Is there a Case for Exchange Rate Coordination in South Asia?[1]

Abhijit Sen Gupta[2] Rajeswari Sengupta[3]

Abstract

This paper evaluates the case for greater exchange rate coordination in South Asia. With inter-regional integration in South Asia progressing at a faster pace than the region's integration with the world as well as the economies of South Asia being buffeted by similar external shocks there is a need for greater exchange rate cooperation among the economies of the region, while retaining the flexibility to adjust to external currencies. Using empirical methods, including those that account for structural breaks, we find limited evidence of comovement of South Asian currencies in nominal terms, while the evidence for degree of comovement is slightly stronger in real terms. Much of the divergence in the movement of currencies is derived from the varied exchange rates being pursued in these economies. While India has increasingly moved towards a more flexible exchange rate regime, Bangladesh, Pakistan and Sri Lanka, continue to remain pegged to US Dollar.

JEL Classification: F36, F55, F15
Keywords: Exchange Rate Coordination, Panel Unit Root, Exchange Rate Regimes.

[1] The views expressed in this paper are those of the authors and do not necessarily reflect the views and policies of the Asian Development Bank (ADB) or its Board of Governors or the governments they represent. ADB does not guarantee the accuracy of the data included in this publication and accepts no responsibility for any consequence of their use. By making any designation of or reference to a particular territory or geographic area, or by using the term "country" in this document, ADB does not intend to make any judgments as to the legal or other status of any territory or area.

[2] Economist, India Resident Mission, Asian Development Bank, New Delhi. Email: asengupta@adb.org
[3] Assistant Professor, Indira Gandhi Institute for Development Research, Mumbai. Email: rajeswari@igidr.ac.in

Introduction

Exchange rate coordination among a group of countries poses a number of benefits for economies striving for greater economic integration. Exchange rate coordination reduces the scope of exchange rate misalignment, which may result in loss of competitiveness for a country, possibly leading to an increase in protectionism, which in turn could promote a round of beggar-thy-neighbor devaluations. Large swings in bilateral exchange rates could also influence decisions about the location of new and existing investments. In contrast, greater stability in exchange rates would support investment by increasing price transparency and reducing currency-related hedging costs for companies. Finally, sharp exchange rate movements in one currency could affect another country's ability to maintain a particular exchange rate regime.

Despite the benefits of exchange rate coordination, such coordination continues to be a long-drawn process at the best of times, involving intensive policy dialogue. The creation of the euro was a culmination of more than two decades of deliberations among the member countries. Coming out of the Asian crisis, many pushed for the replication of the euro experiment in Asia. However, the heterogeneity of the Asian countries in terms of their institutional capability and policy frameworks will add to the difficulty of exchange rate coordination, which is already long and arduous.

In this paper we explore the possibility of exchange rate coordination in another region viz. South Asia. The choice of the region is driven by the fact that the region has emerged as one of the fastest growing region in the world, and has substantially raised its trade integration with the world but is characterized by very low levels of intra-regional trade integration. Secondly, the economies of the region have also witnessed significant integration with global capital markets, thereby making it susceptible to the vagaries of global capital flows.

We monitor the extent of exchange rate coordination in the region by proposing a hypothetical South Asian Currency Unit. This is in line with the recommendation made by Eichengreen (2006) to create a “parallel currency”. This would help to monitor the collective movement of the participating currencies against external currencies as well as the movement of the individual currencies compared to the regional benchmark.

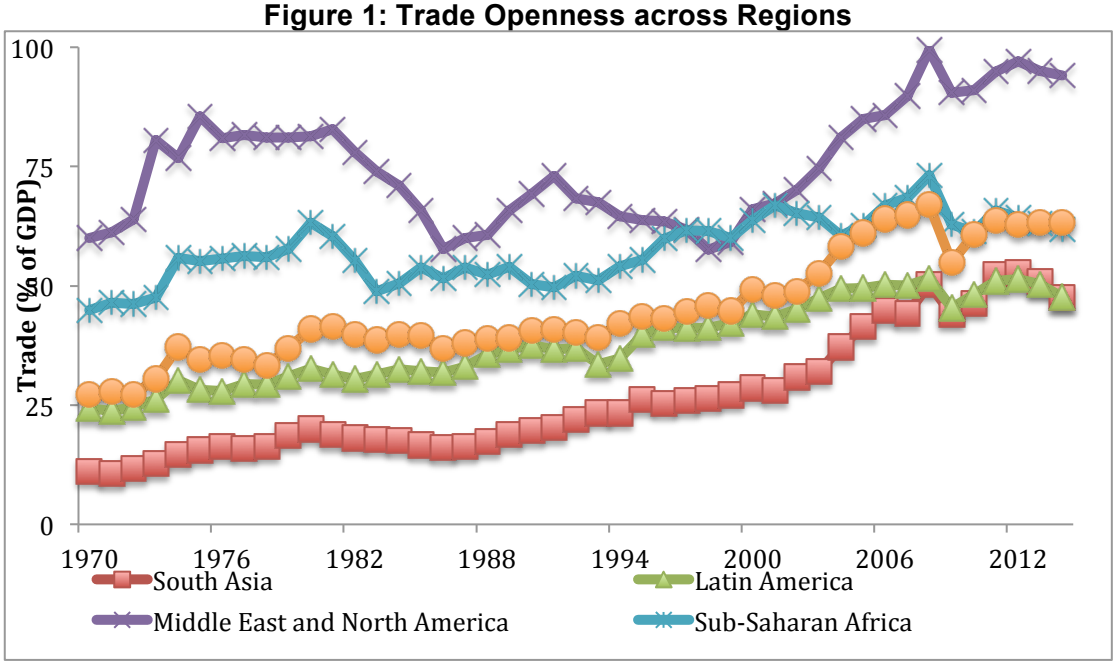
The rest of the paper is structured as follows. Section 2 highlights the recent developments in international trade and global capital flows to the region. Section 3 outlines the creation of a regional benchmark, South Asian Currency Unit, and monitors its evaluation against global numèraire as well as movement of participating currencies against the benchmark in nominal and real terms. In Section 4 we discuss the reasons behind the divergence among the participating currencies, and steps needed for greater coordination. Finally, Section 5 concludes with the main messages of the paper.

2. Trade and Financial Integration in South Asia

2.1 Trade Integration

Historically, South Asia has lagged behind other regions in the world in integration with global markets as it pursued import-substituting policies and put in place restrictive trade and industrial rules. Figure 1 outlines the extent of trade openness, measured as share of trade in GDP across the various regions since 1970ss. South Asia lagged behind not only those of economies of East Asia and Latin America in terms of trade openness, but even those of sub-Saharan Africa and Middle East and North Africa.

Figure 1: Trade Openness across Regions



Source: World Development Indicators 2015, World Bank

Apart from low integration with the rest of the world, intraregional trade among the South Asian economies is also very limited compared to other regions. While in European Union, the share of intra-regional trade in total trade has hovered around 65% since the mid-1990s, in East and Southeast Asia, the share has varied between 20% to 25% and 30% to 35%, respectively. In contrast, intraregional trade share in South Asia has remained below 5.0% through most of this period.

Since the mid-1990s a number of initiatives have been put in place to promote South Asian trade integration. These include a variety of trade pacts at the bilateral and regional levels. In 1995, the South Asian Preferential Trading Arrangement (SAPTA) was initiated to bolster greater integration in the region, and was followed by the South Asian Free Trade Area in 2006. The Trade Liberalization Program of the SAFTA envisages a gradual phase-out of tariffs among member countries over a 10-year period. The member-states agreed to reduce tariffs in two stages. For non-least developed countries tariffs were to be reduced from existing rates to 20% (30% for least developed countries) within two years of the Agreement coming into force. Subsequently, tariffs are to be reduced from 20% or below to less than 5% within 5 years (8 years for least developed countries), beginning from the third year of the Agreement coming into force.

Most South Asian economies progressively reduced their tariff barriers since the mid 1990s under the trade liberalization initiatives as well as in line with the WTO obligations. This resulted in weighted average tariff rate declining from close to 40% in 1998 to 8.6% in 2013. The decline in average tariff rates was associated with an increase in the growth rate of intra-regional trade. While trade growth averaged 13.6% during the 1990s, it increased to 17.9% since 2000. Moreover, a comparison of South Asia's intraregional trade with trade with the world shows that the former registered a higher growth during most of the period, barring the period from 2006 to 2010. Consequently, intra-regional trade share in South Asia more than doubled from 2.7% in 1990 to 5.8% in 2003, although it declined a bit to 4.3% in 2011, before rising to 5.3% in 2014.

Table 1: Evolution of Trade across South Asia

	vis-à-vis South Asia			vis-à-vis World		
	Total Trade	Growth	Share	Total Trade	Growth	Share
1991 to 1995	2.95	20.71	3.65	79.48	10.02	100.00
1996 to 2000	5.46	8.16	4.40	124.40	6.53	100.00
2001 to 2005	11.43	23.48	5.33	212.20	18.42	100.00
2006 to 2010	26.76	15.45	4.87	553.68	18.41	100.00
2011 to 2014	47.95	12.37	4.91	977.31	1.12	100.00

Source: Asian Regional Integration Centre, Asian Development Bank

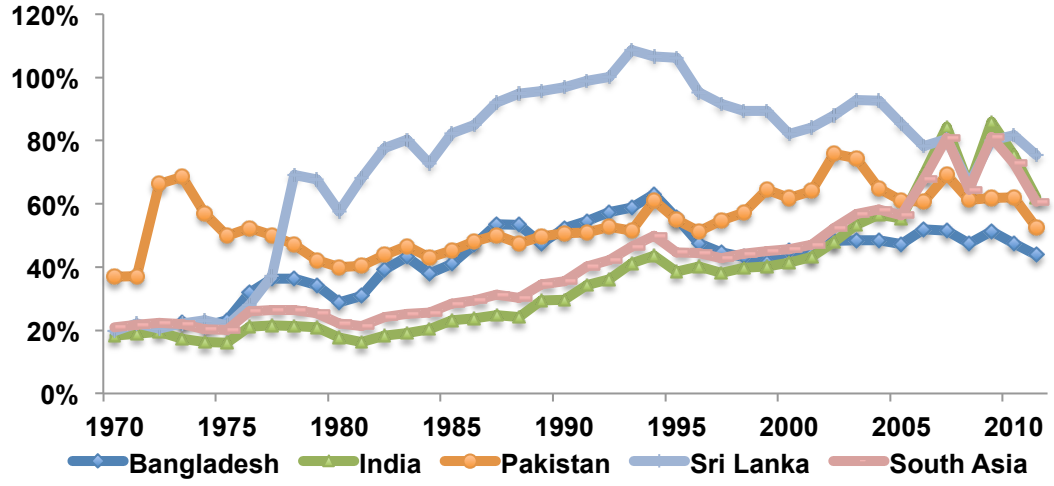
While current initiatives to bolster trade within the region promises to further increase intra-regional trade share in South Asia, greater exchange rate coordination among the currencies of the key economies is likely to provide an additional incentive.

Exchange rate coordination, by mitigating exchange rate volatility, is likely to improve intra-regional trade. Clark (1973) contends that a risk averse firm, facing heightened exchange rate volatility, will reduce exports to partner country, as there is greater uncertainty of future export earnings. The existence of hedging instruments is likely to dampen the negative effect on trade but such instruments unlikely to be available to all the firms in the economies of South Asia, where financial markets are still at a nascent stage of development. Other studies such as Abrahams (1980) and Thursby and Thursby (1987) also document large negative effect of nominal exchange rate variability on trade. A number of studies, including Rose (2000), Engel and Rose (2000) and Frankel and Rose (2002) find that currency unions, by completely eliminating exchange rate variability have a large positive impact on trade.

2.1 Financial Integration and Global Shocks

Apart from the trade benefits, a case for exchange rate coordination also arises from the fact the economies of South Asia have been susceptible to symmetric or similar external shocks in the form of volatile capital flows. Over the last two decades, the region has significantly increased its integration with global capital markets. While there are variations across the major economies, South Asia's financial integration, measured in Lane and Milessi-Ferreti (2007) as the ratio of sum of total foreign assets and total foreign liabilities to GDP, has increased from less than 30% in the late 1980s to over 80% in 2009, before declining to 60% in 2011 (Figure 2).

Figure 2: Financial Openness across South Asian Economies



Source: Lane and Milessi-Ferreti (2007)

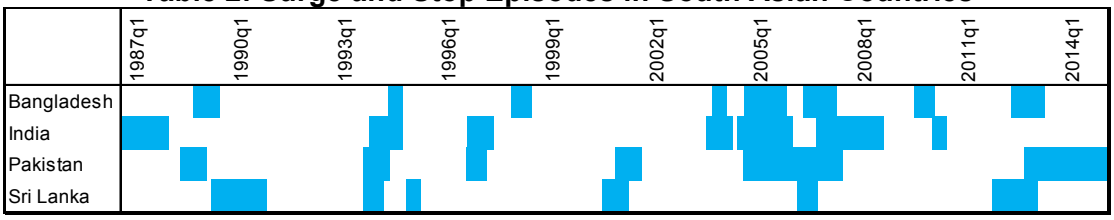
As a result of greater integration, the economies of South Asia have been subject to volatile capital flows. Volatility in the capital inflows has been driven by periods of waves of capital inflows. We use the methodology outlined in Forbes and Warnock (2012) to identify periods of sharp changes in inflows. The primary source of data is the International Monetary Fund's Balance of Payments Statistics (BOPS, accessed through Haver Analytics in November 2015). The period covered is 1987Q1 to 2014Q4. We focus on periods when there has been a sharp increase in the purchase of domestic assets by foreigners, classified as a 'surge', as well as periods that have witnessed an abrupt decline in purchase of such assets or an increase in sale of domestic assets by foreigners.

Computation of surge and stop episodes involve first calculating a four quarter moving sum of gross capital inflows, C_t where

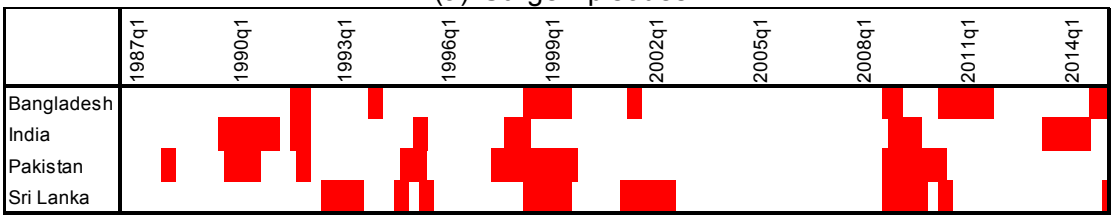
$$C_t = \sum_{i=0}^{3} GINFLOW_{t-i} \quad (1)$$

We then compute the annual year over year changes in C_t, i.e. $\Delta C_t = C_t - C_{t-3}$. Next, we compute the rolling means and standard deviations of ΔC_t over a five-year period. Forbes and Warnock (2014), identify a surge as an episode that starts in the month when ΔC_tincreases more than one standard deviation above its rolling mean. The episode ends once ΔC_t falls below one standard deviation above its rolling mean. Furthermore, for a period to qualify as a surge episode, there must be at least one quarter when ΔC_t increases by a minimum of two standard deviations above its rolling mean. Similarly, a stop episode is defined as the period over which gross capital inflows fall one standard below its rolling mean, and provided it reaches two standard deviations below as some time during the period. We restrict our analysis to four big economies of South Asia, viz. Bangladesh, India, Pakistan and Sri Lanka. Similarly, India experienced seven stop episodes, followed by Pakistan, Bangladesh and Sri Lanka with six, five and four episodes respectively.

Table 2: Surge and Stop Episodes in South Asian Countries



(a) Surge Episodes



(b) Stop Episodes

Note: The shaded areas represent surge and stop episodes of capital inflows
Source: Forbes and Warnock (2014) and Authors' Calculations

Though the number of surge and stop episodes differ across the economies, there are considerable overlap of these episodes. For example, during the period 1993 Q2 to 1994 Q3 all the four South Asian economies experienced quarters with a surge in foreign capital inflows. A similar experience was observed during 1996 Q2 to 1997 Q1, and again between 2005 Q1 and 2007 Q2. Even in the case of stop episodes, there are certain periods of overlap. The earliest such episode occurred in late 1989 and continued till early 1999. Two other such major episodes occurred during the

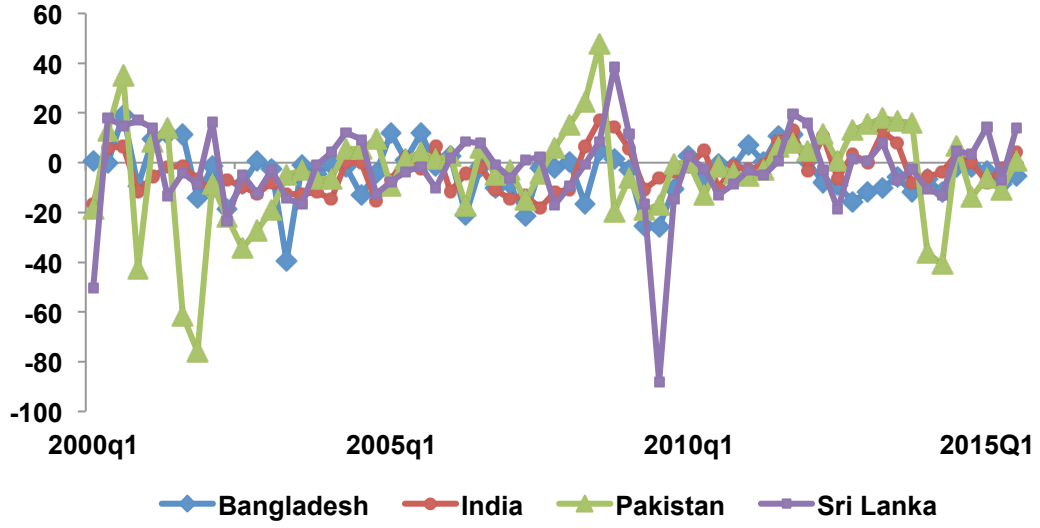
Asian Financial Crisis i.e. 1997 Q4 to 1998 Q4, and during the Global Financial Crisis i.e., 2008 Q2 to 2009 Q4.

The volatility in capital flows along with greater trade integration has resulted in the domestic economy becoming susceptible to global shocks, with the exchange rate coming under pressure because of these shocks. When a country's exchange rate comes under pressure due to excess demand or excess supply of foreign currency, the authorities can allow the market forces to function without intervening and allowing the domestic currency to appreciate or depreciate accordingly. Alternatively, the policymaker can intervene by accumulating or selling of international reserves to mitigate the pressure. In a bid to capture the various aspects of exchange market pressure (EMP) we follow the concept pioneered by Girton and Roper (1977), and applied frequently in the analysis of emerging market economies (Frankel, 2009). A positive (negative) EMP indicates a net excess demand (supply) for foreign currency, accompanied by a combination of reserve loss (gain) and currency depreciation (appreciation).

$$EMPI_t = \Delta\varepsilon_t - \Delta IR_t \qquad (2)$$

where $\Delta\varepsilon_t$ is the percentage change in exchange rate and ΔIR_t is the percentage change in international reserves. Figure 3 outlines the evolution of EMPI across the four South Asian Economies. While all the four economies witnessed considerable volatility in the EMPI over time, there has been some degree of convergence in recent years, with standard deviation of the EMPIs across the countries witnessing a decline since 2009. Again, this points to the four South Asian economies facing symmetric pressures in the exchange market in recent years.

Figure 3: Exchange Market Pressure Indices across South Asia



Source: International Financial Statistics, International Monetary Fund

Thus greater trade integration within South Asia, along with symmetric flow of foreign capital into these economies and these economies being subject to similar exchange market pressure bolsters the case of enhanced exchange rate coordination among the Asian economies. In the sections below we evaluate whether the South Asian economies have made any progress towards exchange rate coordination.

3. A Case for Exchange Rate Coordination using A South Asian Currency Unit

3.1 Proposing a South Asian Currency Unit

A key issue in the formulation of any regional currency unit is the inclusion of participating currencies. Existing studies on East Asian economies such as Ogawa and Shimizu (2005), Ogawa and Yoshimi (2008) and Wyplosz (2010) have focused on the currencies of the ASEAN+3 countries. Sen Gupta (2015) expands the set of participating countries to include Hong Kong, China; and India, arguing that Hong Kong, China has already established close trade and financial links with other East Asian economies and has been a part of a number of regional initiatives, and India is expected to be among the top three economies of the region in the near future and witnessed significant increase in trade with East Asia during the last decade.

South Asia covers the eight economies of Afghanistan, Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka. Given that Nepal and Bhutan have their currency pegged to the Indian Rupee, the movement of these currencies, vis-à-vis the regional benchmark would be identical to the Indian Rupee. As a result we drop these currencies, while constructing the SACU. We also drop currencies from Afghanistan and Maldives, given the limited availability of data on monthly inflation rates, needed to calculate real exchange rate of these economies. Hence, we focus on Bangladesh, India, Pakistan and Sri Lanka. Together, these four economies account for 98.5% of GDP in purchasing power parity terms, 82% of trade within South Asia, and 98% of trade with the rest of the world.

Next, we assign weights to the various participating currencies. The economic indicators on which these weights would be based reflect both the current and the potential size of the economy, and the extent to which the country will use the regional currency unit. Hence, we base our weights on the individual country's share in the regional gross domestic product (GDP) measured at purchasing power parity and intraregional trade. While GDP measured at purchasing power parity is an indicator of the potential size of the economy, trade based weights provide an indication about the extent to which participating currencies could employ the SACU. Based on these criteria we assign weights of 20.6% to Bangladesh, 38.9% to India, 21.3% to Pakistan

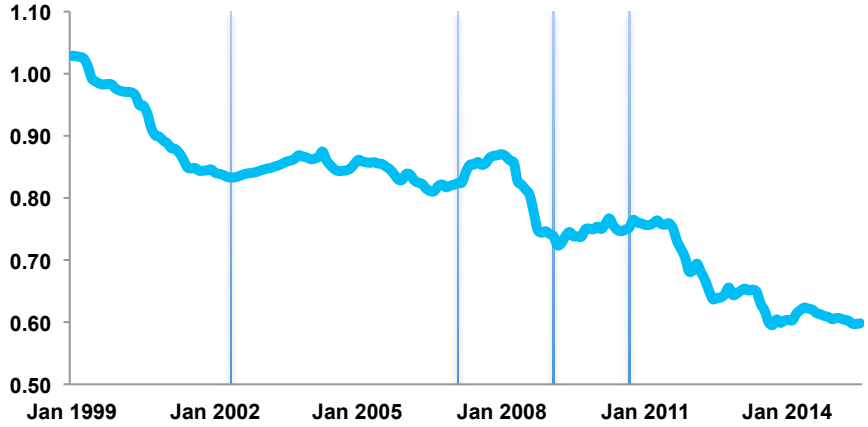
We also need to identify the base period, i.e. a period when deviations among macroeconomic indicators are least, to evaluate the collective movement of the participating currencies against the numèraire currency and the relative movement of these currencies against the SACU. The rationale being members attempting to coordinate their exchange rates need to follow a coherent set of domestic policies. To analyze external and internal stability we focus on government deficits, government debt, inflation rates, exchange rates, and long-term interest rates and current account deficits and find that the divergence among these indicators was least in 1999, and take it as the base period.

We chose the United States Dollar as the reserve currency given that the United States continues to be the dominant trade partner for most of the economies and most of the capital account transactions continue to be invoiced in US Dollars. It is assumed that 1 unit of the SACU is equivalent to 1 unit of the numèraire currency basket in the base period. Briefly, the value of the South Asian Currency Unit in terms of the numèraire currency basket is given as

$$\varepsilon_{SACU,t}^{Num} = \sum_i \omega_i \varepsilon_{i,t}^{Num} \quad (3)$$

where $\varepsilon_{SACU,t}^{Num}$ is the value of the SACU in terms of the numèraire basket at time t, ω_i is the weight of currency i and $\varepsilon_{i,t}^{Num}$ is the value of currency i relative to the currency basket at time t.

Figure 3: Movement of the South Asian Currency Unit vis-à-vis the Numèraire Currency



Source: International Financial Statistics and Authors' Calculations

Figure 3 shows that the SACU depreciated against the US Dollar by about 40% between 1999 and 2015. However, the SACU did not weaken in a monotonic manner. Using the methodology outlined in Bai and Perron (2003) we are able to identify 4 structural breaks in the value of SACU between 1999 and 2015. In the first phase i.e. between Jan 1999 and May 2002, the SACU weakened by almost 15%, with Sri Lankan Rupee depreciating the most, followed by Pakistani Rupee and Bangladeshi Taka. The second phase, between June 2002 and May 2007 was a period of relative stability. Among the constituents, while the Bangladeshi, Taka and Sri Lankan Rupee continued to depreciate, the Pakistani Rupee was stable, while the Indian Rupee appreciated by around 20%. In the third phase, which continued till March 2009 and covered the Global Financial Crisis, after an initial short period of appreciation, the SACU weakened considerably, losing around 15% of its value. Interestingly, the Bangladeshi Taka and Sri Lankan Rupee remained relatively stable during this period while Indian and the Pakistani Rupee depreciated considerably.

The post-Crisis period saw central banks in the developed countries not only cut policy interest rates down to or near zero to restore the functioning of financial markets and provide further stimulus but also implemented unconventional monetary policies including various liquidity provision measures and asset purchases. This accommodative monetary policy in developed economies, a global search for yield, and stronger growth prospects in emerging economies led to a revival of capital flows to some of the South Asian economies, and consequent strengthening of currencies. In particular, the Indian Rupee and the Sri Lankan Rupee strengthened by 7.0% and 1.3% respectively, while the Bangladeshi Taka and Pakistani Rupee depreciated by 1.1% and 7.3%.

However, from September 2010 onwards, a number of factors such as European Debt Crisis and Taper Talk again resulted in reversal of capital flows to emerging economies, and the economies of South Asia were not immune to this phenomenon.

This led to weakening of all the four currencies, with the Indian Rupee weakening the most, followed by Sri Lankan Rupee and Pakistani Rupee. The Bangladeshi taka remained relatively stable.

3.2 Deviation of Participating Currencies from South Asian Currency Unit

The regional currency unit would allow one to evaluate the performance of the individual participating currencies vis-à-vis the regional currency unit. To monitor the movement of the participating currencies we use the following arbitrage condition

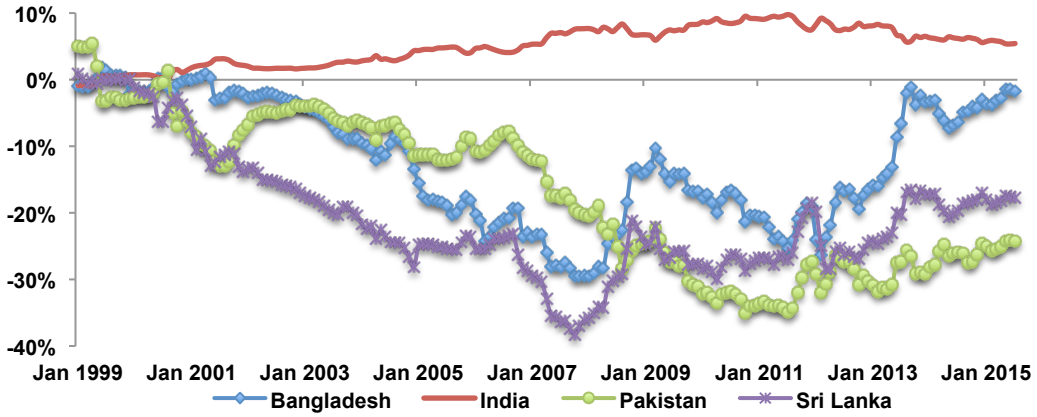
$$\varepsilon_{i,t}^{SACU} = \varepsilon_{i,t}^{Num}\varepsilon_{Num,t}^{SACU} \tag{4}$$

Thus the product of the bilateral exchange rate between the currency and numèraire currency, and the value of the numèraire currency in terms of the SACU provides us the value of the participating currency in terms of the SACU. We then evaluate the deviation of the individual participating currencies from SACU according to

$$D_{i,t} = \frac{\varepsilon_{i,t}^{SACU} - \varepsilon_{i,0}^{SACU}}{\varepsilon_{i,0}^{SACU}} \tag{5}$$

The percent deviation $D_{i,t}$ is defined as with $\varepsilon_{i,0}^{SACU}$ being the value of the ith currency in terms of the ACU in the base period.

Figure 4: Nominal Deviation of the Participating Currencies vis-à-vis the South Asian Currency Unit



Source: International Financial Statistics and Authors' Calculations

Figure 4 traces the percentage deviation of the participating currencies vis-à-vis the ACU. It is clearly evident that there is great deal of divergence in the performance of the individual South Asian currencies, against the regional benchmark. The Indian Rupee strengthened against the SACU till April 2011, after which it weakened a bit, resulting in the Indian Rupee gaining 5.4% in value against the SACU, compared to the base year period. However, the larger weight accorded to Indian Rupee in construction of the SACU meant that Indian Rupee was relatively stable against the SACU.

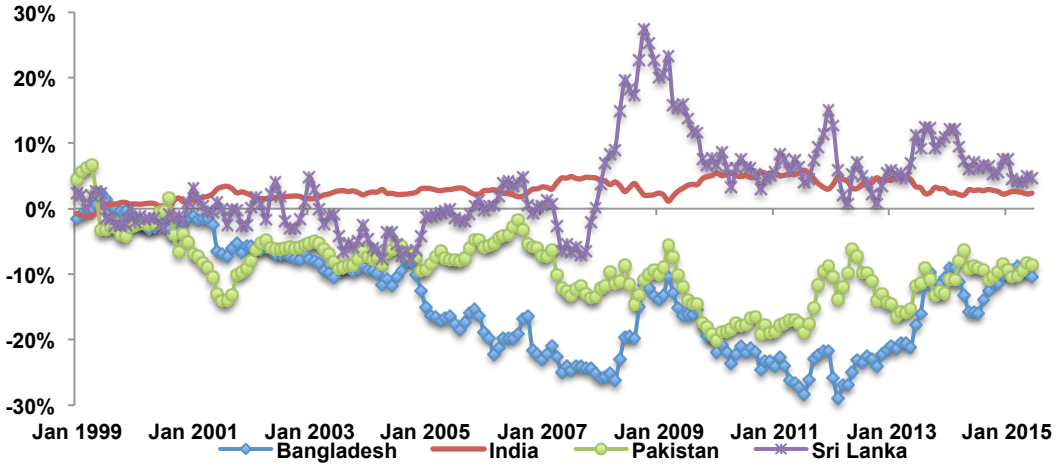
In contrast, both Bangladeshi Taka and Sri Lankan Rupee steadily weakened against the SACU from the base period to about September 2007. They strengthened a bit over the subsequent year, but started weakening again from the beginning of 2009 as Global Financial Crisis spread to South Asia. This continued till mid-2011, after which the currencies strengthened considerably. While the value of the Bangladeshi Taka against the regional benchmark, had almost recovered to its base year value by mid-2015, Sri Lankan Rupee was around 17.5% weaker. On the other hand, the Pakistani Rupee weakened by 35% between January 1999 and July 2011, against the regional benchmark, compared to its base year value. Though, it strengthened somewhat in the subsequent period, it still ended up being 25% weaker.

At times large deviations in nominal exchange rate movements could be driven by different inflation rates prevailing in these economies. Many countries aspire to have a stable real exchange rate to protect their trade competitiveness, and in such instances movements in nominal exchange rate are used to compensate for changes in price level. To evaluate this, we focus on the real exchange rates, and deviation of real exchange rates from the regional benchmark. The real exchange rate is defined as:

$$\theta_{i,t}^{SACU} = \varepsilon_{i,t}^{SACU} \frac{P_t^{SACU}}{P_t^i} \quad (6)$$

where $\theta_{i,t}^{SACU}$ is the real exchange rate, P_t^{SACU} is the weighted average price level for the region, and P_t^i is the price in country i. The extent of real exchange rate deviation is calculated using the deviation in the nominal exchange rates and deviation in consumer price inflation indices. To obtain the inflation for the ACU region, we construct a weighted average of the CPI for the region with the weights being similar to the ones used for construction of the SACU. Since CPI data are available at a monthly frequency the real exchange rate deviation indicators are constructed at a monthly frequency.

Figure 5: Real Deviation of the Participating Currencies vis-à-vis the South Asian Currency Unit



Source: International Financial Statistics and Authors' Calculations

Figure 5 shows that the extent of real exchange rate deviations, which take into account inflation differentials, are considerably different from the nominal exchange rate deviations. The disparities in real exchange rate deviations are considerably smaller than in the case of nominal exchange rate. Sri Lankan Rupee, which had depreciated strongly in nominal terms, witnessed a strengthening trend due to higher

inflation rates in Sri Lanka being considerably higher than average inflation rates in the region. The appreciating trend of the Indian Rupee in nominal terms is also evident in the case of real exchange rates, although the extent of deviation is slightly lower. This is again driven by the fact that inflation rates in India were lower than the region.

The extent of weakening of Bangladeshi Taka compared to regional benchmark is higher in case of real terms, compared to nominal terms. This is again driven by the fact inflation in Bangladesh was considerably lower than the regional average. The opposite was witnessed in the case of Pakistan, where Pakistani Rupee's depreciation was lower in real terms as inflation rates in Pakistan tended to be higher.

3.3 Empirical Estimates of Coordination among South Asian Currencies

To empirically check the extent of convergence among the major currencies of South Asia, we apply the unit root test to examine whether the difference is stationary. The rejection of the unit root hypothesis implies that the time series is stationary and will converge in the long run. However, if these tests fail to reject the hypothesis then the series follows a random path.

To evaluate the extent of nominal and real convergence among participating currencies we employ both the Augmented Dickey Fuller (ADF) and the Phillips-Perron test. The results are reported in Columns (1) and (2) in Table 2. As evident, the ADF and the Phillip-Perron tests find little evidence of nominal convergence among participating currencies over the entire period 2000 to 2011, or in any individual year, barring the period 2000 to 2002.

However, as shown by Fan and Wei (2006) a constraint of these tests is that they have low power as they tend to reject overly the stationarity hypothesis of a time series. To account for this shortcoming we also focus on panel unit root tests.

The benchmark test of exchange rate convergence is based on the stochastic model given by Equation (6) below:

$$D_{i,t} = \alpha_i + \rho D_{i,t} + \mu_{i,t} \quad (7)$$

where i is country index, is the idiosyncratic factor in country i and is a white noise error term. This can be reformulated as Equation (7).

$$\Delta D_{i,t} = \alpha_i + \psi_i D_{i,t-1} + \sum_{j=}^{\rho_i} \xi_j \Delta D_{i,t-j} + \mu_{i,t} \quad (8)$$

Here $\psi > 0$ implies an explosive process, $\psi = 0$ describes random walk behaviour, $\psi < 0$ and implies stationary process and convergence.

To test the stationarity, we employ the Levin-Lin-Chu test developed by Levin et al. (2002) and the Im-Pesaran-Shin test developed by Im et al. (2003). The methodologies in both these tests have been developed from a multivariate generalization of the ADF test. A limitation of the Levin-Lin-Chu test is that it imposes a cross-equation restriction on the first order autocorrelation coefficients. In contrast, Im-Pesaran-Shin test allows these coefficients to differ across panel members. Moreover, the Levin-Lin-Chu test requires the panels to be strongly balanced, while the Im-Pesaran-Shin test works with unbalanced panel. Studies such as Sen Gupta (2015) and Ogawa and Yoshimi (2010) have used these tests in the context of South East and East Asian economies. To ensure a balanced panel we restrict our dataset

on nominal deviation between January 1999 and September 2015. Again, as can be seen from Columns (3) and (4) of Table 2, these tests are also unable to reject the null hypothesis that average weighted deviation has unit root over the entire sample from 2000 to 2015. When we split the sample on a yearly basis it is observed that in 1999 to 2002 there was some evidence of exchange rate convergence, but in the subsequent years there is no such evidence.

Table 2: Convergence among Participating Currencies in Nominal Terms

	Averaged Weighted Deviation		Panel Unit Root Test			
			Assuming Cross Section Independence		Removing Cross Section Mean	
	Augmented Dickey–Fuller	Phillips–Perron	Im–Pesaran–Shin	Levin–Lin–Chu	Im–Pesaran–Shin	Levin–Lin–Chu
	(1)	(2)	(3)	(4)	(5)	(6)
2000–2015	-1.898	-2.001	-0.2650	-1.1178	0.1733	-0.3505
	(0.3332)	(0.2861)	(0.3955)	(0.1318)	(0.5688)	(0.3630)
1999	-1.909	-2.457	-3.0008**	-0.9332	-2.2593**	-0.6521
	(0.3279)	(0.1262)	(0.0013)	(0.1754)	(0.0119)	(0.2572)
2000	-2.024*	-2.200**	-0.7133**	0.2881	-0.5275*	0.3451**
	(0.0760)	(0.0064)	(0.0378)	(0.6134)	(0.0989)	(0.0275)
2001	-1.716	-2.078	-0.302**	1.3788	1.1756*	2.0950
	(0.4231)	(0.2536)	(0.8549)	(0.9160)	(0.8801)	(0.9819)
2002	-0.675	-4.185***	-4.3551***	0.9523	-2.8977***	0.9044
	(0.8532)	(0.0007)	(0.0000)	(0.8295)	(0.0019)	(0.8171)
2003	-1.304	-1.193	0.2435	-1.1841	-0.6689	-0.4027
	(0.6275)	(0.6766)	(0.5962)	(0.1182)	(0.2518)	(0.3436)
2004	-0.018	-0.553	1.1220	0.9047	0.3727	0.0985
	(0.9570)	(0.8813)	(0.8691)	(0.8172)	(0.6453)	(0.5392)
2005	-1.753	-1.973	-1.3267*	-0.6903	-2.1483**	-1.5402**
	(0.4041)	(0.2985)	(0.0923)	(0.2450)	(0.0158)	(0.0618)
2006	-0.413	-1.554	1.8690	2.6898	0.0253	1.8847
	(0.9079)	(0.5067)	(0.9692)	(0.9964)	(0.5101)	(0.9703)
2007	-1.456	-1.515	0.4588	-1.5229	0.3941	-0.9334
	(0.5550)	(0.5261)	(0.6768)	(0.0639)	(0.6532)	(0.1753)
2008	-1.104	-0.959	0.1011	-0.3213	1.2336	-0.4205
	(0.7133)	(0.7679)	(0.5403)	(0.3740)	(0.8913)	(0.3371)
2009	-0.863	-1.409	1.3172	1.4310	0.1228	0.9411
	(0.7998)	(0.5780)	(0.9061)	(0.9238)	(0.5489)	(0.8267)
2010	-1.970	-2.864	-1.0005	0.1420	0.0899	0.9475
	(0.2997)	(0.0498)	(0.1585)	(0.5565)	(0.5358)	(0.8283)
2011	0.267	-0.717	3.6796	3.9393	2.7092	3.3807
	(0.9758)	(0.8424)	(0.9999)	(1.0000)	(0.9966)	(0.9996)
2012	-2.215	-2.513	-1.4832*	-0.6158	-0.3965	-0.5464
	(0.2007)	(0.1124)	(0.0690)	(0.2690)	(-0.3965)	(0.2924)
2013	-1.143	-1.160	0.4336	-0.3130	0.6694	-0.1817
	(0.6977)	(0.6905)	0.6677	(0.3771)	(0.7484)	(0.4279)
2014	-1.721	-1.747	-0.4161	0.4679	-0.2061	0.2667
	(0.4202)	(0.4068)	0.3387	(0.6801)	(0.4184)	(0.6051)
2015	-1.511	-3.366**	0.1084	1.2716	-0.5004	1.5104
	(0.5279)	(0.0122)	0.5432	(0.8983)	(0.3084)	(0.9345)

Note: P-values in brackets. ***, **, and * imply significance at 1%, 5% and 10% respectively.
Source: Author's calculations.

In Column (3) and (4) we assume that the individual panels have display cross section independence. However, if observations are dependent across individuals, then the estimators that are based on the assumption of cross-sectional independence, maybe inconsistent. This is especially true in a globalized world where shocks transmit from one country to another. In the case of South Asia, World bank (2013) finds that India's cyclical upturns have benefitted rest of South Asia in recent years. Hence, with a view to account for In order to account for cross sectional independence, we relax the independence assumption to allow for time-varying

aggregate effects in the data. These effects can be removed by subtracting the cross section mean from the data. The optimal lag length is selected by using the Akaike Information Criteria. The results obtained by removing the cross section mean are reported in Columns (5) and (6) of Table 2. The results again indicate that both for the whole sample as well as for most years it is not possible to reject the null hypothesis of unit root.

Table 3: Convergence among Participating Currencies in Real Terms

	Averaged Weighted Deviation		Panel Unit Root Test			
			Assuming Cross Section Independence		Removing Cross Section Mean	
	Augmented Dickey–Fuller	Phillips–Perron	Im–Pesaran–Shin	Levin–Lin–Chu	Im–Pesaran–Shin	Levin–Lin–Chu
	(1)	(2)	(3)	(4)	(5)	(6)
1999-2015	-3.112**	-2.931**	-2.5883***	-2.1971**	-1.9101**	-1.5081**
	(0.0257)	(0.0418)	(0.0048)	(0.0140)	(0.0281)	(0.0458)
1999-2001	-1.316	-1.134	-0.6371	-1.3687**	-1.0902**	-1.7003**
	(0.6217)	(0.7013)	(0.2620)	(0.0455)	(0.0978)	(0.0445)
2002-2003	-0.765	-1.315	-1.0362	-2.2283**	-3.4935***	-3.5644***
	(0.8293)	(0.6222)	(0.1501)	(0.0129)	(0.0002)	(0.0002)
2004-2005	-1.057	-2.329	-0.6397	-0.9147**	-1.0288**	-1.4160**
	(0.7320)	(0.1627)	(0.2612)	(0.0022)	(0.0418)	(0.0484)
2006-2007	-1.311	-0.944	1.2055	0.2498	-0.1965	0.1160
	(0.6240)	(0.7731)	(0.8860)	(0.5986)	(0.4221)	(0.5462)
2008-2009	-1.095	-1.706	0.5334	0.5304	-0.2051	-1.0323
	(0.7172)	(0.4281)	(0.7031)	(0.7021)	(0.4188)	(0.1510)
2010-2011	-1.471	-0.685	2.7163	3.3569	1.7749	1.4049
	(0.5479)	(0.8506)	(0.9967)	(0.9996)	(0.9620)	(0.9200)
2012-2013	0.624	-1.013	0.2539	-0.0736	0.3184	-0.1211
	(0.9882)	(0.7485)	(0.6002)	(0.4707)	(0.6249)	(0.4518)
2014-2015	-2.365	-2.311	-2.9384***	-3.3342***	-2.3514***	-2.7853***
	(0.0418)**	(0.0484)**	(0.0016)	(0.0004)	(0.0094)	(0.0027)

Note: P-values in brackets. ***, **, and * imply significance at 1%, 5% and 10% respectively.
Source: Author's calculations.

We also look at the convergence in the real exchange rate. Given that data on real exchange rate is available only at a monthly interval we combine the data for two years to ensure adequate degrees of freedom. Here we find evidence of convergence in real exchange rates across the entire sample. The result is robust across the various specifications. Sub-sample analysis shows that this driven primarily by the results of the initial years i.e. the period from 1999 to 2005. This was the period when Pakistani Rupee, Bangladeshi Taka and Sri Lankan Rupee weakened moderately in real terms vis-à-vis the SACU, while the Indian Rupee strengthened. The subsequent years saw further weakening of Sri Lankan and Pakistani Rupee, while the Bangladeshi Taka appreciated in real terms due to higher inflation rate. There was some convergence across the South Asian currencies in real terms since 2014 as Pakistani Rupee, Bangladeshi Taka and Sri Lankan Rupee strengthened against the SACU in nominal and real terms. This largely driven by sharp weakening of the Indian Rupee, which has a nearly 40% weight in SACU, in the aftermath of taper talk.

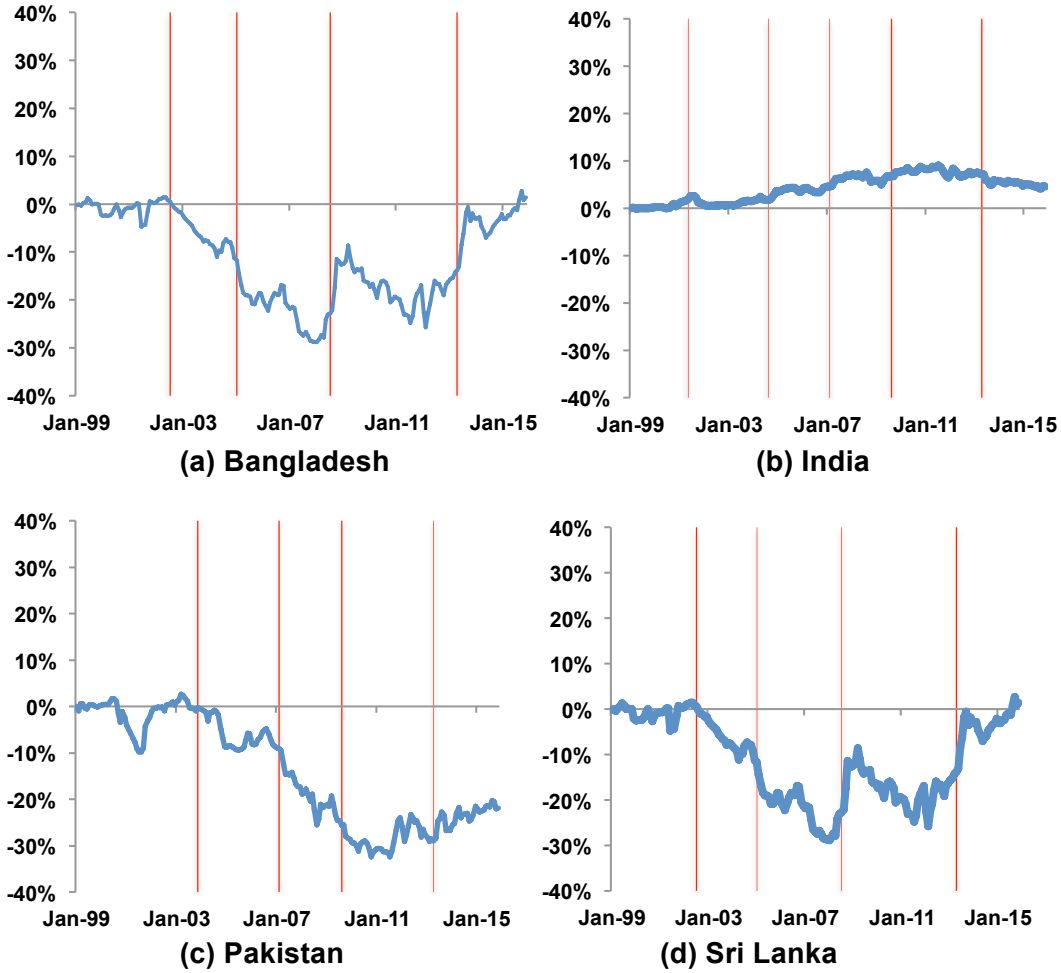
3.4 Empirical Estimates: Allowing Endogenously Determined Structural Breaks

A wide array of studies including Amsler and Lee (1995) has argued the biasness of unit root tests toward accepting the false unit root null hypothesis, especially in the presence of a structural break. The failure of taking into account structural breaks often results in a significant loss of power in unit root tests. Similarly, stationarity tests, which ignore the existence of breaks,

tend to diverge and tend to be biased toward rejecting the null hypothesis of stationarity in favour of the false alternative of a unit root hypothesis. This is driven by severe size distortion caused by the presence of breaks.

In order to account for this feature, we compute the extension of the Hadri (2000) test for stationarity in panel data with multiple structural changes under the null hypothesis, which is proposed in Carrion-i-Silvestre et al. (2005). The framework allows for a number of variations including multiple structural changes, multiple structural changes positioned in different unknown dates and different number of breaks for each individual. To date the breaks, Carrion-i-Silvestre et al. (2005) apply the procedure proposed in Bai and Perron (1998).[4]

Figure 6: Structural Breaks in Currencies' Nominal Deviation vis-à-vis Asian Currency Unit



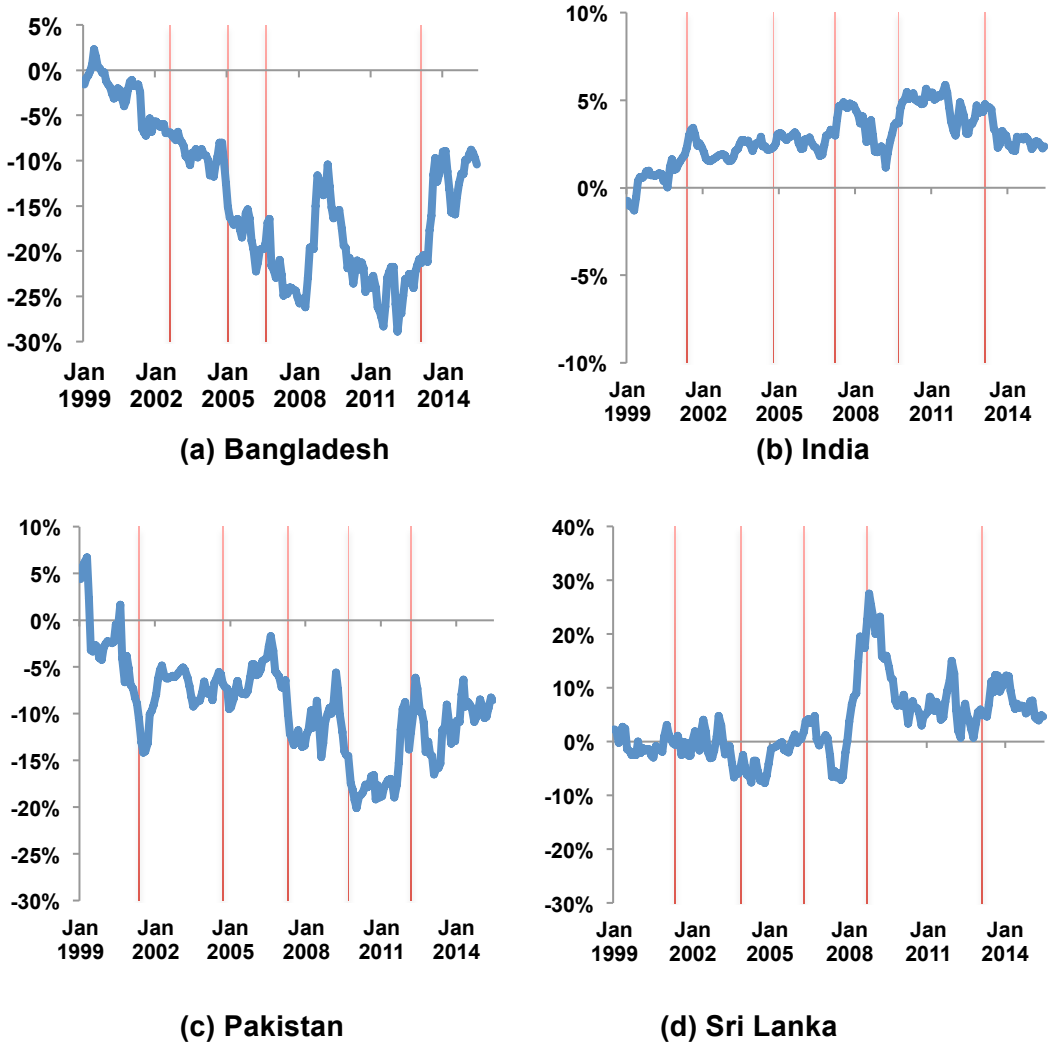
Source: Authors' Estimates

These breaks and the corresponding phases across the 4 South Asian currencies' nominal deviation from the Asian Currency Unit are highlighted in Figure 6. There is clear evidence of variation in both the number and timing of structural breaks experienced by the various countries as well as duration of a

[4] Please see Sen Gupta (2015) for details.

phase. While Bangladeshi Taka, Pakistani Rupee and Sri Lankan Rupee experienced four breaks each, the Indian Rupee experienced five breaks. Similarly, Figure 7 focuses on the structural break in the case of 4 South Asian currencies' real deviation from the South Asian Currency Unit. Here barring Bangladeshi Taka, which experienced 4 structural breaks, the other currencies witnessed 5 structural breaks. Moreover, there is significant variation in the nature of structural breaks among currencies' real and nominal deviation, indicating that inflation has impacted the different currency in various forms.

Figure 7: Structural Breaks in Currencies' Real Deviation vis-à-vis Asian Currency Unit



Source: Authors' Estimates

In the Carrion-i-Silvestre et al. (2005) procedure the test statistic allows each time series to have a different numbers of breaks located at different dates. We use the breaks identified in Figure 6 and Figure 7 using the procedure outlined in Bai and Perron (1998).

Table 4: Panel Data Stationarity Tests with Multiple Structural Breaks

	Nominal Deviation	Real Deviation
Homogenous	-1.923** (0.034)	-0.107 (0.142)
Heterogenous	-2.103** (0.034)	-1.812** (0.042)

Note: P-values in brackets. ***, **, and * imply significance at 1%, 5% and 10% respectively.
Source: Author's calculations.

Table 4 provides the results of the panel stationarity test. The null hypothesis of stationarity can be rejected when the test is computed using the heterogenous long run variance estimate for both nominal and real deviation. Only in the case of real deviations from the Asian Currency Unit under the assumption of homogenous long run variance, the null hypothesis of panel stationarity cannot be rejected. With overall evidence in favour of a rejection being quite overwhelming, one can conclude that the Asian currencies have shown very little indication of convergence in nominal terms. The evidence of real deviation is slightly more mixed with the homogenous and heterogenous long run variance presenting conflicting evidence. This could be driven by similar movement in the currencies and inflation rates in the post 2007 period

4. Diversity in Exchange Rate Regimes

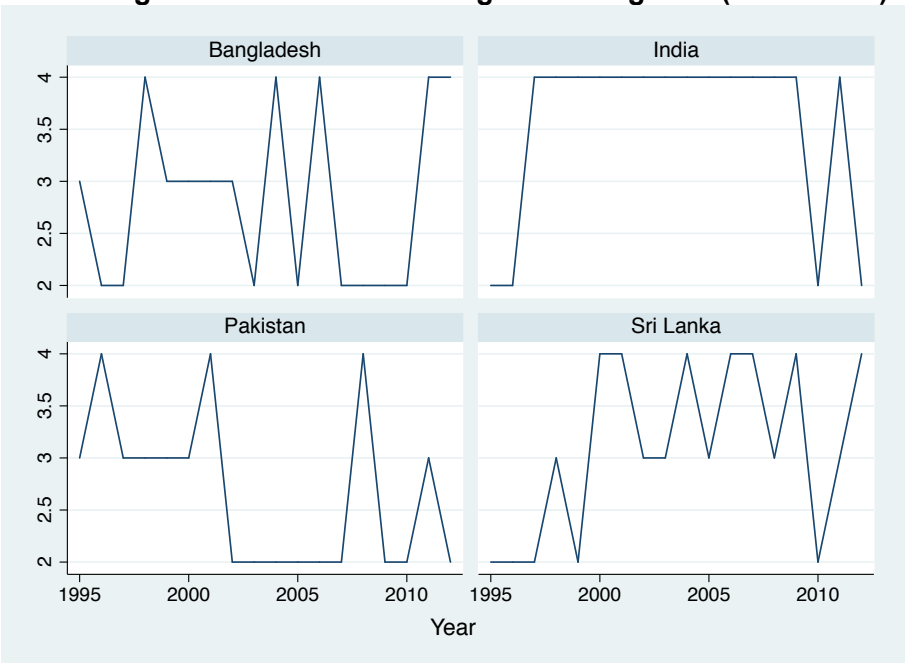
A major reason for the limited convergence of nominal exchange rate is the different exchange rate regimes followed in these economies, which signals difference in the priorities of the monetary and exchange rate policy.

4.1 De Jure Exchange Rate Regimes

The International Monetary Fund, in its 2014 Annual Report on Exchange Rate Arrangements and Exchange Rate Restrictions, classifies India's exchange rate regime as 'floating', while that in Bangladesh and Sri Lanka as 'stabilized arrangement', which implies a soft peg. Pakistan's exchange rate regime is described as 'other managed arrangement', which is a residual category.

In recent years, a considerable work has been devoted to data-driven methods for the classification of exchange rate regimes. This literature has classified exchange rate regimes in operation using a variety of alternative algorithms. Two such methodologies are outlined in Iltzetzki et al (2008) and Bleaney and Tian (2014). Bleaney and Tian (2014) classify the exchange rate regimes based on regression results over the period 1970 to 2014. However, the classification is quite broad with only four major categories i.e. no legal tender, peg, parity change and float. There is considerable diversity among the four economies, with all the four economies transitioning between peg and floating. However, on average it can be seen that India had the most flexible exchange rate regime, followed by Sri Lanka, Bangladesh and finally Pakistan.

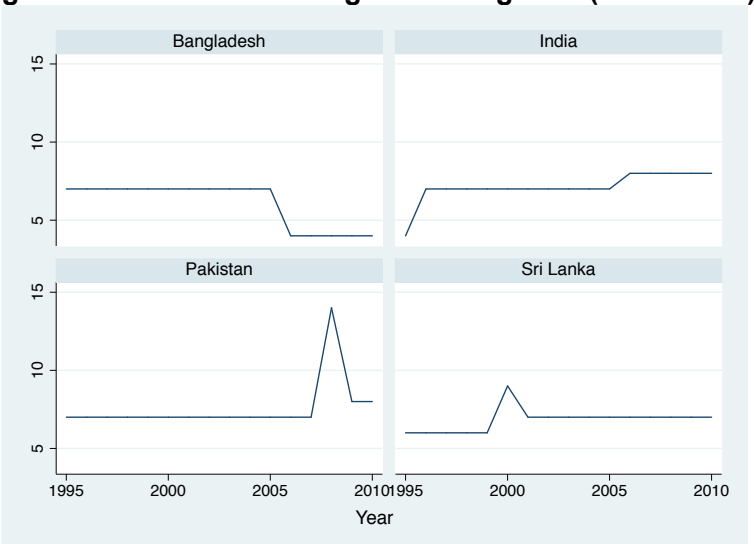
Figure 6: De Facto Exchange Rate Regimes (1995 -2014)



Note: 1=No Legal Tender, 2=Peg, 3=Peg Parity Change, 4=Float
Source: Bleaney and Tian (2014)

The Bleaney and Tian (2014) classification is quite broad, focusing only on 4 different categories of classification. For a finer classification, we also look at the Reinhart et al (2008) classification, which provides 15 types of classification of exchange rate regimes. However, the results are available only till 2010. The results of Itzeki et al (2008) are illustrated in Figure 7. Again, there is considerable divergence across the different countries. While India moved towards greater flexibility by moving from de facto peg to de facto crawling peg to finally de facto crawling band, Bangladesh went the other way from de facto crawling peg to de facto peg. Pakistan transitioned from de facto crawling peg to de facto crawling band, with one year of freely falling currency, while Sri Lanka moved from pre-announced crawling band to de facto peg. Thus all the countries, barring Bangladesh, moved to a more flexible exchange rate regime.

Figure 7: De Facto Exchange Rate Regimes (1995 -2010)



Note: 1: No separate legal tender; 2: Pre-announced peg or currency board arrangement; 3: Pre announced horizontal band that is narrower than or equal to ±2%; 4: De facto peg; 5: Pre announced crawling peg; 6: Pre announced crawling band that is narrower than or equal to ±2%; 7: De facto crawling; 8: De facto crawling band that is narrower than or equal to ±2%; 9: Pre announced crawling band that is wider than or equal to ±2%; 10: De facto crawling band that is narrower than or equal to ±5%; 11: Moving band that is narrower than or equal to ±2%; 12: Managed floating; 13: Freely floating; 14: Freely falling; 15: Dual market in which parallel market data is missing.
Source: Ilzetzki et al (2008)

4.2 De Facto Exchange Rate Regimes

Apart from these databases, we use two empirical measures to look at the exchange rate regimes, and investigate the finer structure of exchange rate regimes. These are based on the movement of the South Asian currencies vis-à-vis the major international currencies.

4.2.1 Exchange Market Pressure Index

This index is based on the exchange market pressure, discussed in Section 2. The index is based on the relationship between exchange rate and the variable used to halt the change in exchange rate, thereby absorbing the exchange rate pressure. In most instances, that variable is international reserves. Hence, following Cavoli and Rajan (2013) we use the following measure as the exchange market flexibility index:

$$I_t = \frac{\left|\Delta\varepsilon_t\right|}{\left|\Delta\varepsilon_t\right| + \left|\Delta IR_t\right|} \tag{8}$$

where $\left|\Delta\varepsilon_t\right|$ is the absolute percentage change in nominal exchange rate, while $\left|\Delta IR_t\right|$ is the absolute percentage change in international reserves. The index ranges from 0 to 1. If the pressure in the foreign exchange market results only in a change in the exchange rate and no change in international reserves i.e. $\left|\Delta IR_t\right| \to 0$, then $I_t \to 1$ and the exchange rate regime is deemed flexible. On the other hand, if the pressure leads to with international reserves being employed to ward off a change in exchange rate then $\left|\Delta\varepsilon_t\right| \to 0$, and $I_t \to 0$. We employ the above index using the major global currencies viz. US Dollar, Euro and the Japanese Yen.

Table 4: Average Exchange Market Flexibility Index in South Asia

	US Dollar	Euro	Yen
Bangladesh	0.095	0.304	0.324
	(0.054)	(0.102)	(0.093)
India	0.425	0.527	0.523
	(0.176)	(0.123)	(0.129)
Pakistan	0.151	0.357	0.357
	(0.043)	(0.100)	(0.084)
Sri Lanka	0.128	0.289	0.283
	(0.075)	(0.079)	(0.074)

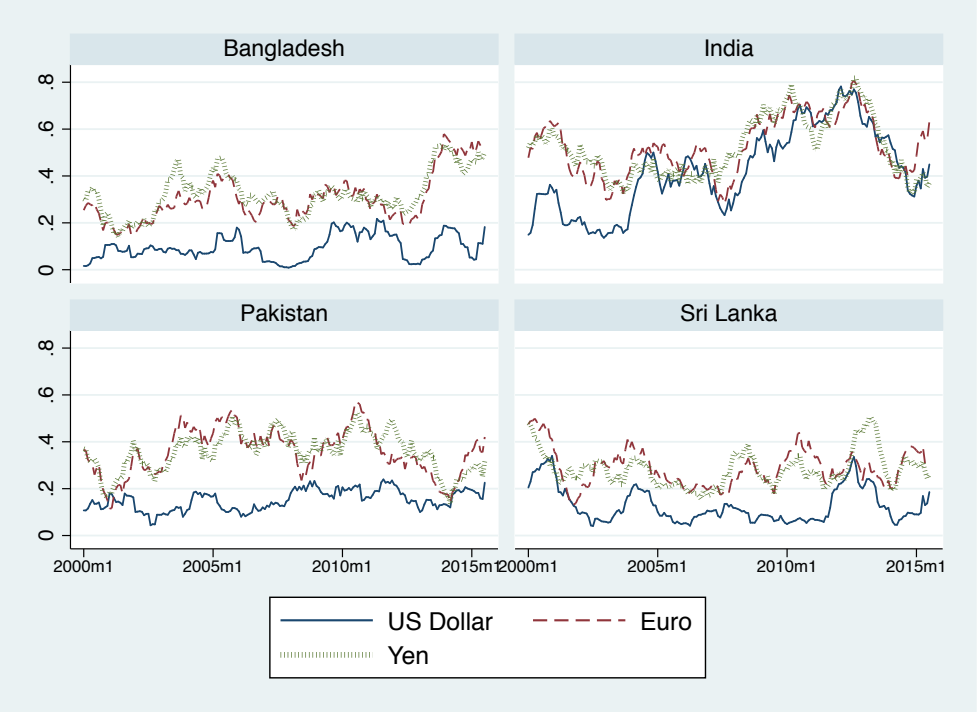
Note: The terms in parenthesis refer to the standard deviations.
Source: International Financial Statistics and Authors' Calculations

Table 4 outlines the average and the standard deviation of the indices in the four South Asian economies. It is evident that the value of the index vis-à-vis the US Dollar is lower compared to Euro and the Japanese Yen, implying that these economies are pegging their currencies more to the US Dollar than the other global currencies. Moreover, the value of the exchange market flexibility index for India vis-

à-vis the US Dollar is significantly higher than other three economies, indicating that India has a less of a US Dollar peg compared to other South Asian economies.

We also evaluate the recursive values of the EMP indices in the four South Asian economies using a 12-month smoothed value. This gives us an idea of how the index evolved since 2000 in these economies.

Figure 8: Recursive Exchange Market Flexibility (2000-2014)



Source: International Financial Statistics and Authors' Calculations

It is evident that throughout the period 2000 to 2014, Bangladesh, Pakistan and Sri Lanka, pegged their currencies more to the US Dollar compared to the Euro and the Yen. Moreover, the extent of the peg has remained relatively same between 2000 and 2014. Even in the case of India, in the initial years i.e. from 2000 to 2003, the Indian Rupee was pegged to the US Dollar. However, the extent of peg started to decline from 2004 onwards, which continued till 2012. In fact, during this period India can be though of pursuing a soft peg to a composite basket, comprising US Dollar, Euro and Japanese Yen. However, since 2012, there has been a moderate tightening of the peg, although it still is weaker compared to the other South Asian countries.

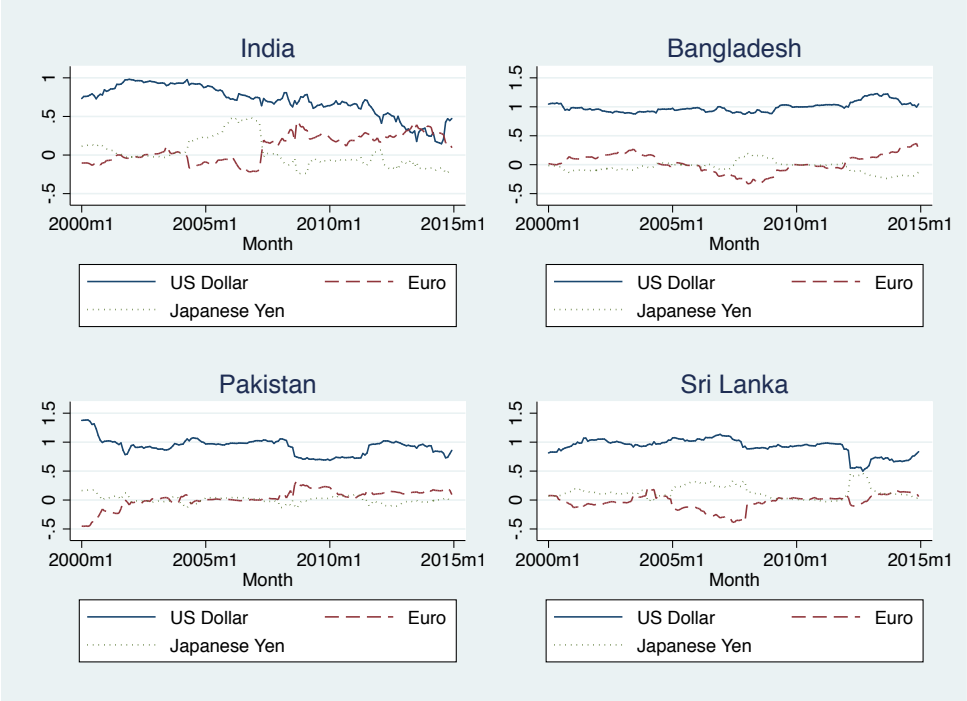
4.2.2 Frankel Wei Regression Estimates

We also employ the methodology outlined by Frankel and Wei (1994) to investigate the extent of the individual currency's linkages with the three major global currencies: the US dollar, the Euro, and the Japanese Yen, we use the methodology outlined by Frankel and Wei (1994). Daily data of exchange rates are used to conduct regression of log differences of the local currency (in terms of the New Zealand Dollar) on log differences of the three major currencies (in terms of the Swiss franc). The coefficients can be interpreted as the extent to which the G3 currencies influence the individual currencies. The regression equation is as follows:

$$\Delta \log \varepsilon_{i,t}^{NZD} = \alpha_0 + \beta_1 \Delta \log \varepsilon_{USD,t}^{NZD} + \beta_1 \Delta \log \varepsilon_{EUR,t}^{NZD} + \beta_1 \Delta \log \varepsilon_{JPY,t}^{NZD} + \mu_{i,t} \quad (9)$$

where $\log \varepsilon_{i,t}^{NZD}$ is the value of currency i vis-à-vis the Swiss franc, and $\log \varepsilon_{USD,t}^{NZD}$, $\log \varepsilon_{EUR,t}^{NZD}$ and $\log \varepsilon_{JPY,t}^{NZD}$ are the values of the dollar, euro, and yen in terms of the New Zealand Dollar. The coefficients are considered to represent the weights of the respective currencies. We look at the recursive least squares estimate from January 2001 to September 2011 to obtain dynamic coefficients. The recursive estimates are generated by running the above regression iteratively using a moving window of data by dropping old observations as new ones are added. Figure 9 plots the coefficients of the recursive estimates.

Figure 8: Recursive Least Square Estimates for Participating Currencies



Source: International Financial Statistics and Authors' Calculations

Across all the four major South Asian economies, the US Dollar exerts the maximum influence over the movement of the domestic currencies. The extent of influence of the US Dollar is maximum in the case of Bangladesh, where the coefficient on the US Dollar ranges between 0.87 and 1.20, and averages 0.997 for the period between 2000 and 2014. Both Pakistan and Sri Lanka also start with high values of coefficient on the US Dollar but the influence of the US Dollar wanes a bit at the time of the Global Financial Crisis. However, the resumption of capital flows into these economies in 2011 and 2012 resulted in an increase in the coefficient on US Dollar, more so in Pakistan than Sri Lanka. India is a notable exception here as the weight on the US Dollar has steadily declined from 2005 onwards as the central bank refrained from intervening in the foreign exchange market. Thus India appears to have become more of a managed floater compared to other economies in the region.

The different exchange rate regimes in the four South Asian economies reflect the differences in the priorities of the macroeconomic policy. In economies such as Pakistan, Bangladesh and Sri Lanka, the strong peg of the domestic currency to the US Dollar can be explained by the desire of these economies to maintain a healthy external balance. A stronger peg to the US Dollar allows these economies to retain their export competitiveness, manage their import bill and maintain the value of the remittances. In contrast, India has moved to a more flexible exchange rate regime, in

a bid to attain greater monetary independence to tackle domestic inflationary pressures. This has also allowed India to transition to an inflation-targeting regime.

The diverse exchange rate regimes across the various South Asian economies implies that a great deal of political commitment would be required if these economies are to move towards a path of exchange rate coordination. Here, it must be noted that the South Asian economies have already established a network of Finance Secretaries and Central bank Governors (SAARCFINANCE) with greater monetary and exchange rate cooperation being one of the key objectives.

Furthermore, a move towards exchange rate coordination will have to be accompanied by crisis prevention and crisis resolution mechanisms. The crisis prevention mechanism is likely to include independent and credible macroeconomic surveillance that can foretell macroeconomic imbalances being created in these economies that can jeopardize exchange rate coordination, and suggest remedial measures. An institution similar to the ASEAN+3 Macroeconomic Research Office (AMRO) can be set up exclusively for South Asia. The crisis resolution mechanism can take the form of reserve pooling and currency swap lines. A swap facility was agreed upon in 2012, under which India would provide resources up to $2 billion to other South Asian economies in case of exigencies. India has subsequently signed currency swap agreement with some countries including Bhutan and Sri Lanka. To be effective in dealing with a full blown crisis, the resources available under such swap lines need to be significantly augmented. Moreover, as pointed in Sen Gupta (2010) activation of bilateral swaps can at times be time consuming, and can preventing the swap requesting country from mounting an effective defence against speculative attacks. Such risks can be minimized by multilateralizing the various bilateral swap arrangements like the Chiang Mai Initiative Multilateralization.

5. Conclusion

The objective of this paper was to evaluate the case for greater exchange rate coordination in South Asia. We find that inter-regional integration in South Asia has progressed at a faster pace than the region's integration with the world. Moreover, the economies of South Asia have been buffeted by similar external shocks in the form of surge and stop of capital flows. Both these developments outline the need for greater exchange rate cooperation among the economies of the region, while retaining the flexibility to adjust to external currencies. However, using a hypothetical South Asian Currency Unit, we find limited evidence of comovement of South Asian currencies in nominal terms, while the evidence for degree of comovement is slightly stronger in real terms. Much of the divergence in the movement of currencies is derived from the varied exchange rates being pursued in these economies. While India has increasingly moved towards a more flexible exchange rate regime, Bangladesh, Pakistan and Sri Lanka, continue to remain pegged to US Dollar.

Thus it is evident that the South Asian economies have a long way to go to achieve greater degree of exchange rate coordination. The recent events in Europe have illustrated the dangers of hastening into monetary integration without internal adjustments in some of the participating countries. Macroeconomic imbalances in any kind of a coordinated system will give rise to economic tensions. A key pre-requisite of enhanced exchange rate cooperation is the presence of institutions that would help prevent and resolve crises. At the minimum these would include regional macroeconomic surveillance and regional reserve pooling. Thus South Asian economies have a long way to go towards exchange rate coordination, and should proceed gradually towards this path that will allow for greater flexibility and room for adjustment.

References

Bai, Jushan and Perron, Pierre (2003), "Computation and Analysis of Multiple Structural Change Models," *Journal of Applied Econometrics*, Vol. 18(1), pp 1-22.

Carrion-i-Silvestre, Josep Lluis, Del Barrio-Castro, Tomes. and Lopez-Bazo, Enrique (2005) “Breaking the Panels: An Application to the GDP Per Capita”, Econometrics Journal, 8(2), pp 159-175.

Eichengreen, Barry (2006), “The Parallel Currency Approach to Asian Monetary Integration", American *Economic Review*, Vol. 96 (2), pp. 432-436.

Bleaney, Michael and Tian, Mo (2014) "Classifying Exchange Rate Regimes by Regression Methods," Discussion Papers 14/02, University of Nottingham, School of Economics.

Fan, C. Simon, and Wei, Xiangdong (2006), “The Law of One Price: Evidence from the Transitional Economy of China", *The Review of Economics and Statistics*, Vol. 88 (4), pp. 682-697.

Frankel, Jeffrey and Rose, Andrew (2002) "An Estimate of the Effect of Common Currencies on Trade and Income," *The Quarterly Journal of Economics*, Oxford University Press, Vol. 117(2), pp. 437-466.

Frankel, Jeffrey A., and Wei, Shang-Jin (1994), “Yen Bloc or Dollar Bloc? Exchange Rate Policies of the East Asian Economies", in Macroeconomic Linkages: Savings, Exchange Rates, and Capital Flows, NBER-EASE Volume 3, (editors) Takatoshi Ito, and Anne O. Krueger, University of Chicago Press, pp. 295-333.

Hadri, Kaddour (2000). "Testing for Stationarity in Heterogeneous Panel Data," Econometrics Journal, Royal Economic Society, vol. 3(2), pages 148-161.

Im, Kyung So, Pesaran, M. Hashem, and Shin, Yongcheol (2003), “Testing for Unit roots in Heterogeneous Panels", *Journal of Econometrics*, Vol. 113 (1), pp. 53-74.

Ilzetzki Ethan., Reinhart, Carmen., and Rogoff, Kenneth (2008), “Exchange Rate Arrangements Entering the 21st Century: Which Anchor Will Hold.” University of Maryland Working Paper.

Lane, P., and Milessi-Ferreti, G.M. (2007), “The External Wealth of Nations Mark II: Revised and Extended Estimates of Foreign Assets and Liabilities: 1970-2004", *Journal of International Economics*, Vol. 73 (2), pp. 223-250.

Levin, Andrew, Lin, Chien-Fu, and James Chu, Chia-Shang (2002), “Unit Root Tests in Panel Data: Asymptotic and Finite Sample Properties", *Journal of Econometrics*, Vol. 108 (1), pp. 1-24.

Ogawa, Eiji, and Shimizu, Junko (2005), “A Deviation Measurement for Coordinated Exchange Rate Policies in East Asia", Research Institute of Economy, Trade and Industry Discussion paper No. 05017.

Ogawa, Eiji, and Shimizu, Junko (2007), “Progress toward a Common Currency Basket System in East Asia", Research Institute of Economy, Trade and Industry Discussion paper No. 07002.

Ogawa, Eiji, and Yoshimi, Taiyo (2010), “Analysis on β and σ Convergences of East Asian Currencies”, *International Journal of Intelligent Technologies and Applied Statistics*, Vol. 3(5) pp. 237-263

Rose, Andrew, (2000), “One Money, One Market: The Effect of Common Currencies on Trade”, *Economic Policy*, 15 (30), pp. 7-46

Sen Gupta, Abhijit, (2010), "Prospects for a Single Asian Currency," *Public Policy Review*, Vol. 6(5), pp. 873-892.

Sen Gupta, Abhijit, (2015), "Extent of Exchange Rate Coordination in Asia," *The Singapore Economic Review*, Vol. 60(02), pp. 1550013-1-1.

Thursby, Jerry G and Thursby, Marie C, (1987), "Bilateral Trade Flows, the Linder Hypothesis, and Exchange Risk," *The Review of Economics and Statistics*, Vol. 69(3), pp. 488-95.

Wyplosz, Charles (2010), “An Asian Monetary Unit?", in The Future Global Reserve System An Asian Perspective, (editors) Jeffrey D. Sachs, Masahiro Kawai, Jong-Wha Lee, and Wing Thye Woo, Asian Development Bank.