Bangladesh Journal of Political Economy

Vol. 30, No. 1, June 2014, pp. 063-078
Bangladesh Economic Association
(ISSN 2227-3182)

Fiscal Sustainability in Bangladesh: The Present Value Budget Constraint Approach

MD ABDUL WADUD*
S M ATIAR RAHMAN**

Abstract *This paper aims to empirically assess the sustainability of the fiscal policy of Bangladesh over the period of 1973-2013 within the framework of the present value budget constraint approach. This approach provides the methodology for analyzing fiscal sustainability in a vector autoregressive (VAR) framework that accommodates testing the short-run instability of variables and the cointegration relationship, and obtaining the normalized cointegrating vector. We apply augmented Dickey-Fuller (ADF) and Philips-Perron (PP) unit root and Johansen cointegration tests, and Dynamic Ordinary Least Squares (DOLS) method to evaluate the sustainability of fiscal policy in Bangladesh. Results of both unit root tests report instability in variables while results of cointegration test indicate long-run cointegration relationship between the variables. Results of normalized cointegrating coefficient and Dynamic Ordinary Least Squares estimate imply that the fiscal policy of Bangladesh is weakly sustainable.*

Keyword: *Cointegration, Fiscal Policy Sustainability, Unit Root Test, Present Value Budget constraint, Dynamic Ordinary Least Square (DOLS) and Bangladesh*

JEL Classification Number: *E62, H62, H63, C32*

1. Introduction

Fiscal policy is one of the most powerful instruments that governments use to maintain macroeconomic stability for rapid economic growth, develop a

* Department of Economics, University of Rajshahi, Rajshahi 6205, Bangladesh
** Research Fellow, Institute of Bangladesh Studies, University of Rajshahi, Rajshahi 6205, Bangladesh

mechanism for equitable distribution of income, reduce poverty and ensure optimum efficiency of economic units as well as for intra- and intergenerational transfers of wealth. Hence the relevance of fiscal strategy and performance is highly critical to a country's development process as it is linked with resource generation and distribution. The main tools to achieve these objectives are variation in public revenue, variation in public expenditure, and management of public debt. In the case of Bangladesh, these are reflected in the budgetary operations of the government, prepared and implemented on year-on-year basis. Fiscal policy is predominantly guided by the Perspective Plan, Five Year Plan and other plans of Bangladesh.

Sustainability of fiscal policy requires government expenditures and revenues to be in equilibrium in the long run. The sustainability of fiscal policy addresses the question of whether the government is able to generate surpluses in future in order to pay off the previous debt or whether it will carry on playing a Ponzi game (financing the debt and interest payments by issuing new debt), as is possible in some dynamically inefficient economies. According to Abel et al. (1989), the economy is dynamically inefficient "in situations where the population growth exceeds the steady state marginal product of capital, or equivalently the economy is consistently investing more than it is earning in profit."

Most often, high public debt level creates repayment flows that can crowd-out much needed public spending on health, education and infrastructure and can generate adverse incentives for private investors to engage in activities that spur long term growth. Moreover, high public debt level has two main negative effects on economic activity. First, it requires high taxes to finance debt and puts upward pressure on real interest rates which imply private investment and certain government expenditures to be crowd out. Second, fiscal policy becomes pro-cyclical rather than countercyclical when the government is forced to reduce its spending or raise revenues due to the lack of its ability to finance its deficits. Furthermore, high public debts adversely affect marginalized people. The government continuously increases the revenue earning through imposing more regressive tax to pay the debt service. Increasing level of tax has two-fold effects on people: firstly, it increases the price level of the economy and secondly, it reduces the disposable income of the people. These two effects result into the fall of real income of the people and make the situation worse off. Therefore fiscal policy sustainability is important to maintain macroeconomic stability.

Fiscal sustainability is a useful criterion to evaluate whether or not fiscal policy is on a right track. There are different notions regarding the analysis of fiscal

sustainability. Traditionally, fiscal sustainability has been assessed in terms of indicator analysis, i. e., summary measures of sustainability. The first specification of fiscal policy sustainability is envisaged at the beginning of the past century after the First World War by Keynes in his study regarding the problem of the French Public Debt: the state liabilities have reached an excessive proportion of national income (Keynes, 1938). The second specification going back to Domar (1944) requires the public debt ratio to converge to a finite value in order to avoid a continuously growing tax ratio. A third specification used by Buiter (1985) and Blanchard *et al.* (1990), requires the debt ratio to converge back to its initial level. A fourth specification employed by Wilcox (1989) states that a sustainable fiscal policy is one that would be expected to generate a sequence of debt and deficits such that the Present Value condition would hold. Finally, Blanchard *et al.* (1990) propose a tougher restriction in that the present discounted value of all future primary surpluses should be equal to the current level of public debt. If this restriction is expressed in nominal values (and the discount rate is the interest rate on public debt), it implies that the debt ratio should converge to zero. Moreover, one concept of fiscal sustainability relates to solvency, the ability of the government to service its debt obligations in perpetuity without explicit default. Another concept of fiscal sustainability relates to the government's ability to maintain its current policies while remaining solvent.

There are two commonly used approaches to evaluate sustainability of fiscal policy in the theoretical literature- Accounting approach and Present Value Budget Constraint (PVBC) approach. Accounting approach focuses on pre-defined macroeconomic targets in the economy which include inflation, growth rate of the economy and interest rate. According to this approach, a primary balance is defined sustainable if it generates a constant (rather than ever-increasing) debt/GDP ratio, given a specified real GDP growth target and constant real interest rate. Therefore, the sustainability condition implies that the growth rate of the economy must be larger than the real interest rate. The Accounting approach involves the use of a number of indicators of fiscal sustainability, which are based on the government budget constraint.

The PVBC approach for assessing fiscal sustainability involves economic testing of the PVBC or of the non-ponzi game (NPG) condition [a condition that states that the present value of the stock of public debt goes to zero in the limit] for a set of time series data on government expenditure, revenue, deficits and/or debt. This involves tests of nonstationarity of variables and analysis of cointegration. According to the PVBC approach, sustainability is said to exist when the present value of budget constraint (PVBC) is satisfied without a major and abrupt

correction having to be made in the balance of income and expenditure to avoid solvency and liquidity problems. Solvency, in turn, is ensured when the present value of current and future primary expenditure is not greater than that of current and future streams of income, net of any initial indebtedness. Hakkio and Rush (1991) develop the empirical approach of the sustainability of fiscal policy through cointegration tests between government revenue and expenditure, while Hamilton and Flavin (1986) consider cointegration tests between fiscal deficit and government debt. Following Hamilton and Flavin (1986), many studies such as Trehan and Walsh (1988), Hakkio and Rush (1991), Tanner and Liu (1994), Liu and Tanner (1995), Makrydakis, Tzavalis and Balfoussias (1999), Issler and Lima (2000), Green, Holmes and Kowalski (2001) and Bravo and Silvestre (2002) have tested the sustainability of budget deficits using the intertemporal budget constraint of the government. While Hamilton and Flavin (1986), Trehan and Walsh (1988, 1991), Hakkio and Rush (1991), Tanner and Liu (1994) and Liu and Tanner (1995) test the sustainability of US government deficits; Makrydakis, Tzavalis and Balfoussias (1999) analyze it for Greece, Issler and Lima (2000) did it for Brazil, Green, Holmes and Kowalski (2001) for Poland and Bravo and Silvestre (2002) for eleven European countries.

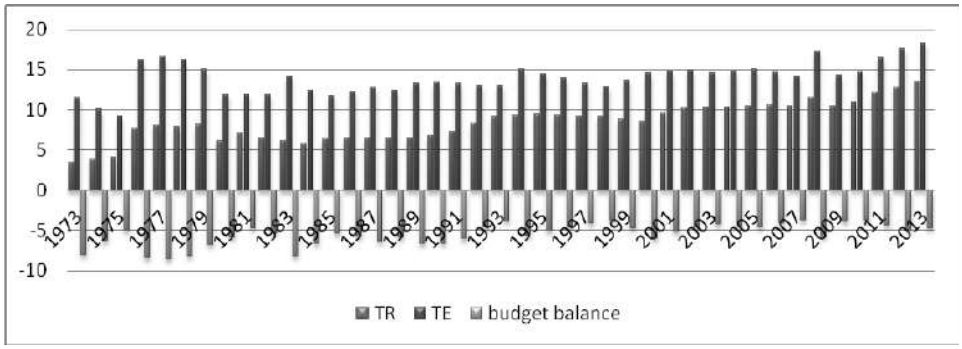
Moreover, there are two types of analysis used to examine the sustainability of fiscal policy- time series and panel data analysis. Studies using time series analysis (e.g., Quintos 1995; Hamilton and Flavin, 1986; Papadopoulos and Sidiropoulos, 1999; Cipollini, 2001; and Qin et al. 2006) examine the long run relationship between government spending and revenues for a particular country over time. The panel data analysis (e.g., Prohl and Schneider, 2006; Llorca and Redzepagic, 2008; Ehrhart and Llorca, 2008; Westerlund and Prohl, 2010) investigates the relationship between revenues and spending across different countries at the same point in time (year). The majority of studies which use time series data have tested the sustainability for a single country, Olekalns (2000) examined the case of Australia, Hatemi-J (2002) tested the case of Sweden, while Davig (2005) examined the case of U.S.A. A few studies examined fiscal sustainability of a group of countries: Prohl and Schneider (2006) examined the EU15 countries, and Westerlund and Prohl (2010) investigated the case of 8 OECD countries.

The Government of Bangladesh spent a large amount of its resources in reconstruction and rehabilitation work in the initial years of independence. It has negative public savings and limited private investment. Despite large inflows of foreign aid, the increasingly large financing gap becomes the main concern of the government. The situation is further aggravated by frequent internal and external

shocks. Under the circumstances, government fiscal policies during the 1970s and 1980s were largely oriented at rehabilitating the war-torn economy as well as stabilizing it from various shocks. This has gradually led to weak fiscal structure and poor fiscal management. The tax structure is such that any increase in taxes due to built-in consequences of economic growth is virtually not possible. More than 80% of the total tax revenue came from indirect taxes, amongst which taxes on imports contributed about 60%. Current expenditure has always been underestimated in the country, while current surplus as well as foreign loans and grants are overestimated. Therefore, the overall fiscal deficit experienced a large variability over the period under observation. The scenario of Bangladesh's revenue, expenditure and fiscal deficit is shown in Figure 3. The overall budget deficit was 8.4% of GDP during the 1980s and came down to 5.9% in 1991-92 and thus provided a breathing ground for the government. Since the 1990s, the country has maintained a fiscal deficit as a ratio of GDP below 4.0 percent except in fiscal year 2000 and 2008. Up to 1997-98, the budget deficit was successfully contained to less than 6% which helped stabilize the economy to a great extent. The overall budget deficit for the fiscal year 2013-14 is estimated at Tk. 55,032.00 crore, which is 4.6% of GDP. The revised budget of fiscal year 2012-13 estimates a deficit of Tk. 49,656.00 crore (4.8% of GDP), which was Tk. 55,000.00 crore (5% of GDP) in the proposed budget of Bangladesh. The economy of Bangladesh thus experienced persistent fiscal instability during the period under review because of various political and economic shocks.

This paper is therefore designed to check whether fiscal sustainability exists in

Figure 1 : Total Revenue, Total Expenditure and Budget Deficit (% of GDP) in Bangladesh



Bangladesh within the framework of the present value budget constraint. We apply Johansen cointegration approach in a VAR framework and Dynamic

Ordinary Least Squares (DOLS) method to assess this sustainability using time series data of government revenue and expenditure for the period 1973 – 2013. To the best of our knowledge, no study has been done applying this methodology to empirically test the fiscal sustainability in Bangladesh. Therefore, this study is the first of its kind in Bangladesh.

The rest of the paper is organized as follows: Section 2 details the theoretical framework; Section 3 explains the econometric methodology and data. Section 4 provides empirical results and Section 5 gives the conclusion.

2. Theoretical Framework

The present value budget constraint (PVBC) pioneered by Hamilton and Flavin (1986) and Hakkio and Rush (1991) is used as the methodology for modeling the dynamics of fiscal sustainability. This choice draws from the fact that the PVBC is anchored on recent advances in the econometrics of non-stationary and cointegration methodology for assessing fiscal sustainability. In addition, unlike the accounting approach, the PVBC does not make assumptions that liabilities can continue to grow at the growth rate of the economy's GDP, so that debt/GDP ratios remain constant leaving rather vague the role that lenders ultimately play in determining what debt strategies are "sustainable" and which are not. From an analytical perspective, fiscal policy sustainability can be indicated by the government intertemporal budget constraint (IBC) or the PVBC (Afonso and Jalles, 2011; and Afonso and Rault, 2010).

The analysis of the PVBC for a single country in a given period t starts with the government budget constraint which can be written as follows:

$$G_t - R_t + r_t B_{t-1} = B_t - B_{t-1} \quad (1)$$

where G_t is the value of government expenditures, R_t is government revenue, B_t is the government debt and r_t is the real interest rate on government debt. From equation (1), if the government runs a primary surplus equal to zero, the stock of debt grows at a rate equal to the interest rate. However, if the government runs a primary deficit, the stock of debt grows at a rate exceeding the interest rate. Also, if the government runs a primary surplus, the stock of debt grows more slowly than the interest rate. If the surplus more than offsets interest payments on existing debt, then the debt actually shrinks over time.

Let, $S_t = R_t - G_t \quad (2)$

where S_t is the primary surplus at the period t . Substituting equation (2) into equation (1) and after some rearranging we get:

$$B_{t-1} = B_t(1+r_t)^{-1} + S_t(1+r_t)^{-1} \quad (3)$$

Substituting recursively forward for N periods gives the following inter-temporal budget constraint equation:

$$B_t = B_N(1+r_t)^{-N(-1)} + S_{t+i}\sum_{i=1}^{N}(1+r_t)^{-i} \quad (4)$$

By letting N $\rightarrow \infty$ the limiting value of equation (4) can be expressed as follows:

$$B_t = \lim_{N\to\infty}\left[(1+r_t)^{-N(-1)}B_N\right] + \sum_{i=1}^{N}\left[(1+r_t)^{-1}S_{t+i}\right] \quad (5)$$

Equation (5) states that the current debt stock is equal to the present value of the debt stock in the limit plus the present value of its future primary surplus. A sustainable fiscal policy should ensure that the "non-Ponzi game (NPG)" condition holds, i.e. the present value of the stock of public debt goes to zero in the limit. It is also worth noting that the hypothesis of fiscal policy sustainability is related to the condition that the trajectory of the main macroeconomic variables is not affected by the choice between the issuance of public debt and the increase in taxation. Under such conditions, it would therefore be irrelevant how the deficits are financed. This implies the assumption of the Ricardian Equivalence hypothesis**.** Thus:

$$\lim_{N\to\infty}\left[(1+r_t)^{-N(-1)}B_N\right] = 0 \quad (6)$$

Equation (6) represents the NPG condition, and the implication of this equation is that in the long run, debt cannot grow at a rate equal to, or higher than the interest rate. Assuming that the NPG is satisfied, then substituting equation (6) into (5) gives the PVBC equation as follows:

$$B_t = \sum_{i=1}^{N}\left[(1+r_t)^{-1}S_{t+i}\right] \quad (7)$$

Equation (7) shows that government debt at any point in time must equal the present value of its future primary surplus. The implication is that public sector debt cannot be continuously rolled over, that is, repayment of the principal must take place at some point and, while the PVBC does not rule out large fiscal deficits or debt ratios, government is required to run some primary surplus in the future by increasing revenue through taxes or grants; reduction in expenditure; monetization of the debt or shifting between debt sources to take advantage of lower interest rate.

The PVBC approach to evaluating fiscal sustainability involves econometric techniques in stationarity and cointegration analysis. Therefore, the starting point for these tests is to take the first difference of equation (5) to get an empirical testable representation of the intertemporal government budget constraint:

$$\Delta B_t = Lim_{N\to\infty}\left[(1+r_t)^{-N(-1)}\Delta B_{N+1}\right] + \sum_{i=1}^{N}[(1+r_t)^{-1}(\Delta R_{t+i+1} - \Delta G_{t+i+1})] \quad (8)$$

Assuming the real interest rate is stationary, with mean, r, and defining and an $E_t = G_t + (r_t - r)B_{t-1}$ additional definition, $GG_t = G_t + r_t B_{t-1}$, and assuming the NPG in equation (6) is satisfied, the intertemporal budget constraint may also be written as:

$$GG_t - R_t = \sum_{i=1}^{N}[(1+r_t)^{-1}(\Delta R_{t+i+1} - \Delta E_{t+i+1})] \quad (9)$$

In equation (9), GG_t is total government spending on goods and services, transfer payments, and interest on the debt; R_t is government revenue. Equation (9) forms the basis for testing the sustainability hypothesis where GG_t and R_t must be cointegrated variables of the same order. Assuming that and are non-stationary variables, and that the first differences are stationary variables, this implies that the series and in levels are I (1). Then, for equation (9) to hold, its left-hand side needs to be stationary. If it is possible to conclude that GG_t and R_t are integrated of order 1, these two variables should be cointegrated with cointegration vector (1, -1) for the left-hand side of equation (9) to be stationary. The conditions for sustainability are that both variables must be integrated of same order and should be cointegrated.

The procedure to assess the sustainability of the intertemporal government budget constraint therefore involves testing the following cointegration regression:

$$R_t = a + bGG_t + \mu_t \quad (10)$$

If the null hypothesis of no cointegration, i.e. that the two I(1) variables are not cointegrated is rejected (with a high-test statistic), this implies that one should accept the alternative hypothesis of cointegration. If there is cointegration, it implies that the PVBC holds and fiscal deficit is sustainable. Similarly, if there is no cointegration, the PVBC does not hold and the fiscal policy is unsustainable. However, the condition b=1 is not, strictly speaking, a necessary condition for the government's budget constraint to hold. When there is co-integration, with b < 1, government expenditures are growing faster than government revenues, and the deficit may not be sustainable. Hakkio and Rush (1991) show that when GG_t and R_t are in levels, the condition 0 < b <1 is a sufficient condition for the budget constraint to be obeyed. However, when revenues and expenses are expressed as a percentage of GDP or in per capita terms, it is necessary to have b = 1 in order for the trajectory of the debt-to-GDP not to diverge in an infinite horizon.

3. Empirical Framework - Econometric Methodology

Econometric methodology of this study consists of testing nonstationarity properties of variables – government revenue and government expenditures, assessing cointegration relationship between the variables and finding normalized cointegration vector, and obtaining the coefficient of regression parameter estimated by DOLS method. These are discussed as follows.

3.1 Unit root tests

The first task is to determine the order of integration of both series after checking the nonstationarity of variables. In order to do so, we employ augmented Dickey-Fuller (ADF) and Phillips Perron (PP) unit root tests. If the variables are nonstationary, then regression results suffer from the problems of endogeneity and spurious correlation. Then the variables need to be made stationary which can be achieved through differencing them. The number of differencing required to make the variables stationary is called order of integration. The ADF test is estimated by the following regression:

$$\Delta Y_t = \beta_1 + \beta_2\ t + \delta Y_{t-1} + \sum_{i=1}^{m} \alpha_i \Delta Y_{t-i} \qquad (11)$$

Where ΔY_t is the first difference of Y series, β_t is a constant term, t is a trend variable, m is the number of lags which are included to allow for serial correlation in the residuals and μ_t is the residual term. A test for nonstationarity of the series, Y_t, accounts to a test of $\delta=0$. If the absolute value of the computed statistics for δ exceeds the absolute critical value, then the null hypothesis, that the Y_t series is nonstationary must be rejected against its alternative hypothesis. That is, if, on the other hand, it is less than the critical value, it is concluded that the Y_t series is nonstationary. While the ADF test takes care of possible serial correlation in the error terms by adding the lagged difference terms of the regressand, the PP test uses nonparametric statistical methods to take care of the serial correlation without adding lagged difference terms. We also apply PP test to check the nonstationarity of variables. The test detects the presence of a unit root in a series, say, Y_t, by estimating the following regression:

$$\Delta Y_t = \alpha + \rho Y_{t-1} + \mu_t \qquad (12)$$

$$\Delta Y_t = \alpha + \beta_t + \rho Y_{t-1} + \mu_t \qquad (13)$$

where the second equation includes a trend variable. The PP test is verified by the t value associated with the estimated coefficient of ?. The series are to be stationary if ? is negative and significant. The test is to be performed for all the

variables where both the original series and the differences of the series are to be tested for stationary. Once the order of integration is determined we test for cointegration.

3.2 Cointegration Approach in a VAR Framework

The Johansen cointegration test is applied for determining cointegration relationship between total revenue and total expenditure following the literature on fiscal sustainability. To determine the number of cointegrating vectors we use the maximum eigenvalue test and the trace test. We formulate the Vector Autoregressive (VAR) model as follows:

$$Y_t = \mu + \sum_{k=1}^{p} \pi_k Y_{t-k} + \varepsilon_t \quad (14)$$

Where Y_t is an (n×1) column vector of *n(I)* variables, π_t is a coefficient matrix, μ presents a (n×1) vector of constants, p denotes lag length, and ε_t is a disturbance term that is independently and identically distributed with zero mean and constant variance. Equation (9) can also be expressed in first difference form as:

$$\Delta Y_t = \mu + \pi Y_{t-1} + \sum_{k=1}^{p-1} \Gamma_k y_{t-k} \quad (15)$$

Where Δ is the first difference operator and I is an $n \times n$ identity matrix, $\eta = \sum_{k=1}^{p} \Pi_k$ -I and $\Gamma_k = \sum_{j=k+1}^{p} \Pi_j$

The rank of matrix ΓI determines the number of cointegration vectors which is equal to the number of independent numbers of cointegrations. If the rank of ΓI equals r and r<n, then there exist r cointegrating relationships in the model. The number of cointegrating relations is tested with two statistics, namely trace statistic and maximum eigenvalue statistic which are obtained respectively from the following equations:

$$\lambda_{trace}(r) = -T \sum_{i=r+1}^{n} \ln (1 - \lambda_i) \quad (16)$$

$$\lambda_{max}(r, r+1) = -T ln(1 - \lambda_{r+1}) \quad (17)$$

where λ_t denotes the estimated values of the characteristic roots obtained from the estimated Õ, and *T* is the number of observations.

3.3 Dynamic Ordinary Least Squares (DOLS) Method

We further apply a more robust method proposed by Stock and Watson (1993) to estimate the long run parameters of the model that corrects for possible simultaneity bias. The method involves estimation of the long run relationship using the Dynamic Ordinary Least Square (DOLS) method. The DOLS method is

often preferred due to its favorable performance in small sample. Moreover, Monte Carlo studies show that DOLS is found to have the lowest root mean square error (RMSE) of all asymptotic estimators (Kao and Chiang, 2000).

3.4 Data

The data set used for the empirical analysis in this paper consists of annual time series data for the period 1973-2013 on total government revenue (R) and government spending (GG). All variables are expressed as a ratio of GDP. Data are obtained from Sixth Five Year Plan (2011-2015), Ministry of Planning, government of the People's Republic of Bangladesh.

4. Empirical Results

4.1 Results of Unit Root Test

We first perform unit root tests on all four series in levels and first differences in order to determine the univariate properties of the data. To investigate the presence of unit root in the variables we conduct the ADF test with an intercept term and trend. We also run the PP test with both an intercept and trend term. Results of both the tests are presented in Table 1.

It is evident from Table 1 that the ADF and PP statistics for both total revenue and total expenditure variables in levels do not exceed their critical values except in the case of total expenditure for ADF test. However, when the variables are differenced once and ADF and PP tests are applied, the test statistics exceed their critical values at the 1% significance level. These results suggest that both series are integrated of order one, that is, they are *I (1)* series. This implies that the variables have instability in the short-run.

Table 1 : Results of Unit Root Test

	Augmented Dickey Fuller (ADF) Test		Phillips-Perron (PP) Test		Order Integratic
	Total Revenue	Total Expenditure	Total Revenue	Total Expenditure	
Level	-2.6971	-3.4907*	-2.8656	-3.1629	
First Difference	-6.2684**	-6.7713**	-6.2684**	-8.5271**	I(1)

Note: * and ** denote rejection of null hypotheses of unit root at10% and 1% levels of significance, respectively.

4.2 Results of Cointegration Test

Having established that all variables are integrated of the same order, we proceed with the Johansen multivariate cointegration tests in a VAR framework which allow us to test for long-run relationship between total revenue as a share of GDP and total expenditure as a share of GDP to assess the fiscal sustainability of Bangladesh. Table 2 presents the cointegration test results. According to Table 2, both trace and maximum eigenvalue tests indicate the rejection of the null hypothesis that there is no cointegrating relationship at 5% level of significance and hence accepts the alternative hypothesis that there is cointegration relationship between the variables. This indicates the existence of one cointegrating relationship between total revenue as a share of GDP and total expenditure as a share of GDP. That is, there is a long term or equilibrium relationship between these two variables. This implies that the present value budget constraint is satisfied and the fiscal policy is sustainable in Bangladesh.

Having found the existence of long-run cointegration relationship between the variables, we obtain the normalized cointegrating coefficients from the long-run equation estimated from the Johansen cointegration results to test whether the economy of Bangladesh exhibits weak or strong fiscal sustainability. This involves testing the hypothesis that b=1 in equation (10) against the alternative that 0<b<1. If the null hypothesis is accepted, we infer that there exists strong sustainability; otherwise we conclude that sustainability is weak. From cointegration analysis we get the value of the normalized cointegrating coefficient (b) to be 0.89. This result indicates that the economy of Bangladesh has weak fiscal sustainability.

Table 2 : Results of Cointegration Test

Hypothesized no of CE(s)	Eigenvalue	Trace statistics	5% critical value	Probability	Maximum eigenvalue statistic	5% critical value	Probability
None*	0.497145	34.41943	25.87211	0.0034	26.81069	19.38704	0.0035
At most 1	0.177244	7.608748	12.51798	0.2853	7.608748	12.51798	0.2853

Note: Both trace and maximum eigenvalue statistic indicate 1 cointegrating equation at the 5% significance level and * denotes rejection of the null hypothesis at the 5% level.

4.3 Result Obtained from Dynamic Ordinary Least Squares (DOLS) Method

We analyze the result obtained from DOLS method to check whether Bangladesh has strong or weak fiscal sustainability. We estimate equation (10), that is, applying DOLS method. Coefficient of the equation captures the relationship

between total revenue and total expenditure and thus sheds light on the sustainability of fiscal policy. The DOLS estimation results are shown in Table 3. Result reports that the estimated value of coefficient is 0.805558 which is statistically significant. The model yields an adjusted R^2 of 0.93, suggesting that 93% of the variation in total revenue can be explained by the explanatory variable total expenditure. This indicates that the fiscal policy of Bangladesh is weakly sustainable.

5. Conclusion

This paper evaluates the fiscal sustainability of Bangladesh within the framework of the present value budget constraint applying cointegration approach in a VAR model and dynamic ordinary least squares (DOLS) method using time series data of government revenue and government expenditures for the period 1973 – 2013. Results from both cointegration analysis and DOLS method indicate that the fiscal variables of Bangladesh are sustainably cointegrated in the long-run, although they have short-run instability and the fiscal policy is weekly sustainable.

Table 3 : DOLS Results

Variables	b	s.e.(b)	t-statistic
TR and TE	0.805558	0.131742	6.114644

References

1. Abel, A. B., Mankiw, N. G., Summers, L. H., and R. J. Zeckhauser, 1989, "Assessing Dynamic Efficiency: Theory and Evidence", Review of Economic Studies, 56, 1-20.
2. Afonso, A. and C. Rault, 2010, "What do We Really Know about Fiscal Sustainability in the EU? A Panel Data Diagnostic", Review of World Economics, 145, 731-755.
3. Afonso, A. and J. T. Jalles, 2011, "A Longer-Run Perspective on Fiscal Sustainability, Technical University of Lisbon", Working Paper, 17, 1-29.
4. Blanchard, O., J.C. Chouraqui, R.P. Hagemann and N. Sartor, 1990, "The sustainability of Fiscal Policy: New Answers to an Old question", OECD Economic Studies, 15, 7-36.
5. Bravo, A. and Silvestre, A., 2002, "Intertemporal sustainability of fiscal policies: Some tests for European countries", European Journal of Political Economy, 18, 517-528.
6. Buiter W.H, 1985, "A Guide to Public Sector Debt and Deficits", Economic Policy, 1, 612-35.
7. Cipollini, A. 2001, "Testing for government intertemporal solvency: A smooth transition error correction model approach", The Manchester School, 69, 643-655.
8. Davig, T. 2005, "Periodically Expanding Discounted Debt: A Threat to Fiscal Policy Sustainability?", Journal of Applied Econometrics, 20, 829-840
9. Domar, E.D. 1944, "The burden of the debt and the national income", American Economic Review, 798-827.
10. Ehrhart, C. and Llorca, M. 2008, "The sustainability of fiscal policy: evidence from a panel of six South- Mediterranean countries", Applied Economics Letters, 15, 797-803.
11. GREEN, C. J., HOMES, M. J. and KOWALSKI, T. 2001. Poland: A Successful Transition To Budget Sustainability?, Emerging Markets Review, Vol. 2, 160-182.
12. Green, C.J., Mark J. H. and Tadeusz, K. 2001, "Poland: A successful transition to budget sustainability?", Emerging Markets Review, 2, 160-182.
13. Hakkio CS, and Rush M, 1991, "Is the budget deficit "too large?", Economic Inquiry, 29, 429-45.
14. Hamilton, J.D. and M.A. Flavin,1986, "On the Limitations of Government Borrowing: A Framework for Empirical Testing", American Economic Review, 76, 808-19.

15. Hatemi-J, A. 2002, "Fiscal Policy in Sweden: Effects of EMU Criteria Convergence", Economic Modelling, 19, 121-136.

16. Issler, J. V. and Lima, L.R., 1997, "Public debt sustainability and endogenous seignorage in Brazil: Time-series evidence from 1947-92", Ensaios Econômicos da EPGE, 306.

17. Kao, C. and M-H. Chiang. 2000 On the Estimation and Inference of a Cointegrated Regression in Panel Data. In Baltagi, Badi, Fomby, Thomas B. and Hill, R. Carter (ed.), Advances in Econometrics: Nonstationary Panels, Cointegration in Panels and Dynamic Panels, Vol: 15: 179-222.

18. Keynes, J M. (1938). "Comment" [on D H Robertson, (1938)], Economic Journal 48 June, 318-22

19. Keynes, J. 1944, A Tract on Monetary Reforms, in The Collected Writings of John Maynard Keynes, IV, London: Macmillan, The Royal Economic Society, 1971.

20. Liu, P., Tanner, E., 1995, "Inter-temporal solvency and breaks in the US deficit process : a maximum-likelihood cointegration approach", Applied Economics Letters, 2, 231-5.

21. Llorca, M. and Redzepagic, S. 2008, "Debt sustainability in the EU New Member States: empirical evidence from a panel of eight Central and East European countries", Post-Communist Economies, 20, 159-172

22. Makrydakis, S., Tzavalis, E. and Balfoussias, A. 1999, "Policy regime changes and long run sustainability of fiscal policy: An application to Greece", Economic Modelling, 16, 71-86.

23. Bangladesh, Finance Division, Ministry of Finance, Government of Bangladesh.

24. Ministry of Finance (MoF). 2013, Sixth Five Year Plan (FY2011-FY2015), Dhaka,

25. Olekalns, N., 2000, "Sustainability and Stability? Australian Fiscal Policy in the 20th Century", Australian Economic Papers, 39, 138-151.

26. Oshikoya T. W and A.B. Tarawalie 2010, "Sustainability of Fiscal Policy: The West African Monetary Zone (WAMZ)", Journal of Monetary and Economic Integration, 9, 2.

27. Papadopoulos, A. and M. G. Sidiropoulos, 1999, "The Sustainability of Fiscal Policies in the European Union," International Advances in Economics Research, 5, 289-307.

28. Prohl, S. & Schneider, F. 2006, "Sustainability of Public Debt and Budget Deficit: Panel cointegration analysis for the European Union Member countries", Department Of Economics,Johannes Kepler University of Linz Working Paper 0610.

29. Qin, D., Cagas, M.A., Ducanes, G., Magtibay-Ramos, N. and Quising, P. 2006, "Empirical Assessment of the Sustainability and Feasibility of Government Debt: The Philippines Case", Journal of Asian Economics, 17, 63-84.

30. Quintos, C. 1995, "Sustainability of the deficit process with structural shifts", Journal of Business and Economic Statistics, 13, 409-417.

31. Stock, James and Watson, Mark W, 1993, "A simple estimator of cointegrating vectors in higher order integrated systems", Econometrica , 61(4) :783-820

32. Tanner, E. and Liu, P. 1994, "Is the budget deficit too large? Some further evidence", Economic Inquiry, 32, 511-518.

33. Trehan, Bharat, and Carl Walsh, 1988, Common Trends, The Government Budget Constraint, and Revenue Smoothing, Journal of Economic Dynamics and Control 12, 425-444.

34. Trehan, B., and Walsh, C. 1991, "Testing Intertemporal Budget Constraints: Theory and Applications to U.S. Federal Budget and Current Account Deficits", Journal of Money, Credit and Banking 23, 210-223.

35. Westerlund, J. & Prohl, S. 2010, "Panel Cointegration Tests of the Sustainability Hypothesis in Rich OECD Countries", Applied Economics, 42, 1355-1364.

36. Wilcox, D. 1989, "The Sustainability of Government Deficits: Implications of the Present Value Borrowing Constraint", Journal of Money Credit and Banking, 21, 291-306.