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Assessing Fiscal Sustainability for SAARC and IMT-GT Countries

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ABSTRACT

This study examines the fiscal sustainability of SAARC and Asian Growth-Triangle countries using Fisher and IPS tests of panel unit root and Pedroni test of panel cointegration. The tests are applied to the relationships, in terms of GDP ratios, between, i) the debt and primary surplus, and ii) government expenditure and revenues. Both models show consistent results suggesting that fiscal policy for the low-income countries is sustainable whereas it may not be sustainable for the high-income countries. This also indicates that the fiscal policy can be sustainable (non-sustainable) even for the debt above (below) 60 percent of the GDP.

Key words: Debt, Fiscal Policy, Sustainability, Panel Unit Roots, Panel Cointegration

JEL Classification: E62, H63

1.Introduction

The great recession caused widespread concern, including the risk of it developing into a global depression.[1] The inability of monetary policy to revive economies has raised concerns about the need to rethink policy. Thus, after the failure of monetary policy worldwide, reductions in taxes, and financial reforms, economists are emphasising a revival of activist fiscal policy (Feldstein, 2009; Jha, 2010; Auerbach, 2009). Many countries announced large fiscal stimuli. However, fiscal stimuli can play their role only if they are used at the right time, at the appropriate level, and for a suitable length of time.

The rigorous use of fiscal policy, however, might end up threatening some countries with insolvency, where countries might not be able to pay off their debt. For instance, Fountas and Wu (1996) stated that Greece had incentives to default on its debt and declared its fiscal policy not be sustainable. Greece enjoyed an average growth of 4.2% in real GDP over the period 2000-2007 compared to 1.9% growth in real GDP for the Euro Zone Athanassiou (2009). The unemployment rate decreased by 2.9 percentage points, but the improvement in these indicators came at the cost of high public deficits; government debt remained between 98% and 104% of GDP. Greece would have default on its debt had it not acceded to Euro Zone Athanassiou (2009); however, Russia in 1998 and Argentina in 2001 defaulted on their debts. The governments of the two countries accumulated debt due to of high spending therefore, the weak economies made it difficult for them to collect enough taxes in order to pay off their debt.

Unlike an individual, the government usually has a set of options to equate expenditures to revenues including taxation, seignorage (monetization), and borrowing; therefore it enjoys the liberty of deciding on the level of expenditures in advance. The sources of income of government are limited to taxes and seignorage (monetization), leaving borrowing as a flexible source of funds in situations where the government's expenditures go beyond revenues. Usually, governments rely on debt but it is important to monitor the structure of debt because the debt may build up to dangerous levels and may lead governments into crisis and eventually default as discussed above.

Given the above issues this paper attempts to examine the sustainability of fiscal policy based on the Intertemporal Budget Constraint for the 10 Asian developing countries including, Bangladesh, Bhutan, India, Indonesia, Malaysia, Maldives, Pakistan, Singapore, Sri Lanka, and Thailand. The issue of fiscal sustainability for the developing countries has been addressed in a very few studies, including Olumuyiwa and Thornton (2010) and Ehrhart and Llorca (2008).

We also examine the sustainability of fiscal policy for the sub-sample of high-income countries (i.e. Indonesia, Malaysia, Thailand and Singapore) and low-income countries (i.e. Bangladesh, Bhutan, India, Maldives, Pakistan, Sri Lanka). The high-income and low-income countries are labelled IMT-GT* and SAARC* respectively.[2] We use Pedroni's panel cointegration test for the relationships between i) the debt to GDP ratio and primary surplus to GDP ratio and between ii) central government expenditure inclusive of interest payments and central government revenue both as ratios to GDP.

The remainder of the paper is organized as follows. The next section explains sustainability and the derivation of Intertemporal Budget Constraint. A literature review is presented in Section 3. Section 4 contains a short description of the data and a comparison between high-income and low-income

[1] See Aiginger (2009a, 2009b), Eichengreen and O'Rourke (2009) and Romer (2009).

[2] Although the SAARC includes eight countries, including, Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka, but due to scarcity of the data we had to exclude Afghanistan and Nepal. Therefore, henceforth the SAARC* represents all the countries in SAARC except Afghanistan and Nepal. Furthermore, the IMT-GT includes only three countries, that is Indonesia, Malaysia, and Thailand, but we add Singapore in this panel in order to increase the number of countries

countries. Section 5 discusses the empirical methods used. The results and discussion are presented in Section 6. Finally, Section 7 concludes the paper.

2.Intertemporal Budget Constraint (IBC)

The sustainability of fiscal policy addresses the question of whether the government will be able to generate surpluses in future in order to pay off previous debt or whether it will carry on playing a Ponzi game.[3] Sustainability requires government expenditures and revenues to be in equilibrium in the long run. The ability of government to equate its present debt to the discounted sum of future surpluses is known as 'dynamic efficiency' and every dynamically efficient economy is subject to a constraint known as the Intertemporal Budget Constraint (IBC henceforth). Therefore, sustainability tests are based on the IBC.

The starting point for analysing the government budget constraint is the period-by-period identity linking revenues, spending and debt, following Afonso (2005):

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

where G is government expenditures excluding interest payments in period t, r the one-period real interest rate, B the real funding raised by issuing new government debt, and R is real government revenues. The basic definition of the IBC requires the existing stock of public debt to be equal to the present value of future primary surpluses; therefore, solving equation (1) recursively for the future period leads to the IBC. But first, to make it appropriate for empirical testing, the real interest rate is assumed to be stationary with mean 'r' and defining G_t^r as:

$$G_t^r = G_t + (r_t - r)B_{t-1} \quad (2)$$

Hence, using (1) and (2) and by solving it recursively the IBC is:

$$B_{t-1} = \sum_{i=0}^{\infty} \frac{R_{t+i} - G_{t+1}^r}{(1+r)^{i+1}} + \lim_{i\to\infty} \frac{B_{t+i}}{(1+r)^{i+1}} \quad (3)$$

The transversality condition implies that the second term (the term with the limit) in (3) goes to zero at infinity imposing a condition that the growth of debt should be slower than the growth of the real interest rate Afonso (2010).

$$B_{t-1} = \sum_{i=0}^{\infty} \frac{R_{t+i} - G_{t+1}^r}{(1+r)^{i+1}} \quad (4)$$

Hence, the transversality condition implies the absence of a Ponzi game and fulfilment of the IBC. Therefore, the government ought to attain future primary surpluses whose present value adds up to the current value of the stock of public debt as given in (4).

[3] The government plays a Ponzi game when it finances the debt and interest payments by issuing new debt Bergman (2001).

3.Literature Review

The IBC was initially used by Hamilton and Flavin (1986). They applied a Dickey-Fuller test to the discounted debt and surpluses series. The discounted debt and surpluses series for the US for the period 1960-1984 were examined for a unit root under the null hypothesis of a zero bubble term or transversality condition.

Some of the later studies, including (Trehan and Walsh, 1988, 1991; Haug, 1995; Hakkio and Rush, 1991; Smith and Zin, 1991), adopted an alternative approach for testing the sustainability of fiscal policy and showed that, if government revenues and expenditures inclusive of interest payments are nonstationary in levels and are integrated of order 1, then the presence of cointegration would imply that the government is not violating the IBC.

Hence, an alternative procedure for examining the bubble term or transversality condition is to test the following cointegrating equation:

$$R_t = \mu + bG_t^r + \varepsilon_t \qquad (5)$$

where, R_t is government tax revenue and $G_t^r = G_t + r_t B_{t-1}$.

The necessary and sufficient condition for the sustainability in Hamilton and Flavin (1986) was the existence of stationary debt series, whereas the necessary and sufficient condition for deficit sustainability in Trehan and Walsh (1991) was the existence of a stationary linear combination of the stock of debt and the net-of-interest deficit or the existence of cointegration between government revenues and government expenditures.

Later studies suggested some more flexible criteria for the sustainability of the IBC. For instance, Quintos (1995) extended the necessary and sufficient conditions for sustainability using cointegration tests. According to Quintos (1995), under the strict interpretation of deficit sustainability, cointegration between revenues and expenditures inclusive of debt payments is not a necessary but a sufficient condition. Under a weak interpretation of deficit sustainability, the necessary condition requires debt to grow slower than the borrowing rate.

In more recent studies, the rapidly growing federal government debt has become a concern for policy makers and public Bohn (2011). Furthermore, the recent global financial crisis have induced economists to recheck the behaviour of government policies with respect to the IBC. Especially in the last decade, attention has been drawn to various countries including Latin American countries, the European Union and some of the developing countries Prohl and Joakim, (2009). Afonso (2010) has examined the sustainability of the deficit process for the European Union using tests of unit roots and cointegration for panel data. The panel cointegration equation for expenditures and revenues becomes:

$$R_{it} = \mu_i + bG_{it}^r + \varepsilon_{it} \qquad (6)$$

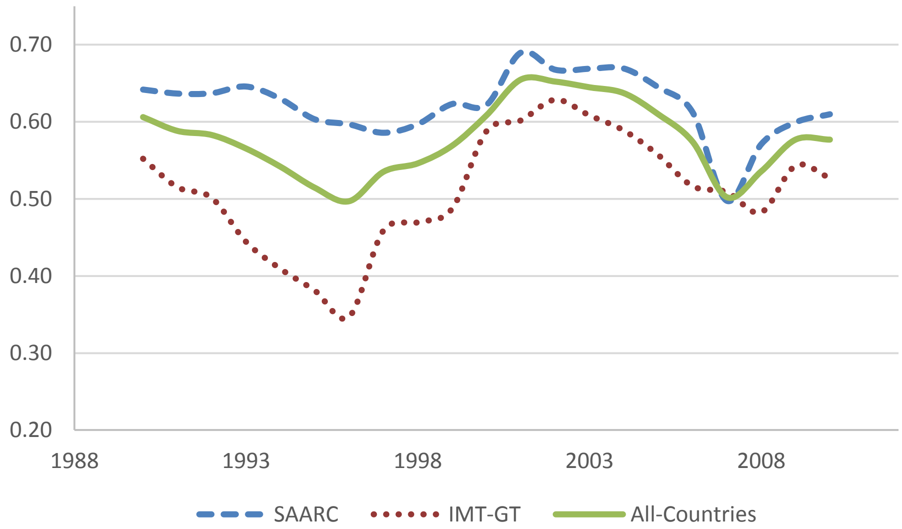
where, R_{it} is government tax revenue and $G_{it}^r = G_{it} + r_{it}\beta_{i,t-1}$ is government expenditure inclusive of interest payments. The subscripts i and t represent the data varying across country and time respectively.

4.Data

Annual data for 10 Asian countries for the period 1990-2010 were collected from different sources including International Financial Statistics (IFS), World Development Indicators (WDI), International Monetary Fund (IMF), Asian Development Bank (ADB), and the Reserve Banks and Finance Ministries of respective countries. The data are all available publicly. The data for the developing countries is scarce therefore we had to rely on a balanced panel covering the period 1990-2010.[4]

Data for the mean of central government debt as a percentage of GDP for SAARC* and IMT-GT* countries are shown in Figure 1, which shows that the mean debt as a percentage of GDP for lower income countries, i.e. SAARC, is 20% to 30% higher than that of the higher-income countries.

Figure 1 Mean Central Government Debt as a Percentage of GDP



5.Methodology

5.1.Unit Root Tests

This section discusses the time-series properties of the relevant variables and their significance for further analysis. The most important issue using time-series data is testing for the presence of a unit root otherwise the analysis may lead to spurious results.

Unit root testing in time series was initiated by Dickey and Fuller (1979). Let a time series have the following data generating process:

$$y_t = \alpha y_{t-1} + e_t, \qquad t = 1, 2, \dots, T \qquad (7)$$

where yt depends upon its autoregressive term and a white noise error term et. The series is stationary if $|\alpha| < 1$. The null hypothesis for nonstationary series is H_0: $\alpha = 1$ against the alternative hypothesis; H1: $\alpha <$

[4] Fiscal data of the developing countries is scarce, therefore, Jaimovich and Panizza (2008) have surveyed and collected the data on public debt for 89 countries. The Jaimovich-Panizza dataset is available at: http://www.iadb.org/res/pub_desc.cfm?pub_id=DBA-005 (Access Date: December 2014).

1. In this case, the critical values derived by Dickey and Fuller (1979, 1981) should be used. Equation (7) can alternatively be tested for a unit root by defining ($\gamma = \alpha - 1$).

Modifications of Dickey and Fuller (1979, 1981) tests have been developed in order to have more power, lower size distortion and flexible assumptions about the error term. The error term was assumed to be white noise in the Dickey-Fuller test, whereas in reality it may not be white noise; therefore Dickey and Fuller extended their model by adding higher order autoregressive terms in the standard models giving the Augmented Dickey Fuller (ADF) test. Hence equation (7) can be extended as equations, 8, 9, and 10:

$$\Delta y_t = \gamma y_{t-1} + \sum_{i=1}^{p} \alpha_i \Delta y_{t-i} + e_t, \qquad t = 1, 2, ..., T \qquad (8)$$

$$\Delta y_t = \alpha_0 + \gamma y_{t-1} + \sum_{i=1}^{p} \alpha_i \Delta y_{t-i} + e_t, \qquad t = 1, 2, ... ,T \qquad (9)$$

$$\Delta y_t = \alpha_0 + \gamma y_{t-1} + \sum_{i=2}^{p} \alpha_i \Delta y_{t-i} + \alpha_1 t + e_t, \quad t = 1, 2, ... ,T \qquad (10)$$

The addition of higher order autoregressive terms ensures that the white noise assumption of the error term is satisfied, including serial correlation of errors. But the data may have error terms that are neither statistically independent nor have constant variance. Therefore, Phillips and Perron (1988) (henceforth Phillips-Perron) treated this problem and extended the Dickey-Fuller test by allowing for autocorrelation and heteroskedasticity in the error.

Dickey-Fuller (DF) and Phillips-Perron (PP) tests are standard tests for a unit root. The DF tests are based on parametric estimation techniques while the PP tests are based on nonparametric techniques.

5.2 Panel Unit Root Tests

One way of increasing the power of unit root tests is to merge the data both across time and space, using a panel data approach. The survey papers by Banerjee (1999) and Breitung and Pesaran (2008) provide an extensive overview of the evolution of panel unit root and cointegration tests.

The power of unit root tests increases when the data are stacked together, due to an increase in information. Panel unit root testing has become widely used in testing Purchasing Power Parity (PPP). The Augmented Dickey Fuller test applied to the series for individual countries does not reject the null hypothesis of a unit root in the real exchange rate. However, panel unit root tests applied to a group of industrialised countries reject the unit root in the real exchange rate, (Coakley and Fuertes, 1997; Choi, 2001).

As the data vary across time (T) as well as across cross-section units (N), another subscript is needed to show the cross-section variation in the series. Following Breitung and Pesaran (2008), let the time series be {y_{i0}, ..., y_{iT}}, where i denotes the cross-sectional unit (country); then the simple first order autoregressive, AR(1), process can be written as;

$$y_{it} = (1 + \alpha_i)\mu_i + \alpha_i y_{i,t-1} + \varepsilon_{it} \qquad (11)$$

for given initial values, y_{i0}, and with errors ε_{it} that are identically, independently distributed (i.i.d.) across *i* and *t* with $E(\varepsilon_{it}) = 0$, $E(\varepsilon^2_{it}) = \sigma^2_i < \infty$ and $E(\varepsilon^4_{it}) = 0 < \infty$. The above model is also known as a simple dynamic linear heterogeneous panel data model, where μ_i helps in introducing heterogeneity in the model Pesaran (2005). The first-order autoregressive model can alternatively be written as a Dickey-Fuller (DF) regression:

$$\Delta y_{it} = (1 + \alpha_i)\mu_i + \gamma_i y_{i,t-1} + \varepsilon_{it} \qquad (12)$$

where Δ is the difference operator, and $\gamma_i = \alpha_i - 1$. The null hypothesis can be written as

$$H_0: \gamma_1 = \cdots = \gamma_N = 0$$

whereas, the alternative hypothesis could be

$$H_1: \gamma_1 < 0, \cdots, \gamma_{N_0} < 0, N_0 \leq N$$

The Im, Pesaran, and Shin (2003) (IPS henceforth) test of a unit root considers the H_1 alternative hypothesis. The IPS test allows the parameter γ_i to vary across cross-section units. Therefore the alternative hypothesis H_1 is known as a heterogeneous alternative. The IPS consider a stochastic process, yit which is generated by a first-order autoregressive process or simple dynamic linear heterogeneous panel data model as in eq (11).

Moreover, the IPS test allows for correlation in the residual terms and heterogeneity of the dynamics and error variances, across groups. As IPS combines the outcomes of unit root tests from the cross-section units, it therefore needs a balanced panel.

We have also applied Fisher PP tests, calculating two test statistics i.e. ADF-χ2 and PP-χ2. The Fisher-ADF and Fisher-PP tests the null hypothesis of a unit root against the heterogeneous alternative H1. The test has been applied with an intercept and linear trend. The Fisher PP test is based on Fisher's (1932) tests results which combine the p-values from individual unit root tests. As discussed by (Maddala and Wu, 1999; and Choi, 2001), let ζ_i be the p-value from any individual unit root test for cross-section i, then under the null of a unit root for all N cross-sections, the following asymptotic result holds:

$$-2\sum_{i=1}^{N} \log(\zeta_i) \rightarrow \chi^2_{2N}$$

In addition, Choi demonstrates that:

$$Z = \frac{1}{\sqrt{N}}\sum_{i=1}^{N} \varphi^{-1}(\zeta_i) \rightarrow N(0,1)$$

where φ^{-1} is the inverse of the standard normal cumulative distribution function (Choi, 2001; Hlouskova and Wagner, 2005).

5.3.Panel Cointegration Tests

As discussed earlier, researchers have a little more faith in panel unit root and cointegration tests than simple time-series tests due to the increased power of the tests, although panel cointegration tests come with their own problems and issues. These problems are common for panel unit root tests and panel cointegration tests; some of these were discussed earlier in the commentary on panel unit root tests.

Breitung and Pesaran (2008) have reviewed the panel cointegration tests including Pedroni (2004) and Kao (1999). The Pedroni (2004) and Kao (1999) tests of panel cointegration are residual based. We have chosen to apply the Pedroni (2004) test of cointegration for the following reasons. First, unlike Kao (1999), the Pedroni (2004) test has the ability to test the null hypothesis in a heterogeneous framework. Moreover the Pedroni (2004) test of cointegration is applicable to a model with a linear trend whereas the Kao (1999) test can only be applied to a model without a linear trend.

We applied the Pedroni (1999; 2004) test of cointegration to series with the same order of integration. These tests are extensions of the Engle-Granger test of cointegration based on residuals. Pedroni's (1999; 2004) test allows both the short-run dynamics and long-run slope coefficients to be heterogeneous across individual members of the panel. Pedroni (2004) has derived the limiting distributions and these are free from nuisance parameters. Wagner (2008) and Wagner and Hlouskova (2010) have recently evaluated the performance of panel cointegration methods. They compared a battery of cointegration tests in a large-scale simulation study including the tests developed by (Pedroni 1999, 2004; Westerlund, 2005; Larsson et al, 2001; and Breitung, 2005). They concluded that, amongst the single-equation tests, where the null hypothesis was that of no cointegration, the Pedroni test of cointegration performed best, whereas all other tests were partly severely undersized and had low power. Furthermore, among the seven panel cointegration test statistics of Pedroni, the group-ADF and panel-ADF are best for small samples as shown by Pedroni in his simulation results. Therefore, keeping in mind the small sample, we would have more faith in the results of Pedroni's panel-ADF and group-ADF compared to other test statistics.

The Pedroni test is an extension of the Engle and Granger (1987) two-step test of cointegration. In the first step, the cointegration equation is estimated separately for each member of the panel. In the second step, the residuals are tested for a unit root. If the null hypothesis of a unit root is rejected, then cointegration exists but the cointegration vector may be different for each cross section. The Pedroni tests use the following system:

$$y_{it} = \alpha_i + x_{it}\beta_i + u_{it} \qquad i = 1, 2, 3... N, \qquad t = 1, 2, 3... T \tag{14}$$

$$x_{it} = x_{it-1} + \varepsilon_{it}$$

where α_i are individual constant terms, β_i is the slope parameter, u_{it} are stationary disturbance terms and y_{it} and x_{it} are integrated of order one for all *i*.

The error terms in the second step can be pooled in two ways, either in the panel (within) or between (group) dimensions of the panel, which leads to seven test statistics. Pedroni proposed these seven test statistics, out of which four are for the panel and three are for the groups. In the case of within or panel statistics the first-order autoregressive parameter is restricted to be the same for all the cross sections i.e. $\beta_i = \beta < 1 \;\forall\; i$. Hence, if the null hypothesis of a unit root in the error terms is rejected, the series are cointegrated for all the cross sections. On the other hand, in the group (between) statistics the autoregressive parameter is allowed to vary across the cross sections; in this case the slope parameter is β_i, with subscript *i*. The group statistic for a group is the average of all the individual statistics drawn from individual cross sections. The rejection of a null hypothesis of a unit root in the error term indicates that cointegration does exist for at least one member of the panel.

A stepwise analysis of sustainability using unit root and cointegration tests is shown in the flow chart in Appendix to this text. The next section presents the results of panel unit root and cointegration tests for the group of all-countries, SAARC* and IMT-GT*.

6.Results and Discussion

The panel unit root and cointegration tests were applied to the following relationships, i) Debt and primary surplus and ii) Government expenditures including the interest payments (*GI*) and government revenue (*R*). We applied the test to the above mentioned variables in terms of GDP ratios, because several researchers, including (Hakkio and Rush, 1991; Bohn, 2005; and Afonso, 2005) are of the view that analysis based on GDP-ratios provide more credible information about the fiscal series than the raw and real data.

The panel unit root test results are presented in Tables 1 and 3 in the Appendix. After having confirmed the same order of integration for the above two cases, Pedroni's panel cointegration test was applied. The results for the panel cointegration tests are presented in Tables 2 and 4 in the Appendix.

As shown in the last column of Table 1 the Debt-GDP and Primary-Surplus-GDP ratios are integrated of order 1 except for the primary-surplus-GDP ratio of a pool of All-Countries and SAARC* in the models with an intercept only.

After having confirmed the order of integration for Debt-GDP and Primary-Surplus-GDP, the Pedroni test of panel cointegration was applied where the order of integration was the same (i.e. I(1)). The panel cointegration results for the three pools, i.e. All-Countries, SAARC* and IMT-GT*, are presented in Table 2. The Pedroni test of panel cointegration is based on the 7 test however for a small sample size the most appropriate test statistics are 'Group-ADF' and 'Panel-ADF' test statistics as shown by simulation results in various papers by Pedroni himself. Therefore, we have relied upon the results of these two test statistics.

Hence, as shown in Table 2, the null hypothesis of 'no cointegration' is rejected for the pools of All-Countries and SAARC*. Whereas, it is not rejected for the pool of IMT-GT*. Thus, the existence of a long-run relationship between the debt to GDP and primary surplus to GDP ratios suggests that fiscal policy is sustainable in the SAARC* countries. The results are interesting for they reveal that fiscal policy cannot be regarded as sustainable for higher-income countries, such as Indonesia, Malaysia, Thailand and Singapore (IMT-GT*), while it is sustainable for the low-income countries, such as Bangladesh, Bhutan, India[5], Maldives, Pakistan, and Sri Lanka. However, as will be shown in the next section, the results for the government expenditure and revenues are different for the pool of All-Countries.

The panel unit root tests results for the government expenditures including interest payments (GI) and government revenues in terms of GDP ratios are presented in Table 3. Again the final column shows the verdict. The results indicate that the GI to GDP ratio and R to GDP ratios are non-stationary and integrated of order (1) except the GI to GDP ratio for the pool of All-Countries, which is stationary in levels. These results reject the existence of cointegration in the first step for the subsample of all Countries, having confirmed the order of integration as I(1) for the GI to GDP and R to GDP ratios for the pools of SAARC* and IMT-GT*, the Pedroni test of panel cointegration was applied to these pools. The results of the Pedroni panel test of cointegration are presented in Table 4. The Pedroni test of panel cointegration was applied to the models 'with intercept only' and 'with intercept and linear trend' in the data. As discussed earlier, our decision is based on the 'Group-ADF' and 'Panel-ADF' tests statistics. Based on the above discussion, the null hypothesis of 'no cointegration' is accepted in both models for the pool of IMT-GT*, whereas, for the pool of SAARC* the null of 'no cointegration' cannot be accepted. Hence, the results indicate that again fiscal policy is sustainable for the SAARC* countries and may not be regarded as sustainable for the countries in IMT-GT*. However, these results are a little different from the results of debt and primary-surplus in terms of GDP ratios. Here the null hypothesis of 'no cointegration' is not rejected for the pool of All-Countries.

There is insufficient evidence of cointegration between the debt to GDP ratio and primary surplus to GDP or between Government spending and revenues for the pool of higher-income countries (i.e. IMT-GT*). This implies that fiscal policy is not sustainable for high-income countries. However for the SAARC* subsample, cointegration exists which implies that fiscal policy is sustainable. This implication is surprising because, as shown in Figure 1, for the selected sample the mean of the debt of IMT-GT* countries remained below 50% of GDP, whereas for the SAARC* countries it is above 50% of GDP. In addition, the debt to GDP ratio for the SAARC* countries does not display any abnormal evidence of shocks even around the year 2000; however a slight spike can be observed.

[5] The data for India contain an outlier for the year 2007; therefore we have ignored this value when the unit root tests were applied to single countries. This is pointed out in the source of the data (Asian Development Bank, Key Indicators of Asia and Pacific 2009). As reported by the ADB, "India's debt-GDP ratio (after 2006) *identifies a break in the analytical comparability of data or a change in magnitude"*.

7.Conclusion

In this study, we have explored the issue of sustainability of fiscal policy for 10 Asian Countries. Panel unit root and cointegration tests were applied to the following two relationships, i.e. i) between Debt to GDP and Primary Surplus to GDP ratios and ii) between GI to GDP and R to GDP ratios. The pool of ten countries was further divided into a pool of SAARC* countries and a pool of IMT-GT* countries.

The results are consistent for both the relationships and suggest that fiscal policy is sustainable for the pool of low-income countries, whereas it may not be regarded as sustainable for the high-income countries. Furthermore, for the pool of All-Countries, the results show that there exists cointegration between debt to GDP and primary surplus to GDP ratios; thus fiscal policy is sustainable in this case. However, the cointegration results for government spending and revenues show that fiscal policy is not sustainable.

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Appendix

Table 1 Panel Unit Root Tests Results for Debt to GDP and Primary Surplus to GDP Ratios

Pool	Series		Fisher ADF-χ^2	Fisher PP- χ^2	IPS	Verdict
All Countries	Primary-Surplus-GDP ratio	Intercept Only	36.709 (0.013)	37.506 (0.010)	-2.394 (0.008)	Stationary I(0)
		Intercept and Trend	24.196 (0.234)	27.547 (0.121)	-0.281 (0.390)	Unit Root I(1)
	Debt to GDP ratio	Intercept Only	25.353 (0.188)	16.179 (0.705)	-0.641 (0.261)	Unit Root I(1)
		Intercept and Trend	18.337 (0.565)	12.723 (0.899)	0.001 (0.501)	Unit Root I(1)
SAARC* Countries	Primary Surplus to GDP ratio	Intercept Only	25.571 (0.012)	26.546 (0.009)	-2.285 (0.011)	Stationary I(0)
		Intercept and Trend	14.346 (0.279)	18.050 (0.114)	-0.630 (0.264)	Unit Root I(1)
	Debt to GDP ratio	Intercept Only	17.134 (0.145)	5.628 (0.934)	-0.578 (0.282)	Unit Root I(1)
		Intercept and Trend	12.855 (0.380)	5.677 (0.931)	-0.432 (0.333)	Unit Root I(1)
IMT-GT* Countries	Primary Surplus to GDP ratio	Intercept Only	9.979 (0.125)	9.791 (0.134)	-1.206 (0.114)	Unit Root I(1)
		Intercept and Trend	9.818 (0.133)	9.469 (0.149)	-0.747 (0.228)	Unit Root I(1)
	Debt to GDP ratio	Intercept Only	7.636 (0.266)	9.980 (0.125)	-0.669 (0.252)	Unit Root I(1)
		Intercept and Trend	4.926 (0.553)	6.490 (0.371)	0.286 (0.613)	Unit Root I(1)

Parentheses contain the p-values, PP-χ^2: Fisher Chi-Square test, PP-Z: Fisher Choi Z-statistics. IPS: Im, Pesaran and Shin.

Table 2 Panel Cointegration Tests for All-Countries Debt to GDP Ratios and Primary Surplus to GDP Ratio

Pools	Pedroni (Engle Granger) tests of Panel Cointegration			
	All-Countries	**SAARC***	**IMT-GT***	
	Intercept and Trend	Intercept and Trend	Intercept Only	Intercept and Trend
Panel-ADF	-2.500 (0.006)	-2.970 (0.001)	-0.422 (0.336)	0.065 (0.526)
Group-ADF	-4.645 (0.000)	-4.480 (0.000)	-0.284 (0.388)	-1.099 (0.136)

Parentheses contain the p-values, Null Hypothesis: No Cointegration

Table 3 Panel Unit Root Test Results for GI to GDP and R to GDP Ratios

	Series	Deterministic Components	Fisher-PP ADF-χ^2	Fisher-PP PP-χ^2	IPS	Verdict
All-Countries	GI to GDP Ratio	Intercept	28.620 (0.095)	22.098 (0.335)	-1.408 (0.080)	Stationary
		Intercept and Trend	30.433 (0.063)	15.956 (0.719)	-1.787 (0.037)	Stationary
	R to GDP Ratio	Intercept	17.742 (0.604)	28.225 (0.104)	0.603 (0.727)	Unit root I(1)
		Intercept and Trend	15.344 (0.756)	16.686 (0.673)	0.488 (0.687)	Unit Root I(1)
SAARC* Countries	GI to GDP Ratio	Intercept	15.219 (0.230)	8.765 (0.723)	-0.595 (0.276)	Unit Root I(1)
		Intercept and Trend	21.254 (0.047)	7.174 (0.846)	-1.684 (0.046)	Unit Root I(1)
	R to GDP Ratio	Intercept	6.077 (0.912)	9.210 (0.685)	1.680 (0.954)	Unit Root I(1)
		Intercept and Trend	8.463 (0.748)	3.934 (0.985)	0.813 (0.792)	Unit Root I(1)
IMT-GT* Countries	GI to GDP Ratio	Intercept	8.465 (0.206)	8.397 (0.210)	-1.003 (0.158)	Unit Root I(1)
		Intercept and Trend	6.136 (0.408)	5.587 (0.471)	-0.508 (0.306)	Unit Root I(1)
	R to GDP Ratio	Intercept	9.998 (0.125)	17.157 (0.009)	-1.146 (0.126)	Unit Root I(1)
		Intercept and Trend	5.088 (0.533)	12.325 (0.055)	-0.056 (0.478)	Unit Root I(1)

Parentheses contains p-values, GI: Government Expenditures including interest payments on debt, PP-χ^2: Fisher Chi-Square test, PP-Z: Fisher Choi Z-statistic. IPS: Im, Pesaran and Shin.

Table 4 Panel Cointegration Test Results for GI to GDP and R to GDP Ratios

Pools	**Pedroni (Engle Granger) test of Panel Cointegration**			
	IMT-GT* Countries		**SAARC* Countries**	
	Intercept Only	Intercept and Trend	Intercept Only	Intercept and Trend
Panel-ADF	-1.067 (0.143)	-1.062 (0.144)	-4.215 (0.000)	-3.759 (0.000)
Group-ADF	-0.309 (379)	-1.075 (0.141)	-3.522 (0.000)	-2.997 (0.001)

Parentheses contain the p-values, Null Hypothesis: No Cointegration