Movement of Exchange Rate on Balance-of-Payments Constrained Growth in South Asia: Panel ARDL

Jayasooriya, Sujith

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S.P. Jayasooriya[1]

Movement of the exchange rate is highly influential for the balance of payments in South Asia. Underpinning literature reveled both positive and negative impacts of real effective exchange rate on current account deficit. The objective of the paper is to understand the exchange rate movement on current account balance and to estimate the misalignment of exchange rates in South Asia. The study use empirical methods including Pooled mean group (PMG) regression, Mean group (MG) estimation, and Dynamic fixed effects (DFE) regression for estimating the predicted values for the current account deficit. Further, the exchange rate misalignment is estimated on the basis of Behavioural Equilibrium Exchange Rate (BEER) theory. The empirical results also support the Thirlwall's hypothesis which states that balance of payments position of the South Asian economies are the main constraint on its economic growth. Panel Dynamic Ordinary Least Square (DOLS) method is used to estimate the misalignment using net foreign assets and productivity differential. The results show that in the long run of PMG model, Real effective exchange rate is negatively significant while GDP growth, Productivity, Trade openness, and Broad money (M2) are positively significant, imply those variables have positive impacts on current account balance. Since Hausman test revealed PGM as the efficient model to predict the relationship, in short run, EC and Real Effective Exchange Rate are negatively and Productivity and Trade openness are positively significant. The results of DEF model suggest that Real effective exchange rate is also negative, meanwhile GDP growth, Productivity, Net foreign assets, Trade openness, Terms of trade are positively predict the impacts on current account balance. Panel estimation of BEER model shows that the productivity differential and net foreign assets are significant positive predictors of the real effective exchange rate. Total misalignment is the difference between the fitted and actual value of the real exchange rate. These determinants of current account balance imply the effectiveness of targeting one of the variables in influencing the long run behavior of other variables by policymakers.

Keywords: Balance of Payment, Exchange rate, Panel ARDL, Misalignment, South Asia

[1] Chartered Economist (Economic Policy)

1. INTRODUCTION

One of the most debating issues in macroeconomics, in recent times, is the current account balance over exchange rate movement. Increase of current account deficits is among the most serious problems in many developing countries, especially in South Asia, because large and persistent current account deficit may result in economic and currency crises (Deistaings et al 2013). Large current account deficit often raise concerns about the sustainability; of such deficits create currency issues from such imbalances, especially under the highly volatile exchange rate movement.

In many developing countries, disequilibrium in real effective exchange rate has caused instability in current account balance. There is also a compromise that current account balance sustainability is very crucial for macroeconomic policy changes and decisions. Further, the current account balance is considered as an important macroeconomic indicator of the viability of the economy since it represents other important economic variables. All these indicators have a direct impact on economic growth, exchange rate and economic competitiveness (Boljanovic 2012). Thus, it is important to understand the determinants of current account balance.

The study examines the determinants of current account balance in South Asian countries through the empirical investigation. A limited number of studies have pointed in the literature on current account balance under the movement of real effective exchange rate in South Asia. Thus, it is an important research question to be investigated to further understanding relationship between current account balances under the volatile exchange rate in South Asia. An understanding the determinants of the current account balance deficits is important in analyzing the sustainability of the country's external position.

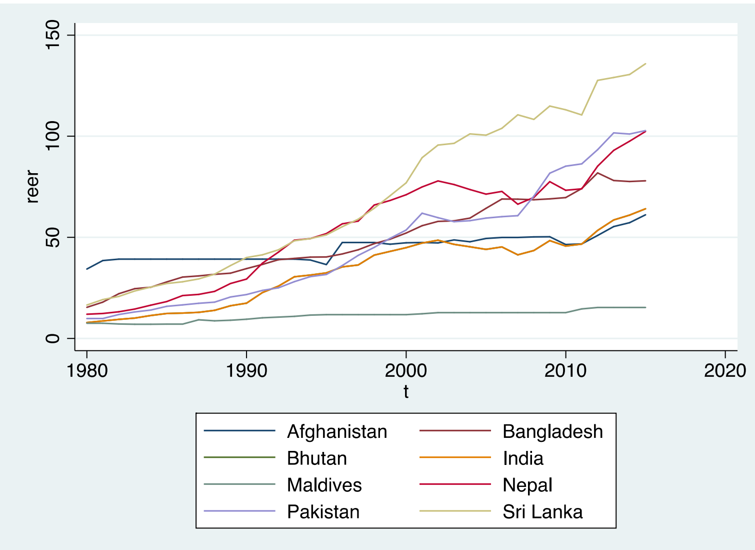

Figure 1: Variation of the real effective exchange rate (reer) in South Asia.

Above graph (Figure 1) shows that the trends of the current account balance and real effective exchange rate in South Asia.

The rest of this paper is structured as follows: Section 2 represents the theoretical framework for the study. Section 3 presents literature review, which includes the theoretical, methodological and empirical literature pertaining to current account balance determination. Section 4 presents data sources and description. The empirical methodology makes up section 5. Section 6 contains the analytical results and discussion. Section 7 includes the conclusion.

2. THEORETICAL FRAMEWORK

Balance-of-payments constrained growth model

In a seminal paper, Thirlwall (1979) developed a model where the long run growth of income is constrained by balance-of-payments. In literature, many papers have tested the simple rule derived from this Keynesian model.

The model describe as follows. The balance of payments equilibrium condition is given by;

$P_d X = P_f M$……………………………………………………………………………………………[1]

Where P_d and P_f are export and import prices, both expressed in domestic currency, and M and X are quantities of imports and exports respectively. Thirlwall uses two standard export and import demand functions.

$M = (P_f/P_d)^g Y^h$…………………………………………………………………………..……………..[2]

$X = (P_d/P_f)^v Y^{*w}$……………………………………………………………………………………[3]

Where, Y and Y^* are domestic and foreign income, g and v are the price elasticities of imports and exports, and h and w are the income elasticities of demand for imports and exports respectively.

Considering, natural logarithms and differentiating equations [2] and [3] with respect to time, the growth rates of the import and export can be expressed as:

$m = g\ (p_f - p_d) + hy$……………………………………………………………………………………[4]

$x = v\ (p_f - p_d) + wy*$……………………………………………………………………….………[5]

Where lower case letters indicate the growth rate of each variable.

From the equation [1] we have:

$p_d + x = p_f + m$…………………………………………………………………………..………..[6]

Substituting equations [4] and [5]in to equation [6] gives the balance of payments equilibrium growth rate (y_b) as:

$y_b = [(1 + v + g)(p_d - p_f) + wy*]$/h…………………………………………………..……………..[7]

Thirlwall (1979) and McCombie and Thirlwall (1994) argue that there is considerable evidence that the rate of changes of relative process has little effect on the growth of imports and exports. This could be because of low price elasticities of demand so that the Marshall-Lerner condition is only barely satisfied, or that there is real wage resistance. In this case, we have the condition that$(1 + v + g)(p_d - p_f) = 0$.

Consequently, equation [7] gives;

$y_b = wy*$/h ………………………………………………………………………………………..[8]

From equation [5], equation [8] can be expressed as;

$y_b = x$/h

This equation is known as “Thirlwall’s Law”. Equations (5) and (6) represent the basic form of Thirlwall’s hypothesis.

3. LITERATURE REVIEW

A number of empirical studies examined the effect of macroeconomic variables on the current account balance. Brissimis et al (2010) found that banks' private sector credit extension (PSCE) to be one of the main determinants of the current account deficit in Greece. Kariuki (2009) examined the determinants of the current account balance in Kenya using the intertemporal approach for the period 1970 to 2006. The study includes economic growth, the fiscal balance, terms of trade, trade openness, money supply, dependency ratio, foreign direct investment and macroeconomic stability. Oshota and Badejo (2015) also examined the determinants of current account balance, using the panel ARDL model for West African countries. The results confirmed that in the long run, GDP per capita, domestic investment, financial deepening and the dependency ratio had a positive impact on the current account balance while the real effective exchange rate had a negative impact on the current account for West African countries.

Lee and Chinn (1998) in their study on The Current Account and The Real Exchange Rate developed their methodology through the IS-LM model. Through this framework Lee and Chinn (1998) showed that under flexible prices, the neutrality of normal shocks would hold on real exchange rate in the long run. Franklin (2010) found the real effective exchange rate to be stationary while current account to GDP ratio is nonstationary, contrary to the existing literature where the real effective exchange rate is nonstationary and the current account to GDP ratio is stationary. Affandi and Mochtar (2013) investigated the relationship between structural changes in Indonesia and shifts in current account patterns in the periods before and after the Asian crisis. They adopted the approach of Lee and Chinn (1998, 2006) that was based on the frame work of Clarida and Gali (1994) with two variables namely the current account and the real exchange rate that are approximated by permanent and temporary variables and shocks at each variable were classified as real and nominal shocks respectively.

Accordingly, the paper Oshota and Badejo, (2015) estimates the long- and short-run relationship between current account balance and its key determinants in West African countries using a panel of data pooling time- series and cross-section effects. This is achieved by specifying an autoregressive distributed lag (ARDL) model for each country for the period between 1980 and 2012, pooling them together in a panel, and then testing the cross-equation restriction of a common long-run relationship between the variables using the pooled mean group (PMG) estimator of Pesaran, Shin, and Smith (1999). This kind of a country-specific ARDL approach allows us to accommodate not only cross-country heterogeneity but also to capture time-series relations that cross-section analysis alone cannot deal with. Moreover, this methodology deal with the low power of unit root tests against plausible alternatives and it partially circumvents some of the problems with cointegration analysis that focuses only on the estimation of long-run relationship among I(1) variables.

Aristovnik (2007) used a (dynamic) panel-regression technique to characterize the properties of current account variations across selected MENA (Middle East and North African countries) economies between 1971 and 2005. The results indicate that higher (domestic and foreign) investment, government expenditure and foreign interest rates have a negative effect on the current account balance. Chinn and Ito (2007, 2008) in their extended research of the work of Chinn and Prasad (2003) find that the standard determinants, such as demographics and income variables, used in the work of Chinn and Prasad (2003) cannot alone explain the upswing in Asian countries' current account. Therefore, they augment Chinn and Prasad (2003) specification with indicators of financial development and legal environment that are likely to affect saving and investment behaviour and economic growth. Gruber and Kamin (2007), using a panel data of 61 countries over the period 1982-2003 and including the standard current account determinants such as per capita income, relative growth rates, fiscal balance, demographic factors and international trade openness find that the Asian surpluses can be well explained by a model that incorporates, in addition to standard determinants, the impact of financial crises on current accounts. However, their model fails to explain the large U.S. current account deficit even when the model is augmented by measures of institutional quality.

Saqib et al (2007) utilized cointegration and error correction techniques in estimating the long and short run behavioral relationship between Pakistan's current account balance and difference economic variables. The empirical results advocate that there exists a significant relationship between the current account balance and the balance of trade, domestic saving, total consumption and workers' remittances during the period 1972-2005. Doisy/Hervé (2003) estimates a benchmark for current account positions applying a solvency constraint and also identifies determinants of the saving-investment balance. They include the fiscal balance, the share of the private sector in value added, per capita income, the ratio of capital income to wage income and the openness of an economy. Calderon, Chong and Loayza (1999) adopt an econometric methodology that controls for simultaneity and reverse causation through a reduced-form approach to investigate the empirical relations between current account developments and a large number of macroeconomic variables proposed in the literature on the panel sample of 44 developing countries during the period 1966-1995.They observed that increase in GDP, the level of public or private savings, real exchange rate appreciation increases the current account deficit while increase in the level of world interest rates reducing the level of current account deficit of developing countries.

The literature proposes different methods of analyzing the current account and real exchange rate. Traditionally, the analysis of current account and real exchange rate has been carried out on largely separate tangents. Edison and Pauls (1993) in their assessment of the relationship between real exchange rate and real interest rate posits that real exchange rate relies upon either interest rate and purchasing power parity conditions or, as proposed by De Gregorio and Wolf (1994) and Chinn (1999), trends in productivity. Meanwhile, in terms of an intertemporal framework, econometric analysis of the current account has often been understood in terms of a composite good world (Sheffrin and Woo, 1990). Shibamoto and Kitano (2012) in their analysis of Structural Change in Current Account and Real Exchange Rate Dynamics assess the issue in the G7 countries extends the framework of previous literature that isolate temporary and permanent shock by examining a possible structural break in current account and real exchange rate dynamics. Their analysis uses the G7 country over the period, 1980–2007. From their analysis they found structural changes in two-variable dynamics for all G7 countries during the 1990s. Their results showed that temporary shocks have not been the main source of fluctuation in the current account since the 1990s and imply that the conventional mechanism has played a limited role in explaining the dynamics of the two variables. Jesus, et. al. (2009) shows the impacts of balance of payment relationship with the real effective exchange rate in Pakistan.

The Behavioural Equilibrium Exchange Rate (BEER) of MacDonald (1997) and Clark and MacDonald (1998) is more than an empirical approach that relies on the estimation a long-run relationship between some fundamental determinants and a measure of exchange rate, usually the real effective exchange rate (REER). The equilibrium exchange rate was determined using BEER approach with the use of the terms of the relative productivity and the net foreign assets as determinants.

4. DATA

The secondary data was gathered form PWT 8, World Development Indicators (WDI) and World Economic Outlook (WEO) from 1980 to 2015 for all South Asian countries.

Table 1: Description of the variables

Variable	Description	Notation
Import volumes	Growth rate of import volumes	impvol
Relative prices	The ratio of domestic to foreign prices. Real effective exchange rate was taken as proxy for relative prices	reer
Population growth	Growth rate of population	popgrowth
GDP growth	GDP growth rate	gdpgrowth
Age dependency ratio	Age dependency ratio	adr
Productivity	Level of PPP-adjusted to GDP	prod
Net foreign Assets	Net foreign assets to GDP	nfa
Trade openness	Trade openness	tradeopen
Terms of Trade	Terms of trade	ttrade
Broad money	M2 broad money	m2

5. EMPIRICAL METHOD

Based on the theoretical framework provided by Thirlwall, 1979 the data was analyzed with the following model:

The empirical panel data analysis is stated as:

$$Log\ Im\ Vol_{i,t} = b_0 + b_1 LogREER_{i,t} + b_2 LogGDP_{i,t} + \varepsilon_{i,t} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots [9]$$

Where, Im Vol.: Rate of growth of Import Volumes, REER: Relative Prices/Real Effective Exchange Rate (reer) and GDP: Rate of growth of Real GDP (Constant Prices, USD).

The study uses the panel auto-regressive distributed lags (ARDL) methodology proposed by Pesaran et al (1999). Following (Pesaran and Smith, 1995; Pesaran et al., 1999), the mean group (MG), pooled mean group (PMG), and dynamic fixed effect (DFE) model was estimated. MG imposes no restrictions on the parameters of ARDL specification and derives long-run parameters from the average of long-run parameters obtained from the ARDL estimators. While this estimator is always consistent it does not take advantage of the possible poolability of the data among panel-forming units. An alternative estimator being set up under the assumption of homogeneity slope is dynamic fixed effects (DFE), in which the slopes are fixed and the intercepts allow to vary across country. Under slope heterogeneity, Pesaran and Smith (1995) point out that the DFE estimates are affected by a potentially serious heterogeneity bias, especially in small firm samples. As an alternative, Pesaran et al. (1999) developed the maximum likelihood- based PMG approach, which yields a more efficient estimate. PMG is used to constrain long-term co-movements among the panel-forming countries while it allows constant term, error variances and short-run parameters to vary by countries. In other words, PGM allows for short-run heterogeneity with regard to long-run homogeneity in the panel ARDL model. However, the relative decision among the three alternative estimators is a common modeling problem. Pesaran et al. (1999) suggested using the Hausman (1978) test for testing the homogeneity of long-run parameters (Erdem et al., 2010, Gülerand Özyurt, 2011).

Pooled Mean Group (PMG) model

PMG is particularly useful when there are reasons to expect that the long-run equilibrium relationship between the variables is similar across countries or, at least, a sub-set of them. The short-run adjustment is allowed to be country-specific, due to the widely different impact of the vulnerability to financial crises and external shocks, and stabilization policies. However, several requirements are needed to be fulfill such as the validity, consistency, and efficiency of this methodology. First, the existence of a long-run relationship among the variables of interest requires the coefficient on the error– correction term to be negative and not lower than -2. Second, an important assumption for the consistency of the ARDL model is that the resulting residual of the error-correction model be serially uncorrelated and the explanatory variables can be treated as exogenous. Such conditions can be fulfilled by including the ARDL (p,q) lags for the dependent (p) and independent variables (q) in error correction form. Third, the relative size of T and N is crucial, since when both of them are large this allows us to use the dynamic panel technique, which helps to avoid the bias in the average estimators and resolves the issue of heterogeneity. Eberhardt and Teal (2010) argue that the treatment of heterogeneity is central to understanding the growth process. Therefore, failing to fulfill these conditions will produce inconsistent estimation in PMG. The PMG estimator constrains the long-term coefficients to be the same across countries and allows only the short-term coefficients to vary.

The dynamic form of the mean group estimators is presented in the form of the self regression pattern with panel ARDL distributional delays (p, q1, q2, …, qN). The mathematical equation of the panel ARDL pattern by assuming the period t = 1, 2, 3 … T, and in the form of groups i = 1, 2, 3 … N, are in the form of equation:

$$Y_{i,t} = \sum_{j=1}^{p} \lambda_{ij} Y_{i,t-j} + \sum_{j=0}^{q} \delta'_{ij} X_{i,t-j} + \mu_i + \varepsilon_{i,t} \qquad (10)$$

where y denotes the dependent variable; X is the vector of explanatory variables; μ is the fixed effects and ε is the disturbing component. In this study, two estimators PMG and MG are used to estimate the equation (1). The estimation method PMG is placed in a position between the MG method and the classical method of fixed effects. In the PMG estimation method, only the long-term coefficients must be equal between countries (or groups), while short-term coefficients are allowed to change. The choice between estimator MG and PMG is done by Hausman test. In this research, the hypothesis of zero and vice versa for the Hausman test is as follows: H0: the long-term coefficients are homogeneous and can be combined (PMG method efficiency) and H1: the long term coefficients that are non-homogeneous and are not combinable (efficiency of MG estimator).

The error- correction form of the PMG model is written as follows:

$$\Delta y_{i,t} = \phi_i \left(y_{i,t-1} - \theta'_i X_{it} \right) + \sum_{j=1}^{p-1} \lambda_{ij}^{*} \Delta y_{i,t-1} + \sum_{j=0}^{q-1} \delta'^{*}_{ij} \Delta X_{i,t-j} + \mu_i + \epsilon_{i,t} \qquad (11)$$

The parameter ϕ_i is the error-correcting speed of adjustment term. If ϕ_i= 0, then there would be no evidence for a long-run relationship. This parameter is expected to significantly negative under the prior assumption that the variables show a return to a long-run equilibrium. Of particular importance is the vector θ'_i, which contains the long-run relationships between the variables.

Mean Group (MG) estimator

Pesaran and Smith (1995) introduced the MG for estimating separate regressions for each country and calculating the coefficients as unweight means of the estimated coefficients for the individual countries. This does not impose any restrictions. It allows for all coefficients to vary and be heterogeneous in the long-run and short-run. However, the necessary condition for the consistency and validity of this approach is to have a sufficiently large time-series dimension of the data. The cross-country dimension should also be large. Additionally, for small N the average estimators (MG) in this approach are quite sensitive to outliers and small model permutations (Favara, 2003).

Dynamic Fixed Effects (DFE) model

The dynamic fixed effects estimator (DFE) is very similar to the PMG estimator and imposes restrictions on the slope coefficient and error variances to be equal across all countries in the long run. The DFE model further restricts the speed of adjustment coefficient and the short-run coefficient to be equal. However, the model features country- specific intercepts. DFE has cluster option to estimate intra-group correlation with the standard error (Blackburne and Frank, 2007). Nevertheless, Baltagi, Griffin and Xiong (2000) point out that this model is subject to a simultaneous equation bias due to the endogeneity between the error term and the lagged dependent variable in case of small sample size.

6. RESULTS AND DISCUSSION

The following table shows the summary statistics of the variables used in the analysis.

Table 2: Summary statistics of the variables

Variable	Observations	Mean	Std. Dev.	Min	Max
Import volumes (impvol)	268	204.12	25.438	7.632	643.753
Real Effective Exchange Rate (reer)	288	42.894	27.587	7.05	135.856
Population growth (popgrowth)	288	2.035	1.326	-3.110	7.555
GDP growth (gdpgrowth)	242	5.673	3.618	-8.124	28.696
Age dependency ratio (adr)	288	75.786	16.384	46.903	103.254
Productivity (prod)	222	59.582	20.581	27.089	105.525
Net foreign Assets (nfa)	252	1.249	2.155	-6.008	17.289
Trade openness (tradeopen)	266	66.662	55.348	12.008	375.378
Terms of Trade (ttrade)	206	101.180	22.117	56.466	162.261
Broad money (m2)	261	42.486	15.581	14.057	98.281

Table 3: Unit root test results (with individual intercept and trend under first difference)

Variable	IPS		PP-Fisher		Fisher-Dfuller	
Natural logarithm	No trend statistic	Trend statistics	No trend statistic	Trend statistics	No trend statistic	Trend statistics
Import volumes	-2.42**	-6.39**	120.13**	152.12**	129.31**	137.19**
Real Effective Exchange Rate	-1.43**	-6.41**	98.34**	122.67**	64.53**	66.42**

Population growth	-7.65**	-9.05**	63.98**	61.34**	66.90**	56.96**
GDP growth	-2.35**	-5.42**	132.91**	142.39**	124.59**	125.93**
Age dependency ratio	-2.98**	-3.24**	35.67**	41.90**	52.97**	57.78**
Productivity	-1.87**	-4.43**	43.07**	45.61**	47.87**	50.72**
Net foreign Assets	-1.54**	-7.09**	49.53**	50.62**	82.39**	84.53**
Trade openness	-3.32**	-3.29**	29.80**	29.42**	34.78**	29.74**
Terms of Trade	-4.31**	-4.76**	67.42**	70.82**	72.25**	70.72**
Broad money	-0.24**	-2.02**	165.90**	166.42**	159.73**	160.94**
All variables in the above are converted to logarithm form. ** indicates that the variables are stationary at 5% level.						

Table 3 presents the test of unit roots of the variables. Accordingly, all first differenced variables are stationary at 5% level. A variety of panel unit root tests were used to test the stationarity of the data. Particularly, Im, Pesaran and Shin (2003) [IPS], PP-Fisher and Fisher-Dfuller. All these tests are considered first generation panel unit root tests because they assumed the independence between cross section units. From Tables 3, we can conclude that all variables under the first difference are significant as shown above, so that we could use the panel ARDL model. This finding is reduced from the conclusions drawn from the majority of panel unit root tests.

Table 4: Results of Pedroni's (2004) cointegration test

	Statistics	Probabilities
Panel v-Statistics	-0.411	0.980
Panel rho-Statistics	0.814	0.761
Panel PP-Statistics	-1.297*	0.071
Panel ADF-Statistics	-1.751**	0.029
Group rho-Statistics	1.544	0.543
Group PP-Statistics	-1.694*	0.061
Group ADF-Statistics	-2.432***	0.000
***, **, * denote respectively significant at 1%, 5% and 10% respectively.		

Table 4 reports the results of Pedroni's (2004) cointegration test. Out of seven statistics four indicators were significant. Those indicate the rejection of the no cointegration null hypothesis. In these three statistics, it is found the panel ADF and group ADF statistics, considered as the more reliable statistics by Pedroni (2004). In these results, the null hypothesis of no cointegration is rejected at 5% level and 10% level by the panel-ADF statistic while the group-ADF statistic rejects this null hypothesis at 1% level. Therefore, the evidence on cointegration is consistent with country-specific and multi-country studies engaged in the literature. Some of these studies have employed the VECM and it is apparent that the underlying methodology is contingent on the presence of cointegration, which reasonably infer that the documented country-specific evidence of cointegration may well be extended to regional levels for broader policy implications. Having cointegration relationship, the panel data structure is used to estimate the panel ARDL model. In comparison with the results of unit root and cointegration method, Panel ARDL method will cater the needs for understanding the relationship between the current account balance and real effective exchange rate.

Table 5: PMG, MG and DFE estimation Results

Dependent Variable: Import volumes	Pool Mean Group (PMG)	Mean Group (MG)	Dynamic Fixed Effect (DFE)

Long run dynamic			
Real Effective Exchange Rate	-0.073*** (-3.67)	-0.281** (-2.99)	-0.620** (-2.84)
GDP growth	0.742***(3.76)	0.240***(3.52)	0.434**(2.48)
Population growth	0.255 (0.27)	0.327 (0.28)	0.235(0.66)
Age dependency ratio	0.332 (1.52)	0.465 (0.74)	1.226(0.94)
Productivity	0.247**(3.22)	0.701** (3.21)	0.371**(2.92)
Net foreign assets	0.201 (0.24)	0.692**(2.98)	0.429**(2.77)
Trade openness	0.225**(3.61)	0.744**(2.37)	0.264**(3.41)
Terms of trade	0.524 (1.08)	0.671*(0.98)	0.808**(3.31)
Broad money	0.341**(3.71)	-0.346**(-2.36)	-0.210**(-1.46)
Short run dynamic			
EC	-0.483*** (-3.97)	-1.173***(-4.73)	-0. 458***(-5.02)
D.Real effective exchange rate	0. 804**(2.99)	0.824** (-2.69)	0.042**(3.41)
D.GDP growth	0.290**(3.94)	0.735 (1.31)	0.545 (0.89)
D.Population growth	0.321 (0.46)	0.212 (0.47)	0.718 (1.55)
D.Age dependency ratio	0.352(2.01)	0.422(0.67)	0.168 (0.79)
D.Productivity	0.611**(2.92)	0.214**(2.78)	0.321**(2.49)
D.Net foreign Assets	0.437 (0.44)	0.128**(2.45)	0.525** (2.88)
D.Trade openness	0.726**(2.38)	0.126 (0.95)	0.812** (3.33)
D.Terms of Trade	-0.483** (-3.21)	-0.252 (-0.69)	0.070 (0.24)
D.Broad money	0.111 (0.36)	0.721*(2.22)	0.630*(1.78)
Constant	-12.620(-1.71)	26.812 (0.77)	12.290 (1.41)
No. of observations	189	189	189
No of groups	8	8	8
Hausman Test Statistics		3.44	2.83
***, **, * denote respectively significant at 1%, 5% and 10% respectively. Log values of the variables are considered; D. means first difference; t values are in parenthesis			

According to PMG. MG and DFE estimators in Table 5, real effective exchange rate has a positive and significant impact on current account balance in the long run. In short run, PMG and MG revealed a negative significant relationship in real effective exchange rate against the current account balance, where as DFE estimator suggests significant and positive impact of real effective exchange rate on current account deficit. In all three models, error correction term is negative and significant at 1%. The result of such analysis indicates that the error-correction coefficient $\phi_i$is negative and significant and fall within the dynamically stable range for PMG, MG and DFE estimators. This indicates that there exists a long-run relationship between the variables of concern. Moreover, this also gives evidences of mean reversion to a non-spurious long-run relationship and therefore stationary residuals, meaning the variables are cointegrated.

The Hausman test is performed to select the robust model out of PMG, MG and DEF. The two tables are presenting the Hausman test statistics (see Annex). According to the test results, the best model for the analysis is PMG. The Hausman test results accept the null hypothesis of homogeneity restrictions on the long-run regressors, which indicates that PMG is a more efficient estimator than MG or DFE.

6.1 Long run estimates:

PMG model in the balance of payment constrained growth shows Real Effective Exchange Rate, GDP growth, Productivity, Trade openness and Broad money are significantly affected the import volume. Next, the MG model reveled that Real Effective Exchange Rate, GDP growth, Productivity, Net foreign assets, Trade openness and Broad money are significant determinants. Meanwhile, DEF model predicts Real effective exchange rate, GDP growth, Productivity, Net foreign assets, Trade openness, Terms of trade, and Broad money are significant predictors of import volumes in the long run. Regarding the long-run coefficient of PMG, 1% increase in Real effective exchange rate, GDP growth, Productivity, Trade openness, and Broad money have -0.073%, 0.742%, 0.247%, 0.225% and 0.341% positive contribution respectively to the growth of current account. In term of the magnitude of effects, GDP growth exerts greater influence on current account, followed by productivity and terms of trade. The percentage increase in exchange rate was negative and not high while real effective exchange rate decreases.

6.2 Short run estimates:

In short run, PMG predicts negatively significant error correction, and positively significant real effective exchange rate, GDP growth, productivity, terms of trade and trade openness. MG revealed a negative and significant error correction term, and significantly positive real effective exchange rate, productivity and net foreign assets. DFE shows a significantly negative relationship in error correction. Further it has a positive relationship with real effective exchange rate, productivity, net foreign assets and trade openness. As for the short-term error correction coefficient, the constant is statistically significant in both PMG and DFE models meaning that there is fixed effect of these variables on the growth of current account balance. Real effective exchange rate exerts positive short run impact on current account balance in the two models. This indicates that the error correction forces the short run coefficient to proceed to its long run path.

6.3 Equilibrium exchange rates and misalignment

Total misalignment of the real effective exchange rate is calculated using BEER model as follows.

Table 6: Panel DOLS Estimation of the BEER model

Variable	All countries	All countries
Net Foreign Assets	0.112*** (5.32)	0.246**(3.42)
Productivity	0.562*** (9.02)	0.428**(2.98)
Constant	-0.750 (0.52)	-0.828 (1.02)
Adjusted R2	0.43	0.47
No. of countries	8	8
Time effects	No	Yes

Equations estimated with a Panel DOLS estimator; t-rations in brackets. ***, **, * denote respectively significant at 1%, 5% and 10% respectively.

Equilibrium exchange rate values are estimated as in Table 6 to drive currency misalignment relying on the BEER approach (MacDonald, 1997; Clark and MacDonald, 1998). Based on the Alberola et al. (1999) and Bénassy-Quéré et al. (2009, 2011), a simple stock-flow model and express the real effective exchange rate (*reer,* in logarithms) as a function of the net foreign asset [nfa] (in percentage of GDP) and a proxy for relative productivity given by the variable [prod]:

$$reer_{i,t} = \lambda_i + \gamma prod_{i,t} + \delta nfa_{i,t} + u_{i,t} \quad (12)$$

$u_{i,t}$ being and i.i.d. error term, and λ_i accounting for country-fixed effects. the equilibrium value of the real effective exchange rate is given by the estimation of long-term, cointegrating relationship (5). The OLS estimates being biased and dependent on nuisance parameters, the Dynamic OLS (DOLS) method introduced by Kao and Chiang (2000) and Mark and Sul (2003) in the context of panel cointegration is applied. The DOLS procedure consists in augmenting the cointegrating relationship with lead and lagged differences of the regressors to control for the endogenous feedback effect.

$$reer_{i.t}^{est} = \lambda_i + 0.428\, prod_{i,t} + 0.246\, nfa_{i,t} + u_{i,t} \quad (13)$$

A rise in the relative productivity as well as in the net foreign assets leads to an exchange-rate appreciation. In addition, both those explanatory variables are significant at conventional levels.

Then the corresponding currency misalignments are given by:

$$Mis_{i,t} = reer_{i,t} - reer_{i.t}^{est}$$

Where a positive (resp. negative) sign refers to an overvaluation (resp. undervaluation).

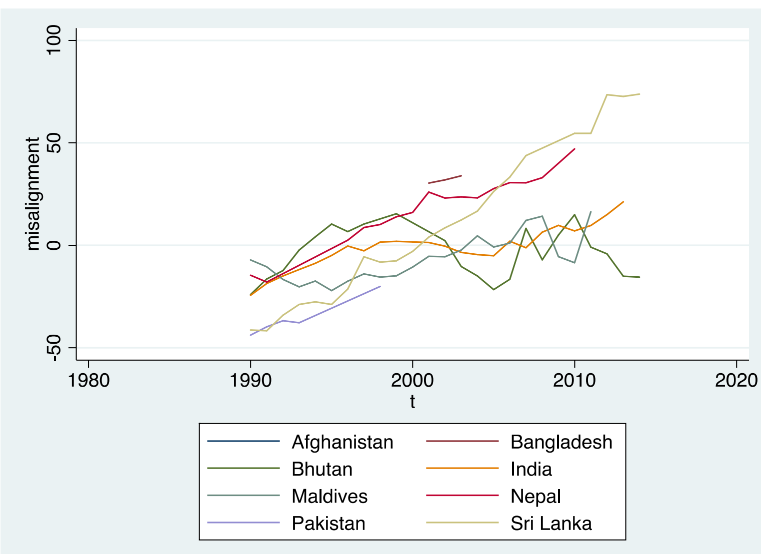

Figure: Total misalignment of eight South Asian countries

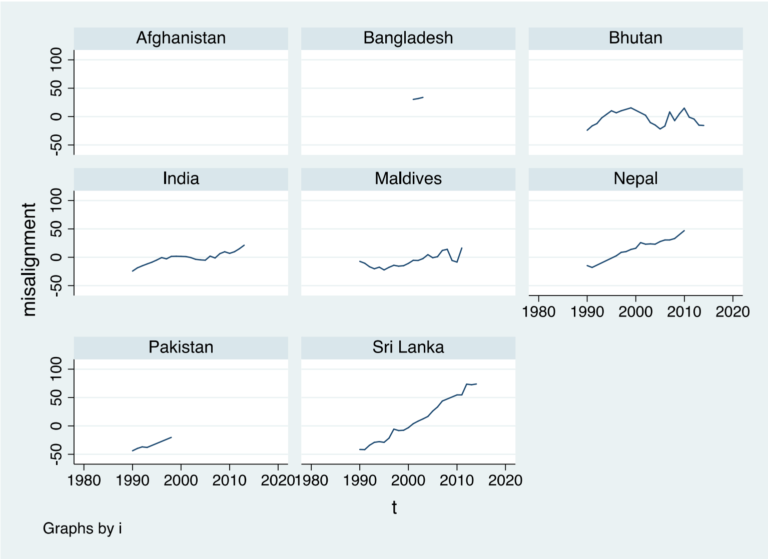

Figure: Total misalignment of eight South Asian countries

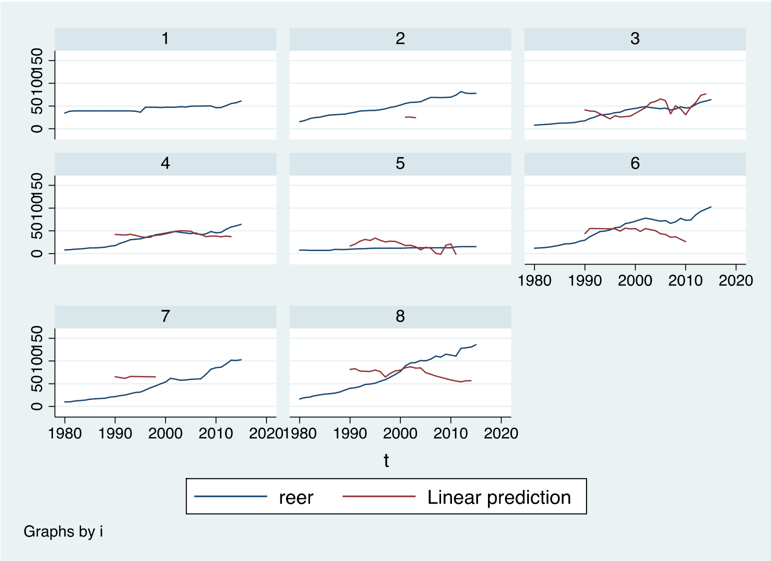

Figure: Linear prediction of total misalignment vs. actual values of real effective exchange rate

7. CONCLUSION

The study examined the effect of movement of real effective exchange rate on the current account balance in South Asia. The investigation was conducted through an extensive review of the relevant theoretical models and empirical literature. The study uses empirical model includes Panel ARDL estimation. The results revealed that all first differenced variables are stationary resulted from various panel unit root tests. General results of Pedroni's (2004) cointegration test predict that evidence on cointegration is consistent with country-specific effects. Considering cointegration relationship, the panel data structure is used to estimate the panel ARDL model.

PMG, MG and DFE estimators were applied; real effective exchange rate has a positive and significant impact on current account balance in the long run. In all three models, error correction term is negative and significant at 1% indicating that a long-run relationship exists between the variables of concern. Hausman test is performed to select the robust model out of PMG, MG and DEF; the best model for the analysis is PMG, which shows Real effective exchange rate, GDP growth, Productivity, Trade openness, Terms of trade, and Broad money are significantly affected the current account deficit. Further, regarding the long-run coefficient of PMG, 1% increase in Real effective exchange rate, GDP growth, Productivity, Trade openness, and Broad money have -0.073%, 0.742%, 0.247%, 0.225% and 0.341% positive contribution respectively to the growth of current account.

In short run, PMG predicts negatively significant error correction, and real effective exchange rate while positive productivity and trade openness. Real effective exchange rate exert negative short run impact on current account balance in the two models. This indicates that the error correction forces the short run coefficient to proceed to its long run path. Equilibrium exchange rate values are estimated to drive currency misalignment relying on the BEER approach. The presence of a long-run relationship between the current account balance (CAB) and its determinants found in this study implies the effectiveness of targeting one of the variables in influencing the long run behavior of other variables by policy makers.

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ANNEX

Table 9: PMG estimation results for individual countries

Dependent Variable: Current Account Balance	Afghanistan	Bangladesh	Bhutan	India
Long run dynamic				
Real Effective Exchange Rate	-0.122***(-3.21)	-0.122***(-3.21)	-0.122***(-3.21)	-0.122***(-3.21)
Population growth	-0.273 (-0.72)	-0.273 (-0.72)	-0.273 (-0.72)	-0.273 (-0.72)
GDP growth	0.153***(3.95)	0.153***(3.95)	0.153***(3.95)	0.153***(3.95)
Age dependency ratio	0.143(0.92)	0.143(0.92)	0.143(0.92)	0.143(0.92)
Productivity	0.555**(2.90)	0.555**(2.90)	0.555**(2.90)	0.555**(2.90)
Net foreign assets	0.312**(2.91)	0.312**(2.91)	0.312**(2.91)	0.312**(2.91)
Trade openness	0.592(1.51)	0.592(1.51)	0.592(1.51)	0.592(1.51)
Terms of Trade	0.062** (2.53)	0.062** (2.53)	0.062** (2.53)	0.062** (2.53)
Broad money	0.021**(2.29)	0.021**(2.29)	0.021**(2.29)	0.021**(2.29)
Short run dynamic				
EC	-0.492***(-4.18)	-0.118***(-4.42)	-0.124**(-3.02)	-0.093(-1.02)
D. Real Effective Exchange Rate	-0.120***(-3.88)	-0.019 (-1.62)	0.031(0.73)	0.131*(1.42)
D.Population growth	-0.545***(-3.23)	-3.037(-2.30)	-5.40(-1.23)	3.245(0.99)
D.GDP growth	0.290***(3.38)	-0.221***(-3.83)	0.411(0.92)	-0.512(-1.12)
D.Age dependency ratio	0.437(0.42)	0.139(1.00)	0.643(1.89)	0.371(0.32)
D.Productivity	0.248**(2.51)	0.463(1.22)	0.428(1.29)	0.347(1.82)
D.Net foreign Assets	0.243(0.92)	0.213(0.99)	0.476**(2.98)	0.496**(2.91)
D.Trade openness	0.212**(2.90)	0.527**(2.26)	0.460(0.75)	0.132**(3.67)
D.Terms of Trade	-0.885**(3.35)	-0.241**(-2.77)	-2.31(-0.34)	0.125(1.82)
D.Broad money	0.172(3.60)	0.925 (1.22)	0.441(0.72)	0.203(1.28)
Constant	12.456***(4.05)	-4.473***(-4.01)	-18.889**(-3.71)	-0.050(-1.09)
No. of observations	189	189	189	189

***, **, * denote respectively significant at 1%, 5% and 10% respectively.

Table 10: PMG estimation Results for individual countries

Dependent Variable: Current Account Balance	Maldives	Nepal	Pakistan	Sri Lanka
Long run dynamic				
Real Effective Exchange Rate	-0.122***(-3.21)	-0.122***(-3.21)	-0.122***(-3.21)	-0.122***(-3.21)
Population growth	-0.273 (-0.72)	-0.273 (-0.72)	-0.273 (-0.72)	-0.273 (-0.72)
GDP growth	0.153***(3.95)	0.153***(3.95)	0.153***(3.95)	0.153***(3.95)
Age dependency ratio	0.143(0.92)	0.143(0.92)	0.143(0.92)	0.143(0.92)
Productivity	0.555**(2.90)	0.555**(2.90)	0.555**(2.90)	0.555**(2.90)
Net foreign Assets	0.312**(2.91)	0.312**(2.91)	0.312**(2.91)	0.312**(2.91)
Trade openness	0.592(1.51)	0.592(1.51)	0.592(1.51)	0.592(1.51)
Terms of Trade	0.062** (2.53)	0.062** (2.53)	0.062** (2.53)	0.062** (2.53)
Broad money	0.021**(2.29)	0.021**(2.29)	0.021**(2.29)	0.021**(2.29)
Short run dynamic				
EC	-0.147*(-2.63)	-0.421***(-10.34)	-0.805***(-2.98)	-0.282**(-2.56)
D. Real Effective Exchange Rate	0.711(0.34)	0.400***(8.09)	-0.290(-2.11)	0.133**(2.36)
D.Population growth	-0.234(-0.24)	-8.015***(-5.52)	-2.294(-1.29)	-1.915*(-1.90)
D.GDP growth	-0.056(-0.43)	-0.131**(-3.00)	0.222*(1.51)	-0.127*(-1.34)
D.Age dependency ratio	0.320(0.30)	0.391(0.12)	0.513(0.10)	0.734(0.71)
D.Productivity	0.810(1.41)	0.158**(2.59)	0.317(1.61)	0.116*(1.17)
D.Net foreign Assets	0.421**(3.16)	0.800(0.48)	0.952(0.96)	0.124(1.00)
D.Trade openness	0.552(1.94)	0.623(0.90)	0.111**(1.94)	0.221*(1.89)
D.Terms of Trade	0.772*(1.90)	0.004(0.02)	0.024(0.04)	0.232***(4.10)
D.Broad money	-0.892(-0.12)	-0.050(-1.96)	-0.025(-0.27)	-0.131(-1.34)
Constant	-9.632(-1.90)	-9.420***(-3.29)	-3.192**(-2.41)	-3.903**(-2.39)
No. of observations	189	189	189	189

***, **, * denote respectively significant at 1%, 5% and 10% respectively.