand enhancing growth can help technological innovation (it's already evident[13] in remarkable scale) and domestic industrialization through the development of the consumption based industry. As the long run curve of Bangladesh is relatively flatter so there is a window where we can use consumption enhancing policy keeping a watchful eye on the value of money and budget deficit.

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[13] Pharmaceutical industry, Engine driven boat and Engine driven rickshaw, Walton products.

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