



## BUDGET DEFICIT SUSTAINABILITY OF BANGLADESH



**Mohammad  
Mahbubur Rahman<sup>1</sup>**

<sup>1</sup>Graduate School for International Development and Co-operation (IDEC),  
Hiroshima University, Hiroshima, Japan



### ABSTRACT

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Budget deficiency has become a regular phenomenon in the fiscal policy of Bangladesh since its inception. In recent times the amount of deficiency has been accounted to a considerable amount and showing an upward trend which has drawn attention of various sector intelligence including media. Hence, we became interested to analyze the sustainability of the budget deficit of the central government of Bangladesh. We have applied various methods to check both the strong form of sustainability and long run sustainability. To check the strong form of sustainability, we have used government budget deficit to GDP ratio as our concern variable and we have applied standard unit root tests. Subsequently we have checked the long run sustainability by applying Johansen co-integration test and [Quintos \(1995\)](#) approach based on governmental IBC (Inter-temporal Budget Constraint). In co-integration test and [Quintos \(1995\)](#) approach we have used Government revenue to GDP ratio and Government expenditure to GDP ratio as our concern variable. We have covered a sample period from 1972 to 2012. Both types of test tell us that the government budget deficit in Bangladesh is sustainable.

**Contribution/ Originality:** This study is one of very few studies which have investigated the budget deficit sustainability of developing countries and the first study for checking the budget deficit sustainability of Bangladesh.

### 1. INTRODUCTION

The sustainability of government deficits is a crucial issue for economic policy ([Bajo-Rubio et al., 2010](#)). If the budget is out of control, economic policies at both the macro- and microeconomic levels will quickly become unworkable, and required changes to be made ([Green et al., 2001](#)). A number of studies have done in USA and other Western European countries on budget deficit sustainability. However, there are few studies in developing countries. We became interested to check the budget deficit sustainability in a developing country-Bangladesh, in which fiscal policy was started with deficit budget and subsequently this trend continued till now. To our best knowledge, this is the first study which checks the sustainability of budget deficit of Bangladesh by applying various types of statistical tests.

Budget deficit in many cases leads to inflation, increase interest rate and shows many other macroeconomic phenomenon. “Recent rise in deficit in budget balance in Bangladesh has made the government borrow from both domestic and foreign sources. One domestic source is; the central bank prints new money to lend to the government. As a result, the supply of money increases more than the demand, it in the economy. Consequently, the economy undergoes a high inflationary pressure. Recent trend of inflation rate admits this notion. The average rate of inflation was 7.31 per cent, 8.8 per cent and 10.62 per cent in FY2009-10, FY2010-11 and FY2011-2012 respectively. For huge government borrowing from the commercial banks, the private investors do not get enough money to invest in the economy. Thus the government's borrowing from commercial banks crowds out private investment and retards the growth of the economy’ (Rana, 2013). According to *Hafiz A. Pasha and A.F. Aisha Ghaus* (web [www.spdc-pak.com/publications/Conference%20Papers/CP-21.pdf](http://www.spdc-pak.com/publications/Conference%20Papers/CP-21.pdf)), the government collects this deficit money in four ways; (i) by printing money, (ii) running down foreign exchange reserves, (iii) borrowing from abroad and (iv) borrowing domestically. According to *Unnayan Onneshon (2011)* (a policy research organization in Bangladesh) “there are two sources of deficit financing; internal and external debt. The government has become more dependent on banking sectors other than non-banking ones for domestic financing over the time. In FY 2010-11, government has borrowed 4.43 times higher from banking sectors in comparison to that of FY 2001-02 indicating a sharp crowding out effect which has dampened private investments. The government borrowing from banking sector in FY 2010-11 was 1.43 percent of GDP”. The budget deficit of the government in the last forty years is shown below-

Figure in billion Taka

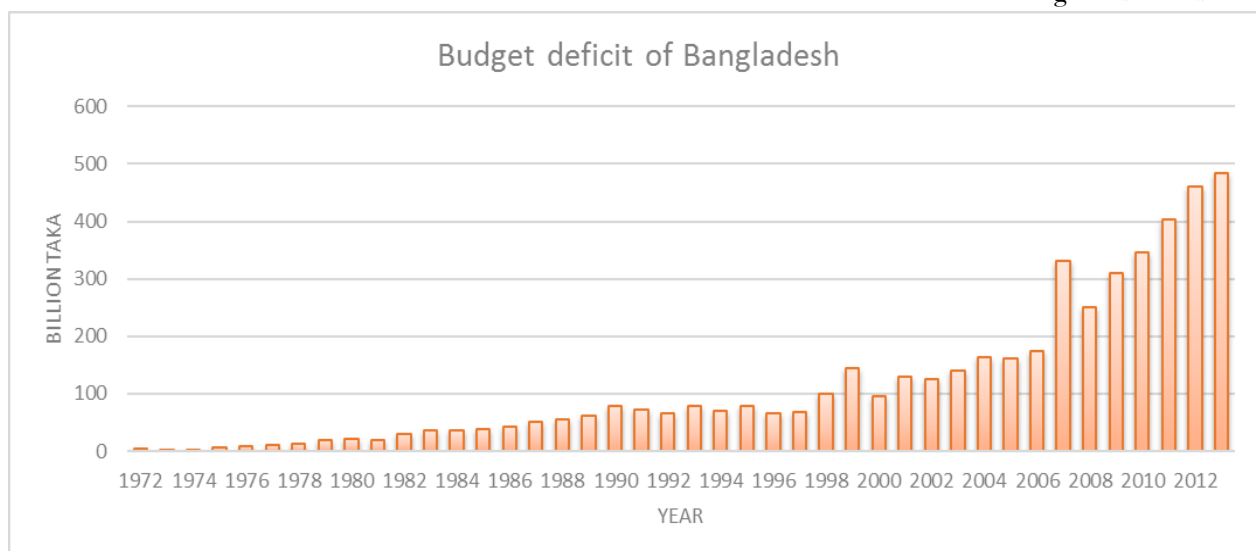


Figure-1. Budget deficit of Bangladesh Government in the last forty years

(Data source: Ministry of Finance, Bangladesh)

Bangladesh became independent in 1971. It started its first budget as deficit budget. For the first time the budget deficit increased considerably in 1974 after a famine and the next budget deficit was abruptly increased in 1999 followed by a devastating flood in 1998. But in recent times the budget deficit increased at rapid rate. However, in most cases the government uses this money for the public welfare and for betterment of economy directly or indirectly. Bangladesh has been pursuing an expansionary fiscal policy since its independence with a view to channeling adequate resources to appropriate directions that reduce poverty and sustain economic growth in the country (Rana, 2013).

On the other hand Government is trying to increase its revenue in accordance with the budget deficit. However, at the beginning the gap was close but now it is getting wider. Total expenditure and total revenue of Bangladesh government in the last forty years are shown below-

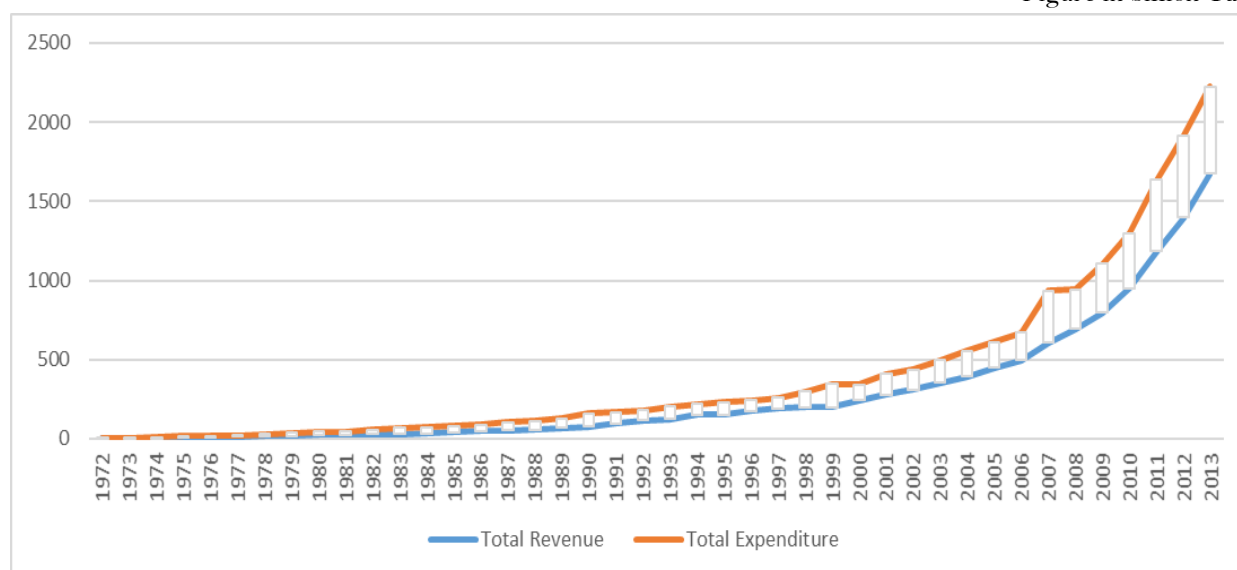


Figure-2. Government expenditure and revenue in the last forty years

(Data source: Ministry of Finance, Bangladesh)

Increasing money supply in the market creates employment and boost up economy in the short run (Mankiw, 2010). However, if the budget deficit is not sustainable it could be a potential concern for macro-economic instability. Fischer and Easterly (1990) indicate that as a first approximation each form of budget deficit financing is associated with a major macro-economic imbalance. Indeed, if budget deficit is not sustainable there is a need for policy discussion as to the appropriate adjustment in expenditure decision and tax policy to rectify the situation (Payne and Mohammadi, 2006). Our purpose is to check whether the budget deficit of Bangladesh government is sustainable or not and is there any major macroeconomic policy change is desirable or not.

Several studies are available to check the sustainability of budget deficits; e.g., Hamilton and Flavin (1986); Trehan and Walsh (1988;1991); Smith and Zin (1991); Haug (1995); Quintos (1995); Martin (2000) or Bajo-Rubio *et al.* (2009) and many others. The results, though, seem to be still rather inconclusive due to differences in the econometric methodology. However, basically there have been two approaches for determining budget deficit sustainability. The first approach is to examine the possibility of being stationary of budget deficit by conducting unit root tests, that is, the 'strong form' of the budget deficit sustainability (Payne and Mohammadi, 2006). In the same way, Hamilton and Flavin (1986) found that the budget deficit follows a stationary stochastic process and thus is sustainable. In the same way, Wilcox (1989); Trehan and Walsh (1988;1991) and Kremers (1989) found that the budget deficit is non-stationary implying an unsustainable budgetary process. The second approach is to examine the long-run relationship between government revenues and expenditures by conducting co-integration tests, that is, the 'weak form' of the budget deficit sustainability (Payne and Mohammadi, 2006).

In our study we have used both approaches to conclude firmly. We have covered forty years data (year 1972 to 2012). The results suggest that the budget deficiency of Bangladesh follows strong form of sustainability as well as sustainable in the long run. The rest of the study is arranged as follows; Chapter 2 describes data and methodology; chapter 3 shows result and discussion and chapter 4 gives conclusion and policy recommendation.

## 2. DATA AND METHODOLOGY

### 2.1. Data

In this study we used annual data for budget deficit, government revenue and government expenditure, Gross Domestic Product (GDP) of Bangladesh from the financial year 1972-73 to 2011-12. We have used nominal data for the above mentioned items. As we have used budget deficit to GDP ratio, total revenue to GDP ratio and total

expenditure to GDP ratio as our concern variables, so using nominal value is not supposed to create any inconsistency in this regard. The budget deficit data, government revenue and expenditure have been collected from the Ministry of Finance, Bangladesh, in which the data has been enlisted in Budget Summary Books and “Bangladesh Economic Review”.

## 2.2. Methodology

### 2.2.1. Strong form of Sustainability

Payne and Mohammadi (2006) stated that if the budget deficit to GDP ratio shows stationary property, then budget deficit is sustainable and this form of sustainability can be termed as strong form of sustainability. For checking the stationary property of Bangladesh we have used budget deficit to GDP ratio as our concern variable and used standard Augmented Dicky-Fuller unit root test and Philips-perron test. We can write the standard ADF model for the data set as follows:

$$\Delta BD_t = \alpha_0 + \alpha_1 BD_{t-1} + \sum_{i=1}^n b_i \Delta BD_{t-1} + u_t$$

$$\Delta BD_t = \alpha_0 + \alpha_1 BD_{t-1} + \sum_{i=1}^n b_i \Delta BD_{t-1} + \delta + u_t$$

Where,  $BD$  is budget deficit to GDP ratio,  $\Delta BD_t = BD_t - BD_{t-1}, i=1,2,\dots,n$ . and  $\alpha_0, \alpha_1, b_i$  are the parameters to be estimated and  $u_t$  is the white noise error .

And Philips-perron model for the data set can be written as follows-

$$\Delta BD_t = \alpha_0 + (\alpha - 1)BD_{t-1} + \gamma(t - \frac{T}{2}) + \sum_{i=1}^p \beta_i \Delta BD_{t-1} + u_t$$

Where,  $BD$  is budget deficit to GDP ratio,  $\Delta BD_t = BD_t - BD_{t-1}, i=1,2,\dots,n$ . and  $\alpha_0, \alpha - 1, \beta_i, \gamma$  are the parameters to be estimated and  $u_t$  is the white noise error .

In both Augmented Dicky-Fuller (ADF) and Philips-perron (PP) model, the null hypothesis is the series contains a unit root. If the null hypothesis is rejected, the alternative hypothesis will be established, which mean the variable will be stationary. In our case it will be indicated that budget deficit is sustainable

### 2.2.2. Long Run Sustainability

#### A. Co-Integration Test

Hamilton and Flavin (1986); Trehan and Walsh (1991) and Haug (1991) used conventional test for co-integration to check the sustainability of budget deficit by using the variable government spending and revenue. Some other authors considered a break date and applied co-integration test to check sustainability. For example Hakkio and Rush (1991) imposed a break date exogenously, applied co-integration test and found co-integration in the early years but found no co-integration in the later part. They interpreted it as budget deficit was sustainable in the early stage, but later part it was problematic mean not sustainable. In our study we apply both types of method. First we apply widely used test to check the presence of co-integration between two variables named Johansen co-integration test for the full sample period. Later we impose break date at 1990 as from this year the gap between government expenditure and revenue was started become much wider. Basically, co-integration test explain that, if two variable moves closely together for long run, even though they are trended, the distance between these two variables are constant. If co-integration present between two variables it indicates that, two variables are closely

related in the long run. In this study, if government revenue to GDP ratio and government expenditure to GDP ratio is co-integrated, it will suggest that, budget deficit is sustainable in the long run.

**B. Quintos (1995) Approach Based On IBC**

Usual procedure of assessing long run sustainability of fiscal policy consist of testing the government’s IBC. In brief, for the budget deficit to be sustainable, the government must run future budget surpluses equal, in present-value terms, to the current value of its outstanding liabilities.

The customary framework used to test for the sustainability of budget deficits starts from the government’s revenue and expenditure in terms of GDP shares, becomes:

$$b_t = \sum_{j=0}^{\infty} \left(\frac{1+x}{1+r}\right)^{j+1} E_t s_{t+j+1} + \lim_{j \rightarrow \infty} \left(\frac{1+x}{1+r}\right)^{j+1} E_t b_{t+j+1} \dots\dots\dots(1)$$

Where, b and s denotes, the total government debt and the primary budget surplus (i.e., excluding interest payments) respectively, both as ratios to GDP. In addition, E is the expectations operator; and x and r stand, respectively, for the rate of growth of real GDP and the real interest rate, both assumed to be constant for simplicity. From here, the condition for fiscal sustainability is:

$$\lim_{j \rightarrow \infty} \left(\frac{1+x}{1+r}\right)^{j+1} E_t b_{t+j+1} = 0 \dots\dots\dots(2)$$

i.e., the government must run expected future budget surpluses equal, in present value terms, to the current value of its outstanding debt. The co-integration framework to test for the RE (We have used government revenue and expenditure-RE in the form of revenue to GDP ratio and expenditure to GDP ratio) follows once first differences are taken in (1):

$$\Delta b_t = \sum_{j=0}^{\infty} \left(\frac{1+x}{1+r}\right)^{j+1} E_t \Delta s_{t+j+1} + \lim_{j \rightarrow \infty} \left(\frac{1+x}{1+r}\right)^{j+1} E_t \Delta b_{t+j+1} \dots\dots\dots(3)$$

So, that sustainability would require:

$$\lim_{j \rightarrow \infty} \left(\frac{1+x}{1+r}\right)^{j+1} E_t \Delta b_{t+j+1} = 0 \dots\dots\dots(4)$$

Under a no-Ponzi scheme rule, the right-hand side of equation (3) will be stationary as long as the budget surplus and the stock of government debt are all stationary in first differences. In order to test for condition (4), the usual procedure consists of testing for the stationary of

$$\Delta b_t = exp_t - rev_t ,$$

Where,  $exp_t$  and  $rev_t$  denote the ratios of the government’s total expenditures and revenues to GDP respectively; that is,  $exp_t - rev_t$  is the total budget deficit as a ratio to GDP. Provided that, both  $exp_t$  and  $rev_t$  are I (1) with a co-integration relationship (1, -1), one should then test the linear restriction  $\beta = 1$  in a regression model of the form:

$$rev_t = \alpha + \beta exp_t + \varepsilon_t \dots\dots\dots(5)$$

where,  $\varepsilon_t$  is an error term. According to Quintos (1995), if  $exp_t$  and  $rev_t$  are co-integrated and  $\beta = 1$ , the government deficit is strongly sustainable; whereas, if  $0 < \beta < 1$ , the deficit is only weakly sustainable. Finally, if  $\beta = 0$  the deficit is unsustainable.

**3. RESULTS AND DISCUSSION**

**3.1. Strong Form of Sustainability**

To check the strong form of sustainability, like Payne and Mohammadi (2006) and Takeyuki and Masuo (2011) we have used budget deficit to GDP ratio as our concern variable. If we put the value into graph from the year 1971 to 2011 it shows as follows-

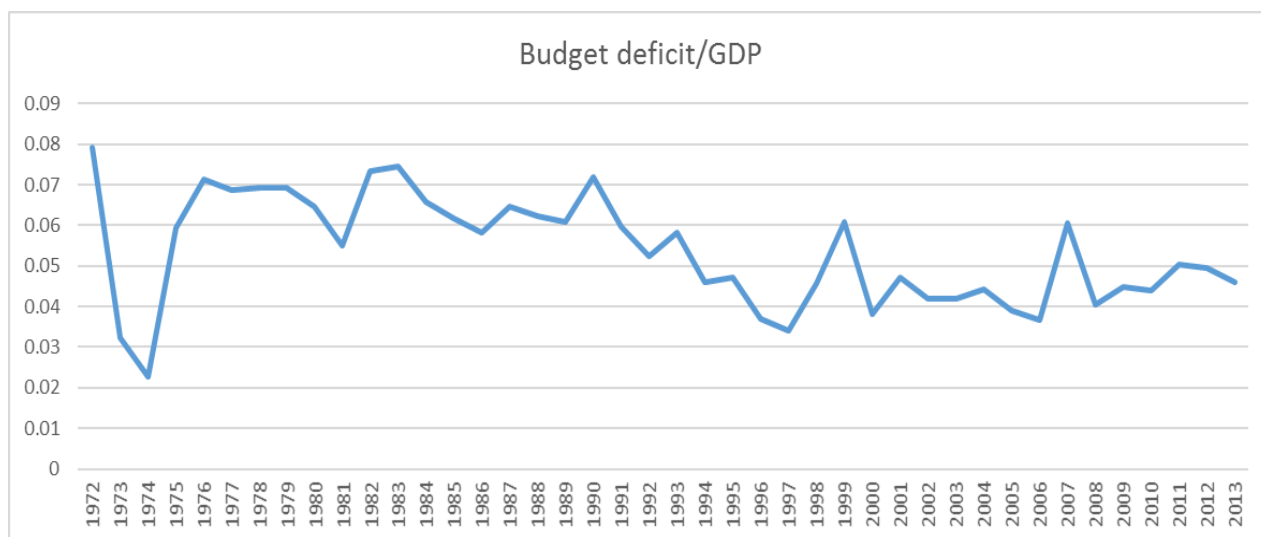


Figure-3. Bangladesh Budget Deficit/GDP data from 1972 to 2011

(Data source: author's calculation based on data of Ministry of Finance, Bangladesh)

Before going to stationary test we have examined the summary statistics of our concern variable (budget deficit to GDP ratio) which is shown in Table 1.

Table-1. Summary statistics of deficit/GDP ratio

Mean	0.0536
Median	0.057
Maximum	0.023
Minimum	0.079
Standard Deviation	0.01412
Skewness	-0.2199
Kurtosis	2.126
Jarque-Bera	2.82 (0.2444)

Note: Probability value in parenthesis

Table 1 reports the summary statistics and uni-variate time series properties of the budget deficit. The Jarque-Bera test reveals that the budget deficit follows a normal distribution. For checking the stationary property of our concern variable, the result of Augmented Dicky –Fuller test and Phillip Perron Unit root tests are as follows-

#### a. Augmented Dicky –Fuller test

ADF Test	ADF statistics	Lag length
ADF(C) <i>bdt</i>	-3.971	0
ADF(C) $\Delta bdt$	-8.571	0
ADF(C+T) <i>bdt</i>	-4.404	1
ADF(C+T) $\Delta bdt$	-8.446	0

Notes: The critical values for the ADF unit root tests which include a constant are the following: a. (1%) -2.43, b. (5%) -1.68, and c. (10%) -1.3. The critical values for the ADF unit root tests which include a constant and linear trend are the following: a (1%) -4.251, b (5%) -3.544, and c (10%) -3.206.

For ADF(C+T) *bdt*, we set lag length  $K=1$ , which is selected by using *FPE* (Final Prediction Error), *AIC*(Akaike's Information Criterion), *HQIC*(Hannan and Quinn Information Criterion), *SBIC*(Schwarz's Bayesian Information Criterion), with  $K_{max}=4$ . Every method shows the same result. The standard Augmented Dicky-Fuller test shows that the absolute value of the test statistics is higher than the absolute value of t statistics which means

the null hypothesis is rejected and the data set has no unit root which means data set is stationary at 1% level of significance.

#### b. Phillips Perron Tests

Phillips Perron Test	Test statistics	Lag length
PP (C) <i>bdt</i>	-4.153	Default
PP(C) $\Delta bdt$	-10.235	0
PP (C+T) <i>bdt</i>	-4.528	2
PP (C+T) $\Delta bdt$	-10.280	0

Notes: The critical values for the Phillips Perron unit root tests which include a constant are the following: a. (1%) -3.65, b. (5%) -2.96, and c. (10%) -2.61.

The critical values for the Phillips Perron unit root tests which include a constant and linear trend are the following: a (1%) -4.25, b (5%) -3.54, and c (10%) -3.20.

For Phillips Perron (C+T) *bdt*, we set lag length  $K=1$ , which is selected by using *FPE* (Final Prediction Error), *AIC* (Akaike's Information Criterion), *HQIC* (Hannan and Quinn Information Criterion), *SBIC* (Schwarz's Bayesian Information Criterion), with  $K_{max}=4$ . Every method shows the same result. The standard Augmented Dicky Fuller test shows that the absolute value of the test statistics is higher than the absolute value of t statistics which means the null hypothesis is rejected and the data set has no unit root which means data set is stationary at 1% level of significance.

Both the test shows that our concerned variable budget deficit to GDP ratio is stationary ie. budget deficit is sustainable. This type of sustainability is termed as strong form of sustainability. So, we can say that, sample period result analysis shows that Bangladesh budget deficit is sustainable.

### 3.2. Long Run Sustainability

#### 3.2.1. Johansen Co-Integration Test

##### i. Johansen Co-Integration Test For the Full Sample Period (1972-2012)

Another way of checking budget deficit sustainability is checking the co-integration relationship between the government revenue and government expenditure. For checking the long run relationship between the government revenue and government expenditure we have used revenue to GDP ratio and expenditure to GDP ratio as our concern variable which is standard practice. The argument is, if government revenue and expenditure increased with the increase of GDP, then increase in government expenditure is supposed to not create any problem to the economy.

Before going to Johansen co-integration test we checked the stationary properties of the variables. Here as well, we have used standard Augmented Dicky-Fuller test and Philips Perron unit root test for checking stationary properties of the concern variables. Test result of Augmented Dicky-Fuller test and Philips Perron unit root test-

Table-2. Unit root test of revenue to GDP ratio and expenditure to GDP ratio

Name of the Variable	Augmented Dicky-Fuller test		Philips Perron test	
	Test Statistics	5% critical value	Test Statistics	5% critical value
Rev/GDP	-2.005	-3.544	-0.821	-2.961
$\Delta$ Rev/GDP	-5.450	-3.548	-5.523	-2.964
Exp/GDP	-3.338	-3.544	-2.338	-2.961
$\Delta$ Exp/GDP	-6.853	-3.548	-6.958	-2.964

Note: if the absolute value of test statistics is higher than absolute value of critical value, then variables are stationary

The test result shows that the variables are non-stationary at level and stationary at first difference. So, we can use these variables for Johansen co-integration test. Johansen test result is shown in table 3. The test result clearly shows that, co-integration prevails between the variables of government revenue and expenditure. It indicates that there is a balance between the government expenditure and revenue collection with the GDP ratio in the long run. It means that government budget deficit is sustainable in the long run. The Johansen co-integration test result is as follows-

Table-3. Johansen Test for Co-integration for overall sample

Null Hypothesis	Alternative Hypothesis	Test Statistics	5-percent Critical Value	Conclusion
Maximum Eigen value Test				
$r = 0$	$r = 1$	.	15.41	One co-integrating equation
$r \leq 1$	$r = 2$	.426	3.76	
Trace Test				
$r = 0$	$r = 1$	21.2787	15.41	One co-integrating equation
$r \leq 1$	$r = 2$	.1837	3.76	

### ii. Johansen Co-Integration Test For the Sample Period 1990 to 2011

The distance between government revenue and expenditure was very close at the beginning years. However, it started to become wider after mid 80's and got a wider distance from 1990 and continued to wider till now. So, we imposed the break date at 1990. Johansen test result after imposing the break date is shown in table 4.

Table-4. Johansen Test for Co-integration for the sample period 1990 to 2011

Null Hypothesis	Alternative Hypothesis	Test Statistics	5-percent Critical Value	Conclusion
Maximum Eigen value Test				
$r = 0$	$r = 1$	.	15.41	One co-integrating equation
$r \leq 1$	$r = 2$	.5529	3.76	
Trace Test				
$r = 0$	$r = 1$	16.53	15.41	One co-integrating equation
$r \leq 1$	$r = 2$	.4330	3.76	

The test result clearly shows that co-integration prevails between the variables of government revenue and expenditure which means government budget deficit is no problem in the later part as well.

### 3.2.2. Quintos (1995) Approach

We have applied Quintos (1995) approach (equation 5) to see the co-integration between government revenue and government expenditure which is shown in the beneath table. Here as well, we have used government revenue to GDP ratio and expenditure to GDP ratio as our concern variable. As prerequisite of the regression analysis, we test the stationary properties of our variables which is shown afterwards in Table 2 by using standard unit root tests (ADF and PP). The test result shows that the variables (revenue to GDP ratio and expenditure to GDP ratio) are non-stationary at level and stationary at first difference which satisfies the requirement of the test. The result of Quintos (1995) approach is shown below (Table 5)-



Table-5. Quintos (1995) Test result

Dependent Variable: revenue to GDP ratio  
Sample period: 1972 to 2011

Variable	Coefficient	Standard Error	t-statistic	P-value	W <sub>OLS</sub>
Constant	-.031	.016	-1.97	.056	
expenditure to GDP ratio	.842	.114	7.33	.00	53.73 (0.00)

R-squared .585  
Adjusted R-squared .574  
F-statistic 53.71  
Probability (F-statistic) 0.00

The null hypothesis of deterministic co-integration between *rev* and *exp* is not rejected at the 1% level of significance. It indicates that, there is a co-integration exists between our concern variables. According to the Wald test on the null hypothesis  $\beta^{\wedge}=1$  against the alternative  $\beta^{\wedge}<1$ , distributed as a  $\chi^2$  denotes that the estimate of  $\beta$  is 0.842 is significantly different from zero at the 1% level; but not significantly different from one at the 1% level, which is shown in table 4 by W<sub>OLS</sub>. The test result shows that, according to Quintos (1995) approach, the Bangladesh budget deficit is sustainable.

Budget deficit sustainability is an important aspect of government fiscal policy and macroeconomic stability. Bangladesh government borrowing is increasing every year and sometimes it might induce crowding out effects on private sector which is not good sign for a growing economy like Bangladesh. However, government expenditure has some positive effect as well as government expenditure has multiplying effect in economy. Hence, government should decide carefully to maintain a balance between government expenditure and revenue collection and maintain a healthy economic environment for private sector. However, the good news is all of our statistical method says us till now the budget deficit of Bangladesh is sustainable.

#### 4. CONCLUSION AND POLICY RECOMMENDATION

This paper examines the sustainability of Bangladesh government budget deficit over the sample period of 1972 to 2012 by applying various techniques. We analyze the time series property of budget deficit by unit root tests and co-integration tests. Like Payne and Mohammadi (2006) and Takeyuki and Masuo (2011) we used budget deficit to GDP (Gross Domestic Product) ratio as our dependent variable for stationary test. Then we have applied standard unit root test of Augmented Dicky Fuller and Phillip-Perron. Tests result show that, our concern variable have no unit root means it is stationary and sustainable. To check long run sustainability, we have used Johansen co-integration test and Quintos (1995) approach. In this case also, both the test tells us that budget deficit of Bangladesh is sustainable in the long run.

Our sample size is relatively small compared to Bajo-Rubio *et al.* (2010) and Payne and Mohammadi (2006) but similar to Takeyuki and Masuo (2011). Payne and Mohammadi (2006) used Augmented Dicky Fuller unit root test and found that data set was not stationary. After that they used Perron (1997) unit root test which allow an endogenous structural break and found that data is stationary. Takeyuki and Masuo (2011) tried in the same way and found that Japan's budget deficit is non-stationary which means Japan's budget deficit is not sustainable.

However, in Bangladesh case, though the amount of budget deficit is increasing day by day, simultaneously the size of the GDP is also increasing at a similar rate. As a result, the ratio of budget deficit to GDP is remaining almost similar, which is following stationary process.

On the other hand, government expenditure is increasing; simultaneously the revenue collection is also increasing. As a result, the relationship is showing co-integrated in the long run. Basically, in many cases, government is using this extended budget for the development activities and growth of the economy. Relatively Bangladesh economy is still young and growing; hence, it might require more governmental expenditure for its higher growth. However, in recent years this gap is extending to huge amount. Hence, the Government should

maintain a balance between the governmental expenditure and revenue collection. Overall, from various types of examinations, our study suggests that budget deficit in Bangladesh is sustainable.

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