Budget Deficit Sustainability and Revenue Expenditure Linkages in Major South Asian Economies

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Abstract

The paper examines sustainability of budget deficits and dynamic linkages between government revenues and expenditures in five major South Asian economies, namely India, Pakistan, Bangladesh, Srilanka and Nepal for period 1985-2014. The study contributes to the literature by combining individual-country analysis with recent panel data approaches for robustness of results. Our results support existence of long-run relationship between government revenues and expenditures for the countries in a specification allowing for unknown structural break. The size of slope parameter obtained from Dynamic Ordinary Least Squares is however significantly less than one except for Bangladesh indicating incoherence with 'strong' sustainability of deficits. The long run causality analysis lends support to 'spend-tax hypothesis' for India, Bangladesh, Pakistan and Srilanka and 'tax- spend hypothesis' in case of Nepal. From perspective of design of fiscal consolidation programmes, this implies that adjustment of revenues would be optimal solution to control spending in Nepal while control of expenditure would be effective in case of India, Bangladesh, Pakistan and Srilanka. The results from Pedroni (1999) and Westerlund (2007) panel cointegration tests and block exogeniety and Dumitrescu-Hurlin (2012) panel causality tests are broadly in conformity with the time series results.

Keywords: Budget Deficit Sustainability, South Asia, Cointegration, Structural Break, Panel Data.

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1. Introduction

Maintaining a sustainable fiscal position to ensure macroeconomic and financial stability is currently a key policy issue in both developed and developing economies. Focusing on developing economies, the case of South Asia deserves particular attention. Given the enormous responsibilities reposed in fiscal policy, fiscal resources available in the South Asian countries are quite meager. Despite an impressive growth performance and reforms aiming at simplification of tax systems, introduction of value added tax during the 1980s and 1990s, the progress in boosting government revenues is slow. Relative to GDP, revenue generation and collection in the region is well below peer standards[1]. This should not come as a surprise in a conflict-affected country like Afghanistan, but it is also happening in the fast-growing Bangladesh and in the relatively wealthier Srilanka.

Further, political pressures for specific public expenditures, in particular poorly targeted and wasteful current subsidies, are intense and hard to resist leading to structurally entrenched fiscal deficits (Jha, 2010). Consequent upon the reforms, South Asia's fiscal deficits are decreasing gradually but remain consistently high relative to other developing regions (see Table 1).

Table 1. Fiscal balance in South Asia vis a vis developing country groupings

Country Groups	2000-10	2011	2012	2013	2014	2016[f]
East Asia and Pacific	-1.6	0.2	-0.3	-2.3	-2.1	-2.1
Europe and Central Asia	-4.4	0.7	-0.6	-1.3	-1.5	-1.5
Latin America and the Caribbean	-2.6	-3.1	-3.6	-4.0	-5.2	-4.1
Middle East and North Africa	0.1	-4.0	-3.8	-6.0	-7.1	-5.3
South Asia	-7.4	-7.6	-7.2	-6.9	-6.7	-6.1
Sub Saharan Africa	-0.6	-1.1	-1.7	-2.9	-2.5	-2.2

Source: Global Economic Prospects (2015). *Note:* f denotes forecast.

A perusal of Figure 1 indicates that the debt to GDP ratio in the major South Asian countries exhibits a decline after 2000. An uptick in the debt ratio may however be observed during 2007-08 in case of India, Pakistan and Srilanka reflecting the effect of the Global Financial Crisis. Though the debt to GDP ratio has been declining over time, in consonance with the high fiscal deficits, the region's debt ratio stands highest among the developing regions (World Bank, 2016).

The average debt /GDP ratio for the five leading South Asian economies mentioned above is around 54%, well above the average of emerging market middle income economies(41%) and the low income economies(36%)(IMF, 2016).

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[1] The average general government revenue for the five major South Asian economies, namely India, Pakistan, Bangladesh, Srilanka and Nepal is 15% of GDP. This is even less than half the ratio for advanced economies (36.6%). The ratio does not compare favorably with the emerging market middle income economies (26.8%) and even with the low income economies (15.4%) (IMF, 2016).
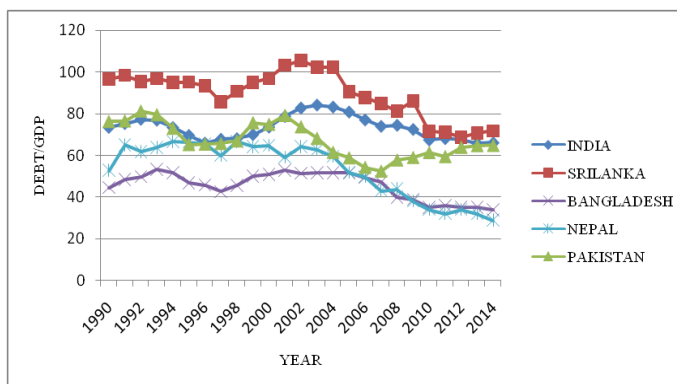
Figure 1.Public Debt to GDP: 1990-2014
Source*:* World Economic Outlook Database

Against this backdrop, this paper aims to examine the issue of sustainability of budget deficits for five largest countries in South Asia namely, India, Pakistan, Bangladesh, Srilanka and Nepal for the period 1985-2014.

In particular, the study seeks to address following two issues. First, if there is a long-run relationship between government revenues and expenditures which is compatible with sustainable budget deficits. The sustainability of budget deficit implies the fulfillment of the so-called inter-temporal budget constraint (IBC), which states that the current level of debt in an economy should equal the present value of future fiscal surpluses. If this condition is to be met, economies cannot indefinitely issue debt to cover fiscal deficits as the markets will observe a risk of bankruptcy (Carrion- i- Silvestre, 2015).

Second, the study seeks to examine the causal linkages between government revenue and expenditure. Establishing the direction of interdependence between government expenditures and revenues would provide an insight for identification of the source of fiscal imbalances facilitating formulation of suitable fiscal reform strategy.

The paper contributes to existing literature by combining individual country analysis by means of time-series techniques with panel data approaches for completeness and robustness purposes. A further contribution is the evaluation of the degree of fiscal sustainability. This issue is usually disregarded in the existing literature pertaining to the selected countries, either because the analysis of sustainability is based on the assessment of interest –growth differentials (e.g., Ejaz & Javid, 2011; Mahmood, Arby & Sherazi 2014) or stochastic properties of public debt (e.g., Buiter & Patel, 2006; Deyshappriya, 2012) or because the estimates of the cointegrating vector between expenditure and revenue are not discussed (Jha & Sharma, 2004; Kaur & Mukherjee ,2012; Munawar-Shah, Mariani & Syed, 2014).

The rest of the paper is organized as follows: Section 2 discusses theoretical underpinnings and a brief resume of literature. Section 3 discusses data and methodology. Section 4 deals with the empirical assessment of sustainability of deficits and revenue expenditure linkages and Section 5 offers concluding remarks.

2. Theoretical Underpinnings and Review of Empirical Literature

The concept of sustainability of budget deficit implies the fulfillment of the so-called the present value borrowing constraint (PVBC). Quintos (1995) argues that fiscal policy is constrained by the requirement to finance the public deficits, and any pattern of deficit will be sustainable, if it is possible to have access to borrowing without control. However, economies face the difficulty of limits to borrowing and face PVBC, so the government balances its budget intertemporally by setting the current market value of debt equal to the discounted summary of expected future surpluses. A violation of PVBC would point out that fiscal policy cannot be sustainable evermore because the value of public debt will explode over time, at a rate faster than the economic growth of the economy (Quintos, 1995).

This line of argument i.e. the fulfillment of the government's PVBC has been at the heart of the studies assessing the sustainability of budget deficits. The following budget constraint may be used to derive the PVBC:

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

Where *G* represents government expenses net of debt service, *R* represents revenues inclusive of seigniorage, *B* is the stock of public debt and *r* is the interest rate in period *t*.

Rewriting equation (1) for subsequent periods, the recursive solution of the equation leads to the following IBC:

$$B_t = \sum_{s=1}^{\infty} \frac{R_{t+s} - G_{t+s}}{\prod_{j=1}^{s} (1+r_{t+j})} + \lim_{s \to \infty} \prod_{j=1}^{s} \frac{B_{t+s}}{(1+r_{t+j})} \tag{2}$$

With the above equation it is possible to present analytically two complimentary definitions of sustainability that set the background for empirical testing:

i. The value of current public debt must be equal to the sum of future primary surplus:

$$B_t = \sum_{s=1}^{\infty} \frac{R_{t+s} - G_{t+s}}{\prod_{j=1}^{s} (1+r_{t+j})} \tag{3}$$

ii. The present value of public debt must approach zero in infinity:

$$\lim_{s \to \infty} \prod_{j=1}^{s} \frac{B_{t+s}}{(1 + r_{t+j})} = 0 \tag{4}$$

The empirical contributions in the literature on sustainability of deficits can broadly be classified into two strands. The earlier studies following a univariate approach analyse the compliance to the budget constraint in terms of mean-reverting behavior of deficit and debt-GDP ratio series (Hamilton & Flavin, 1986; Wilcox, 1989). Alternatively, the multivariate approach assesses sustainability through cointegration between government revenues and expenditures (e.g., Trehan and Walsh, 1988; Hakkio and Rush, 1991; Haug, 1991).

Assuming that the interest rate with mean r follows a stationary stochastic process using $E_t = G_t + (r_t - r)B_{t-1}$ and $GG_t = G_t + r_t B_{t-1}$ the intertemporal budget constraint becomes

$$GG_t - R_t = \sum_{s=0}^{\infty} \frac{1}{(1+r)^{s-1}} [\Delta R_{t+s} - \Delta E_{t+s}] + \lim_{s \to \infty} \frac{B_{t+s}}{(1+r)^{s+1}} \qquad (5)$$

and with the no-Ponzi game condition, GG_t and R_t must be co-integrated variables of order one for their first differences to be stationary. Sustainability of deficits can then be tested through the following cointegrating regression:

$$R_t = a + bG_t + u_t \qquad (6)$$

Where R_t and G_t are government revenue and expenditures inclusive of interest payments on debt; u_t is a stationary random variable and a and b are cointegrating parameters.

The subsequent studies refined the analysis by incorporating the possibility of structural changes that are associated with different degrees of sustainability (e.g., Quintos, 1995; Martin, 2000; Afonso, 2005) and have also generalized the definition of sustainability to distinguish between strict and weak sustainability.

Following Quintos (1995), the budget deficit sustainability exists in "strong" form if and only if R_t and G_t are cointegrated and $b = 1$. The budget deficits are instead only "weakly" sustainable if $0 < b < 1$ in equation (6). Under this milder sustainability condition, government expenditures grow, on average, at a rate higher than government receipts.

Finally, if the null hypothesis $b = 0$ cannot be rejected, the deficits are unsustainable. With advancements in cointegration techniques, the long-run relationship between revenue and expenditure has been widely examined for assessing sustainability of deficits (see Appendix Table A.1).

Although stationarity and cointegration tests are widely used in empirical work, Bohn (2007) criticizes these approaches, maintaining that the IBC is satisfied even when either the debt series or the fiscal flow variables are integrated of arbitrarily high order. Given the limitations of standard approaches, Bohn suggests using error correction–type policy reaction functions as a suitable strategy for investigating fiscal sustainability.

Besides the above, the literature offers other approaches to test sustainability. Summary indicators, a commonly employed approach to assess sustainability, are based on projections of future public debt and give the budgetary adjustment required to satisfy the IBC and reach a target level of debt (see e.g., Buiter et al., 1985;Blanchard et al., 1990; Aristovnik,2008). The value at risk framework uses stochastic simulations of the public sector balance sheet to study the degree of public sector solvency. It gives an estimate of the probability distribution for government's future net asset position (see e.g., Barnhill & Kopits, 2003). Fiscal limit and fiscal space approaches attempt to estimate a public debt ceiling for the country based on assumed constraints to government's fiscal policy (see e.g., Cochrane, 2010; Leeper & Walker,2011) . The fiscal limits of a country represent the maximum level of debt that the country's government can accommodate by fiscal instruments. After an economy hits the fiscal limit the debt needs be stabilized by monetary instruments. If the generation of seigniorage revenue is not possible, the government may default on its obligations. Thus, determining the fiscal limits of the country and comparing it with the present and projected level of debt gives indication of how much room the government has for fiscal policy adjustment. This provides a valuable piece of information regarding the assessment of fiscal sustainability. Ostry et al.(2011) introduced the fiscal space approach to estimate the degree to which a country has room for fiscal maneuvering by looking at the historical record of the country's fiscal space.

In order to understand dynamics of formulation of budget deficit, analysis of intertemporal causality between revenue and expenditure is useful. Causality per se does not have implications for sustainability condition but provides insight to the dynamics of fiscal adjustments process. There are four competing hypotheses regarding nexus between government revenue and expenditure. *Tax-and-spend hypothesis* proposes that authorities adjust their expenditure to level of revenue so that control over revenue leads to limiting growth in public sector (Friedman, 1978). *Spend-and-tax hypothesis* points out that government adjusts revenue to level of planned expenditure. Along these lines, Barro (1979) suggests that an increase in government spending financed by borrowing will translate into higher future tax liabilities for public. In addition, Peacock and Wiseman (1979) argue that temporary increases in government spending in response to 'temporary' crises will translate to higher permanent taxes. Empirical dynamics consistent with *tax and spend hypothesis* are reported by Bohn (1991), Park (1998), Payne, Muhammadi and Cak (2008) Mutascu (2015) while *spend and tax hypothesis* is empirically supported by Anderson, Wallace & Warner (1986), Richter and Dimitrios (2013), Edirisinghe and Sivarajasingham (2015) etc.

Fiscal synchronization reflected in bidirectional causality between revenue and spending suggests simultaneous decisions on expenditure and revenue (Owoye, 1995; Puah, Lau & Teo, 2008 ; Mehrara, Pahlavani & Elyasi, 2011; Al-Zeaud, 2015).

Lastly, *no causation* between government expenditure and revenue is consistent with no cointegration and potential sustainability problem. It may also reflect *institutional separation* of allocation and taxation functions of government (Hoover & Sheffrin, 1992).

The aforementioned survey of literature indicates that empirical studies offer divergent results regarding sustainability of deficits as well as causal nexus between government revenue and spending. Weak empirical support of sustainability hypothesis by number of studies may be due to inadequate econometric methods in particular, failure of accounting for structural breaks and poor precision of commonly applied time series tests (Westerlund & Prohl, 2010). The latter problem has prompted some of the recent studies to use panel data for group of countries as panel methods are considered more powerful than the conventional time series methods (see Appendix Table A.1).

In view of the above, the present study examines sustainability of budget deficits in the major South Asian countries by combining individual country analysis by means of time-series techniques with panel data approaches. To the best of our knowledge, the present study is the first empirical application of panel cointegration and causality tests in assessment of budget deficit sustainability and revenue expenditure nexus for the selected countries.

A further contribution of the study is the evaluation of the degree of budget deficit sustainability. This issue is usually disregarded in the existing literature pertaining to the selected countries, either because the analysis of sustainability is based on the assessment of interest –growth differentials (Ejaz & Javid, 2011; Mahmood et al., 2014) or stochastic properties of public debt (e.g., Buiter & Patel, 2006; Deyshappriya, 2012) or because the estimates of the cointegrating vector between expenditure and revenue are not discussed (Jha & Sharma, 2004; Kaur & Mukherjee, 2012; Munawar Shah et al., 2014).

3. Data and Methodology

The empirical estimates in the study are based on annual data on general government revenue and expenditure spanning from 1985-2014. The choice of the period as well as the selection of the five countries out of the eight in the South Asian region is based on the availability of consistent data. Both the variables are measured in relation to GDP to obtain a more natural definition of sustainability that keeps pace with economic growth (Afonso, 2005) and to achieve similarly scaled series that offer easily interpretable information. The data are assembled from Key Indicators for Asia and the Pacific, Asian Development Bank.

At the outset, the series are tested for presence of unit root using the conventional Augmented Dickey- Fuller (ADF) and Phillips –Perron (PP) tests. As noted by Perron (1989) the conventional unit root tests are biased towards a false unit root null when the data are trend stationary with a break. This observation led to the

development of breakpoint unit root tests based on modified ADF tests that allow for levels and trends to differ across a break date. Following Perron (1989), Perron and Vogelsang (1992) and Vogelsang and Perron (1998), four models of breakpoint unit root tests are developed. Model 1 supposes a non-trending series with a break in the intercept; Model 2 supposes a trending series with a break in the intercept; Model 3 supposes a trending series with a break in the intercept and trend; and Model 4 supposes a trending series with a break in trend. The null hypothesis is that the data follow a unit root process, possibly with a break, against a trend stationary with break alternative.

The long-run relationship between the variables of interest is tested using Johansen-Juselius (1990) test and Gregory-Hansen (1996) test. The second test is a residual-based approach to test the null hypothesis of absence of cointegration against the alternative of cointegration in the presence of a structural break at an unknown point in time. The approach considers three possible changes in the cointegrating equation corresponding respectively to a level shift (C), a level shift in the presence of a time trend (C/T), and a shift both in the intercept and in the slope of the equilibrium relationship (C/S) and relies on modified versions of the ADF test and the test statistics developed in Phillips (1987) ($Z\alpha$, Zt) for the computation of the unit root tests on residuals across all possible break points in the sample. The test statistics used to assess the existence of cointegration are the smallest values (i.e., the largest negative values) of ADF, $Z\alpha$, and Zt obtained across each possible break point in the data sample.

The coefficients of long-run relationship are obtained using Dynamic Ordinary Least Squares (DOLS) estimator by Stock and Watson (1993). The DOLS allow proper statistical inference in cointegrated system with structural changes and corrects for regressor endogeneity by including leads and lags of first difference of the regressors.

 Given the traditional problems related to the cointegration analysis using short-term data, the results of single-country estimates are compared to those derived using panel data econometric techniques for the robustness of results. Single country time series estimation may suffer from shorter spans of data with associated less degrees of freedom and low power. Panel cointegration allows more variation in the data that could result in increased efficiency of the estimators.

The stationarity properties of the panel are tested using the Maddala and Wu (1999) test (MW) and a second generation test – the Pesaran (2007) CIPS test. The latter test accounts for cross-sectional dependence of the contemporaneous error terms. A failure to consider this may cause substantial size distortions in panel unit root tests (Pesaran, 2007).

To investigate the presence of long-run relationship, both first and second generation panel cointegration tests by Pedroni (1999) and Westerlund (2007)

respectively are employed. The Pedroni tests allows for heterogeneity among cross-sectional elements by using idiosyncratic parameters that are allowed to differ among the cross-section units. Westerlund's (2007) test is an error correction based test which can compute asymptotic and bootstrap p-values, making inference possible under very general forms of cross-sectional dependence. The $G\tau$ and $G\alpha$ statistics test the null hypothesis of no cointegration for all cross-sectional units against alternative that there is cointegration for at least one cross-sectional unit. Rejection of null is therefore taken as evidence of cointegration of at least one of the cross-sectional units. $P\tau$ and $P\alpha$ test statistics pool information over all cross-sectional units to test the null of no cointegration for all cross-sectional units against alternative of cointegration for all cross-sectional units.

The coefficients of long-run relationship are obtained using group-mean estimators which allow for flexibility related to cross-country heterogeneity. In particular, we employ the Group Mean Fully Modified Ordinary Least Squares (GM-FMOLS) and Group Mean Dynamic Ordinary Least Square (GM-DOLS). Pedroni (2000) derives the GM -FMOLS estimator, which uses the group mean of individual FMOLS estimators and corrects for endogeneity and serial correlation by estimating the long-run covariance directly. The estimator has satisfactory size and power properties even for small panels, as long as T is larger than N (Perdroni, 2000).

The GM-DOLS is based on the group mean of the Stock and Watson (1993) DOLS estimator, which uses leads and lags of the differenced right hand side variables to correct for endogeneity and serial correlation. Both the technique may control the likely cross-sectional dependence by including common time dummies in the model.

For the robustness of results, we employ the common correlated effect mean group (CCEMG). CCEMG is a generalization of mean group estimator of Pesaran and Smith (1995) and is consistent in presence of unobserved common factors proxied by inclusion of cross sectional averages of dependent and independent variables in the regression setup.

4. Empirical Analysis

Before a formal econometric analysis of sustainability and revenue expenditure nexus, a brief characterization of the data may be appropriate at the outset. Figure 2 captures the trends in revenue/GDP and expenditure/GDP for the countries. It may be observed that among all economies, only Nepal has experienced a notable rise in its revenue/GDP ratio during 1985-2014. The ratio has indeed declined for Pakistan and Srilanka and oscillated in a narrow range for India and Bangladesh. A preliminary inspection of the graphs indicates a synchronized behavior of revenue and expenditure for all countries hinting at the possible long-run relationship. However, expenditure as a share of GDP on average exceeds revenue share for all the countries which seemingly support weak sustainability hypothesis.
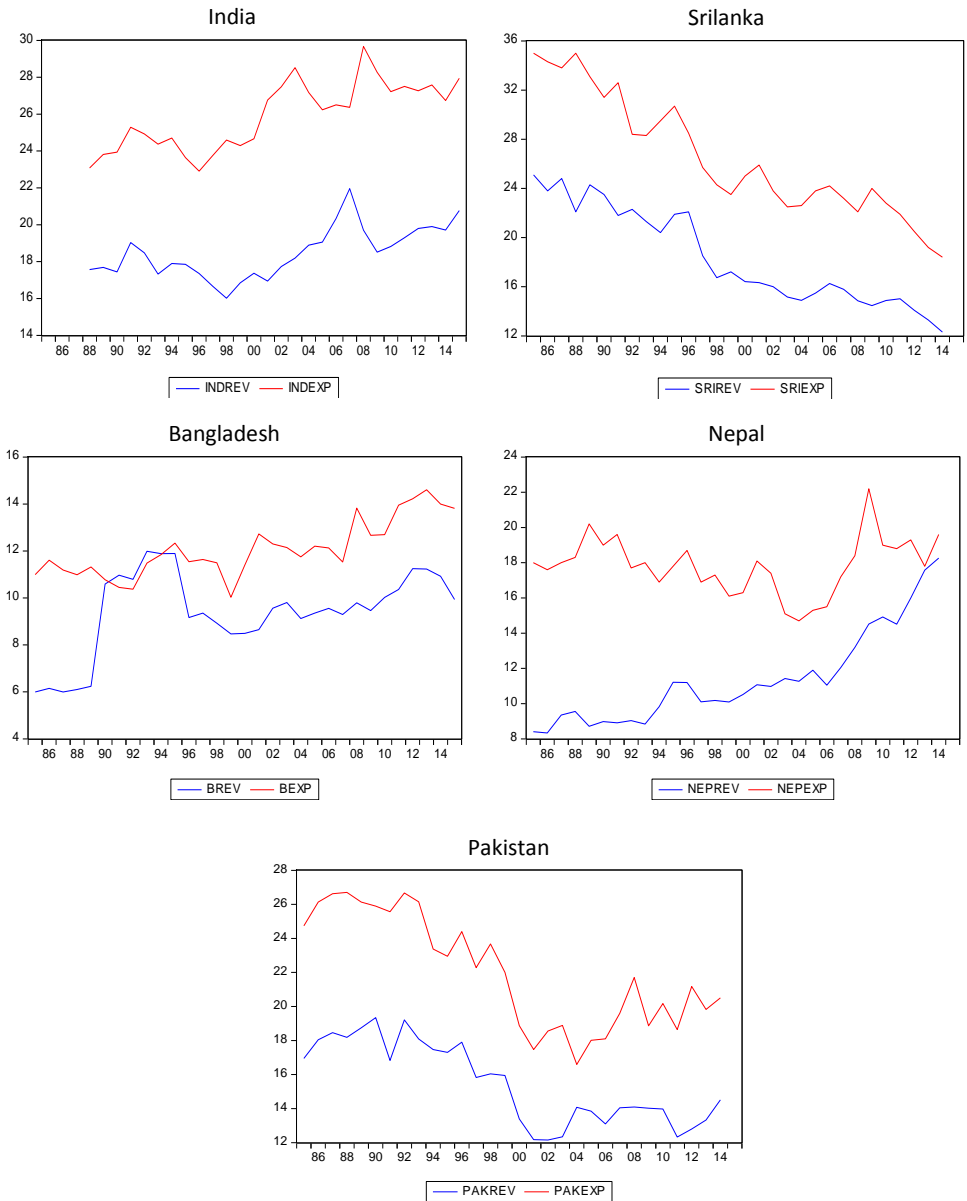
Figure 2. Revenue and Expenditure to GDP Series (1985-2014)
Source: World Economic Outlook Database

4.1 Country Analysis

After an overview of the data, we first focus on the examination of sustainability conditions for each individual country. In order to set the stage for cointegration

analysis, the series are subjected to the investigation of unit roots. For that purpose, in addition to ADF and PP unit root tests, the breakpoint unit root test considering a break type of additive outlier (AO) is applied[2].

As shown in Table 2, ADF and PP tests provide overwhelming evidence that Revenue and Expenditure series contain a unit root in levels. For the first-differenced specification, both the tests reject the null of unit root indicating that the three series are I(1) for all countries. The results of breakpoint unit root test are in conformity with the previous test results.

Table 2. Results of Unit Root Tests

Country	ADF		PP		Breakpoint Test (Additive Outlier)
	Level	FD	Level	FD	ADF
Revenue					
India	-3.08	-5.59**	-3.16	-5.99**	-3.48 [2004]
Bangladesh	-1.81	-4.90**	-1.81	-4.91**	-4.12[2010]
Pakistan	-1.76	-6.58**	-1.63	-6.60**	-4.78[2006]
Srilanka	-2.79	-6.47**	-2.30	-6.14**	-4.31[2006]
Nepal	-1.45	-5.43**	-0.92	-8.34**	-4.77[2007]
Expenditure					
India	-2.96	-4.34**	-2.52	-4.41**	-4.52[2000]
Bangladesh	-1.79	-5.48**	-1.80	-5.53**	-4.72[2007]
Pakistan	-2.07	-6.81**	-2.06	-7.12**	-3.80[2007]
Srilanka	-2.88	-4.45**	2.55	-9.05**	-4.27[2005]
Nepal	-2.46	-6.31**	-2.43	-6.91**	-3.23[2009]

Source: Author's calculation
Note: FD denotes first difference. Mackinnon's CVs (with trend and intercept) for ADF and PP tests are-4.33, -3.58 and -3.22 for 1%,5% and 10% respectively.***, **, * show significance at 1%,5% and 10% respectively. Results for breakpoint tests are for levels of variables. The choice of model from the four available models is based on the significance of the break in trend and break in the intercept. CVs for break in intercept (for trend and intercept specification) which is the preferred model in most of the cases are -5.3 and -4.85 respectively for 1% and 5%.

As a first step towards investigating the existence of a long-run relationship the Johansen–Juselius test has been applied. The results of the test indicate presence of one cointegarting relationship between R and G in case of Bangladesh and Srilanka only[3]. For rest of the countries the test fails to reject the null of no cointegration raising prospects of non sustainable deficits.

However, this conclusion might be misleading if there has been a shift in long-run relationship between revenue and expenditure due to a structural change. In order

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[2] As discussed in Vogelsang and Perron (1998), for an unknown shift date situation, the AO framework may be preferable to the innovational outlier statistics (IO), even if the data generating process is an IO process

[3] Full details of the results from Johansen–Juselius cointegration test are available from the authors upon request

to account for possibility of structural break, Gregory and Hansen (1996) test has been employed.

As shown in Table 3 the null hypothesis of no cointegration is rejected by all three tests, namely ADF, Z_a and Z_t test under the regime shift model in case of India and by ADF and Z_t test in case of Bangladesh. Both ADF and Z_t tests consistently reject the null under all break specifications for Pakistan and Srilanka providing strong support in favor of cointegration. The identified break dates in case of India and Srilanka correspond to the commencement of rule based fiscal management.

Table 3. Results of Gregory-Hansen Cointegration Test

Country	ADF	Zα	Zt
India			
C	-4.16 [2003]	-20.80[2004]	-3.70[2004]
C/T	-4.51[2003]	-24.60[2004]	-4.50[2004]
C/S	-9.73***[2003]	-47.90**[2004]	-13.93***[2004]
Bangladesh			
C	-3.75[1994]	-20.00[1995]	-3.82[1995]
C/T	-4.90*[1994]	-24.80[1994]	-4.95*[1994]
C/S	-9.06***[1994]	-42.7*[1994]	-8.89***[1994]
Pakistan			
C	-4.66**[1995]	-24.70[1997]	-4.78**[1995]
C/T	-5.68***[2002]	-29.10[2002]	-5.90***[2002]
C/S	-5.11**[1998]	-29.02[1998]	-5.26**[1998]
Srilanka			
C	-6.71***[2004]	-38.4*[2003]	-7.58***[2003]
C/T	-6.67***[2003]	-36.4[2003]	-6.79***[2003]
C/S	-6.57***[2003]	-37.49[2003]	-7.74***[2003]
Nepal			
C	-5.50***[1997]	-30.20[1997]	-5.60***[1997]
C/T	-4.35[2009]	-20.30[2009]	-3.78[2009]
C/S	-4.47[2009]	-21.80[2008]	-3.80[2008]

Source: Author's calculation

Note : ***,** ,*denote rejection of null of no cointegration at 1% and 5% and 10% respectively. Figures in parenthesis show endogenous break dates. Approximate asymptotic critical values reported in Gregory and Hansen (1996, pp. 109, table 1) are used.

The two countries implemented the Fiscal Responsibility and Budgetary Management (FRBM) Act and Fiscal Management Responsibility Management Act respectively in 2003 that resulted in a subsequent decline in debt/ GDP ratio.

Finally, in case of Nepal the empirical support in favor of cointegration comes from the level shift model. The Z_α test in most of the cases fails to reject the null which might be due to low power of the test. Overall, the empirical evidences establish the long-run relationship between revenue and expenditure in presence of structural break for all the countries.

After confirming the presence of cointegration, the next step is to estimate the coefficients of long-run relationship and draw inferences regarding degree of sustainability. As reported in Table 4, point estimates of slope parameters obtained from DOLS turn out to be lower than one in all cases. The restriction on the coefficients consistent with 'strong' fiscal sustainability (b=1) is rejected at high significance levels except for Bangladesh thus supporting 'weak' sustainability. 'Weak' fiscal sustainability means that government expenditures are systematically higher than government revenues. Therefore, although the IBC is satisfied in the strict sense (because the bubble term goes to zero), the upward pressure on the stock of debt is likely to increase the risk of default, forcing the government to offer higher interest rates to service its debt (Quintos, 1995).

Table 4. Estimates of Long Run Relationship (DOLS Approach)

Country	b	Chi square statistic for b=1
India	0.81	4.44(0.03)
Bangladesh	0.95	0.19(0.66)
Pakistan	0.51	5.99(0.01)
Srilanka	0.59	4.86(0.02)
Nepal	0.79	5.53(0.01)

Source: Author's calculation.   *Note:* figures in parenthesis show p values.

To understand dynamics of formulation of budget deficit, analysis of intertemporal causality between revenue and expenditure is useful. The results of causality tests reported in Table 5 indicate no short run causation between revenue and expenditure in case of Bangladesh, India, Pakistan and Nepal indicating that decisions regarding spending and revenue generation are taken disjointly in short run**.**

Table 5. Results of Causality Tests

Country	Standard Causality Test		Toda-Yamamoto Test		Long Run Causality	
	R ► G	G ► R	R ► G	G ► R	ECM (ΔG dependent)	ECM (ΔR dependent)
India	0.15	1.15	0.28	0.51	0.13	-0.25**
	(0.69)	(0.21)	(0.86)	(0.77)	[1.05]	[-2.39]
Bangladesh	0.76	0.01	0.76	0.21	-0.14*	-0.18**
	(.85)	(0.97)	(0.85)	(.97)	[-1.63]	[-1.88]
Pakistan	0.20	1.75	0.10	0.00	0.09	-0.19**
	(0.64)	(0.18)	(0.74)	(.994)	[.851]	[-2.01]
Srilanka	17.2	13.14	4.00	12.84	0.17	-0.21***
	(0.00)	(0.01)	(0.40)	(0.01)	[0.71]	[-3.07]
Nepal	1.02	0.82	0.36	1.63	-0.29**	-0.009
	(0.31)	(0.36)	(0.54)	(0.20)	[-2.41]	[-0.11]

Source: Author's calculation
Note: In the case of standard Granger-causality tests the null is of non-Granger causality. VAR leg length is identified using AIC.Chi square statistics are displayed along with p values in parenthesis. Figures in brackets show t –value. *, ** and *** denote significance at 10, 5 and 1% levels, respectively.

Unidirectional causation running from spending to revenue is found in case Srilanka. In case of Srilanka the hypothesis of revenue not causing expenditure is also rejected under standard Granger test. The last two columns of table report results of long run causality detected through the significance of negative error correction term. In case of India, Bangladesh, Srilanka and Pakistan we find long run causality running from expenditure to revenue indicating that government in these economies sets its spending objectives first and subsequently raises revenues to finance its committed expenditures. It should be noted that institutional mechanism of financing deficits might also be a driver of direction of causation between revenue and spending. The causation running from revenue to expenditure in case of Nepal may be explained by the fact that Nepal receive a large amount of grant thus leading to a phenomenon where revenue availability constraints spending.

4.2. Panel Analysis

In view of low power of individual country based tests for unit roots and cointegration, it may be useful to conduct panel analysis for robustness. The results of M-W and CIPS unit root tests in panel framework reported in Table 6 show that the null hypothesis of I(1) series cannot be rejected for both the series[4].

Table 6. Results of Panel Unit Root Tests

Test	R		G	
M-W	37.56***	(0)	42.59***	(0)
	20.00	(1)	22.72	(1)
	10.85	(2)	16.09	(2)
	14.02	(3)	8.22	(3)
CIPS	0.48	(0)	-1.09	(0)
	2.04	(1)	-0.37	(1)
	3.04	(2)	1.95	(2)
	3.06	(3)	2.62	(3)

Source: Author's calculation*Note:* Δ denotes first .***,** show significance at 1%and 5%.
Figures in parenthesis are lag lengths.

The results of Pedroni cointegration test are reported in Table 7. The results indicate that majority of within and between dimension tests reject null hypothesis of no cointegration. The results of second generation test, namely the Westerlund (2007) test are reported in Table 8. In small datasets, with *T*=30, Westerlund (2007) warns that results of tests may be sensitive to specific choice of lag and lead lengths. Hence, to avoid over parametrization and resulting loss of power, we hold short-run dynamics fixed by taking lead and lag=1.

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[4] At the outset the cross sectional dependence in the data was tested using Breusch Pagan LM test. The test statistics calculated from individual ADF regressions were 25.99 and 20.26 for expenditure and revenue series respectively leading to the rejection of the null of cross sectional independence at 5 %.

Table 7. Results of Pedroni Cointegration Test

Pedroni Cointegration Test	
Panel Cointegration (within dimension) statistics	
Panel v- statistic	1 .04
Panel rho- statistic	-2.02**
Panel PP- statistic	-2.91***
Panel ADF- statistic	-3.04***
Group Mean (Between Dimension) statistics	
Group rho- statistic	-1.00
Group PP- statistic	-2.59***
Group ADF- statistic	-2.68***

Source: Author's calculation. *Note*: ***shows significance at 1% .

The results of the test as reported in Table 8 indicate that all four tests confirm presence of cointegration at 5%.

Table 8. Results of Westerlund's Cointegration Test

Test	Value	p -val	Robust p-val
$G\tau$	-2.12	0.00	0.01
$G\alpha$	-9.60	0.00	0.00
$P\tau$	-4.60	0.00	0.02
$P\alpha$	-7.58	0.00	0.01

Source: Author's calculation

The estimates of long-run coefficients are reported in Table 9. To control for cross sectional dependence, MG-DOLS and MG-FMOLS models are estimated including time dummies. As evident from the table, all three estimators namely MG-DOLS, MG-FMOLS and CCEMG indicate a positive slope coefficient. However, the chi square test rejects null of b=1 consistently for all three estimates thus corroborating the time series evidence of weak sustainability. The error correction term estimated by inserting long run coefficients in short run dynamic specification of the models is negative and statistically significant under all estimators. The negative ECT shows that the system is driven to its long run cointegration path with speed of adjustment around 22-24% per year.

Table 9. Long Run Coefficients under Alternative Estimators (Dependent Variable: Revenue)

	MG-DOLS		MG-FMOLS		CCEMG	
	Coeff	Chi square (H_0: b=1)	Coeff	Chi square (H_0: b=1)	Coeff	Chi square (H_0: b=1)
Expenditure	0.73	11.32 (0.00)	0.61	8.27 (0.00)	0.76	18.61 (.000)
ECT	-0.24***		-0.23***		-0.21***	

Source: Author's calculation. *Note:**** indicates significance at 1%.

Results of panel causality provided in Table 10 indicate that null of expenditure not causing revenue can be rejected at 5% level under both block exogeniety and Dumitrescu and Hurlin (2012) panel causality tests while the null of revenue not

causing expenditure can only be rejected under Dumitrescu and Hurlin (2012) at 10%. The long run causality reflected by the statistical significance of negative ECT (based on MG-DOLS) also runs from expenditure to revenue only. Thus our panel results support 'spend and tax' phenomenon in case of the selected countries.

Table 10. Results of Panel Causality

Null Hypothesis	Block Exogeneity Test	Dumitrescu Hurlin Panel Causality Tests	Long-Run Causality (ECT)
R does not cause E	2.68 (0.26)	2.44 (0.06)	0.03
E does not cause R	17.13 (0.00)	5.39 (0.00)	-0.24***

Source: Author's calculation

 Note : ECT is based on MG-DOLS estimates.*** shows significance at 1%

5. Conclusion and Policy Implications

The study examines the issue of budget deficit sustainability and revenue expenditure linkages for five major South Asian economies for period 1985-2014. The study contributes to literature by combining individual-country analysis with panel data approaches. Our results provide support for existence of long-run relationship between government revenues and expenditures for all selected countries in a specification which allows for unknown structural break. However, size of the slope parameter is significantly less than one, except for Bangladesh suggesting that budget deficits in the countries exhibits weak sustainability. The results from panel analysis are in conformity with time series results. The weak sustainability implies compliance to IBC in the strict sense but point to the difficulty the governments might face in marketing long term debt.

Though not indicating sustainability in strong form, our results point to an improvement in the fiscal outlook of South Asia compared to some of the previous studies. Unlike Olekalen and Cashin (1997), our results are able to establish a long-run relationship between government revenue and expenditure in case of India. This is explained by the fact that our study covers post reform era where government is having a more cautious approach towards fiscal management. Moreover, the estimate of cointegrating slope parameter indicates a much higher speed of adjustment to the intertemporal budget constraint compared to Goyal, Khundrakpam & Ray (2004). Contrary to Jha and Sharma (2004) who could not find cointegrating relationship between government revenue and expenditure for Nepal (for 1960-1996) and Pakistan(for 1956-1999), our study utilizing more recent data provides evidence in favor of synchronization between revenue and expenditure for both the countries.

The long run causality lends support in favor of 'spend and tax hypothesis' in case of India, Bangladesh, Pakistan and Srilanka while 'tax and spend hypothesis' holds only for Nepal. These results are consistent with those of Barua(2005), Edirsinghe

and Sivarajansingham (2015) who found existence of spend- tax phenomenon in case of Bangladesh and Srilanka respectively. Our study indeed reaffirms these results in a more robust way by accounting for structural breaks, using Toda Yamamoto non causality test and panel techniques.

The main policy implication of the paper is that in view of the weakly sustainable fiscal stance, the South Asian countries should reinforce their commitments to long-term fiscal discipline. From perspective of design of fiscal consolidation programmes, due to existence of 'tax and spend' phenomenon, adjustment of revenues would be optimal solution to control spending in case of Nepal while control of expenditure would be effective in case of India, Bangladesh, Pakistan and Srilanka. The spending curbs become all the more important in view of the fact that in spite of undertaking considerable tax reforms in the last decade these countries have been less successful in widening their tax base due to structural factors such as large share of agriculture, low literacy and large informal sectors. Hence, control of spending is clearly needed in a growth friendly manner with expenditure pattern shifting from consumption activities to productive sectors. In this context, the recent attempts of subsidy rationalization by countries like India would be effective which should further be accompanied by downsizing of government staff to control unproductive consumption spending.

The analysis presented in the study is subject to caveats. One major limitation of the present study is that it covers only five out of the eight countries in the South Asian region due to paucity of data. Another limitation is the quality of fiscal data which may give an incomplete picture of the sustainability situation as the countries do not generally report contingent and other hidden (off-balance-sheet) liabilities. Accounting for hidden liabilities would likely lead to the possibility of higher debt ratios, and potentially larger threats to fiscal sustainability. Moreover, the analysis of the present study is based on the assumption of linear adjustment of the fiscal variables. This means that fiscal authorities are expected to correct every budgetary imbalance (no matter whether they are large or small) adopting the same error correction mechanism. It may, however, be argued that the process of fiscal adjustment is non linear in the sense that fiscal policy authorities take decisions when deficits become too large.

The study may further be extended by examining the possible non linearities in the fiscal adjustment process. In line with the growing literature on fiscal sustainability, other approaches to sustainability (as discussed in Section 2) may also be used to compliment the results of the present study. The use of quarterly data for the analysis may further improve the power of tests.

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Appendix

TableA1. Empirical Studies Examining Sustainability of Budget Deficits

S.No	Author	Country & Time Period	Methodology	Result
Univariate Approach				
1.	Hamilton and Flavin (1986)	U.S.A (1962-84)	Stationarity properties of deficit and debt (using Dickey- Fuller test)	Sustainable
2.	Trehan and Walsh (1991)	U.S.A (1890-1983)	Stationarity properties of deficit and debt (using Dickey- Fuller test and Phillips test)	Sustainable
3.	Banglioni and Cherubini (1994)	Italy (monthly observations for 1979-1991)	Stationarity properties of debt (using Phillips-Perron test)	Unsustainable
4.	Uctum et al. (2006)	G7 and selected Latin American and Asian countries (1970-2002)	Stationarity properties of debt (using Zivot Andrews Unit Root test)	Mixed
5.	Afonso and Jalles (2011)	19 countries including selected European nations, U.S.A, Brazil, Russia, New Zealand (1880-2009)	Stationarity properties of debt using ADF,PP and Ng-Perron Unit root test and first and second generation panel unit root	Sustainability condition satisfied in most of the cases; panel results in conformity with time series results
Multivariate Approach(cointegration between spending and revenue)				
6.	Hakkio and Rush (1991)	U.S.A (1950-1988)	Cointegration tests based on Durbin-Watson statistic, ADF statistic, the Stock and Watson statistic	Unsustainable
7.	Quintos(1995)	U.S.A (1947-1992)	Cointegration tests searching for shifts in the rank of the cointegrating matrix	Sustainable until 1980
8.	Kalyoncu (2005)	South Korea, Mexico, Philippines, South Africa and Turkey (Quarterly observations for 1970-2003)	Johansen–Juselius maximum likelihood testing approach	Unsustainable for Mexico, Philippines and South Africa; Weakly sustainable for Turkey and South Korea
9.	Dalgic, Iyidogan and Balikcioglu (2014)	Turkey (Quarterly observations for 2006-2013)	ARDL bounds testing approach	Weakly sustainable

TableA1 (cont.). Empirical Studies Examining Sustainability of Budget Deficits

S.No	Author	Country & Time Period	Methodology	Result
10.	Jibrilla(2016)	Nigeria (1961-2014)	ARDL bounds testing approach	Weakly sustainable
11.	Ehrhart and Llorca (2007)	OECD countries (1975-2005)	Pedroni's Panel Cointegration Test	Sustainable
12.	Afonso and Rault (2007)	EU 15 countries (1970-2006)	Pedroni's panel Cointegration test; Westerlund and Edgerton's Test, Banerjee and Carrion –i-Silvestre Test (2006)	Sustainable
13.	Adedeji and Thornton(2008)	Phillipines, Thailand, India, Srilanka, Pakistan (1974-2001)	Pedroni's panel cointegration test, DOLS estimator	Weak sustainability
14.	Mercan (2014)	18 OECD countries (1980-2012)	Westerlund's panel Cointegration test and CCEMG estimator	Weak sustainability
15.	Afonso and Rault (2013)	EU countries (1960-2012)	Bootstrap cointegration technique, CCEMG estimation strategy	Deficits found unsustainable for panel. Weakly sustainable deficits for most of countries.
16.	Alagidede and Tweneboah(2015)	Latin American Countries (1990-2012)	Pedroni's Panel Cointegration test; Westerlund's ECM based cointegration test	Weak sustainability