Government Expenditure and Household Consumption in Bangladesh through the Lens of Economic Theories: An Empirical Assessment

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Abstract

The relationship between government and household consumption remains to be one of the contentious issues in both theories and empirics, though its' immense importance in fiscal policy formulation. Like theories, the empirical studies regarding the relationship between government and household consumption provide opposing results. In this backdrop, the present study examines public-private consumption relationship for Bangladesh economy through the lens of economic theories using the cointegration and error correction modeling strategies to tackle the problem of non-stationary data. Two different variant of cointegration technique have been employed and in either case a valid long run positive relationship has been found. However, the error correction model has found an inverse relationship between public and private consumption in the short run. Finally, we test for Granger causality and find no long run causal relationship between government consumption and household consumption. In general, our finding goes with the Barro-Ricardian equivalence hypothesis of government spending that household consumption is unrelated with government consumption decision in the long-run.

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I.   Introduction:

How government consumption affects household's consumption remains as one of the contentious issues in macroeconomics literature. Three major schools of thought are observed in literature, e.g. Keynesian views of government consumption, 'substitutability hypothesis'; and 'Ricardian equivalence'. Each school has come up with distinct set of explanations regarding the relationship between government consumption and households' consumption. Conclusions of empirical works on the issue also diverge (see Kormendi, 1983; Aschauer, 1985; and Karras, 1994).

In Keynesian view a given change in government spending will produce a multiplier effect on the aggregate demand[3], as consumption expenditure is regarded as one of the major components in aggregate demand. This multiplier effect is set in motion when households start to spend out of their additional income from work opportunities funded by government spending. Substitutability hypothesis has come into front due to the seminal contribution of Martin Bailey (1962) who hypothesized that private consumption would be substituted one for one for a given change in government consumption regardless of the way it is financed. Empirical research to test the substitutability hypothesis has reached mixed results. For example, Kormendi (1983) and   Aschauer (1985) found evidence in support of incomplete substitution. On the contrary, Karras (1994) concluded that the relationship between government and private consumption is best described as being "complementary or unrelated". Explaining relationship between government and private consumption as unrelated goes with the explanation provided by

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[3] Aggregate Demand would change by more than proportionally for a given change in exogenous variable like government spending. In a simple model, multiplier happens to be $\dfrac{1}{1-MPC}$ where MPC refers to Marginal Propensity to Consume. As, $0 < MPC < 1$, value of the multiplier would always exceed unity.

Ricardian Equivalence (also known as Barro-Ricardian Equivalence[4]) which predicts government spending, regardless the way of financing, does not affect household consumption as household internalize government's budget constraint into their own life time budget constraints.

Conclusions of the empirics on relationship between government consumption and household consumption are also mixed and varies with the regions, countries; as well as time. Though, plethora of researches on the issue has been carried out at country level and cross country level, we were unable to find a sound empirical work in light with the contentious economic theories regarding Bangladesh economy. In this backdrop, we make an attempt to carry out the empirical exercise in the context of a small open economy namely Bangladesh.

The motivation of the present paper comes mainly from three sources. Firstly, dispute on the relationship between government consumption and household consumption that exists in both theories and empirics. Secondly, most of the empirical studies are focused on developed countries that are much different from developing countries in terms of economic structure and government spending patterns, hence household consumption might exhibit a different response after a fiscal shock. Finally, though government's budget implications on household welfare are widely discussed issue, there are no rigorous empirics that might provide the ultimate magnitude of the impact that government consumption potentially has on private households' consumption in developing countries like Bangladesh. The study also has important policy implications. Unbridled relationship between government consumption and private consumption will help in formulation of informed fiscal policy making, as the policy makers will have the knowledge that how government consumption affects private consumption.

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[4] In 1974, Robert J. Barro provided some theoretical foundation for Ricardo's speculations assuming households as infinitely lived agent which exhibit intergenerational altruism and also assuming the capital market is perfect.

Here we utilize the recently developed time series econometric tools to find whether there exists a valid long run relationship between the public and private consumption. Evidence suggests that for Bangladesh government consumption does not influence household consumption, in a significant manner, in the long run though in the short run, higher government consumption is found to reduce household consumption. Therefore fiscal shock is believed to be useful in producing desired effect as aggregate demand is neither "crowded in" nor "crowded out" due to the indifference of households about a rise in government consumption in the long run context.

This paper is divided into six major sections. In section II, we discuss the main features of public consumption and financing in Bangladesh; while in the following section, we review available major literatures, both theory and empirics, on the issue. The Section IV includes brief derivation of the theoretical model and empirical specification of the econometric model of our consideration. The next section presents empirical estimations of the model and the analysis of the results; while section VI culminates the paper with concluding remarks.

II.   Overview of Government Consumption and Financing in Bangladesh

In economics, government is traditionally responsible for the provision of goods and services that private market fail to provide. These may include provision of national defense, civil administration, law and order and establishing various other economic and social infrastructures which can play important role in economic growth and development. However, for developing and low income countries like Bangladesh, which are severely constrained by lack of "private savings and private investment" and where cost of doing business is very high due to lack of efficient institutional set up coupled with rampant corruption, government has a bigger role to

play[5]. Moreover, government needs to play wider role raising national investment, as Blejer and Cheasty (1989) recognized the complementarities between public and private investment in case of developing countries. They reasoned that public investment which are related to infrastructure and provision of public goods can enhance the possibilities for increasing the expected rate of return of the private capital by increasing its productivity and raising demand for the private sector output.

Other than the traditional obligations, government of Bangladesh (GOB) undertakes various development efforts to foster economic growth on a persistent basis. This dual role of GOB is well reflected by the structure of its annual budget-which consist "revenue budget" section that includes government incomes and expenditures pertaining to traditional duties, whereas the "development budget" is formulated to build on socioeconomic infrastructure to propel growth and development of the country. This section is devoted to streamline the features of fiscal management of Bangladesh to provide a general evaluation of how efficiently government of Bangladesh mobilizes and spends its domestic resources.

If we look at the trend of fiscal measures over 1973 to 2008, Bangladesh government seems to be experiencing a stable fiscal disequilibrium over the period in question (Figure 1).

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[5] Bangladesh ranked 119 out of 183 economies according to the recent issue of "Doing Business 2010" survey conducted by the World Bank and IFC. In the previous survey Bangladesh had ranked 115.

**Figure 1: Evidence of Fiscal Disequilibrium**
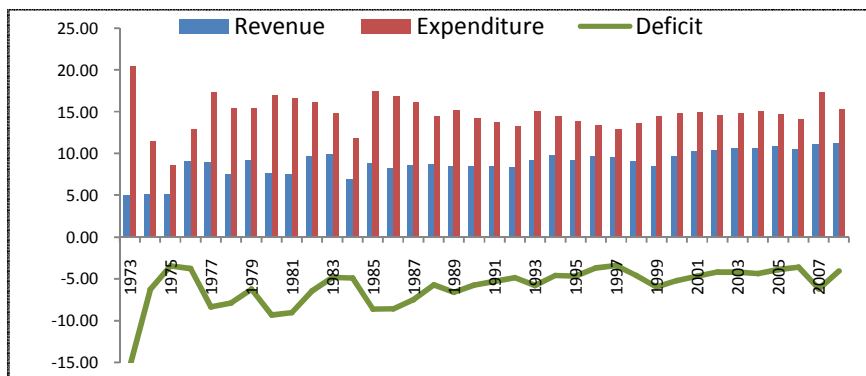
The average deficit for the whole time period had been 5.9 percent of Gross Domestic Product (GDP). Since the revenue as a percent of GDP had averaged at around 9 percent of GDP, it fell short of the expenditure GDP ratio which averaged at around 15 percent level over the period. The deficit however remained more or less stable. Islam and Wahid (1996) identified an interesting "cyclical pattern" of fiscal deficit in Bangladesh. The cyclical pattern is attributed due to the improvement in the fiscal management every time a political party takes the office newly. However, as time goes on the initial momentum evaporates and fiscal disequilibrium worsens. Though the budget balance remained stable and had always been negative, Hossain (1996) concluded that fiscal deficit is within tolerable limit since it did not cause any major economic problem.

To finance its activities, Government of Bangladesh extracts resources both from internal and external sources. Central government collects bulk of the revenue, about 97 percent and the remainder is collected by the local government which reflects the lack of decentralization in the revenue mobilization activities in Bangladesh (Hossain 1996). Here we analyze the features of revenue collection venture by the central government. There are two broad categories- Tax revenue and Non-tax revenue. Major share of the revenue comes from different kinds of taxes.

While other forms of non-tax sources remain to be narrow for GOB. In recent years, tax revenue account for about 9 percent of GDP while non-tax revenue is around 3 percent of GDP. Another important feature of the revenue composition is that GOB collects most of the revenue from indirect taxes with custom duty, excise duty and commodity taxes being the most dominant sources of revenue generation. Income tax to GDP ratio for Bangladesh stands out to be one of the lowest in the world. Low per capita GDP, even lower tax base coupled with weak administration and tax evasion tendency contribute to low revenue coming from income and wealth taxes. On the other hand industrial development in Bangladesh is at its beginning and GOB in an attempt to promote industrial growth, exercise various kinds of tax relief and exemptions to firms which keeps revenue from corporate and industrial firms at a low level. Despite these facts Tax to GDP ratio remained stable and registered a steady increase over the years, some researchers attribute this to exercise of "discretionary changes" in tax policy. Since the need for increasing government involvement would keep on rising and with lower income tax to GDP ratio, GOB would have to rely on such discretionary changes in the tax policy to generate extra revenue which in the long run might be problematic for Bangladesh (Islam and Wahid 1996).

Figure 2: Tax and Non-Tax Revenue as a Percent of GDP
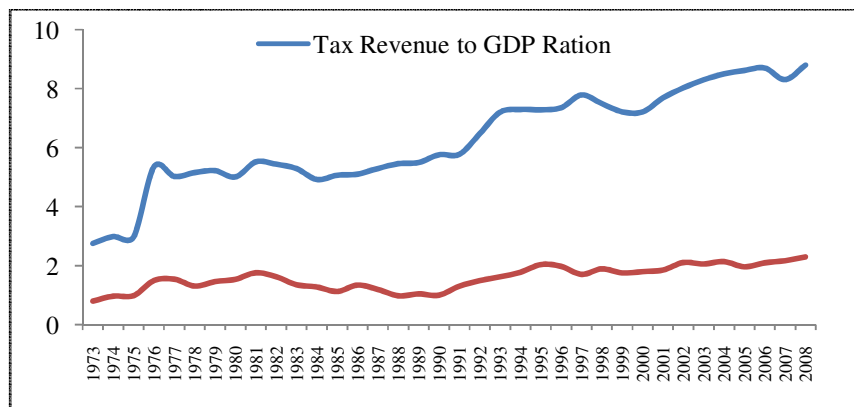
One more point about the revenue sector of GOB is worth mentioning- as custom duty and excise duty are the main sources of revenue generation for Bangladesh, it can be inferred that Bangladesh would remain very vulnerable to external shocks. And greater share of taxes coming from such indirect sources also imply that the tax structure of Bangladesh is regressive in nature i.e. the poor people pay more. It is therefore necessary for Bangladesh to shift from commodity based indirect taxation towards income based direct taxation system.

As the government expenditure as a percent of GDP always exceeded the revenue output ratio, it caused a consistent level of deficit. It is also worth mentioning that growth of government expenditure in Bangladesh follows Wagner's law i.e. government expenditure expands at a more speedy rate than that of the rise of economic activity of the country.[6] Therefore the elasticity of government spending with respect to GDP is greater than unity.

As we decompose the expenditure of GOB, it could be found that the share of defense spending is one of the major components. Though, in recent years, the relative magnitude of the defense allocation decreased but the absolute magnitude of the military expenditure registered significant

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[6] The most popular model of "determination of government spending" is propounded by German economist Adolph Wagner back in 1883 which states that as a country develops more and more, the expansion of public and state activities would accompany it even at an increasing rate, not vice versa (Wagner, 1890).

increase. This feature is often linked to two event of coup de tat by Zia and Ersad (Hossain 1996). Even after restoration of democracy in 1990, the elected government continues to allocate more than sufficient resources to defense sector. For a country like Bangladesh with high prevalence of poverty and dearth of economic and social infrastructure such a fiscal practice is unhealthy.

Figure 3: Defense Spending as a Percent of GDP
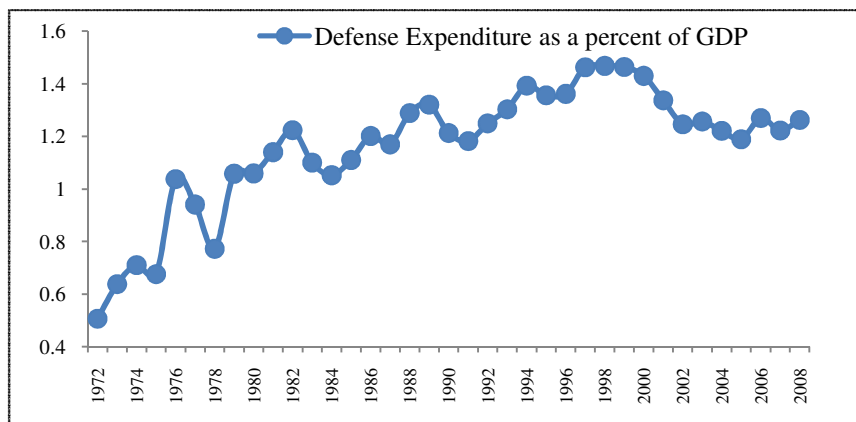
Another important expenditure component appears to be debt services. To finance the deficit government of Bangladesh continue to borrow both form domestic and international sources and this accumulates the debt obligation of the successive governments and debt services remain as one of the major expenditure component for Bangladesh.

From the above discussions, it is clear that GOB needs to mobilize more resources from domestic sources rather than international sources as foreign debt is piling up overtime and debt servicing consists a major part of the national budget. Moreover, financing through printing money leaves a significant risk of high inflation which might endanger the stability of the whole economy. Under such circumstances, raising tax revenue and taking debt from the domestic banking sectors are the major options of financing continuously rising government expenditure.

This policy option necessitates the examination of the effect of government expenditure on private household consumption which is the ultimate goal of this paper.

III.   Government Consumption and Household Consumption: What Literature Says?

The analysis of consumption used to disregard the activities of government until Keynes (1936) explained the importance of "multiplier process" in generating desired outcome from a fiscal shock. Since then consumption remained at the heart of Keynesian analysis. A rise in government expenditure is supposed to create increased income opportunities and thereby raising "effective demand". People with additional income are supposed to consume more and thus boost aggregate demand according to the Keynesian view. It was Martin Bailey (1962) who recognized the fact that whether government spends on "consumption goods" or "investment goods", in either way it reduces total resources currently available for households' private consumption. As a result, one unit increase in government expenditure would reduce private expenditure by an equal amount. This phenomenon is known as "substitutability hypothesis" between public and private consumption. The substitution, as to Bailey (1962), is inevitable regardless of the way how government manages to finance its spending.

However "Ricardian Equivalence" used to predict differently regarding the relationship between government's activities and households' consumption decision. According to the proposition of Ricardian equivalence households are assumed to have prefect foresight and knowledge about the economy. They can alter their consumption plan between today and tomorrow according to the choice made by the government regarding tax financing and debt financing. Ricardian equivalence used to predict that any fiscal shock is supposed not to have an impact on the

household's consumption-savings plan, thus refuting the Keynesian Multiplier effect. Household sector's myopia and information asymmetry about the government policy were thought to be the reasons behind the empirical evidence of multiplier effect due to fiscal shock. But Bailey (1962) contradicted Ricardian equivalence by offering theoretical explanation about substitution between government and household consumption. Regarding the potency of fiscal policy these two streams of thought provided two distinct notions, both vary from Keynesian view. According to the Ricardian view consumer take decisions by considering their current disposable income and most importantly future tax obligations. Feldstein (1982) augmented the decision making process by another factor – "fiscal signals" perceived by both government and households. "Fiscal signal" implies that any event of government spending shock in one point of time may suggest the private sector about periods of similar or even higher spending years to follow in the future date. Or a rise in taxes in a given year might give indication to individuals about higher future taxes and motivate them to modify their expectations about the future based on such "fiscal signals". Finally Feldstein (1982) went on to data and provided empirical evidence against the Ricardian implications and validates the potency of fiscal policy as he found no evidence of ex ante crowding out after any expansionary fiscal shock. David Aschauer (1985) put forward criticisms about Feldstein's empirical approach on several fronts. For example he questioned the use of current income as a proxy for permanent income which may be endogenous and render biased and inconsistent results. Aschauer suggested that technical limitations might cause Feldstein (1982) to suggest the potency of fiscal shock. He attempts to correct all these and adopts Full Information Likelihood Method to test the joint hypothesis of "Rational Expectations" and "Ricardian Equivalence" and found evidence that government

spending reduces private consumption on nondurables and services in the range of 23 to 42 percent.

Roger Kormendi (1983) developed a "consolidated approach" to test the impact of government spending on private sector's consumption-savings behavior. Kormendi regards the "standard approach" for incorporating fiscal policy into consumption equation is far from rational and flawed since it assumes households to be too myopic about government's fiscal behavior. "Consolidated approach", on the other hand, gives birth to a different econometric specification. Evidence in support of substitutability hypothesis between public and private consumption had been recorded in Kormendi paper. Karras (1994) conducted empirical investigation on a number of countries and come to the conclusion that in the aggregate public and private consumption could be best described as "complementary or unrelated" rather than "substitutes". However, it is interesting to find that Karras (1994) and Aschauer (1985) employed same general econometric specification (although for different samples) and reached opposite results. Shagil Ahmed (1986) found substantial though less than perfect evidence of substitutability for UK.

In addition to the standard time series models recent researchers utilize the Bayesian estimation methods to capture the transmission mechanism of fiscal policy in the New-Keynesian Dynamic General Equilibrium (DSGE) models. For example, Gunter Coenen and Ronald Straub (2005) made an attempt to investigate the impact of government consumption on household's consumption in the Euro area. Since the share of non-Ricardian household are relatively low in the Euro area and because of the substantial negative wealth effect of persistent government

spending shock, they found that government spending would rarely crowd in private consumption.[7]

Based on our reading of the literature, it could be deduced that no consensus has been reached by the empirical investigations which provides us opportunity to carry out the exercise for a less developed countries like Bangladesh. Since Bangladesh features different structural properties in comparison to the high income countries like US, UK and other OECD countries, on which most of the research, on the subject, has so far been done, it is worthwhile to find whether it brings outs a different result or it reconciles with existing findings.

IV.   The Model

Specification of the Theoretical Model

In this section we would derive the equation of our interest using the dynamic macroeconomic model with government sector. We derive our model based on a standard text 'Economic Growth' by Barro and Sala-I-Martin (2004). Representative households are discrete and infinitely lived. Their preference is summarized by the following utility function:

$$U = \sum_{t=0}^{\infty} \beta^t \, u(c_t, \ell_t) + \vartheta(g_t)$$

Households derive utility from private consumption (c_t) and leisure activities (l_t). β is the subjective discount factor. Instantaneous utility function is assumed to be twice differentiable,

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[7] By the term non-Ricardian households the authors refer to the households that consume their disposable income and do not trade in assets. There exist other studies where the notion of non-Ricardian households is defined differently.

increasing in both arguments and strictly concave. Besides the models maintains the following feature:

$$\vartheta(.) = 0$$

Which implies government spending doesn't have direct implications to the consumer's utility.

The production side of the economy is represented by an A-K type technology[8]:

$$y_t = z_t n_t$$

Where z_t represents labor-augmenting technology and n_t denotes the amount of labor used.

Each household is endowed with one unit of time such that

$$\ell_t + n_t = 1$$

And firms are owned by households.

The government has to meet exogenously determined sequence of public spending $\{g_t\}$. To finance these projects, government has the authority to impose tax $\{\tau_t\}$ or issue government bonds $\{b_t\}$.

Households maximize their lifetime utility function taking into account the budget constraint:

$$\max_{\{c_t, \ell_t, s_{t+1}\}} \sum_{t=0}^{\infty} \beta^t u(c_t, \ell_t) + \vartheta(g_t) - - - - (0)$$

Subject to

$$c_t = w_t(1 - \ell_t) - \tau_t - s_{t+1} + (1 + r_t)s_t - - - - - (1)$$

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[8] To keep the analysis simple and tractable, we exclude capital from the production process.

$$n_t + \ell_t = 1 - - - - - - - (2)$$

$$s_0 = 0 - - - - - - - (3)$$

Here s_t refers to the savings brought from previous period. The model also assumes the no ponzi condition for the stability of the model:

$$\lim_{t \to \infty} \frac{s_t}{\Pi_{i=1}^{t-1}(1 + r_i)} = 0 - - - - - -(4)$$

In order to find the competitive equilibrium of the model we maximize equation (0) subject to equations (1) to (4).

First order conditions are given by:

$$\ell_t: \beta^t u_1(c_t, \ell_t)(-w_t) + \beta^t u_2(c_t, \ell_t) = 0 - - - -(5)$$

$$s_{t+1}: \beta^t u_1(c_t, \ell_t)(-1) + \beta^{t+1} u_1(c_{t+1}, \ell_{t+1})(1 + r_{t+1}) = 0 - - - -(6)$$

On the other hand, firm's problem is:

$$\max_{n_t} \quad z_t n - w_t n_t$$

The first order condition is:

$$w_t = z_t - - - (7)$$

Government has to satisfy the budget constraint (GBC):

$$\tau_t + b_{t+1} = g_t + (1 + r_t)b_t - - - -(8)$$

Market clearing conditions are:

$$n_t = 1 - \ell_t \; - - - (9)$$

$$b_t = s_t \; - - - -(10)$$

$$c_t + g_t = z_t n_t \; - - - - -(11)$$

Now we can substitute the government budget constraint in to household's budget constraint equation and use the market clearing conditions in the bonds market $b_t = s_t$ and get the following:

$$c_t = z_t(1 - \ell_t) - g_t \; - - - -(12)$$

Equation (12) shows that recardian equivalence emerges from the dynamic competitive macroeconomic model with government having discretion to issue bonds and impose tax to finance government spending. In this paper we would use modern econometric tools to estimate an econometric model that is counterpart of the deterministic equation (12)

Specification of the Econometric Model

In this study, our purpose is to analyze the impact of government consumption on household consumption rather than to study the behavior of household consumption function as such we use the simplest form of consumption function and augment the function with government consumption. Based on the derived deterministic model (12), we use following econometric specification for the estimation purpose.

$$\ln(hscons_t) = \alpha + \beta Ln(rgdp_t) + \gamma \ln(gvtcons_t) + e_t$$

Where hscons, rgdp, gvtcons stand for real household consumption, real gross domestic product (GDP) and real government consumption respectively. e_t stands for stochastic disturbance term

and assumed to follow normal distributions; $e_t \sim iid(0,1)$. One may argue that the consumption and income variables are simultaneously determined, hence inclusion of the real GDP might bias the result, we therefore estimate the model using Instrument Variable technique and employ Durbin-Wu-Hausman test to find whether OLS estimates differ significantly from the IV estimates. The literature of relationship between public and private consumption also argue that labour income would be the appropriate variable where we use real GDP as a proxy for labour income for this study. There may be other very important variables which also have important influence on household consumption other than these variables, but we do not over parameterise the model with additional variables since in the context of Bangladesh we have maximum number of 37 observations since we consider the post liberation period only (1973-2008). The data on government consumption and household consumption and GDP are collected from World Development Indicators. The definition of the variables is presented in the Appendix A. Data on the relevant variables were obtained in current prices and then using GDP deflator they were converted into real terms. All the variables are then transformed using natural logarithm to have the estimation of elasticities instead of absolute coefficients. We make use of standard time series econometrics to test for the presence of cointegration and define error correction model and find direction of causality for Bangladesh.

V.   Empirical Estimation and Analysis
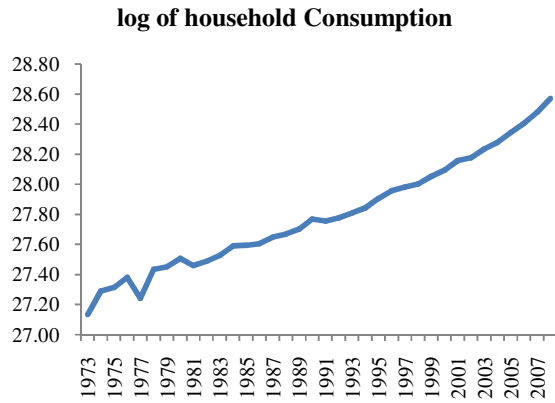
5.1 Time Series Properties of the Data:

The basic objective of the current study is to investigate whether there is any long run relationship between government and private consumption. Existence of such a cointegrating

relationship would then permit us to formulate the short run error correction model which would be useful to know the short run dynamics of the variables if they deviate from the equilibrium. It is also very important to identify the direction of causality between the variables in question. Recent development in time series econometrics enables us to detect a valid long run relationship as opposed to spurious regressions.[9] Therefore the time series properties of the variables should be identified before regressing one variable on another. Formal test to distinguish between stationary and non-stationary series are available as known as unit root tests in general. Before we embark on the formal way of testing for unit root, the relevant variables could be plotted both in their level and in first differences to get some impression. While the variables in level are presented in the left panel A and corresponding first differences are presented in right panel B. Variables in level seem to show a continuous upward trend over all the time. We can presume from this time lines that the variables in their level may contain an unit root while in their first difference seems to be stationary on the first glimpse.
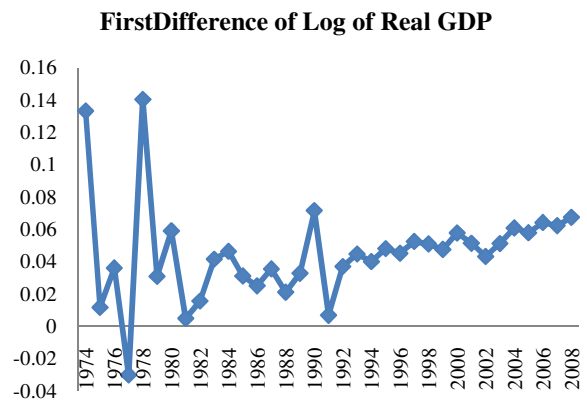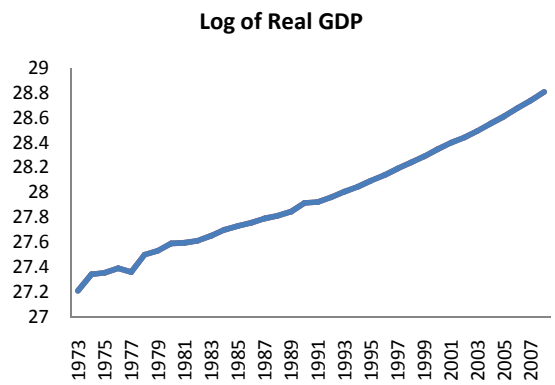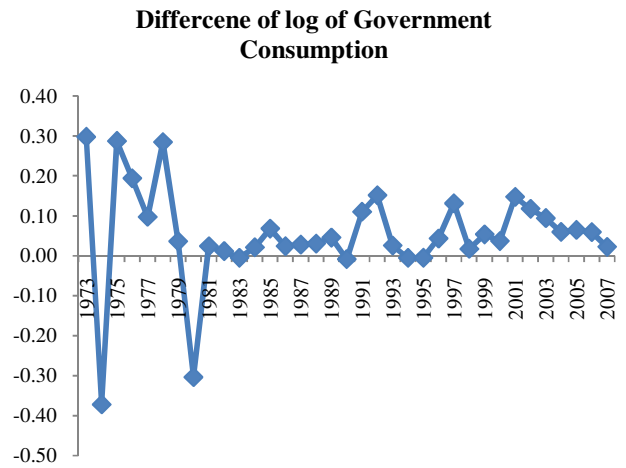
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[9] Non-stationary time series can produce highly significant non-sense correlation between variables although in reality there may not exist any such long run relationship.

Figure 4: Time Series Plots of the Variables

Panel A: Variables in their Level

Panel B: Variables in their First Difference

log of household Consumption

Differnce of log of household consumption

log of Government Consumption

Differcene of log of Government Consumption

Log of Real GDP

FirstDifference of Log of Real GDP
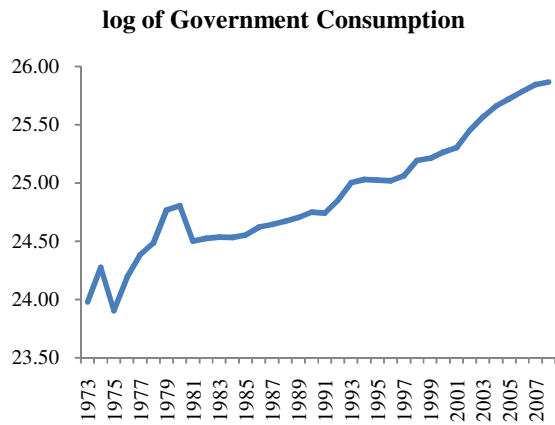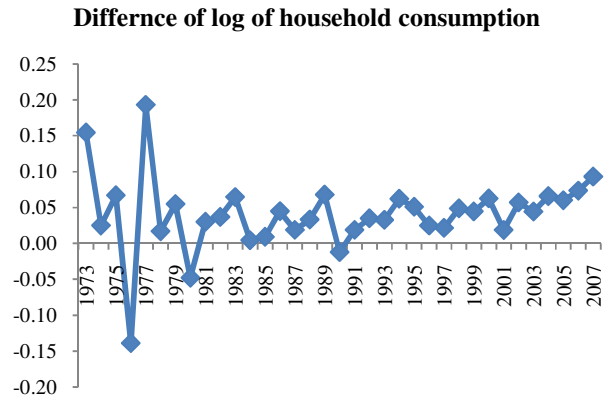
However non-stationarity could arise from two distinct reasons- Trend Stationary Process (TSP) Difference Stationary Process (DSP). Since TSP contains deterministic trend, for stationarity we need to detrend the series in case of TSP. On the other hand, the DSP series needs to be differenced appropriately until it become stationary. It is thus very important to distinguish between TSP and DSP as they require different treatment. We undertake the popular tests of find unit root in the error process. They are Dickey Fuller Test (DF) and Augmented Dickey Fuller Test (ADF). The Dickey Fuller Test of unit root is based on the following equation:

$$\Delta Y_t = \alpha + \beta Y_{t-1} + \varepsilon_t$$

Where we test the null hypothesis, $H_0 : \beta = 0$ against the alternative hypothesis, $H_a : \beta < 0$. The 't' test on the estimated coefficient of the Y_{t-1} variable provides the Dickey Fuller test statistic. While the Augmented Dickey Fuller test is an improvement over the DF on two accounts. By augmenting the lagged values of the dependent variable, it removes the biasness for failure to include relevant lags and the other improvement being that such a formulation ensures that the error process in the estimating equation is residually uncorrelated. The ADF test is based on the following equation:

$$\Delta Y_t = \alpha + \beta Y_{t-1} + \sum_{t=1}^{p} \Delta Y_t + v_t$$

The 't' ratio on the coefficient of Y_{t-1} provides the ADF statistics. In recent years Phillips Perron (PP) test for testing the presence of unit root has become increasingly popular. The advantage of PP over the DF and ADF is that time series variables might exhibit heteroskedasticity and non-normality in the raw data which DF and ADF tests do not consider. There seems to be a

consensus in the cointegration literature that ADF test is preferable to DF test while PP test is superior to ADF test.

It is also imperative to know the order of integration of the variables in question before we test for cointegration. The aforementioned tests of unit root are also useful to determine the order of integration of the variables. For that, first we carry out test for non-stationarity of the variables in levels. However failure to reject the null is not sufficient to indicate the correct order of integration. Then in the second step, the first difference of the variables is tested for unit root in the same manner. If we could reject the null this time, we can conclude that the variable is I (1). [10]

In the following table we report the values of the test statistics both on their level and their first differences. It is found that the absolute value of value of the Lnrhscons, Lnrgvtcons and Lnrgdp are smaller than their critical values implying that they are non-stationary in level. However in the next step test statistics of the variables in their first differences exceed the critical value irrespective of the test applied. Therefore we can conclude that all of our variables are integrated of order one, I (1).

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[10] If a time series follows a random walk and its first difference forms a stationary process then the variable is said to be integrated of order one I(1). If it needs to be differenced d-times to get stationary process, it is said to be I(d).

Table 1: DF, ADF and PP Tests for Unit Root

Variables	DF	ADF	PP
Lnrhscons	- 2.118	2.606	1.036
Δ Lnrhscons	-9.366	-4.569	-10.146
Lnrgvtcons	-2.600	-2.331	-0.483
Δ Lnrgvtcons	-7.573	-3.761	-7.539
Lnrgdp	-1.129	0.084	1.291
Δ Lnrgdp	-8.649	-3.907	-8.441

Note: (1) The DF, ADF test for the variables in level are based on the inclusion of an intercept and a trend term.while the tests for the first difference do not include a trend term (2)The lag chosen for the ADF test are determined using popular information criterion like AIC and BIC. (3) 95% critical value for these tests are reported here which can be found in the data analysis.log file.

Before finishing this section, we examine the relationship between the household consumption and government consumption both in their level and in first differences using simple scatter plot. It is obvious from the graph that government and household consumption exhibit a positive relationship in both cases. Though these graphs alone cannot validate the fact and formal tests of cointegration needs to be deployed to reach a conclusion.

Figure 5: Scatter plot of Government and Household Consumption
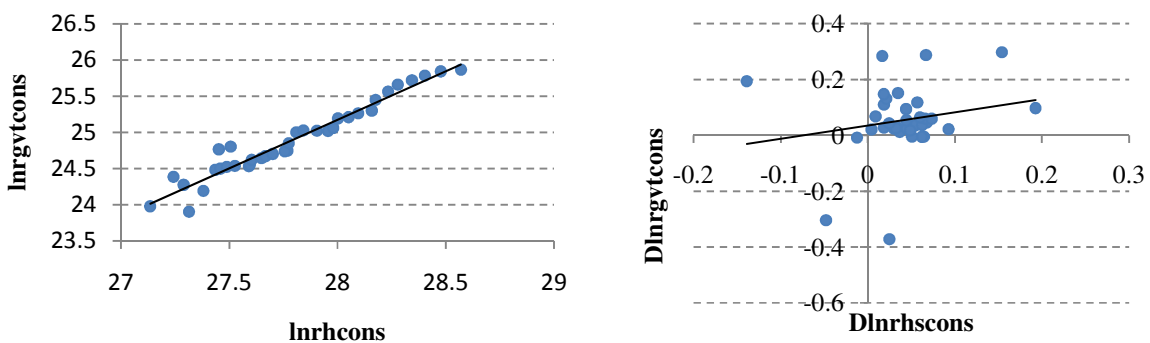
5.2 Test of Cointegration

5.2.1 Engle-Granger Two Stage Procedure:

The earlier works of Granger and Newbold (1974) highlighted the danger of generating spurious results while regressing one non-stationary series on another. However, Engle and Granger (1987) identified a link between non-stationary process and the concept of long run equilibrium. A linear combination of two I (1) series happens to be I(1) in general. Granger found an exception to this general rule when the variables are cointegrated. In such a situation, linear combination of two I (1) series would yield a I (0) series. In the previous section we concluded that all of our variables are integrated of order one. In the present section we would carry out Engle-Granger two step procedures in order to test for the presence of long run equilibrium relationship between private and government consumption. In the first step, the process requires us to regress the level of private consumption on level of government consumption and level of real GDP. Then the error from this regression would be retrieved and be tested in the second step. If the residual is found to be I (0) i.e. stationary, we can conclude that there exists a long run equilibrium relationship between the variables. The variables in question are qualified for the first step of the Engle-Granger procedure since they are found to be of the same order, I(1) irrespective of the test applied. We estimate the long run equation:

$$\ln(hscons) = 4.28 + 0.837\ln(\text{rgdp}) + 0.0047\ln(gvtcons)$$

$$\text{Adj R}^2 = 0.99 \qquad\qquad \text{D.W.} = 1.49$$

The estimated standard errors are not reported since they do not provide the basis for valid inferences. Both the long run coefficient of real GDP and government consumption appear to be positive though the coefficient on government consumption is statistically insignificant. These

estimates would be *super consistent* since they would converge to their true values at a faster rate than it would be the case if all stationary variables were used in the regression. The Durbin-Watson statistic is reported here which is 1.49 which can be used to test for cointegration and known as Cointegrating regression Durbin Watson (CRDW) test. A low value of DW statistics suggests no cointegration while a large value is a indication for cointegration. Maddala (1992) provides the critical value for the CRDW test which is 0.78 in our case. The DW statistic is more than the critical value we reject the null of no cointegration. However the conventional way of testing for cointegration is to check the residual of the regression for stationarity. We retrieve the residual for the regression and estimate the following equation and examine the 't' statistic on the lagged of Error term.

$$\Delta Error_t = \rho Error_{t-1} + \delta \Delta Error_{t-1} + v_t$$

As we regressed the first difference of the residual from the cointegrating equation on the lag of error and lag of the dependent variable we obtain that:

$\Delta Error_t = 0.0017 Error_{t-1} - 0.0156\ \Delta Error_{t-1}$

t-ratio   (7.05)   (-1.94)

The t-ratio on the lag of error term represents the ADF statistic. As we know the 99% critical value is -2.64 and therefore we can deduce that the error process is stationary, I (0). We also perform the Phillips-Perron test and obtain that the residual is stationary. We report the results of unit root tests in the following table:

Table 2: Testing the Error for Stationarity

Variable	DF	ADF	PP
Error	8.79	7.05	11.70

All these tests suggest that error process is stationary. Therefore we can predict that there appear to be a valid long run relationship between household consumption, real GDP and government consumption.

One might argue that household consumption and real GDP are simultaneously determined. Inclusion of real GDP might therefore bias the result. Therefore we investigate whether endogeneity produces inconsistent estimates through Durbin-Wu-Hausman Test. We use the lag of real GDP as the instrument variable. The findings suggests, the there is a no significant (chi-square =34.00, df =3, p = 0.001 where as Chi-square critical value with df=3 is 7.81) difference between the IV and OLS coefficients, indicating clearly that OLS are consistent estimator in this equation. The conclusion is that endogeneity of GDP is not an issue here.

5.2.2 Error Correction Model:

Since Engle-Granger procedure does indicate the existence of cointegration, we can formulate the error correction model in this section. As we know that error correction model provides the short run behavior of the variables and the nature of the adjustment process once they deviate from the equilibrium. Here the "general to specific" approach proposed by Hendry (1979, 1995) has been adopted. First, we start with larger model and then discard the insignificant variables to obtain a parsimonious model. Given the yearly nature of the data, we include 2 lags of both the

independent and dependent variables and 1 lag of the error process generated from the long run regression.

The error correction model is defined as follows:

$$\Delta \ln(hscons) = \sum_{m=1}^{p_1} \alpha_{1m} \Delta \ln(hscons) + \sum_{m=1}^{q_1} \beta_{1m} \Delta \ln(rgdp) + \sum_{m=1}^{r_1} \eta_{1m} \Delta \ln(gvtcons) + \delta_1 Error_{t-1} + u_t$$

The coefficient of the first difference of the government consumption and real GDP variables provide indication about the short run phenomenon and the coefficient of the lag of error term shows how the variables would adjust once they deviate from the equilibrium. The error correction term should therefore be negatively signed and the magnitude should be less than unity in order to be meaningful from economic point of view. Another advantage of estimating the error correction model is that all the variables appear in the first difference. As we found that all our variables are I (1), when differenced once they would become stationary.

Table 3: Error Correction Model using "General to Specific" Approach

	Δlnhscons$_{-1}$	Δlnhscons $_{-2}$	Δlnrgdp	Δlnrgdp$_{-1}$	Δlnrgdp$_{-2}$	Δlngvtcons	Δlngvtcons$_{-1}$	Δlngvtcons$_{-2}$	Error$_{-1}$
Coefficient	-0.204	-0.101	1.678	0.289	0.177	-0.009	-0.091	0.005	-0.001
t -ratio	(-1.05)	(-0.53)	(-10.510)	(-0.840)	(-0.560)	(-0.28)	(-2.91)	(-0.14)	(-3.01)
Coefficient	-0.223		1.695	0.470		-0.045	-0.094		-0.001
t -ratio	(-1.23)		(-11.68)	(-1.57)		(-1.57)	(-3.45)		(-4.26)
Coefficient			1.673				-0.064		-0.001
t -ratio			(-13.26)				(-2.46)		(-4.77)

Note: In every case dependend variable is Δlnhscons.

The final two rows provide the parsimonious error correction model where the real GDP variable is highly significant. It implies that the growth of household consumption I n response to a given growth in real GDP is greater than unity. The table shows that the coefficient on the government consumption variable appears to be negatively signed and it is statistically significant. The implication is that for a given growth in government consumption the growth in household consumption is likely to decrease in the short run. Most importantly the error correction term appears to be correctly signed and statistically significant in every case, though the magnitude of the error correction term is very low. Such a lower value of the error correction indicate that it would take a long time to revert back to the equilibrium path if there is a deviation.

5.3 Another test for Cointegration: The Johansen Procedure

As the Engle-Granger two stage procedure suggested us evidence of cointegration, we finally embarked on the Johansen procedure to test for cointegration. Unlike the single equation cointegration technique, Johansen procedure has the advantage of detecting multiple cointegrations. The procedure requires estimating the unrestricted vector auto regression (VAR) in the first place. The VAR is of the following form:

$$\Delta Y_t = a + \sum_{m=1}^{p-1} M_m \Delta Y_{t-m} + \Pi Y_{t-1} + u_t$$

Where Y_t and u_t are (n x 1) vectors, $M_m = I - (\Pi_1 - \dots \dots - \Pi_m)$, m = 1, …………, p-1, $\Pi = I - (\Pi_1, \dots \dots \Pi_m)$ And I stand for an Identity matrix. Information about the long-run relationship between the variables is contained in the matrix Π. If the rank of the matrix is zero, it would imply that the variables are not cointegrated. A rank equal to 1 implies existence of one cointegrating relationship.

Johansen and Juselius (1990) developed two tests for cointegration- the trace test and the maximum Eigen value test. At first we had to choose an autoregressive order for the Johansen test. The lag length is chosen on the basis of AIC and SIC criterion. However, it is interesting to note that the Johansen procedure produced different results based on different choice of lags. While we chose the lag lengths to be 3, the test suggested existence of no cointegrating relationships. If the lag length is 2, the test suggests evidence of one cointegrating relationship. Since the Unrestricted VAR with lag order (2,2) minimizes the value of the AIC and SIC tests, we report in the following table the results of Johansen test with autoregressive test order (2,2). The computed trace statistic and maximum Eigen value statistic are reported and as we can find that they exceed the 95% critical value on both the cases to reject the null that the rank of the matrix is zero. Johansen procedure concludes that there is one cointegrating relationship between household consumption, real GDP and government consumption, while maximum number of cointegration relationships could be 3. Though, Johansen test has given us indication about the presence of one long-run cointegrating relationship, it does not provide definite pair of variables that are cointegrated.

Table 4: Johansen test for Cointegration

Null Hypothesis	Alternative Hypothesis	Test Results	95% Critical value	Conclusion
Maximum Eigen Value Test				
r =0	r =1	41.61	17.89	One Cointegrating
r≤1	r=2	5.51	11.44	Relationship
r≤2	r=3	2.29	3.84	
Trace Test				
r =0	r =1	49.42	24.31	One Cointegrating
r≤1	r=2	7.81	12.53	Relationship
r≤2	r=3	2.29	3.84	

In the cointegration literature it is recognized that Johansen Procedure is sensitive to the choice of lag length (Hall, 1991). Therefore the findings should be taken with caution.

5.4 Testing For Causality

Regression results in the previous sections imply that there is a positive association between household consumption and government consumption. However association does not necessarily imply causation. It might also happen that greater household consumption may lead towards greater government consumption since greater consumption would generate higher government revenue from indirect taxes like sales tax, VAT etc. Therefore it is important to detect the direction of causality. In this section the most popular approach to test for causality developed by Granger (1988) would be employed to determine the direction of causality.

The following model of Engle-Granger error correction model is estimated to test the Granger causality:

$$\Delta \ln(hscons) = \sum_{m=1}^{p_1} \alpha_{1m} \Delta \ln(hscons) + \sum_{m=1}^{q_1} \beta_{1m} \Delta \ln(rgdp) + \sum_{m=1}^{r_1} \eta_{1m} \Delta \ln(gvtcons) + \delta_1 Error_{t-1}$$

$$\Delta \ln(rgdp) = \sum_{m=1}^{p_2} \alpha_{2m} \Delta \ln(hscons) + \sum_{m=1}^{q_2} \beta_{2m} \Delta \ln(rgdp) + \sum_{m=1}^{r_2} \eta_{2m} \Delta \ln(gvtcons) + \delta_2 Error_{t-1}$$

$$\Delta \ln(gvtcons) = \sum_{m=1}^{p_3} \alpha_{2m} \Delta \ln(hscons) + \sum_{m=1}^{q_3} \beta_{3m} \Delta \ln(rgdp) + \sum_{m=1}^{r_3} \eta_{3m} \Delta \ln(gvtcons) + \delta_3 Error_{t-1}$$

The advantage of this model is that it can identify both the long run and short run causality. Significant coefficient on the error correction term would imply long run causality while the short run dynamics is captured by the individual coefficients on the differenced terms of independent variables. The choice of lag is important for the test. Due to annual nature of the

data we first decided to add two lags of each variable and one lag of the error correction variable. First, we estimated model one and test whether all the coefficients on the first difference of GDP and first difference of the government consumption are jointly significant through F test. The intuition behind the procedure is to investigate whether past values of GDP and government consumption can explain variation in the dependent variable more than the lagged values of dependent variable can alone explain. If we reject the null then we can deduce that GDP granger causes household consumption in the short run. The other model is the mirror image of the previous model and same methodology would be employed to test for causality:

Table 5: Granger Causality Test

Causality	Δlnhscons	Δlnrgdp	Δlngvtcons	Test of Joint Hypothesis	Error Correction Term
Δlnhscons Equation					
Null Hypothesis		$\beta_{1m}=0, \forall m$	$\eta_{1m}=0, \forall m$	$\beta=\eta=0, \forall m$	$\delta_1=0$
F –Statistic (P-Value)		38.00 (0.001)	3.43(0.03)	29.44(0.001)	-3.01(0.006)
Δlnrgdp Equation					
Null Hypothesis	$\alpha_{2m}=0, \forall m$		$\eta_{2m}=0, \forall m$	$\alpha=\eta=0, \forall m$	$\delta_2=0$
F –Statistic (P-Value)	8.83(0.001)		1.66(0.21)	5.19 (0.001)	-0.64(0.53)
Δlngvtcons Equation					
Null Hypothesis	$\alpha_{3m}=0, \forall m$	$\beta_{3m}=0, \forall m$		$\alpha=\beta=0, \forall m$	$\delta_3=0$
F –Statistic (P-Value)	0.37 (0.77)	0.48(0.70)		0.53 (0.78)	-0.35(0.73)

Form the first equation; it is found that both real GDP and real government consumption Granger causes household consumption in the short run. The second equation suggests that only household consumption Granger causes real GDP in the short run. Neither household consumption nor real GDP Granger causes government consumption in the short run. The error correction term is significant in the first equation suggesting that both real GDP and real government consumption Granger cause real household consumption in the long run which has been evident in error-correction model. Both household consumption and government consumption are found to Granger cause real GDP in the long run. However there is no long run granger causality from GDP and household consumption towards government consumption. From these three results, it is obvious that only valid long-run relationship, as predicted by Johansen procedure and first-stage error-correction model, exists between real GDP and household consumption; not between government consumption and household consumption.

In the first equation, one interesting piece of observation can be made. The joint hypothesis that all the government consumption variables have no impact on the household can be rejected at 5 percent level.   However, the summation of the government consumption variable appear to be negative which suggests that it is lower government consumption which can cause household consumption to grow at least in the short run.

5.5 Implication of the result

We have found a valid long run relationship between the household consumption, real GDP and government consumption though the government consumption has been found to be statistically insignificant. We also carried out both recursive and reverse recursive estimations of the long-run equation to identify is there any structural change over time and found no change in the

significance level of coefficient of government consumption over different sample periods (see Figure 6). Bold-dotted lines represents the non-rejection area of null hypothesis that government consumption has no significant relation with household consumption; and it failed to reject null hypothesis for any sample period in consideration.

Figure 6: t-statistics of coefficient of *lngvtcons* from the recursive and reverse recursive long-run regressions
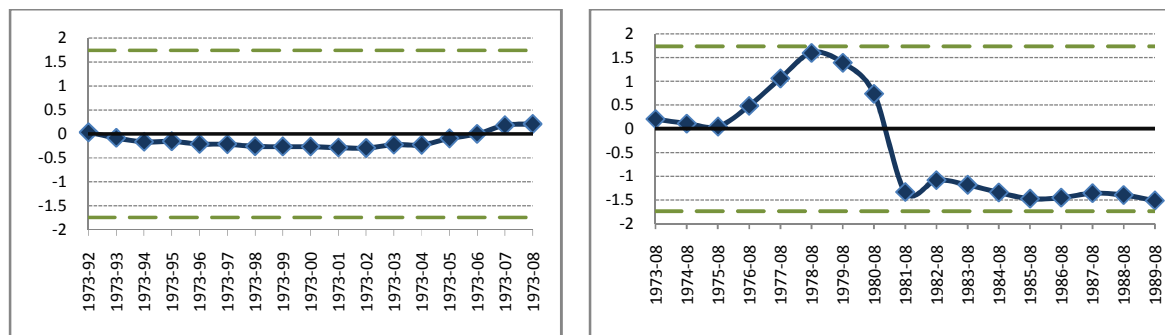
It implies that public and private consumption can be described as unrelated in the long run which goes with the theory of Barro-Ricardian equivalence. It calls for some plausible reasons behind the nature of the relationship. One obvious point may be raised about the relation between public and private consumption in the aggregate level and in the disaggregated level. Since various components of the public spending would be valued differently by the household, hence would affect their consumption decision differently. For instance, if government spends more on items like education, households would then have to spend less on education. On the contrary, government spending in some of its component like (improvement in the public transport system) might induce household to use public transport more frequently and spend more on transportation. While some other component like spending on national defense (without war situation) may not at all have any impact on general people's consumption pattern. Therefore, on the aggregate, it is the composition of the government spending that determines the

nature of the impact on household consumption. In case of Bangladesh, it can be found that the largest component of government spending happens to be defense expenditure. Since Bangladesh is not in a war, such large allocation of national budget in the defense sector (non-productive sector) does not have any impact on the households' consumption decision. Another large component of national budget happens to be education and spending of education is supposed to bring about a substitution effect in the household consumption. But bulk of education budget is intended to build new infrastructure (schools and colleges), hence the impact of higher educational allocation in the budget remains ambiguous. Government consumption and household consumption therefore appear to be unrelated in the long run for Bangladesh for aggregate data.

Another plausible explanation of our result lies in the financing method for government spending. It is argued in the economic theory that an increase in government spending may reduce the household consumption since additional government spending needs to be financed which necessitates the government to raise tax. Households facing increased tax burden finds a shrinking budget and may end up spending less. But careful analysis of the revenue generation history of Bangladesh Government (GOB) may reveal the fact that bulk of the government revenue is generated from the custom duites and levies. Income tax to GDP ratio of Bangladesh is one of the lowest in the world (around 9 %). Besides tax evasion and corruption is rampant in Bangladesh. Therefore rise in government spending hardly impact household budget constraint. Households therefore do not respond significantly to a government consumption shock.

However, in the short run, growth in government consumption is found to affect household consumption negatively. This would dampen the aggregate demand to some extent for a while after a fiscal shock is executed. In the long run, government consumption will neither "crowd in"

nor "crowd out" household consumption for Bangladesh. This finding has important direction for policy options in Bangladesh.

VI.   Concluding Remarks

In this study, an attempt has been made to test the substitutability hypothesis between government and household consumption in the context of Bangladesh. The motivation was that government consumption shock might affect households' consumption differently for a country like Bangladesh which has different set of fiscal attributes than the developed counterparts. To overcome the danger of spurious regression while dealing with non-stationary time series data, Engle-Granger two stage procedures and Johansen Procedure had been employed. In every case we found a valid long run relationship between household consumption, real GDP and government consumption. However the long run coefficient on the public consumption is found to be statistically insignificant to suggest that public and private consumption are unrelated in the long run. An error correction model is formulated where we discovered that in the short run, growth of government consumption might affect growth of household consumption inversely. The error correction mechanism is found to be very slow. Test for causality using Granger method suggests that both government consumption and real GDP Granger cause household consumption in the long run.

The conclusion is that, for Bangladesh government and household consumption could be described as being unrelated in the long run but in the short run, they are inversely related. The finding that government spending shock does not exert any positive or negative effect on household consumption can be attributed to the tax structure of Bangladesh as it extracts bulk of

the resources from indirect taxation. Consequently, financing of additional government expenditure does not create a substantial negative wealth effect on the households to force them to cut back consumption which validate the Barro-Ricardian equivalence hypothesis in Bangladesh. However, the result is obtained from aggregate data and as we know that individual components of government spending might have different connotations to household consumption, hence the aggregate data might not be the most appropriate input to gauge the relationship. The result suggests about the potency of fiscal policy for Bangladesh as fiscal shock neither "crowd in" nor "crowd out" household consumption thereby leaving aggregate demand undisturbed in the long run. However, in the short run, fiscal shock may crowd out household consumption to some extent.

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Appendix-A

Definition of the Variables:

GDP: GDP at market prices in current Bangladeshi Taka (BDT) is the sum of gross value added by all resident producers in the economy plus any product taxes and minus any subsidies not included in the value of the products. It is calculated without making deductions for depreciation of fabricated assets or for depletion and degradation of natural resources.

GVTCONS: GVTCONS is general government final consumption expenditure in current Bangladeshi Taka (BDT) which includes all government current expenditures for purchases of goods and services (including compensation of employees). It also includes most expenditures on national defense and security, but excludes government military expenditures that are part of government capital formation.

HSCONS: HSCONS is household final consumption expenditure in current Bangladeshi Taka (BDT) which includes the market value of all goods and services, including durable products (such as cars, washing machines, and home computers), purchased by households. It excludes purchases of dwellings but includes imputed rent for owner-occupied dwellings. It also includes payments and fees to governments to obtain permits and licenses. Here, household consumption expenditure includes the expenditures of nonprofit institutions serving households, even when reported separately by the country.

GDP deflator: The GDP implicit deflator is the ratio of GDP in current local currency to GDP in constant local currency. The base year is 1996.