

An empirical assessment of fiscal sustainability for selected South Asian economies

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Abstract. *The paper examines sustainability of public finances for five major South Asian economies namely, India, Pakistan, Bangladesh, Sri Lanka and Nepal for period 1985-2014. The results of Gregory–Hansen (1996) and Carrion-i-Silvestre and Sanso (2006) tests confirm presence of long-run relationship between government revenue and expenditure for all the countries. The ARDL estimates of fiscal reaction function indicate positive long-run response of primary balance to rising public debt ratio in case of India, Bangladesh, Pakistan and Sri Lanka. The empirical results thus demonstrate coherence with intertemporal budget constraint for the countries. However, except for Bangladesh, sustainability exists only in weak form underscoring the need to reinforce commitments to long-term fiscal discipline.*

Keywords: Fiscal Sustainability, Cointegration, Structural Break, Fiscal Reaction Function, ARDL model.

JEL Classification: H2, H5, H6, C5.

1. Introduction

In the aftermath of the 2008-2009 global financial crisis (GFC) chronic fiscal imbalances have emerged as one of the major risks facing the global economy. As financial and capital markets have become more focused on fiscal risks, fiscal sustainability in countries at all income levels has become a major concern for policymakers.

Managing fiscal deficits and sustainability prospects is among the key macroeconomic management issues in South Asia as well. Notwithstanding a high economic growth in the recent past, the fiscal situation in the region exhibits signs of distress. The reform process initiated in late 1980s and early 1990s in the region involved measures aiming at simplification of tax systems, introduction of value added tax and streamlining of expenditure. 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 (% of GDP) 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	.2	-.3	-2.3	-2.1	-2.1
Europe and Central Asia	-4.4	.7	-.6	-1.3	-1.5	-1.5
Latin America and the Caribbean	-2.6	-3.1	-3.6	-4	-5.2	-4.1
Middle East and North Africa	.1	-4	-3.8	-6	-7.1	-5.3
South Asia	-7.4	-7.6	-7.2	-6.9	-6.7	-6.1
Sub Saharan Africa	-6	-1.1	-1.7	-2.9	-2.5	-2.2

Note: f denotes forecast.

Source: Global Economic Prospects, January 2015.

The persistence of the deficits may be attributed to the region's limited success in widening tax base due to structural factors such as large share of agriculture, low literacy, large informal sectors etc. coupled with hard to resist populist spending raising prospects of unsustainable fiscal policy. Against this backdrop, the purpose of this paper is to examine the sustainability of public finances for five major economies in South Asia namely, India, Pakistan, Bangladesh, Sri Lanka and Nepal for the period 1985-2014.

The contribution of the paper to the existing literature concerning the selected countries is threefold. First, the paper draws inferences regarding fiscal sustainability from two alternative approaches. First, we use co-integration techniques to assess whether there is a long-run relationship between the government revenues and expenditures. Second, we investigate if the fiscal rule that relates the primary surplus and debt holds for the countries.

A further contribution is an 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 an eclectic approach (e.g., Waheed, 2008; Ejaz and Javid, 2011; Mahmood et al., 2014) or on stochastic properties of public debt (e.g., Buiters and Patel, 2006; Deyshappriya, 2012), or because the estimates of the cointegrating vector between expenditure and revenue are not discussed (e.g., Jha and Sharma, 2004; Kaur and Mukherjee, 2012; Munawar Shah et al., 2014).

Thirdly, a common argument in the empirical literature is that the standard cointegration tests tend to have limited power when variables are exposed to structural breaks (Gregory

and Hansen, 1996; Johansen, Mosconi and Nielsen, 2000). Accordingly, the paper analyses fiscal sustainability by accounting for endogenous shifts that might affect the budgetary process, an issue that has largely been overlooked in studies related to the selected countries.

The rest of the paper is organized as follows: Section 2 provides a brief resume of literature. Section 3 discusses data and methodology. Section 4 deals with the empirical assessment of fiscal sustainability and finally, Section 5 offers concluding remarks.

2. Review of literature

The concept of fiscal sustainability 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).

The empirical studies assessing the compliance to IBC can broadly be classified into two strands. The earlier studies following a univariate approach analyse the mean-reverting behavior of deficit and debt-GDP ratio series (e.g., Hamilton and Flavin, 1986; Wilcox, 1989). Second, the multivariate approach involves examining the long-run relationship between the flows of revenues and expenditures (e.g., Trehan and Walsh, 1988; Hakkio and Rush, 1991; Haug, 1991; Quintos, 1995).

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 (see the discussion below). With advancements in cointegration techniques, the long-run relationship between revenue and expenditure has been widely examined for assessing fiscal sustainability (e.g., Payne, 1997; Olekalns and Cashins, 1997; Hatemi-J, 2002; Afonso and Jalles, 2012; Dalgiç, İyidoğan and Balıkçioğlu, 2014).

Bohn (1998, 2007) in his seminal work, however, challenges the time series literature on fiscal policy suggesting that stationarity-based sustainability tests are invalid because in an infinite sample, any order of integration of debt is consistent with the transversality condition, which implies that the intertemporal budget constraint may be satisfied even if these particular time series tests are not. Moreover, the time series tests of sustainability do not explicitly identify the fiscal policy reactions underlying the data. As a result, they do not shed much light on the kind of policies that might deliver sustainability. (Adams et al., 2010)

Bohn (1998, 2007), therefore, suggested an alternative model-based approach to fiscal sustainability. In case fiscal authorities take corrective measures in response to deterioration in debt position, rising debt ratios lead to higher primary surpluses relative to GDP indicating a tendency towards mean reversion. Accordingly, a stable and strictly positive feedback from debt stock to primary surplus is a sufficient condition for fiscal

sustainability. The model-based approach to fiscal sustainability has also been widely employed in the empirical literature (e.g., Prohl and Schneider, 2006; Ghatak and Sánchez-Fung, 2007; Afonso and Jalles, 2012; Carrion-i- Silvestre, 2015; Mackiewicz-Lyziak, 2015).

3. Data and methodology

The empirical strategy of the paper relies on two alternative approaches proposed by Hakkio and Rush (1991) and Bohn (1998) discussed above. The theoretical framework underlying the first approach relies on the government's dynamic budget constraint and on the assumption that the interest rate follows a stationary stochastic process. Fiscal sustainability can then be tested through the following cointegrating regression ⁽¹⁾:

$$R_t = a + bG_t + u_t \quad (1)$$

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. Following Quintos (1995), the fiscal sustainability exists in "strong" form if R_t and G_t are cointegrated and $b = 1$. The fiscal stance is instead only "weakly" sustainable if $0 < b < 1$. Under this milder sustainability condition, government expenditures grow, on average, at a rate higher than receipts. Finally, if the null hypothesis $b = 0$ cannot be rejected, the fiscal stance is unsustainable.

The alternative strategy proposed by Bohn (1998) involves checking whether there is a corrective response by the government to increases in the public debt. The model suggested by Bohn takes the following form:

$$PS_t = \rho B_t + \alpha Z_t + \varepsilon_t \quad (2)$$

Where PS_t is the primary balance, B_t is the level of debt in the economy at the beginning of period t (which can be approximated by the level of debt in the period $t - 1$) and Z_t is a vector of explanatory variables that capture the economic cycle. The sufficient condition for sustainability requires $\rho > 0$ so that the government would be taking corrective actions – reducing the level of expenditure (excluding interest on debt) and/or increasing tax revenues – to offset the changes in the level of debt.

The empirical estimates in the paper are based on annual data on general government fiscal variables 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. All 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 and various International Monetary Fund (IMF) country publications and reports, such as IMF Article IV documents and Statistical Appendixes.

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 Gregory Hansen (1996) test and Carrion-i-Silvestre and Sanso (2006) test. The Gregory- Hansen 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 of 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 advantage of Carrion-i-Silvestre and Sanso (2006) cointegration test over Gregory Hansen Test (1996) is that it has null hypothesis of the presence of a cointegration relationship against the alternative of no cointegration and both the null and alternative hypothesis allow for the presence of structural break. Allowance of structural shift in the cointegration test introduces spurious unit root behavior that makes it difficult to reject the hypothesis of no cointegration. Therefore, alternative cointegration tests with null hypothesis of no cointegration have a higher possibility of failing to find cointegration, which leads to spurious results (Gregory and Hansen, 1996). Carrion-i-Silvestre and Sanso (2006) test is a Lagrange-multiplier type cointegration test based on the multivariate extension of the Kwiatkowski, et al. (1992) test. When the date of the shift is not known a priori, the test estimates the break date by minimizing the sequence of the sum of squared residuals. The test specifies six different models for estimations: model *An* allows for a break in the level, model *A* has a trend and allows for a break in the level, model *B* accounts only for a change in the slope of the time trend, and model *C* allows for a break in both the level and slope of the time trend. Model *D* allows a break in the deterministic components and the cointegrating vector, and model *E* contains a trend and allows for a shift in both the deterministic component and the cointegrating vector.

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.

In the presence of a mix of stationary and non stationary series the fiscal reaction function may be estimated through the Autoregressive Distributed Lag (ARDL) approach (e.g., Asiama et al., 2014; Akosah, 2015; Waheed, 2016 etc.).

The unrestricted error correction model (UECM) of ARDL model used to examine the long- run and short- run relationship takes the following form:

$$\Delta PS_t = \mu_0 + \delta_1 B_{t-1} + \delta_2 Z_{t-1} + \sum_{i=1}^q \alpha_i \Delta PS_{t-i} + \sum_{i=1}^q \beta_i \Delta B_{t-i} + \sum_{i=1}^q \gamma_i \Delta Z_{t-i} \varepsilon_t \quad (3)$$

where the series are as defined earlier. Following the basic specification of Bohn (1998), Z includes temporary factors impacting the primary balance including output gap (Ygap) and government expenditure gap (Ggap). The former captures the cyclical conditions and the latter accounts for unexpected expenditures, unrelated to the economic cycle, such as military expenditures. The output (expenditure) gap is measured as a ratio to potential output (expenditure) i.e. actual output (expenditure) less potential output (expenditure) divided by potential output (expenditure) where the potential output is proxied by the trend obtained with the Hodrick- Prescott filter. The possible non-linearities in the relationship are investigated by adding the quadratic term $(B_{t-1})^2$ as explanatory variable. δ_1, δ_2 in equation (iii) refer to the long-run coefficients and α, β and γ refer to the short-run coefficients. The null hypothesis is of no co-integration ($H_0: \delta_1 = \delta_2 = 0$) and the alternative hypothesis $H_1: \delta_1 \neq \delta_2 \neq 0$ implies co-integration among the series.

Given a relatively small sample size in the study of 30 observations, the critical values used are as reported by Narayan (2005). The null hypothesis of no long-run relationship is rejected if the computed F -statistic is greater than the upper critical bound as tabulated by Narayan (2005). However, if the computed F -statistic is less than the lower critical bound, then, the test fails to reject the null, suggesting no cointegration. If there is evidence of cointegration among the variables, the following long-run model is estimated:

$$\Delta PS_t = \mu_1 + \delta_1 B_{t-1} + \delta_2 Z_{t-1} + \nu_t \quad (4)$$

The ARDL specification of the short-run dynamics can be derived by constructing an ECM of the following form:

$$\Delta PS_t = \mu_2 + \sum_{i=1}^q \alpha_i \Delta PS_{t-i} + \sum_{i=1}^q \beta_i \Delta B_{t-i} + \sum_{i=1}^q \gamma_i \Delta Z_{t-i} + \psi ECM_{t-1} + \xi_t \quad (5)$$

where ECM is the error correction term and ψ represents the speed of adjustment.

4. Analysis of fiscal sustainability

4.1. Fiscal profile and implications for fiscal sustainability

Before a formal econometric analysis, a brief discussion on the fiscal profile of the selected countries and its implications for fiscal sustainability may be appropriate. Figure 1 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 Sri Lanka 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 for all the countries which seemingly supports weak sustainability hypothesis.

Figure1. Revenue and expenditure to GDP Series: 1985-2014
 Figure 1(a): India

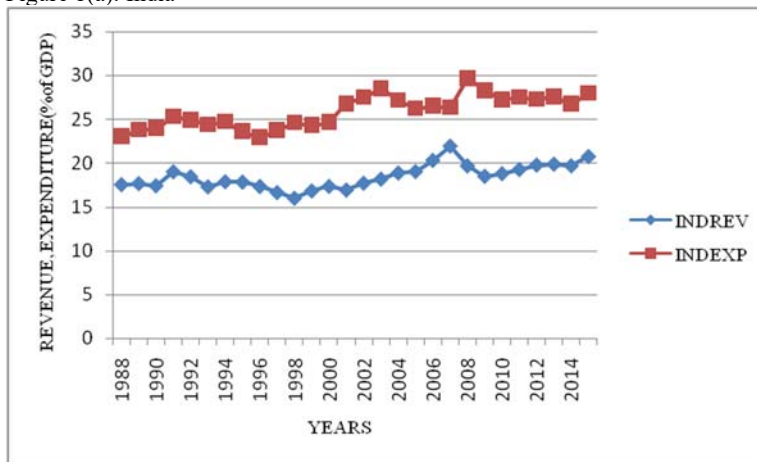


Figure 1(b): Sri Lanka

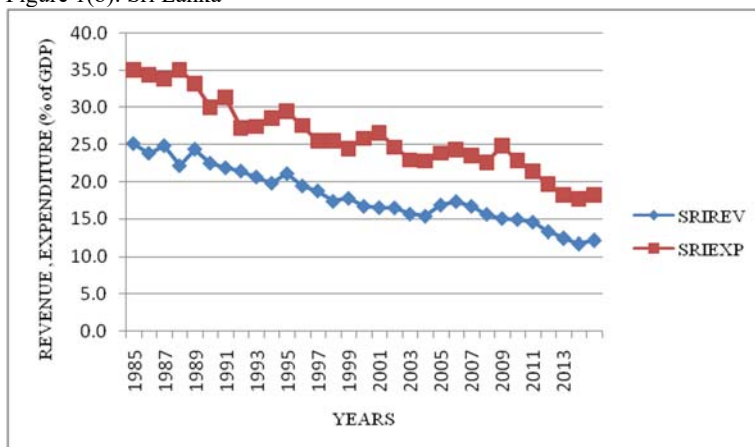


Figure 1(c): Bangladesh

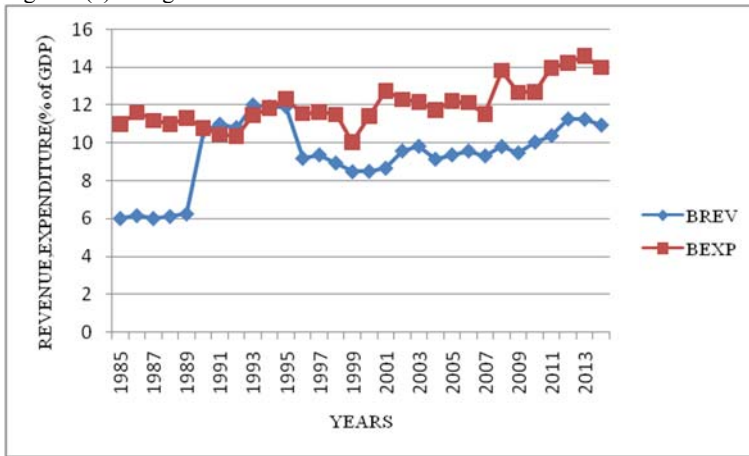


Figure 1(d): Pakistan

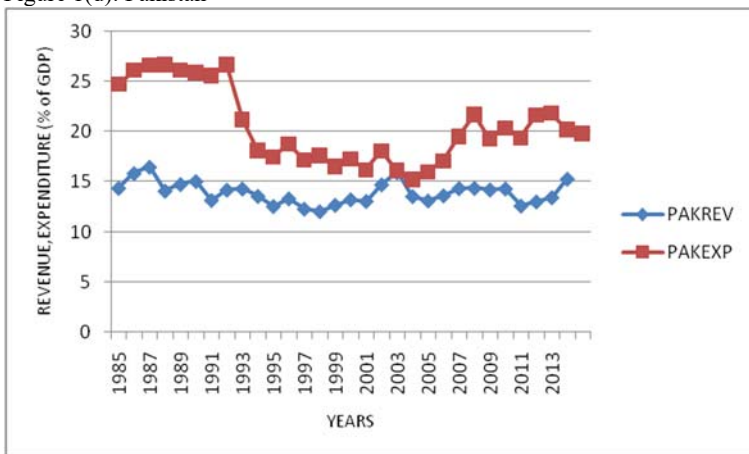
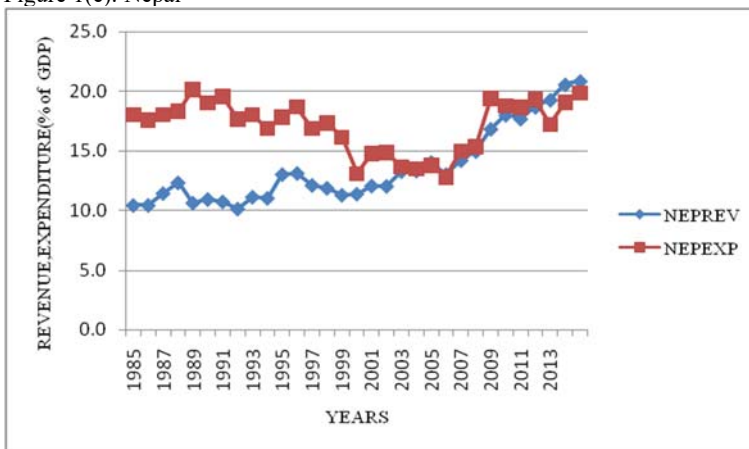
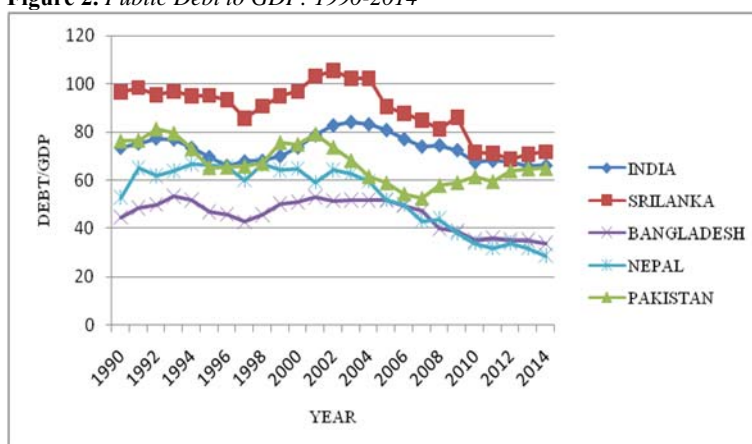


Figure 1(e): Nepal



Generally speaking, the debt to GDP ratio exhibits a declining trend after 2000 for all the countries (see Figure 2). In case of India, the debt ratio registers a decline from 2003 that marks the period of implementation of Fiscal Responsibility and Budgetary Management (FRBM) Act. An uptick in the debt ratio during 2007-08 may be observed in case of India, Pakistan and Sri Lanka reflecting the effect of the Global Financial Crisis.

Figure 2. Public Debt to GDP: 1990-2014



The declining trend in debt /GDP ratio points towards long-term sustainability of public debt. However, along with the level of debt, its composition, maturity profile, cost etc. have important consequences for sustainability. In this regard, the following observations can be made:

- i) The post reform period witnessed a decline in the share of external debt in all the countries. Currently, a larger share of public debt in South Asia is domestic, which reduces exposure to exchange related risks and adds to sustainability. In 2014, the share of external debt in public debt in India was only 7.1% compared to 15.1% in 1999. In Pakistan, share of external debt declined from 51.7% in 2000 to 31.7% in 2014. Sri Lanka and Bangladesh also witnessed a decline in the share of external debt in total debt from mid 90s. Sri Lanka currently holds 42.2% of debt externally compared to 54.4% in 1995. Nepal has a relatively higher share of external debt in the total public debt (63%) but much of the external debt is on concessional terms hence, sustainability is not considered at risk.
- ii) The interest cost of debt is another crucial indicator of sustainability. The ratio of interest payments to revenue receipts (IP/RR) witnessed a decline in case of only India, Pakistan and Nepal between 1996-2014. The ratio for India declined from an average of 35.7% in 1996-2000 to 22% in 2014. For Nepal, it came down from 10.9% in 1996-2000 to 4% in 2013. The IP/RR ratio exhibited a slightly increasing trend in case of Bangladesh and Sri Lanka. In case of Bangladesh, the ratio went up from 14.36 in 1996-2000 to 15.5% in 2010. The increase may be attributed to greater reliance on high cost domestic borrowing. In consonance with its highest debt ratio in the region, Sri Lanka registers the highest IP/RR ratio (40 and 37% respectively in

2013 and 2014 respectively) The situation is worrisome as the ratio is higher than the tolerable ratios of interest burden recommended by institutions like World Bank (35%), IMF(30%).

- iii) In terms of maturity profile of debt, India is most comfortably placed with short-term debt comprising only 8% of total debt and average term to maturity (ATM) of around 10.23 yrs in 2014-2015 which is high compared to international standards. Sri Lanka and Bangladesh are reasonably comfortable with share of short-term debt in total debt of order 22.4% and 16.5% respectively. In Pakistan, however, the share of floating debt (with maturity up to one year), constituted a whopping 54.5 percent of the domestic debt in 2013 indicating an elevated refinancing risk. The country however recently achieved improvement in its risk profile by retiring an outstanding rupees 1.2 trillion in short maturity treasury bills and replacing it with long maturity Pakistan Investment Bond in amount of Rs. 1.8 trillion, 2013-14. Sri Lanka too slightly reduced the weight of short term debt from 23.7 to 22.4 percent in 2013-14 through issuance of 30 years treasury bonds. (World Bank, 2014).

To sum up, it may be said that in the post reform period debt ratio have generally registered a decline from 2000 in the region. There are some improvements in the composition as well. Debt is mostly of domestic origin implying low currency risk. The countries have also been undertaking efforts to improve the debt risk profile by shifting towards the longer end of yield curve. The cost indicators show visible improvements in India and Nepal but interest payments still pose a substantial burden on budgets in Sri Lanka. Moreover, a synchronized behavior of revenue and expenditure may be observed for all countries. However, expenditure as a share of GDP on average exceeds revenue which seemingly supports weak sustainability hypothesis

4.2. Econometric analysis

In this section, we focus on the econometric examination of sustainability conditions as discussed in Section 3 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⁾.

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]
Sri Lanka	-2.79	-6.47**	-2.3	-6.14**	-4.31[2006]
Nepal	-1.45	-5.43**	-9.26	-8.34**	-4.77[2007]
				Expenditure	
India	-2.96	-4.34**	-2.52	-4.414**	-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]
Sri Lanka	-2.88	-4.45**	2.55	-9.05**	-4.27[2005]
Nepal	-2.46	-6.31**	-2.43	-6.91**	-3.23[2009]

Country	ADF		PP		Breakpoint Test (Additive Outlier)
	Level	FD	Level	FD	ADF
				Debt	
India	-1.45	-3.60**	-1.35	-3.64**	-4.50[2008]
Bangladesh	-2.67	-5.19**	-1.70	-5.22**	-4.1[2006]
Pakistan	-2.59	-5.49**	-2.62	-5.50**	-3.6[1997]
Sri Lanka	-1.68	-5.23**	-6.30	-5.27**	-4.22[2008]
Nepal	-1.81	-7.27***	-2.06	-7.2***	-4.77[2004]
				Primary Balance	
India	-4.08**	-7.22***	-4.09**	-8.1***	-4.95**[1996]
Bangladesh	-4.29**	-5.4**	-2.67	-5.58**	-5.6***[1998]
Pakistan	-2.17	-6.99**	-2.04	-7.31**	-4.99**[1996]
Sri Lanka	-3.53*	-5.69**	-3.40*	-14.4***	-5.78***[2007]
Nepal	-4.32**	-6.8***	-4.20**	-14.4***	-4.88**[2003]

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 shown in Table 2, ADF and PP tests provide overwhelming evidence that Revenue, Expenditure and Debt 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 primary balance series, however, turns out to be I(0) for India, Bangladesh and Nepal.

The results of break point unit root test are broadly in conformity with the previous test results. The primary balance series after allowing for an endogenous break turns stationary at level for Pakistan and Sri Lanka. Overall, therefore, the evidences indicate that all series except primary balance are first-order integrated.

As a first step towards investigating the existence of a long-run relationship between revenue and expenditure, the Johansen-Juselius test has been applied. The results of the test indicate presence of one cointegrating relationship between R and G in case of Bangladesh and Sri Lanka.⁽³⁾ For rest of the countries the test fails to reject the null of no cointegration raising prospects of non sustainable fiscal stance.

However, this conclusion might be misleading if there has been a shift in the long-run relationship due to a structural change. In order 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 Sri Lanka providing strong support in favor of cointegration. The identified break dates in case of India and Sri Lanka correspond to the commencement of rule based fiscal management. The two countries implemented 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.

Table 3. Testing for regime shifts in cointegration: Gregory-Hansen test

Country	ADF	Z α	Zt
India			
C	-4.16 [2003]	-20.8[2004]	-3.7[2004]
C/T	-4.51[2003]	-24.6[2004]	-4.5[2004]
C/S	-9.73***[2003]	-47.9**[2004]	-13.93***[2004]
Bangladesh			
C	-3.75[1994]	-20.0[1995]	-3.82[1995]
C/T	-4.90*[1994]	-24.8[1994]	-4.95*[1994]
C/S	-9.06***[1994]	-42.67*[1994]	-8.89***[1994]
Pakistan			
C	-4.66**[1995]	-24.7[1997]	-4.78**[1995]
C/T	-5.68***[2002]	-29.1[2002]	-5.9***[2002]
C/S	-5.11**[1998]	-29.02[1998]	-5.26**[1998]
Sri Lanka			
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	-5.5***[1997]	-30.2[1997]	-5.6***[1997]
C/T	-4.35[2009]	-20.3[2009]	-3.78[2009]
C/S	-4.47[2009]	-21.8[2008]	-3.8[2008]

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, p. 109, Table 1) are used.

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.

For robustness of the results, we perform the Carrion-i-Silvestre and Sanso's cointegration test. As revealed by Table 4, the null hypothesis of cointegration could not be rejected by any of the six models at 5% significance level for India and Bangladesh while four out of six models support presence of cointegration for the rest of the countries.

Table 4. Results of Carrion-i-Silvestre and Sanso Cointegration Test (2006)

Country	India	Bangladesh	Pakistan	Sri Lanka	Nepal
A _n	0.13[2002]	0.132[1997]	0.22**[1995]	0.16**[2002]	0.145[1999]
A	0.085[2004]	0.089[1994]	0.065[1999]	0.05[2002]	0.107**[1991]
B	0.044[2001]	0.132[1997]	0.045[2000]	0.042[2002]	0.082[1991]
C	0.059[1997]	0.031[1994]	0.061 [2004]	0.029[2002]	0.058[1992]
D	0.157[1993]	0.10[2000]	0.068[1996]	0.29***[1994]	0.19**[1992]
E	0.060[1993]	0.050[1994]	0.08**[2004]	0.064[2003]	0.040[2004]

Note: H₀: cointegration with break at unknown time. Critical values are from Table 2 of Carrion-i-Silvestre and Sansó (2006).

Overall, the empirical evidences establish the long-run relationship between revenue and expenditure in presence of structural break for all the countries.

After confirming cointegration, the next step is to estimate the coefficients of long-run relationship and draw inferences regarding degree of sustainability. As reported in Table 5, point estimates of slope parameters obtained from DOLS turn out to be smaller 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.

Table 5. *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	.190(0.66)
Pakistan	0.519	5.99(0.01)
Sri Lanka	0.596	4.86(0.02)
Nepal	0.72	5.53(0.01)

Note: figures in parenthesis show p values.

‘Weak’ fiscal sustainability implies 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).

Given the mixture of stationary and non-stationary variables in the model as established from the unit root tests, fiscal policy reaction function is estimated using ARDL co-integration technique. Table 6 suggests the existence of long-run relationship between primary balance, public debt, output gap and expenditure gap for Bangladesh, India, Pakistan and Sri Lanka as the computed F-statistic exceeds the critical upper bound at 95% confidence interval. The results are inconclusive for Nepal as the F-statistic lies between the upper and lower bounds.

Table 6. *Results of bound test for cointegration*

Country	F statistic	Cointegration
Bangladesh	6.69**	Yes
India	7.84***	Yes
Pakistan	4.59**	Yes
Sri Lanka	5.99***	Yes
Nepal	4.01	Inconclusive

Note: The critical values are cited from Narayan (2005) for restricted intercept and no trend.

The long run parameter estimates are reported in Table 7.

Table 7. *Estimated long run coefficients using ARDL approach*

	Bangladesh		India		Pakistan		Sri Lanka	
	coeff	t- val	coeff	t- val	coeff	t- val	coeff	t- val
B_{t-1}	.023	2.84 (.01)	.104	2.99 (0.00)	.036	5.16 (.00)	.031	2.44 (.02)
$(B_{t-1})^2$	.042	3.12 (0.00)	0.120	2.43 (0.02)	.0013	2.20 (0.04)	0.001	1.81 (0.08)
Ygap	.024	2.94 (.00)	.33	1.78 (0.09)	-.35	-2.87 (.00)	.209	2.19 (.03)
Ggap	-.029	-4.32 (.00)	-.044	-3.86 (0.00)	-.31	-2.81 (.01)	-.203	-2.24 (.03)
R^2	0.79		0.72		0.65		0.87	
Adj R^2	0.72		0.58		0.59		0.84	
F statistics	11.41(0.00)		5.00(0.00)		10.95(0.00)		25.16(0.00)	
D.W.	2.14		2.10		2.16		2.03	
Serial correlation	F=0.42(0.52)		F=1.79(0.201)		F=1.62(0.21)		F=0.035(0.85)	
Heteroskedasticity	F=0.343(0.56)		F=0.007(0.93)		F=0.04(0.82)		F=0.013(0.90)	
Ramsey's Reset Test	F=1.48(0.23)		F=3.23(0.09)		F=0.24(0.62)		F=0.35(0.60)	

Note: For annual data, Pesaran and Shin (1999) recommended choosing a maximum of two lags. From this, the lag length that minimizes Schwarz Bayesian criterion (SBC) is selected. Figures in parenthesis are p values.

The long run coefficients of public debt is positive and statistically significant indicating that fiscal authorities react systematically to rising public debt ratio to ensure fiscal sustainability. The estimates indicate that the primary balance improves on average between 0.02 and 0.10 percentage point in response to a one percentage point increase in debt ratios thus confirming fiscally responsible behavior. For Bangladesh, India and Pakistan the response of primary balance to the squared debt term is positive and significant. For India and Bangladesh this coefficient is larger than the coefficient of lagged debt implying a stronger fiscal response when debt-to-GDP ratios are higher.

The coefficient on output gap is positive in case of India, Pakistan and Sri Lanka. This implies that a positive shock to the output gap raises primary surplus by a factor of 0.02, 0.33 and 0.209 on average in Bangladesh, India and Sri Lanka respectively. The coefficient is however weak in terms of statistical significance in case of India. In case of Pakistan, the coefficient is negative suggesting a procyclical character of fiscal policy. The coefficient of expenditure gap is negative across countries indicating that an increase of expenditure above its potential lowers primary surplus. The estimated statistics shows that the model specification seems to pass all diagnostic tests successfully.

The short-run error correction models linked to the long run functions reported in Table 8 show that the explanatory variables maintain their long run signs in the short run as well. Consistent across the countries is the sign and significance of the estimated coefficient of lagged primary balance varying in the range of 0.23 to 0.54. Fiscal policy is thus found to have a strong degree of inertia in the region, causing the sign and magnitude of primary budgets in one year to depend substantially on previous years' budgetary outcome and decisions. This should be no surprise, as government budget plans typically run over several years, and many of the revenue and expenditure items are irreversible in the short term. The response of primary balance to lagged debt is however significant only for India and Bangladesh and the coefficient of squared debt is significant for all countries but Sri Lanka.

Table 8. Results of Short Run Error Correction Model

	Bangladesh		India		Pakistan		Sri Lanka	
	coeff	t- val	coeff	t- val	coeff	t- val	coeff	t- val
ΔPS_{t-1}	0.20	3.76 (0.00)	0.234	3.33 (0.00)	0.34	2.76 (0.01)	0.54	3.80 (0.00)
ΔB_t	.0069	2.30 (0.03)	0.14	1.35 (.19)	0.007	.297 (.77)	.014	.67 (.50)
$\Delta(B_{t-1})^2$	.029	3.12 (0.00)	0.15	2.67 (0.01)	.003	2.06 (0.05)	.001	.27 (0.78)
ΔY_{gap_t}	.40	3.08 (0.00)	.25	1.59 (.12)	-.068	-2.87 (0.00)	.09	1.87 (.07)
$\Delta Y_{gap_{t-1}}$	.42	2.73 (0.01)						
ΔG_{gap_t}	-.039	-4.19 (0.00)	-.129	-2.05 (.05)	-.061	-2.07 (0.05)	-.18	-3.77 (0.00)
$\Delta G_{gap_{t-1}}$			-.111	-2.35 (.03)			-.104	-2.87 (0.01)
ECM	-.113	-7.77 (0.00)	-.86	-4.49 (0.00)	-.19	-3.5 (0.00)	-.45	-3.22 (0.00)

Note: For annual data, Pesaran and Shin (1999) recommended choosing a maximum of two lags. From this, the lag length that minimizes Schwarz Bayesian criterion (SBC) is selected. Figures in parenthesis are p values.

The coefficient of the error correction is statistically significant across countries. The negative ECT shows that the system is driven to its long run cointegration path. The coefficient of ECT reflecting the speed of adjustment is estimated to be around 11% for Bangladesh, 86% for India and 19% and 45% for Pakistan and Sri Lanka respectively.

5. Conclusion

The study examines the issue of fiscal sustainability for five major South Asian economies namely, India, Pakistan, Bangladesh, Sri Lanka and Nepal for period 1985-2014 using two alternative approaches. First, we assess whether there is a long-run relationship between the government revenues and expenditures. Second, we investigate if the fiscal rule that relates the primary surplus and debt holds for the countries.

The results of Gregory and Hansen (1996) and Carrion-i-Silvestre and Sanso (2006) tests confirm the presence of long-run relationship between government revenue and expenditure for all the countries. The ARDL estimates of fiscal reaction function indicate a positive long-run response of primary balance to rising public debt ratio in case of India, Bangladesh, Pakistan and Sri Lanka. However, since the size of the cointegrating slope parameter between revenue and expenditure is significantly less than one, except for Bangladesh, fiscal sustainability exists only in weak form. The weak sustainability implies compliance to IBC in the strict sense but point to difficulties in marketing of future 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. First, an overview of the fiscal profile during the study period point to declining trend in debt ratios since 2000 and some improvements in its composition. The declining share of external debt in total debt indicates lowering of currency risk. Moreover, the countries have also been putting serious efforts to improve the risk profile of debt by shifting towards the longer end of yield curve.

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 because our study covers the post reform period where government is having a more cautious approach towards fiscal management. Moreover, our estimate of cointegrating slope parameter indicates a much higher speed of adjustment to the IBC compared to Goyal, Khundrakpam and Ray (2004). Contrary to Jha (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 and accounting for structural breaks provides evidence in favor of synchronized movement between revenue and expenditure for both the countries.

The results thus establish that South Asian countries have adhered to their intertemporal budget constraints in the post reform period. However, in view of the weakly sustainable fiscal stance, except in case of Bangladesh, the countries still need to reinforce their commitments to long-term fiscal discipline.

Notes

- (1) See Afonso and Jalles (2012) for a formal proof.
- (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 standard cointegration methodologies are available from the authors upon request.

References

- Adams, C., Ferrarini, B. and Park, D., 2010. Fiscal sustainability in developing Asia. *ADB Economics Working Paper Series*, No. 205.
- Afonso, A., 2005. Fiscal sustainability: the unpleasant European case. *FinanzArchiv*, 61, pp. 19-44.
- Afonso, A. and Jalles, J. T., 2012. Revisiting fiscal sustainability: panel cointegration and structural breaks in OECD countries. *ECB Working Paper*, No. 1465.
- Akosah, N., 2015. Empirical appraisal of fiscal stability: the case of Ghana. *Journal of Economic Studies*, 42, pp. 753-779.
- Asiama, J., Akosah, N. and Owusu-Afriyie, E., 2014. An assessment of fiscal sustainability in Ghana. *Bank of Ghana Working Paper WP/BOG-2014/09*, [online] Available at: <https://www.bog.gov.gh/privatecontent/Publications/Staff_Working_Papers/%20Fiscal%20Sustainability%20in%20Ghana.pdf> [Accessed 22 July 2016].
- Bohn, H., 1998. The behavior of U.S. public debt and deficits. *Quarterly Journal of Economics*, 113, pp. 949-963.
- Bohn, H., 2007. Are stationarity and cointegration restrictions really necessary for the intertemporal budget constraint? *Journal of Monetary Economics*, 54, pp. 1837-1847.
- Buiter, W.H. and Patel, U.R., 2006. India's public finances: excessive budget deficits, a government-abused financial system and fiscal rules. *Centre for Economic Policy Research Discussion Paper*, No. 5502.
- Carrion-i-Silvestre, J.L. and Sanso, A., 2006. Testing the null of cointegration with structural breaks. *Oxford Bulletin of Economics and Statistics*, 68, pp. 623-646.
- Carrion-i-Silvestre, J.L., 2015. Fiscal deficit sustainability of the Spanish region. *Regional Studies*, 50, pp. 1-12.
- Dalgıç, B., İyidoğan, P.V. and Balıkçioğlu, E., 2014. Sustainability of fiscal policy: an empirical examination for Turkish economy. *Journal of Business Economics and Finance*, 3, pp. 13-137.
- Deyshappriya, N.P.R., 2012. Debt and fiscal sustainability in Sri Lanka. *International Journal of Scientific and Research Publications*, 2, pp. 1-8.
- Ejaz, K. and Javid, A.Y., 2011. An assessment of debt sustainability in scenario of Pakistan's debt burden. *MPRA Paper No.37563*, [online] Available at: <<https://mpra.ub.uni-muenchen.de/37563>> [Accessed 20 August 2016].
- Ghatak, S. and Sánchez-Fung, J. R., 2007. Is fiscal policy sustainable in developing economies? *Review of Development Economics*, 3, pp. 518-530.
- Goyal, R., Khundrakpam, J.K. and Ray, P., 2004. Is India's public finance sustainable? Or, are the claims exaggerated? *Journal of Policy Modeling*, 26, pp. 401-420.

- Gregory, A.W. and Hansen, B.E., 1996. Residual-based tests for cointegration in models with regime shifts. *Journal of Econometrics*, 70, pp. 99-126.
- Hakkio, C.S. and Rush, M., 1991. Is the budget deficit 'too large?' *Economic Inquiry*, 29, pp. 429-45.
- Hamilton, J. and Flavin, M., 1986. On the limitations of government borrowing: a framework for empirical testing. *American Economic Review*, 76, pp. 808-819.
- Hatemi, J.A., 2002. Fiscal policy in Sweden: effects of EMU criteria convergence. *Economic Modelling*, 19, pp. 121-136.
- Haug, A., 1991. Cointegration and government borrowing constraints: evidence for the U.S. *Journal of Business and Economic Statistics*, 9, pp. 97-101.
- Jha, R. and Sharma, A., 2004. Structural breaks, unit roots, and cointegration: a further test of the sustainability of the Indian fiscal deficit. *Public Finance Review*, 32, pp. 196-219.
- Johansen, S., Mosconi, R. and Nielsen, B., 2000. Cointegration analysis in the presence of structural breaks in the deterministic trend. *The Econometrics Journal*, 3, pp. 216-249.
- Kaur, B. and Mukherjee, A., 2012. Threshold level of debt and public debt sustainability: the Indian experience. *Reserve Bank of India Occasional Papers*, [online] Available at: <https://m.rbi.org.in/scripts/bs_viewcontent.aspx?Id=2843> [Accessed 20 August 2016].
- Kwiatkowski, D., Phillips, P.C.B., Schmid, P. and Shin, Y., 1992. Testing the null hypothesis of stationarity against the alternative of a unit root: how sure are we that economic time series have a unit root? *Journal of Econometrics*, 54, pp. 159-178.
- Mackiewicz-Łyziak, J., 2015. Fiscal sustainability in CEE countries: the case of the Czech Republic, Hungary and Poland. *Equilibrium*, 10, pp. 53-71.
- Mahmood, T., Arby, M.F. and Sherazi, H., 2014. Debt Sustainability: a comparative analysis of SAARC countries. *Pakistan Economic and Social Review*, 52, pp. 15-34.
- Martin G., 2000. US deficit sustainability: a new approach based on multiple endogenous breaks. *Journal of Applied Econometrics*, 15, pp. 83-105.
- Munawar-Shah, S., Abdul-Majid, M. and Hussain-Shah, S., 2014. Assessing fiscal sustainability for SAARC and IMT-GT countries. *Romanian Journal of Fiscal Policy*, 5, pp. 26-40.
- Narayan, P.K., 2005. The saving and investment nexus for China: evidence from co-integration tests. *Applied Economics*, 37, pp. 1979-1990.
- Olekals, N. and Cashin, P., 1997. An examination of the sustainability of Indian fiscal policy. Available at: <http://fbe.unimelb.edu.au/data/assets/pdf_file/0012/805989/748.pdf> [Accessed 24 August 2016].
- Payne, J.E., 1997. International evidence on the sustainability of budget deficits. *Applied Economics Letters*, 4, pp. 75-779.
- Perron, P., 1989. The great crash, the oil price shock, and the unit root hypothesis. *Econometrica*, 57, pp. 1361-1401.
- Perron, P. and Vogelsang, T.J., 1992. Nonstationarity and level shifts with an application to purchasing power parity. *Journal of Business and Economic Statistics*, 10, pp. 301-320.
- Phillips, P.C., 1987. Time series regression with a unit root. *Econometrica*, 55(2), pp. 277-301.
- Prohl, S. and Schneider, F.G., 2006. Sustainability of public debt and budget deficit: panel cointegration analysis for the European Union member countries. *Johannes Kepler University of Linz. Department of Economics Working Paper No. 0610*. [online] Available at: <<http://www.econ.jku.at/papers/2006/wp0610.pdf>> [Accessed 30 August 2016].
- Quintos, C.E., 1995. Sustainability of the deficit process with structural shifts. *Journal of Business and Economic Statistics*, 13, pp. 409-417.
- Stock, J.J. and Watson, M.W., 1993. A simple estimator of cointegrating vectors in higher order integrated systems. *Econometrica*, 61, pp. 783-820.

- Trehan, B. and Walsh, C.E., 1991. Testing intertemporal budget constraints: theory and applications to U.S. federal budget and current account deficits. *Journal of Money, Credit and Banking*, 23, pp. 206-223.
- Vogelsang, T.J. and Perron, P., 1998. Additional test for unit root allowing for a break in the trend function at an unknown time. *International Economic Review*, 39, pp. 1073-1100.
- Waheed, A., 2008. Sustainability and determinants of domestic public debt of Pakistan. *Nagoya University, Graduate School of International Development Discussion Paper*, No. 137.
- Waheed, A., 2016. Sustainability of public debt: empirical analysis for Bahrain. *Journal of Internet Banking and Commerce*, 21, pp. 2-15.
- Wilcox, D., 1989. The sustainability of government deficits: implications of the present value borrowing constraint. *Journal of Money, Credit and Banking*, 21, pp. 291-306.
- World Bank, 2014. South Asia economic focus: time to refocus. <<http://dx.doi.org/10.1596/978-1-4648-0425-0>>