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Management of Exchange Rate Regimes in Emerging Asia

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Abstract

This paper revisits the issue of exchange rate regimes in emerging Asia. It is divided into two main parts. The first part compares de jure and de facto exchange rate regimes in Asia over the decade 1999–2009. It finds that while Asia is home to a wide array of exchange rate regimes, there are signs of gradual movement towards somewhat greater exchange rate flexibility in many of the regional countries. However, the propensity for foreign exchange intervention and exchange rate management among regional central banks remains fairly high in many instances. Beyond a general reluctance of many Asian economies to allow for a "benign neglect" of their currencies both in terms of managing volatility as well as in terms of "leaning against the wind," the sustained stockpiling of reserves in developing and emerging Asian economies since 2000 (interrupted only briefly by the global financial crisis) suggests that they are more sensitive to exchange rate appreciations than to depreciations. This is the focus of the second part of the paper. We find there to be evidence of an apparent "fear of appreciation" which is manifested in asymmetric exchange rate intervention—i.e., a willingness to allow depreciations but reluctance to allow appreciations. This policy of effective exchange rate undervaluation is rather unorthodox from a neoclassical sense, but is consistent with a development policy centered on suppressing the price of non-tradable goods relative to tradables (i.e., real exchange rate undervaluation). The paper concludes with a few observations on the management of Asian currencies in light of the global financial crisis and concerns about global imbalances.

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1. INTRODUCTION

Maintaining a stable and "competitive" exchange rate has been one of the cornerstones of Asian industrialization strategies starting with Japan in its high-growth period from 1950–73, and largely emulated by the Republic of Korea (hereafter, Korea) and some of the other newly industrializing economies (NIEs) in the 1970s and 1980s. The "near NIEs" in Southeast Asia—Malaysia, Indonesia, and Thailand, which had effectively pegged their currencies to the US dollar—benefitted significantly from a revaluation of the Japanese yen following the Plaza Accord of 1984–85 as Japanese foreign direct investment (FDI) moved offshore to maintain export competitiveness. This flood of Japanese FDI helped kick-start growth in the region, which continued until the Asian crisis in 1997. More recently, the People's Republic of China's (hereafter, PRC) devaluation of the yuan in January 1994, and its continued peg to the US dollar until recently, has, it has been argued, helped transform the country into the world's factory and export powerhouse.

This paper revisits the issue of exchange rate regimes in emerging Asia.[1] The paper is divided into two main parts. The first part of the paper (Sections 2 and 3) compares the de jure and de facto exchange rate regimes in selected emerging Asian economies. An enduring question in the literature on exchange rate regimes is: how do official classifications compare with de facto regimes? The paper facilitates this comparison by presenting an analysis of the degree of de facto exchange rate flexibility in the exchange rate regimes for emerging Asian economies. To preview the main conclusion, it is evident that Asia is home to a wide array of exchange rate regimes, though there are signs of a gradual movement towards somewhat greater exchange rate flexibility in many of the regional countries. Nonetheless, the propensity for foreign exchange intervention and exchange rate management among regional central banks remains fairly high in many instances, particularly in terms of managing against a currency basket (i.e., maintaining a stable nominal effective exchange rate, or NEER).

However, beyond a general reluctance of many Asian economies to allow for a "benign neglect" of their currencies both in terms of managing volatility as well as in terms of "leaning against the wind," the sustained stockpiling of reserves in developing and emerging Asian economies since 2000 (interrupted only briefly by the global financial crisis) suggests that they are more sensitive to exchange rate appreciations than to depreciations. This is the focus of the second part of the paper (Sections 4 and 5). Section 4 empirically explores the particular issue of this asymmetry in exchange rate intervention in developing and emerging Asia. We find there to be evidence of an evolution of Asian exchange rate policy towards an apparent "fear of floating in reverse" or "fear of appreciation" (Levy-Yeyati and Sturzenegger 2007). This policy of exchange rate undervaluation is rather unorthodox, and at odds with most neoclassical/mainstream wisdom, which likely would recommend that policymakers aim to keep the real exchange rate (RER) as close as possible to its equilibrium level, as any sort of misalignment could in theory create macroeconomic disruptions. Specifically, according to conventional wisdom, RER overvaluation stifles economic growth and export competitiveness while persistent undervaluation leads to inflationary concerns. Section 5 reconsiders the PRC's and East Asia's unorthodox development, which has been centered on suppressing the price of non-tradable goods relative to tradables (RER undervaluation).

The final section concludes with a few observations on Asian currency management in light of the global financial crisis and concerns about global imbalances.

[1] We limit ourselves to a subset of Asian currencies for which comparable data are more easily available: Bangladesh, PRC, India, Indonesia, Korea, Malaysia, Pakistan, the Philippines, Singapore, Sri Lanka, Thailand, and Viet Nam.

2. EXCHANGE RATE REGIMES IN DEVELOPING AND EMERGING ASIA[2]

2.1 De Jure Classifications

Until 1998 it was fairly easy to obtain de jure exchange rate classifications, as this data was compiled from national sources by the IMF. Specifically, between 1975 and 1998, the IMF's *Annual Report on Exchange Arrangements and Exchange Restrictions* was based on self-reporting of national policies by various governments, with revisions in 1977 and 1982. Since 1998—and in response to criticisms that there can be significant divergences between de facto and de jure policies—the IMF's exchange rate classification methodology has shifted to compiling unofficial policies of countries as determined by the Fund staff.[3] While the change in IMF exchange rate coding is welcome for many reasons (including the fact that the new set of categories is more detailed than the older one), the IMF no longer compiles a list of the de jure regimes. The only way this can be done is by referring to the website of each central bank or other national sources individually, and wading through relevant materials. The results are summarized in Table 1.[4]

As is apparent, the de jure exchange rate regimes in Asia span a wide spectrum. Many smaller Asian economies appear to prefer some form of single currency pegs. This is true of Hong Kong, China (whose currency board arrangement is pegged to the US dollar), as well as others like Brunei (pegged to the Singapore dollar) and Bhutan and Nepal (pegged to the Indian rupee) and Myanmar (pegged to Special Drawing Rights, or SDR). In contrast, Bangladesh and Sri Lanka in South Asia and the East and Southeast Asian economies of Indonesia, Korea, and the Philippines officially operate flexible exchange rate regimes. The flexible exchange rates in the three East Asian countries are accompanied by inflation-targeting frameworks. Thailand too operates an inflation targeting arrangement, though it defines itself officially as a managed floater. Table 2 summarizes some key components of the inflation targeters in Asia.[5]

A number of other Asian countries have adopted a variety of intermediate regimes (currency baskets, crawling bands, adjustable pegs, etc.). For instance, according to the Reserve Bank of India (RBI), India "monitors and manages the exchange rates with flexibility without a fixed target or a pre-announced target or a band, coupled with the ability to intervene if and when necessary."[6] Viet Nam officially maintains a crawling peg and band around the US dollar. Singapore officially manages its currency against a basket of currencies, with the trade-weighted exchange rate used as an intermediate target to ensure that the inflation target is attained.[7] While Singapore's currency basket regime follows a more strategic orientation, both PRC and Malaysia in July 2005 officially shifted to what may be best referred to as a more mechanical version of a currency basket regime (i.e., keeping the trade-weighted exchange rate within a certain band as a goal in and of itself). Pakistan seems to operate rather ad hoc adjustable pegs. Overall, therefore, it is readily apparent that "one size does not necessarily fit all" when it comes to the choice of exchange rate regimes in Asia.

[2] This section is based on Rajan (2010).

[3] The data has since been applied retroactively to 1990.

[4] The descriptions in Table 1 are mostly direct quotes from official sources and not paraphrased by the authors.

[5] Roger (2009) offers a useful overview of the achievements and challenges faced by countries that have adopted inflation targeting frameworks over the last two decades.

[6] See Cavoli and Rajan (2009, Chapter 4) for an analysis of India's exchange rate regime.

[7] See Cavoli and Rajan (2009, Chapter 5) for an analysis of Singapore's exchange rate regime.

2.2 De Facto Classifications

As noted, the IMF has replaced its compilation of de jure exchange rate regimes with the behavioral classification of exchange rates. The new IMF coding is based on various sources, including information from IMF staff, press reports, other relevant papers, as well as the behavior of bilateral nominal exchange rates and reserves.[8] As is apparent from a comparison of Tables 1 and 3, there is no discrepancy between the de jure and de facto regimes of Hong Kong, China, which operates an exchange rate fixed to the US dollar. Similarly, India, Malaysia, Pakistan, Singapore, and Thailand are categorized as managed floaters, broadly consistent with their official pronouncements. Korea and the Philippines are characterized as independent floaters, consistent with their official assertions but somewhat odd in view of the fact that both countries have been rapidly building up reserves. There are, however, divergences from the official pronouncements. According to the public statements of the PRC's authorities, the exchange rate regime is a based on a currency basket, though the IMF classifies the PRC's system as a crawling peg.[9] Viet Nam is classified as having a conventional fixed peg regime compared to its official pronouncement of maintaining a crawling peg and band around the US dollar. Bangladesh, Indonesia, and Sri Lanka have also been characterized as managed floaters (with no predetermined exchange rate path), despite their official declarations of being independent floaters.[10] Overall, with a few exceptions, most developing and emerging Asian exchange rate regimes are, according to the IMF, either completely fixed (soft or hard) or managed.

3. DE FACTO EXCHANGE RATE REGIMES[11]

This section presents a measure that has been recently used in Frankel and Wei (2007) as a way of incorporating exchange rate regime flexibility (or fixity) into the original Frankel-Wei (2004) method for inferring implicit basket weights.

3.1 Model

Consider the following:

$$Intervention\_Index = \Delta e + \Delta r \qquad (3.1)^{12}$$

where Δe is defined as the (log difference of the) local currency per some independent numeraire—here we use the SDR[13]—and Δr is the monthly change in net foreign assets

[8] Bubula and Ötker-Robe (2002) appears to be the intellectual basis for the IMF de facto regimes. Also see Barajas, Erickson and Steiner (2008) for a summary overview of the various methodologies to classify exchange rates regimes.

[9] See Eichengreen (2006) who provides a broader discussion of issues surrounding the PRC's currency and its exchange rate regime.

[10] There is an interesting question as to why many countries in Asia and elsewhere have a "fear of declaring" they are fixed or managed, especially since there is no clear-cut evidence that markets punish countries with de facto or de jure fixed rates in terms of demanding higher sovereign spreads. If anything, the opposite seems to be the case (Barajas, Erickson, and Steiner 2008)

[11] This section is based on Cavoli and Rajan (2010).

[12] This is the same index used by Frankel and Wei (2007). However, they use the term "EMP index" as opposed to "intervention index."

(IMF *IFS*, lines 11–16c) scaled by lagged money base (line 14).[14] To see how equation 3.1 relates to the choice of exchange rate regime, we need to use an intervention index to augment the original Frankel-Wei method as follows:

$$\Delta e_t = \alpha_0 + \alpha_1 \Delta US_t + \alpha_2 \Delta JP_t + \alpha_3 \Delta EU_t + \gamma\ Intervention\_Index + \mu_t \quad (3.2)$$

The α coefficients in equation 3.2 are often interpreted as implicit currency weights. The G3 currencies (in log differences) of US dollar, euro, and the yen (all per the SDR) are chosen, as they represent world currencies deemed to exert sufficient influence on the local currency. While it is tempting to interpret these coefficients as potential basket weights, it is probably more prudent for them to be interpreted as "degrees of influence," as it is very difficult to say whether a high and significant coefficient value implies a basket currency, or merely market-driven correlations.[15]

Under equation 3.2, as $\gamma \rightarrow 1$ the exchange rate per local currency becomes more flexible as the intervention index converges to the dependent variable, Δe, and the α coefficients should be close to zero and/or statistically insignificant. As $\gamma \rightarrow 0$, the exchange rate becomes more fixed and the extent of fixity to various major currencies is captured by the α coefficients.[16]

3.2 Results

We use monthly data for the period 1999:m2 and 2009:m9, or some sub-periods thereof depending on data availability.[17] Two samples are presented for each country: one including and one excluding the final two years of the sample where results may reveal the effect of the recent global financial crisis (Table 4).[18]

By and large the US dollar is the currency that has the greatest degree of influence on local currencies. Results do not change much when we truncate the sample to the pre-global crisis period, with the exceptions of Korea and India, the two countries initially impacted by a reversal of global capital flows. In essence, both central banks allowed much greater exchange rate flexibility during the crisis, and this shows up in terms of much higher US dollar weights pre-crisis.

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13 The idea behind using the SDR revolves around finding a currency that is not excessively related to any of the currencies used in this study. A common choice in this literature has often been the Swiss franc, but there are concerns that its strong correlation with the euro may bias parameter estimates.

14 Reserve differences are scaled by lagged domestic monetary base in order to compare the magnitude of the reserve change in relation to the stock of money base in the system. The result is an index that is more easily interpretable than if absolute values are taken.

15 It is also for this reason that we did not impose the restriction that all the currency weights should add up to one, or for that matter, why we do not just restrict the parameters to take values between 0 and 1 (as there may be more complex correlations that we might know about *a priori*).

16 In our estimations we do not impose any constraints on the γ coefficient; thus, it could exceed one or be negative.

17 Two caveats should be noted. One, we prefer lower frequency data in terms of month-to-month changes, as there is too much noise in low frequency data (day-to-day or month-to-month). High frequency data tends to tell us more about ad hoc interventions to minimize volatilities as opposed to degrees of influence of G3 currencies. In addition, the data on reserves are only available on a monthly basis, so there is a practical dimension to our choice as well. Two, reserve values could change because of currency fluctuations and, ideally, we should exclude these effects before estimation. However, this is not possible since we lack data on the currency composition of reserves. This may impact the precision of the results in some cases.

18 Time dummies were also used with little success. As such, we decided that presenting two sets of results will show more explicitly the effect of the crisis on the exchange rate.

With the exceptions of Korea, Malaysia, Pakistan, and Viet Nam, the intervention index is statistically significant and therefore open to interpretation. The values are all under 0.1 in the cases of the PRC, the Philippines, Singapore, Sri Lanka, and Thailand, and close to zero in many cases, suggesting there exists a high deal of fixity in the local currencies (vis-à-vis a single currency or basket of major currencies). The intervention index has a slightly stronger economic weight in Indonesia and India, suggesting these two economies allowed relatively greater exchange rate flexibility than the others. The pertinent question here is, to what extent are these weights market-driven versus policy targets?

We can attempt to answer this by summarizing the interaction between the currency weights and the intervention index. We focus first on those currencies with intervention indices that are at or close to zero and are statistically significant. The PRC's case is the most clear-cut with the US dollar weight at 1, implying continued heavy exchange rate management.[19] The US dollar weights for the Bangladesh taka, Sri Lankan rupee, and the Philippine peso are surprisingly large, suggesting a high degree of fixity. While this is consistent with the IMF's categorization of Sri Lanka and Bangladesh as both having conventional fixed peg arrangements, it is at clear odds with the Philippines being described as operating an "independent floating" arrangement. Thailand and Singapore also have low and statistically significant intervention indices but with far lower US dollar weights and some positive and statistically significant weight to other currencies. This is indicative of management against a currency basket, consistent with the official proclamations by the Monetary Authority of Singapore (MAS) as well as an oft-noted desire for currency basket pegging by the Bank of Thailand (BOT). Both are broadly defined by the IMF as being managed floaters.[20]

Two other currencies characterized as managed floaters by the IMF are India and Indonesia. As noted, both have relatively higher intervention indices, suggestive of a greater degree of exchange rate flexibility. The currency weights for Indonesia suggest it is market-driven, as the α coefficients are either statistically insignificant (US dollar and euro) or zero/negative (yen). The Indian rupee appears to have a degree of flexibility in the exchange rate with a possible loose US dollar peg. The intervention index measures for Korea, Malaysia, and Pakistan are all statistically insignificant, implying there is insufficient evidence from the intervention index coefficient to suggest the existence of any systematic exchange rate fixity over the sample period under consideration. However, examining the α coefficients, one notes a high degree of influence of the US dollar and negligible influence of the other currencies for Malaysia and Pakistan, suggesting that both countries manage their currencies against the US dollar.

To further check whether there has been a change in the degree of intervention/flexibility in Asia over time, we undertake recursive least squares estimates for the US dollar coefficient, α_1. The recursive estimates are generated by running the regression for equation 3.2 iteratively—beginning with k observations and recording the coefficient values until we reach the full sample.[21] Figures 1a-b show the recursive coefficients for the US dollar for the inflation targeting countries versus the remainder of the countries sampled (the non-inflation targeters). Generally, the influence of the US dollar is lower for the inflation targeting group than for the other group, as would be expected *a priori.* Figures 2a-c suggests that the degree of influence of the US dollar is high across the board. While this is anticipated with the conventional fixed peggers, we would expect the US dollar peg to have been lower for the floating pair of Korea and (especially) the Philippines. Figure 2b for the managed floaters is broadly consistent with that regime choice. The exchange rates in those countries with a

[19] The weight on the US dollar declines marginally if we consider the sub-period from 2006.

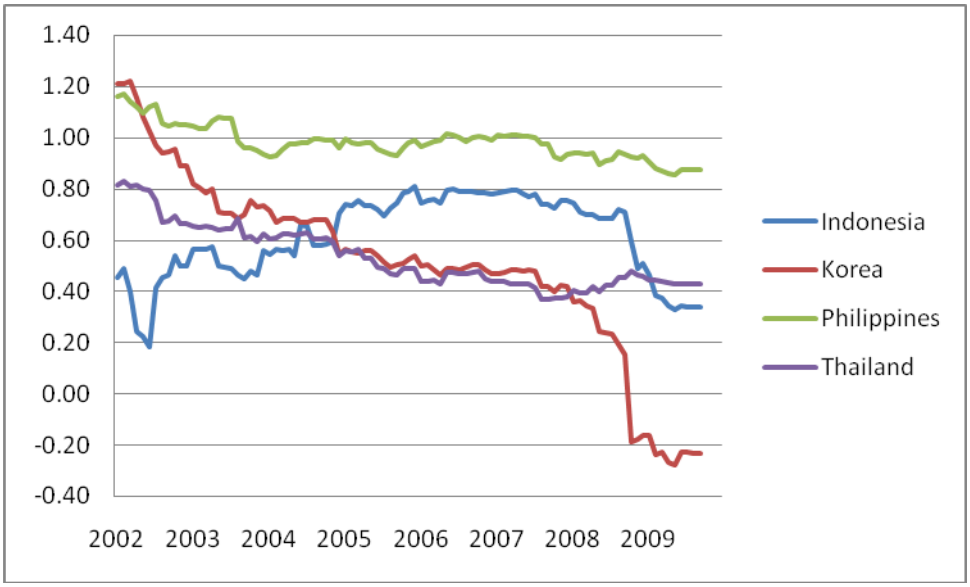
[20] However, the lack of statistical significance of the non-US dollar-weighted currencies is odd.

[21] k is the number of regressors. Due to insufficient degrees of freedom we discard the first few coefficient values—about three years' worth. Recursive OLS is a special case of the Kalman Filter modeling strategy with time-varying coefficients. These results are typically consistent with the rolling fixed window regressions where one would drop the oldest observation before incorporating the most recent.

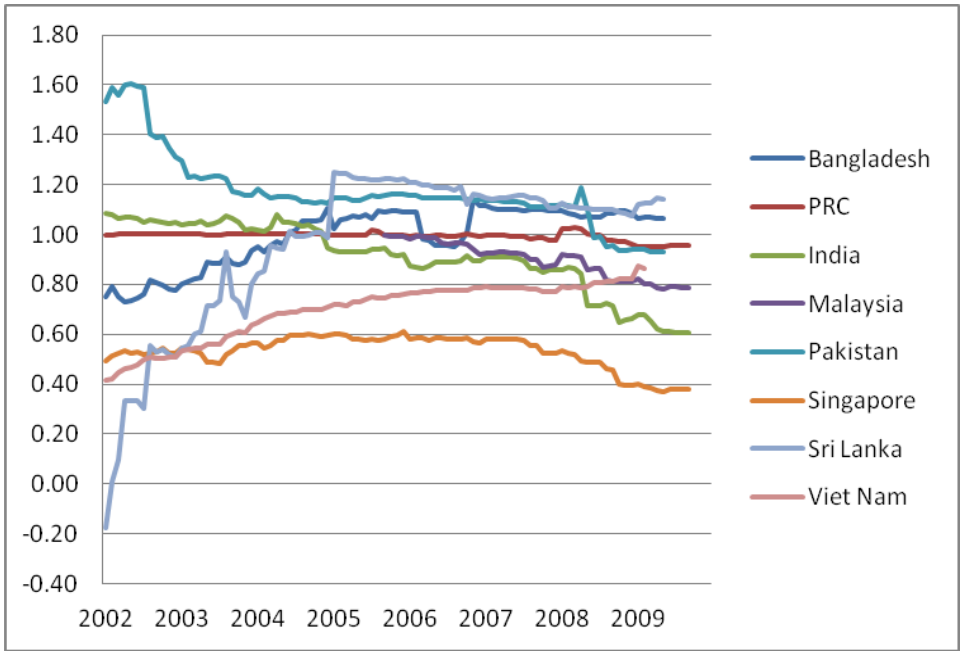
lower US dollar coefficient value—namely, Singapore and Thailand—are also influenced by other currencies, while the others tend to be influenced more exclusively by the US dollar.

Figure 1: Recursive Least Squares Estimates for the US dollar Weight

1a: Inflation Targeting Countries



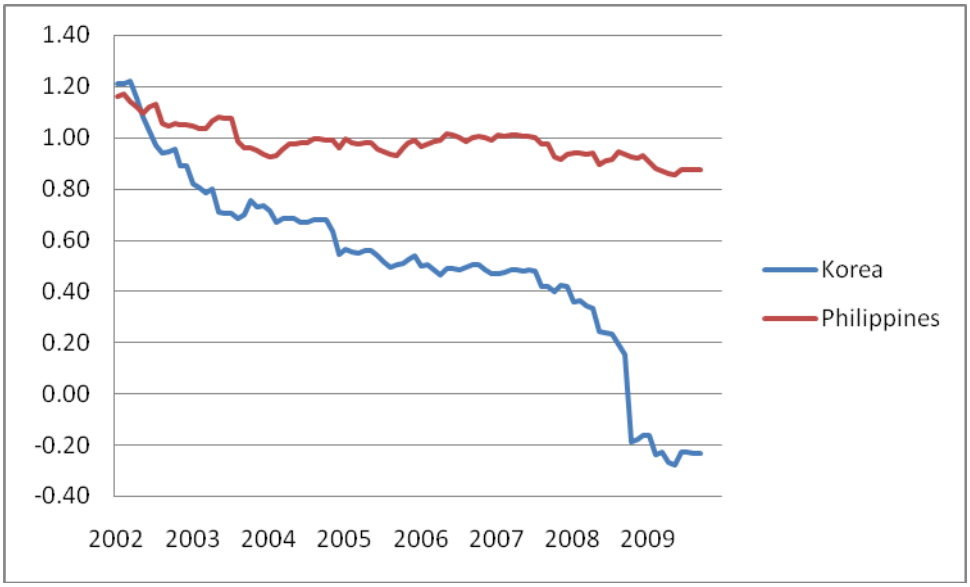
1b: Non-Inflation Targeters



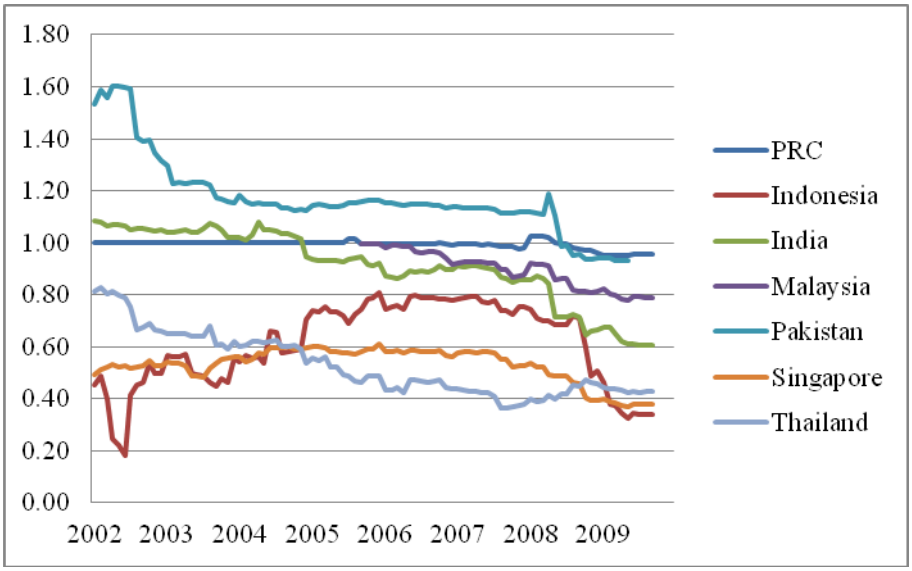
Source Cavoli and Rajan (2010).

Figure 2: Recursive Least Squares Estimates for the US dollar Weight

2a: Independent Floaters

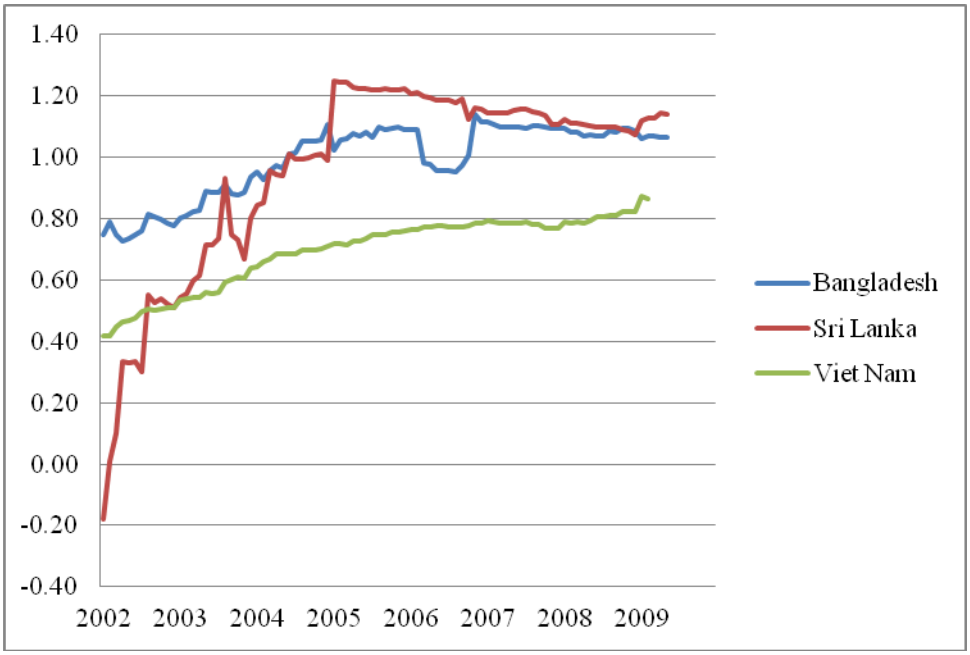


2b: Managed Floaters



Source: Cavoli and Rajan (2010)

2c: Conventional Fixed Peggers



Source: Cavoli and Rajan (2010).

4. ASYMMETRY IN ASIAN EXCHANGE RATE POLICIES

The foregoing analysis makes apparent that, by and large, Asian currencies remain fairly heavily managed—mostly against the US dollar, but sometimes against a basket of currencies. The additional fact that the region has rapidly built up reserves implies the currencies are effectively undervalued, presumably in order to sustain export-led growth. This in turn has contributed to a massive reserve accumulation in emerging Asian economies as well as to ongoing global macroeconomic imbalances. In other words, whereas Calvo and Reinhart (2002) noted that exchange rate policy in the 1990s in emerging economies was best characterized as "a fear of floating," we conjecture that Asian exchange rate regimes in the 2000s can be more precisely described as being a "fear of appreciation" or a "fear of floating in reverse," a term initially coined by Levy-Yeyati and Sturzenegger (2007). Somewhat surprisingly, there has been scant discussion of this possible asymmetry in foreign exchange market intervention in the debate over de facto exchange rate regimes in Asia, a gap that this section attempts to fill.[22] We first outline a simple model of optimal central bank behavior, which derives a simple central bank intervention reaction function as our estimating equation.

4.1 Central Bank Intervention Reaction Function[23]

As noted, our focus is on managed floaters in Asia—specifically, India, Korea, the Philippines, Singapore, Thailand, and Indonesia—which are generally assumed to allow balance of payments pressures to be partly reflected in exchange rate changes and partly in foreign exchange intervention and corresponding reserve changes. More formally, the central bank is assumed to have full and direct control over a proxy measure of intervention

[22] Two notable exceptions are Ramachandran and Srinivasan (2007) and Srinivasan, Mahambare, and Ramachandran (2008), who find evidence in the Indian context that support the existence of asymmetric foreign exchange intervention (Indian rupee per US dollar).

[23] Sections 4.1 and 4.2 are based on Pontines and Rajan (2011).

defined as the percent changes in foreign exchange reserves (r_t). The central bank intervenes in the foreign exchange market to minimize the following inter-temporal criterion:[24]

$$\min_{(R_t)} E_{t-1} \sum_{\tau=0}^{\infty} \delta^{\tau} L_{t+\tau} \tag{4.1}$$

where δ is the discount factor and L_t is the period loss function. We follow Surico (2008) and Srinivasan, Mahambare, and Ramachandran (2008) in specifying the loss function in linear-exponential form:

$$L_t = \frac{1}{2}(r_t - r^*)^2 + \frac{\lambda}{2}\left\{(e_t - e^*)^2 + \frac{\gamma}{3}(e_t - e^*)^3\right\} \tag{4.2}$$

where $\lambda > 0$ is the relative weight and γ is the asymmetric preference parameter on exchange rate stabilization. e_t denotes the percent change in the exchange rate, r^* is the optimal level of reserves, and e^* is the central bank's target exchange rate, which is assumed to be zero in this case. If $\gamma < 0$, deviations of the same size but opposite sign yield different losses and, thus, the rate of appreciation is weighted more heavily than the rate of depreciation. Analytically, $\partial L_t / \partial(e_t) = \lambda[e_t + (\gamma/2)(e_t)^2] < 0$, for $e_t < 0$.

Two points of clarification should be noted. With regard to the issue of why the level of reserves as opposed to deviation matters, we can never of course be sure, as central banks do not make clear their objectives. That said, one might argue that central banks are actually quite sensitive about declines in reserves as they may be viewed by markets as a sign of some concern or weakness (for instance, see Bird and Rajan 2003). In relation to this, the fact that many regional central banks rapidly rebuilt their reserves once the crisis abated further adds to the conjecture that central banks arguably are very concerned about the actual reserve levels. By equating e^* to zero, we are assuming the choice by countries of a fixed exchange rate regime, which is admittedly a simplifying assumption. That said, it is fairly clear in some instances, such as Singapore, that the central bank targets a particular level (within a range) as opposed to a rate of depreciation *per se*. In any case, making the theoretical framework more general would not necessarily add much, if any, value to the empirical results.

It is assumed that interventions can reduce the rate of change (depreciation/appreciation) in the exchange rate. Accordingly,

$$\tilde{e}_t - e^* = a_0 + a_1 R_t + \varepsilon_t \tag{4.3}$$

where $a_1 > 0$ and the error term, ε_t, are independent and identically distributed (i.i.d.) with zero mean and variance σ_ε^2. Minimizing equation 4.2 by choosing R_t subject to the constraint 4.3 leads to the following intervention reaction function of the central bank:

$$R_t = R^* - \lambda a_1 E_{t-1}\left\{\tilde{e}_t + \frac{\gamma}{2}(\tilde{e}_t)^2\right\} \tag{4.4}$$

Replacing expected values with actual values, the empirical version of the intervention reaction function can be simplified as follows:

[24] Data on actual central bank intervention are not available for the countries considered.

$$R_t = c + \alpha \tilde{e}_t + \beta(\tilde{e}_t)^2 + v_t \quad (4.5)$$

where $\alpha = -\lambda a_1$ and $\beta = -\lambda a_1 \gamma/2$. The reduced form parameters $[\alpha,\beta]$ allow us to identify the asymmetric preference on exchange rate stabilization, γ. It can be shown that the asymmetric preference parameter is $\gamma = 2\beta/\alpha$. This parameter is the main concern of our empirical exercise in the next section (Surico 2008 and Srinivasan, Mahambare, and Ramachandran 2008).

4.2 Results

Our estimation is based on monthly data for the sample period between 2000:m1 and 2009:m7 for six emerging Asian economies: India, Korea, the Philippines, Singapore, Thailand, and Indonesia (largely the same set as in Section 3, excluding the non-Indian South Asian economies of Bangladesh, Pakistan, and Sri Lanka, as well as Malaysia and the PRC, which maintained US dollar pegs until late 2005, and Viet Nam, which also has a strong and growing de facto US dollar peg). This was the period of rapid stockpiling of reserves in the region (i.e., after the Asian crisis of 1997–98), including the global financial crisis of 2008–9, which started to have an impact on developing and emerging Asian countries' balance of payments by early to mid-2008.

The variables used in the estimation are as follows: the US federal funds rate, r_t = (Δlog *Reserves*$_t$)*100 and $\tilde{e}_t$ = (Δlog e_t)*100 with e_t being the nominal exchange rate (US dollar per domestic currency) and the nominal effective exchange rate (NEER), respectively, such that a rise in each of these two alternative definitions of the nominal exchange rate denote a currency appreciation, and vice versa. The data are sourced from the IMF's *International Financial Statistics* except for the NEER, which is sourced from the Bank for International Settlements (BIS).

As implied earlier, equation 4.5 is the main equation of interest in the empirical test.[25] Table 5 reports the estimates of the intervention reaction function as well as the asymmetric preference parameter. For each country we present two sets of results: Row (1) using the nominal bilateral exchange rate (US dollar per domestic currency) and Row (2) using the NEER. The *J* test indicates that the hypothesis of valid over-identifying restrictions is never rejected. The parameters on $\tilde{e}_t$ and α are statistically different from zero in all cases. Of primary interest to us is the parameter on the squared $\tilde{e}_t$ -- the β coefficient. This is because testing the restriction that H_0: $\beta = 0$ is akin to testing H_0: $\gamma = 0$. β is significant in all countries.

What are our prior expectations of the γ, the asymmetric preference parameter? As noted in Section 4.1, a rise in the nominal bilateral exchange rate (NEER) denotes an appreciation, implying γ should be positive. The asymmetric preference parameter is significantly positive when either the nominal US dollar per domestic currency exchange rate or the NEER is used as the measure of the exchange rate (rise implies appreciation). This implies that the central banks of these countries appear to react differently to appreciation and depreciation

[25] The orthogonality conditions implied by the inter-temporal optimization-rational expectations paradigm make the generalized method of moments (GMM) approach the appropriate method of estimating equation 4.4. We follow Hansen (1982) and use an optimal weighting estimate of the covariance matrix that accounts for both serial correlation and heteroscedasticity in the error terms. Hence we report robust standard errors. For the most part, constant, lagged values (1 to 10, 12, and 15 months) of r_t, e_t, as well as current and lagged values (1 to 4, 8, and 15 months) of the US federal funds rate are used as instruments.

pressures. More to the point, the responses of central banks in these countries to rates of appreciation are much stronger than to rates of depreciations of the same value.[26]

The estimated asymmetric parameter is also much higher in the case of the NEER than the nominal bilateral exchange rate for three of the six countries examined--namely, India, Singapore, and Thailand. For these three countries, the asymmetric preference parameter, γ, ranges from 0.23 for India to a high of 0.71 for Singapore when the nominal bilateral exchange rate is used, and from 0.69 for India to 4.57 for Thailand when the NEER is used. The estimates of the asymmetric preference parameter for these same three countries are about two (Singapore), three (India), and seven (Thailand) times larger when the NEER is employed as the regressor in the intervention reaction function compared to when the nominal bilateral exchange rate is used. This implies that these three economies tend to pay more attention to managing their effective exchange rate than the US dollar rates. This is consistent with other studies that have estimated the degree of influence of major currencies on the Asian economies since the Asian crisis and have found evidence of loose pegging to a basket with the Japanese yen and euro also influencing movements in the Asian currencies beyond the US dollar (as discussed in Section 3). Once again, while this finding for Singapore is consistent with the fact that it officially pursues a "Basket, Band, and Crawl" (BBC) regime, with a basket essentially referring to the NEER, two other countries in the region, Thailand and India, are also believed to operate a de facto currency basket arrangement.

5. EXCHANGE RATE UNDERVALUATION

Many emerging Asian economies have, like Japan, remained circumspect about allowing for a freely floating regime and continue to manage their currencies heavily both to "lean against the wind" as well as to manage short-term currency volatility.[27] With regard to the latter, given the heavy reliance of Asia on external trade, FDI, and capital flows, the obvious desire by many Asian policymakers to minimize currency volatility (quite apart from leaning against the wind) is understandable, even if the theoretical and empirical evidence linking currency volatility to trade, investment, and growth is not unambiguous (Eichengreen 2009 and Schnabl 2007).[28]

Leaving aside for now the rather voluminous issue of the impact of currency volatility, we focus on the issue of currency undervaluation, which is arguably more controversial given its cross-border repercussions ("beggar-thy-neighbor" and global imbalances). In particular, we offer a simple analytical exposition of some of the issues relating to the PRC, East Asian development, and global imbalances using a simple two-sector tradables and non-tradables model.[29]

[26] We have also tried the estimations for smaller sub-periods, such as the pre-global financial crisis period (until early or mid-2008), and the results remain intact.

[27] There may even be a degree of endogeneity in the sense that as countries "learn to float," they gain a greater degree of monetary policy autonomy (see Hakura 2005). Of course, if unrestrained monetary policy has been a facet of a country's past, imposing exchange rate fixity may be an advantage as it constrains the active use of monetary policy.

[28] There are technical issues in terms of how exchange rate volatility is measured, whether certain outliers drive the results, differentiating between volatility and valuations, and the underlying causes of volatility, among other questions.

[29] We assume for simplicity a common terms-of-trade between importables and exportables such that they can be combined into "tradables."

5.1 Defining the Real Exchange Rate[30]

To understand the issue of real exchange rate undervaluation it would be useful to remind ourselves that the real exchange rate (RER) can be decomposed into two sets of relative prices: the relative price of traded goods between countries (so-called "price competitiveness") and the relative price of tradables and non-tradables within a country. The (log) aggregate price index can be expressed as a weighted average of the price of tradables (T) and non-tradables (NT):

$$p = (1-\alpha)p^T + \alpha p^N \text{ for the domestic country} \quad (5.1)$$

and,

$$p^* = (1-\beta)p^{T^*} + \beta p^{N^*} \text{ for the foreign country.} \quad (5.2)$$

Then the RER, $q = s + p^* - p$, can be written as the sum of the relative price of traded goods (a) and the relative price of non-traded goods (b).

$$q = \overbrace{e + p^{T^*} - p^T}^{(a)} + \underbrace{\beta(p^{N^*} - p^{T^*}) - \alpha(p^N - p^T)}_{(b)} \quad (5.3)$$

where $a = e + p^{T^*} - p^T$ and $b = \beta(p^{N^*} - p^{T^*}) - \alpha(p^N - p^T)$

Given the increasing degree of trade openness of economies to international trade flows, it is likely that the Law of One Price in traded goods tends to hold over time (at least among the East Asian economies). If this is the case, the RER is primarily a reflection of relative prices of tradables and non-tradables and thus has implications for both internal resource allocations as well as external repercussions (on global imbalances).[31]

One simple, albeit highly imperfect, proxy for the RER would be the ratio of the Wholesale/Producer Price Index or WPI/PPI (a broad measure of tradables) vis-à-vis the Consumer Price Index or CPI (which consists of a significant share of non-tradables).[32] Figure 3 reveals that while there have been some fluctuations in this ratio over the last decade, these movements have been within a rather narrow range of 6% or so either way. Given the extraordinarily rapid growth of the economy during this period (9.5% on average between 1998 and 2009),[33] the lack of discernible appreciation of the real exchange rate suggests a significant degree of undervaluation (we return to this point later in the paper).

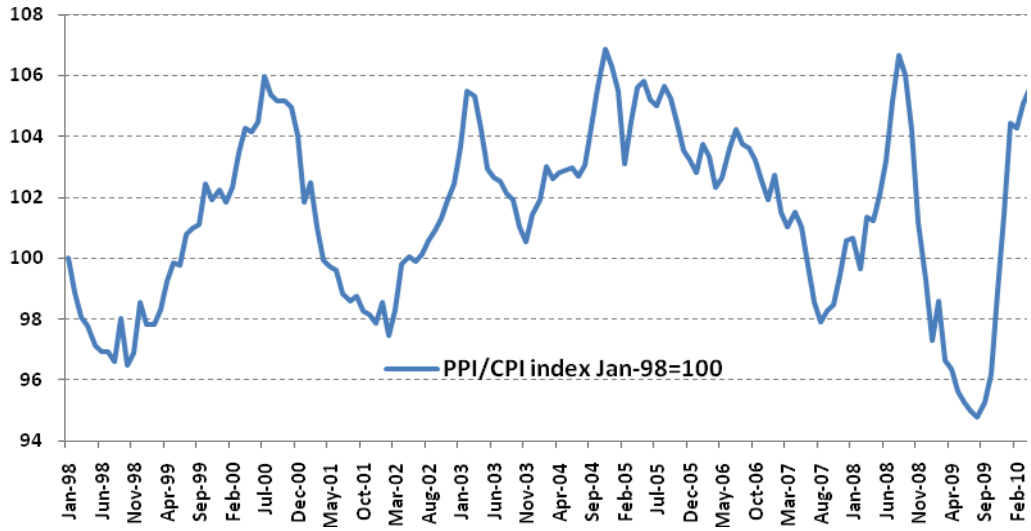
[30] Sections 5.1-5.3 are based on Rajan and Beverinotti (2011).

[31] The empirical literature estimating variations in the real exchange rate (RER) is mixed at best. For instance, Chinn (2000) finds some East Asian RERs (Japan, Korea, the Philippines, and Singapore) to be co-integrated with relative prices, while others (the PRC, Indonesia, and Thailand) are not. Parsley (2007) finds that about 60% of the variations in bilateral real exchange rates in East Asian bilateral exchange rate movements can be explained by variations in the relative price of tradables and non-tradables. See Rajan and Beverinotti (2011) and the literature cited within.

[32] Of course, not all components of the PPI (or WPI, for that matter) are tradable, and not all components of the CPI are non-tradable. A somewhat more precise measure could be to examine the ratio of the trade index (i.e., exports plus imports) to $CPI_{NT,}$ (i.e., the consumer price index of those components that are non-tradable). However, even such a measure is not without its problems. Specifically, even when many goods are tradable, not all of them are actually traded (see Helpman, Melitz, and Rubinstein 2008).

[33] According to the World Bank World Development Indicators.

Figure 3: PRC Real Exchange Rate, 1998–2010

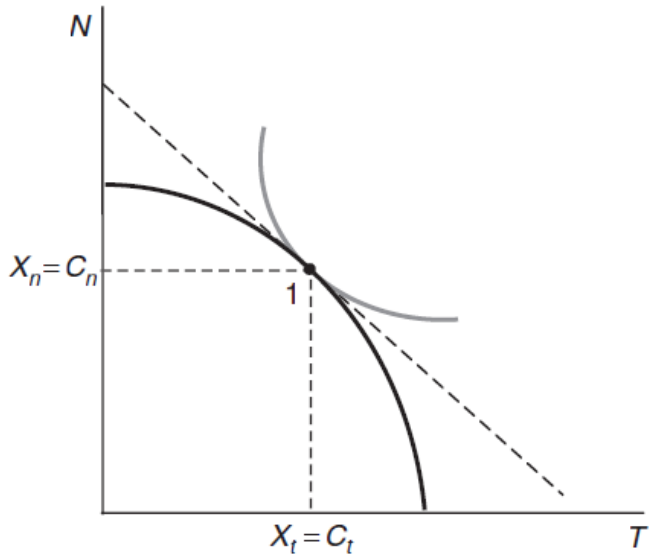


Source: National Bureau of Statistics.

5.2 Mean Reverting Real Exchange Rate: No Growth Effects

Assume that the country was initially running a balanced current account and produces and consumes at point 1, where production (X) is equal to consumption (C) for both products ($X_T = C_T$ and $X_{NT} = C_{NT}$), as in Figure 4. The slope of the budget line is given by the relative price of tradables to non-tradables—i.e., p_T / p_{NT}, where $p_T = e * p_T^* * (1+s)$, i.e. e is the domestic currency per unit of foreign currency, p_T^* is the world price of tradables, and *s* is the per unit net subsidy on domestic non-tradables.[34]

Figure 4: Non-distorted Equilibrium

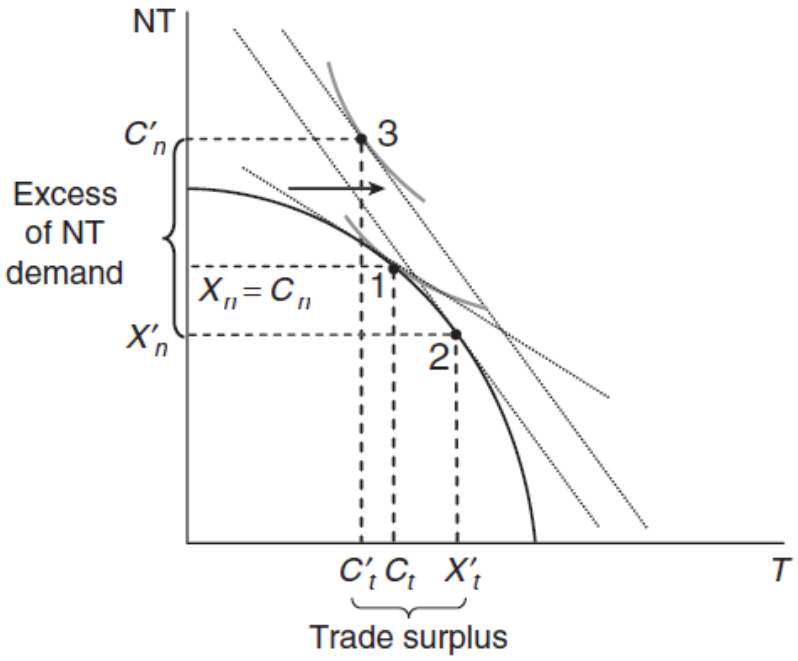


Source: Rajan and Beverinotti (2011).

[34] Think of *s* as being the net of per unit tariff on imports and subsidy (financial or otherwise) to domestically-produced tradable goods (exports and/or import-competing goods).

A RER undervaluation (accomplished via nominal devaluation, subsidies, tariffs, etc.) leads to a steeping of the budget line (Figure 5). The rise in the relative price of tradables leads to a shift of domestic resources to that sector away from non-tradables (point 2) and a corresponding fall in the consumption of tradables (C_T) and rise in the consumption of non-tradables (C_{NT}) (point 3).[35] As can be seen, at the new equilibrium, $X_T > C_T$ (X'_t and C'_t). Thus, the excess production of tradable goods is exported overseas (especially to the US), helping East Asia generate large and sustained trade surpluses (defined as excess production over consumption of tradables). These trade surpluses in turn led to a massive infusion of global liquidity and kept global credit conditions exceptionally loose, financing—and possibly contributing to—the trade and current account deficits abroad and the consequent global imbalances.[36] However, on its own, the process would not persist forever.

Figure 5: Real Exchange Rate Undervaluation in a Static Setting



Source: Rajan and Beverinotti (2011).

As noted, at this new equilibrium, $X'_{NT} < C'_{NT}$. Thus, the conundrum is why this undervaluation of relative non-tradables prices persisted; by lowering the production of non-tradables relative to consumption, why was its price not pushed up relative to tradables—the so-called "mean reversion of the real exchange rate"?[37]

Conventional wisdom has been that the East Asian economies were able to keep a lid on the domestic demand for non-tradables via financial repression, which kept domestic credit reined in while maintaining a high degree of fiscal restraint (since government expenditures

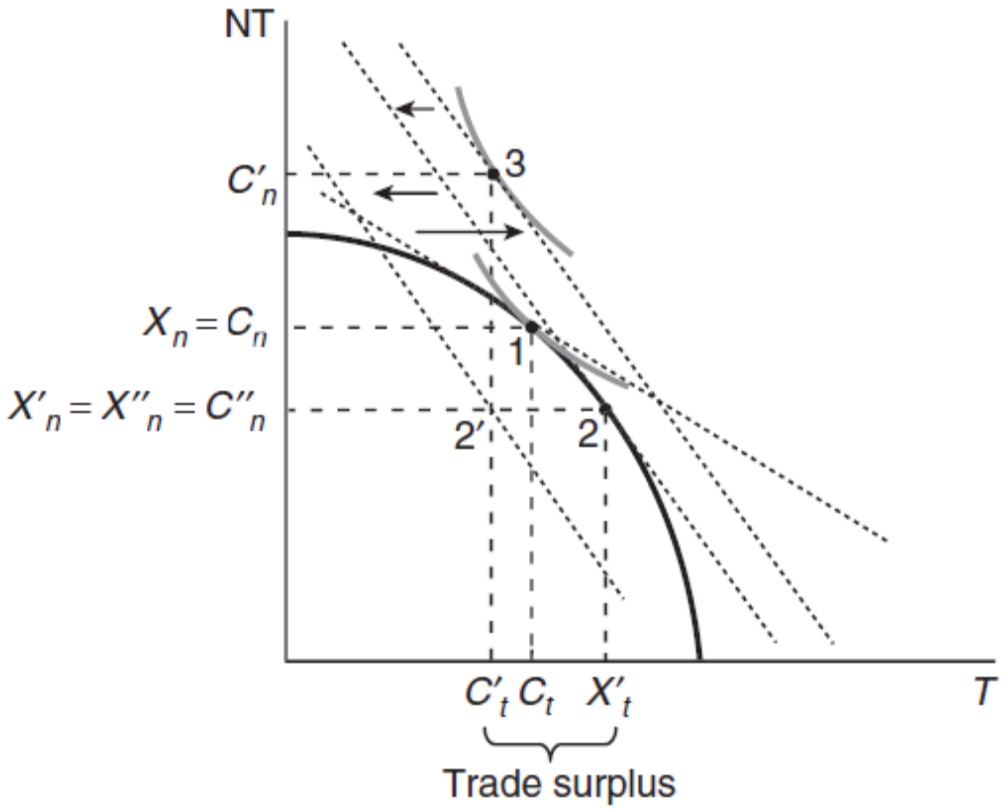
[35] We assume here that substitution effect outweighs the income effect such that C_{NT} rises.

[36] While one school of thought argues that the US current account deficit was financed via capital inflows, the other school of thought, led by Ben Bernanke (2005), has argued that the global savings glut overseas led to large-scale capital inflows into the US, causing lower long-term interest rates, increased consumption and investment, and contributing to the worsening current account deficit. Also see Blanchard and Milesi-Ferreti (2009) and Wyplosz (2010).

[37] There is a burgeoning literature that attempts to test if real exchange rates are mean-reverting. For instance, see Gil-Alana (2000) and Jorap (2009).

tend to fall overwhelmingly on non-tradables).[38] As can be seen from Figure 6, this implies a leftward parallel shift of the budget line until we are back to a point on the PPC like point 2, where the economy produces at point X'_{NT} and X'_{T}. However, consumption is reined in to a point such as 2' where there is no disequilibrium in the non-tradables sector and the economy continues to run a current account surplus ($X'_T - C'_T$). Notice that compared to the original point 1 (where there is no intervention), at point 2' the economy consumes relatively less of both tradables and non-tradables, implying that welfare must be lower (lower indifference curve). In other words, in the absence of any market failures, any government intervention must be welfare-reducing.[39]

Figure 6: Real Exchange Rate Undervaluation Accompanied by Contractionary Demand



Source: Rajan and Beverinotti (2011).

While this combination of macroeconomic policies (real exchange rate undervaluation and demand contraction) was clearly used by the PRC and its East Asian neighbors, given the rapid pace of infrastructural and real estate development and overall credit growth in that region, one would be hard-pressed to argue that demand for non-tradables was as heavily suppressed as some economists have suggested. While the non-tradables sector may not have grown as rapidly as the tradables sector, it has, nonetheless, grown quite rapidly (Barnett and Brooks 2006). How does one reconcile this seeming discrepancy? Of course, the easy answer would be that these countries—the PRC, most notably—have an abundant supply of rural labor looking for work in the fast-growing manufacturing sector, and this labor surplus helped contain the wage costs and kept the price of non-tradables down. This

[38] Of course, another way countries were able to keep the prices of non-tradables down was via direct price controls, though this merely transforms the problem from one of prices to that of quantities and rationing (Huang and Tao 2010).

[39] It is plausible that point 2' could be located below point 1, implying consumption of non-tradables is the same; but at point 2', the consumption of tradables is lower than point 1, still implying lower welfare.

phenomenon—the so-called Arthur-Lewis "classic dual-sector model," where wages are set in the rural sector as supply of labor—is almost perfectly elastic.[40] However, while this may have been true in the early stages of industrialization, most data suggests that wages started rising fairly quickly. Cai Fang (2007), for instance, has argued that the PRC has already reached a "Lewis turning point," and that there will be significant upward pressures on industrial wages.[41]

But there is the broader question as to why, in the era of non-commodity based currencies, countries would ever want to bias production towards the tradables sector, let alone run trade surpluses at the seeming expense of overall consumer welfare.[42] The obvious answer here would be that, from a growth perspective, the demand for non-tradables is limited by the size of the domestic market and is relatively inelastic, while that for exportables is highly elastic. However, the problem with this line of reasoning is that if market forces were allowed to operate on their own, the price of non-tradables would fall relative to tradables, leading to a sectoral resource reallocation without any need for government intervention in the form of currency undervaluation. The same point holds true if, as some have argued, export markets are more dynamic and allow a country to rapidly move up the value-added chain. This implies that the relative price of tradables will rise even more rapidly vis-à-vis nontradables and lead to a natural movement of resources from non-tradables to tradables without any need for government intervention.

5.3 Dynamic Growth Effects and Market Failures

Rodrik (2008) has offered an explanation/justification for the East Asian countries' undervaluation policies. He argues that one must go beyond the usual (static) resource reallocation effects, instead emphasizing dynamic gains from favoring export-linked manufacturing. These benefits could be in the form of learning-by-doing and demonstration effects that are external to the firm. Thus, left to themselves, markets would under-produce such goods and government intervention could jump-start growth via RER undervaluation to internalize these externalities. In other words, RER undervaluation could act as a form of industrial policy, helping to rapidly propel East Asian economies into global manufacturing powerhouses.[43] Taking this argument further, by channeling resources into the production of tradables, there may also be some positive productivity spillovers to the non-tradables sector helping to keep the output of that sector up despite the relative decline in its price. In other words, there may be dynamic expansionary effects which balance, if not outweigh, the static contractionary effects.

The foregoing possibility is outlined more formally in Figure 7 below. The starting point is as before. To be more specific, the economy is initially in equilibrium at point 1 and the RER undervaluation changes the composition of consumption and production, generating a trade surplus and excess demand of non-tradables. We know from previous explanation that this would not be sustainable without demand compression. However, assume now that there are growth effects that make possible an outward movement of the production frontier.[44] In the case where the economy experiences growth effects, the economy could be in an equilibrium such as point 5 where the production and consumption of both tradables and

[40] For a recent review of the model, see Kirkpatrick and Barrientos (2004).

[41] Zhao (2010) offers a useful discussion of the predicament and policy concerns regarding migration of the PRC's rural workers to the country's urban and industrializing areas.

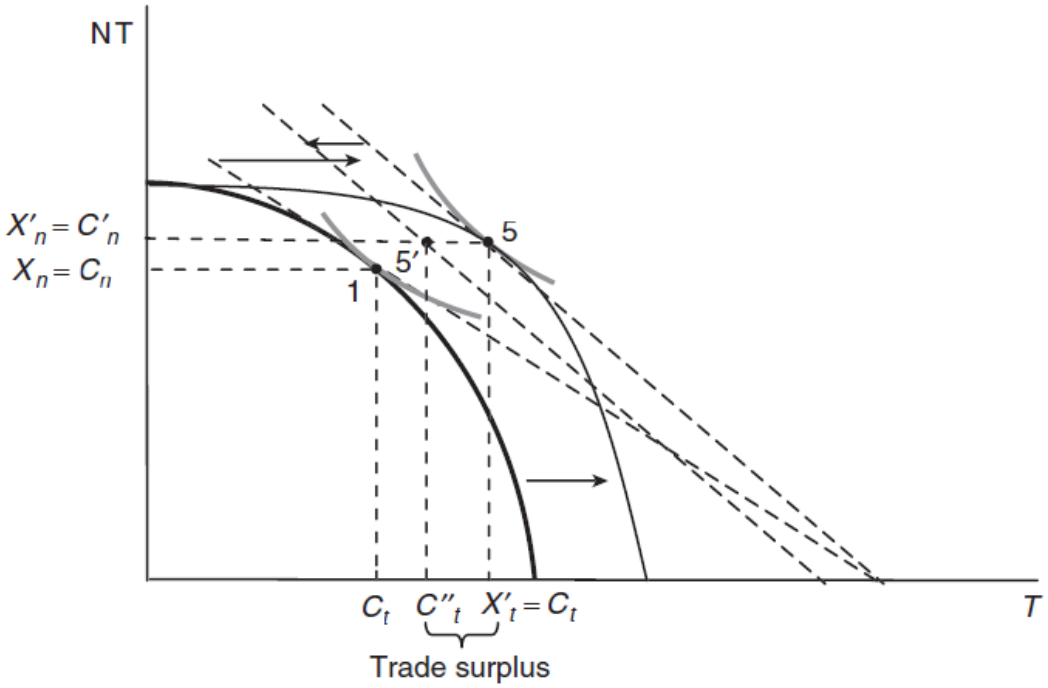
[42] More precisely, as noted later, the issue of biasing production towards tradables and running a trade surplus do not always go hand-in-hand.

[43] The Rodrik story is elaborated upon in a more sophisticated model by Korinek and Serven (2010) who show how undervaluation can help firms internalize "learning by investing" spillovers in a two-factor model.

[44] The economy can produce the same amount of non-tradables, and more tradables with the same quantity of resources, or even more of both goods if externalities spill over from the tradables to nontradables sectors.

non-tradables rise, thus unambiguously increasing overall welfare (point 5 being northeast of point 1).

Figure 7: Real Exchange Rate Undervaluation with Dynamic Growth Effects



Source: Rajan and Beverinotti (2011).

As before, if the country wanted to run a trade surplus for whatever reason, it would require a degree of contractionary aggregate demand policies such that consumption is below the production frontier. The important point, though, is that even at point 5' it is plausible that the consumption of both tradables and non-tradables is higher than the initial equilibrium (point 1). What we have not explained is why the authorities would want to run a trade surplus (i.e., choose point 5', which is welfare-inferior to point 5). In fact, many East Asian countries began the process of effectively subsidizing the tradables sector far before they started running trade surpluses. Broadly, Aizenman and Lee (2008) refer to the former (i.e., supporting tradables, especially exports) as "financial mercantilism" and the latter (i.e., trade surpluses and reserve hoarding) as "monetary mercantilism." The latter may be due to a desire to build up net foreign assets for precautionary purposes as a "war chest" against future crises (see, for example, Caroll and Jeanne 2009 and Durdu et al. 2008), or the neo-mercantilist belief that exports are special (as opposed to tradables more generally) (Korinek and Serven 2010).

6. CONCLUSION

This paper has examined the de facto exchange rate regimes in emerging Asia. There is some evidence indicating a greater degree of exchange rate flexibility in the regional economies. However, there is still a high level of fixity to the US dollar regardless of the de jure exchange rate regime.

Levy-Yeyati and Sturzenegger (2007) conjectured that exchange rate policies have evolved towards an apparent "fear of floating in reverse" or "fear of appreciation," whereby interventions have been aimed at limiting appreciations rather than depreciations. Our results confirm the existence of an asymmetry in central bank foreign exchange intervention responses to currency appreciations versus depreciations in many developing and emerging Asian economies, particularly in the case of nominal effective exchange rates (NEERs). This

in turn rationalizes the relative exchange rate stability as well as the sustained reserve accumulation in the region.[45]

The paper went on to explore how real exchange rate undervaluation in much of East Asia led to sectoral reallocation of resources, which may in turn have helped transform them into industrial and export powers. In the scenario outlined in this paper, if there are positive externalities from producing tradables, which might also benefit the non-tradables sector[46], it is plausible that the country is able to produce and consume more of both tradables and nontradables simultaneously. While the country would still need to curb domestic demand if it desires to run a trade surplus, we have shown that it could still be in a welfare-enhancing position compared to the case where the markets were able to operate freely. This seems to be a plausible growth story for East Asia and PRC. Of course, these policies have also contributed to external imbalances with the US as well as globally. However, from the PRC's perspective, why would it consider changing its policy stance now if this undervalued RER-based development strategy has indeed been so successful?

The dynamic growth story based on externalities from producing more tradables as outlined above is unlikely to be valid forever. It is generally believed that the productivity of the tradables sector will outpace that of non-tradables and real wages will have to start rising over time as the country develops. The PRC has clearly been feeling intense price pressures in recent times.[47] Indeed, a number of commentators have expressed concerns that such large-scale intervention runs a serious risk of generating increases in inflation in the intervening countries, and some have even suggested that such reserve accumulations have played a major role in the creation of excessive global liquidity. Key to such issues is the extent to which monetary authorities can successfully sterilize the domestic monetary effects of reserve accumulation. Most monetary models of the exchange rate and balance of payments assume no sterilization so that large reserve accumulations would automatically lead to rapid growth in domestic money and credit. Sufficiently high levels of international capital mobility would make effective sterilization impossible, no matter the intensity of efforts of the domestic monetary authorities.

Ouyang, Rajan, and Willett (2010) and Ouyang and Rajan (2008) analyzed these issues for the PRC and India, respectively (pre-global financial crisis), and found that both countries had been able to effectively sterilize a high proportion of their recent reserve increases. If, however, the reserve build-up persists unabated and the fiscal costs of sterilization begin to escalate (Calvo 1991), it is unlikely that the regional monetary authorities can persist with aggressive sterilization on such a huge scale.[48] In such a situation domestic macroeconomic stability could be compromised. However, this effective undervaluation of the currency and the consequent bias towards external demand as opposed to domestic consumption may need to be reconsidered, particularly in view of the decline that is likely to occur in the trend growth in the US and rest of the industrialized world over the medium-term.

A more sustainable strategy would be to allow its RER to appreciate somewhat and reorient production and consumption towards non-tradables. If so, the PRC's undervaluation policy and its hitherto export-led growth paradigm may have reached its limits. Further yuan revaluation along with expansion of domestic demand is likely necessary going forward. With

[45] This is not to suggest that the policy was implemented mechanically at all times. Countries in Asia—India, Korea, and Indonesia, most notably—allowed for greater currency flexibility during the 2007–8 periods when there were concerns of commodity-induced inflation.

[46] Of course, stating that there may be market distortion is easy; providing specific evidence is a much tougher proposition.

[47] Anecdotal evidence pointing to wage-price pressures and labor unrest in the PRC is growing (for instance, see Peaple 2010 and *The Economist*, 10 June 2010).

[48] The World Bank (2005) and Mohanty and Turner (2005) discuss the latter two costs, and Rodrik (2006) discusses the issue of opportunity costs. These costs need to be balanced against the likelihood that higher reserve holdings reduce a country's perceived international credit standing, hence lowering the country's risk premium.

regard to the latter, substantial increases in domestic demand in the PRC would require domestic structural reforms, including removing domestic cost distortions, upgrading domestic financial markets and safety nets, as well as reducing retained earnings of firms.[49] With regard to the former, the announcement by the PRC on 19 June 2010 that it will abandon its currency peg to the dollar and manage the yuan more flexibly against a currency basket should be viewed in this context.[50]

What does a more flexible (and presumably stronger yuan) imply for the rest of Asia? The dynamics between the PRC's real exchange rate and the rest of the region is complex. For instance, while it is commonly believed that a real exchange rate appreciation of the yuan would benefit some other Asian economies with broadly similar comparative advantage (e.g., India and Viet Nam), allowing them to gain global market share, it could also hurt others in the region as the PRC's imports from the region might decline as production networks between the PRC and Southeast Asia move elsewhere (Garcia-Herrero and Koivu 2009).

Regardless of whether the PRC's exports are a substitute or complement to other Asian economies, there appears to be a prisoner's dilemma with regard to exchange rate policies in Asia, which in turn implies that there may be potential benefits from pursuing a more coordinated approach to dealing with monetary and exchange rate policies in the region.[51] Certainly, coordination does not imply straight-jacketing all countries in the region to a common exchange rate regime. More specifically, rather than adopting a single currency immediately, Asian economies might gradually move towards pegging to a currency basket—starting with individual currency weights and varying extents of flexibility around the pegs with a gradual convergence over time.

[49] See Goldstein and Lardy (2009), Huang and Tao (2010), and OECD (2010) for discussions on structural reforms needed in the PRC. Qiao and Song (2009) offer a detailed overview of the PRC's savings rate.

[50] See the People's Bank of China: http://www.pbc.gov.cn/english/detail.asp?col=6400&id=1488. It is important to keep in mind that the PRC did make a similar announcement on 21 July 2005, when it started allowing the RMB to gradually appreciate vis-à-vis the US dollar. That policy was put on hold from July 2008 as the PRC returned to a firm US dollar peg with the onset of the global financial crisis because of concerns about export and growth slowdown and global deflation. See Frankel (2009) for an empirical evaluation of the PRC's exchange rate regime.

[51] Park (2006) elaborates on the prisoner's dilemma in East Asia and the central role played by the PRC.

REFERENCES

Aizenman, J., and J. W. Lee. 2008. Financial versus Monetary Mercantalism: Long-run View of Large International Reserves Hoarding. World Economy 31(5): 593–611.

Barajas, A., L. Erickson, and R. Steiner. 2008. Fear of Declaring: Do Markets Care What Countries Say About Their Exchange Rate Policies? IMF Staff Papers No. 55: 445–480. Washington, DC: International Monetary Fund.

Barnett, S., and R. Brooks. 2006. What's Driving Investment in China? IMF Working Paper No. WP/06/265, November. Washington, DC: International Monetary Fund.

Bernanke, B. 2005. "The Global Saving Glut and the U.S. Current Account Deficit. Homer Jones Lecture, St. Louis, Missouri, 14 April.

Bird, G., and R. S. Rajan. 2003. Too Much of a Good Thing? The Adequacy of Reserves in the Aftermath of Crises. *World Economy* 26: 873–891.

Blanchard, O., and G. M. Milesi-Ferretti. 2009. Global Imbalances: In Midstream? IMF Staff Position Note SPN/09/29, December. Washington, DC: International Monetary Fund.

Bleaney, M., and M. Francisco. 2005. Exchange Rate Regimes and Inflation: Only Hard Pegs Make a Difference. *Canadian Journal of Economics* 38: 1453–1471.

Bonnang, P. B. 2009. Role of Monetary Policy in Response to the Global Financial Crisis: The Case of Cambodia. Regional High-Level Workshop on Strengthening the Response to the Global Financial Crisis in Asia-Pacific: The Role of Monetary, Fiscal and External Debt Policies, 27–30 July 2009, Dhaka, Bangladesh.

Bubula, A., and I. Ötker-Robe. 2002. The Evolution of Exchange Rate Regimes Since 1990: Evidence from De Facto Policies. IMF Working Paper No. 02/155. Washington, DC: International Monetary Fund.

Burstein, A., M. Eichenbaum, and S. Rebelo. 2006. The Importance of Nontradable Goods' Prices in Cyclical Real Exchange Rate Fluctuations. *Japan and the World Economy* 18(3): 247–253.

Cai Fang, ed. 2007. *Green Book of Population and Labor: The Coming Lewisian Turning Point and Its Implications*. Beijing: Social Sciences Academic Press.

Calvo, G. 1991. The Perils of Sterilization. *IMF Staff Papers* No. 38: 921–926.

Calvo, G., and C. Reinhart. 2002. Fear of Floating. *Quarterly Journal of Economics* 107: 379–408.

Carroll, C., and O. Jeanne. 2009. A Tractable Model of Precautionary Reserves or Net Foreign Assets. NBER Working Paper No. 15228, August. Cambridge, MA: National Bureau of Economic Research.

Cavoli, T., and R. S. Rajan. 2009. *Exchange Rate Regimes and Macroeconomic Management in Asia*. Hong Kong, China: Hong Kong University Press.

Cavoli, T., and R. S. Rajan. 2010. How Flexible Have Asian Exchange Rate Regimes Become in the Post-Crisis Era? Unpublished mimeo.

Chinn, M. D. 2000. The Usual Suspects? Productivity and Demand Shocks and Asia-Pacific Real Exchange Rates. Review of International Economics 8: 20–43.

Chinn, M. D., and S. J. Wei. 2009. A Faith-based Initiative: Does a Flexible Exchange Rate Regime Really Facilitate Current Account Adjustment? NBER Working Paper No. 14420, August. Cambridge, MA: National Bureau of Economic Research.

Dooley, M., D. Folkerts-Landau, and P. Garber. 2003. An Essay on the Revived Bretton Woods System. NBER Working Paper No. 9971, September. Cambridge, MA: National Bureau of Economic Research.

Durdu, B. C., E. G. Mendoza, and M. E. Terrones. 2009. Precautionary Demand for Foreign Assets in Sudden Stop Economies: An Assessment of the New Mercantilism. Journal of Development Economics 89(2): 194–209.

Eichengreen, B. 2006. China's Exchange Rate Regime: The Long and Short of It. Unpublished mimeo. University of California, Berkeley.

Eichengreen, B. 2009. The Real Exchange Rate and Economic Growth. Working Paper No. 4, Commission on Growth and Development. Washington, DC: The World Bank.

Eichengreen, B., and M. Hatase. 2005. Can a Rapidly-Growing Export-Oriented Economy Smoothly Exit a Peg? Lessons for China from Japan's High Growth Era. NBER Working Paper No. 11625. Cambridge, MA: National Bureau of Economic Research.

Eichengreen, B., and A. Rose. 2010. 27 Up: The Implications for China of Abandoning its

Dollar Peg. Unpublished mimeo. University of California, Berkeley.

Elmendorf, D. W. 2010. U.S. Fiscal Policy After the Financial Crisis and Recession. Presentation to the International Monetary Fund Fiscal Forum, 23 April.

Evenett, S., ed. 2010. *The US-Sino Currency Dispute: New Insights from Economics, Politics, and Law*. London, UK: VOX-EU.org and Centre for Economic Policy Research.

Frankel, J. A. 2009. New Estimation of China's Exchange Rate Regime. NBER Working Paper No. 14700, February. Cambridge, MA: National Bureau of Economic Research.

Frankel, J. A. and S. J. Wei. 1994. Yen Bloc or Dollar Bloc? Exchange Rate in the East Asian Economies. In T. Ito and A. Krueger, eds. *Macroeconomic Linkage: Savings, Exchange Rates, and Capital Flows*. Chicago, IL: University of Chicago Press.

Frankel, J. A. and S. J. Wei. 2007. Estimation of De Facto Exchange Rate Regimes: Synthesis of the Techniques for Inferring Flexibility and Basket Weights. IMF Annual Research Conference, International Monetary Fund, Washington, DC. 16 November.

Garcia-Herrero, A., and T. Koivu. 2009. China's Exchange Rate Policy and Asia Trade. BIS Working Paper No. 282. Basel, Switzerland: Bank for International Settlements.

Garcia-Herrero, A., and T. Koivu. 2010. What Can the Rest of Asia Do About China's Exchange Rate? Unpublished mimeo. Bank of Finland.

Gil-Alana, L. A. 2000. Mean Reversion in the Real Exchange Rates. *Economics Letters* 69(3): 285–288.

Goldstein, M., and N. Lardy. 2009. *The Future o*f *China's Exchange Rate Policy.* Washington, DC: Petersen Institute for International Economics.

Hakura, D. S. 2005. Are Emerging Market Countries Learning to Float? IMF Working Paper No.WP/05/98. Washington, DC: International Monetary Fund.

Hansen, P. 1982. Large Sample Properties of Generalized Method of Moments Estimators. Econometrica 50(4): 1029–54.

Husain, A. M. 2005. Choosing the Right Exchange Rate Regime for Pakistan. Paper prepared for the State Bank of Pakistan's Conference on Monetary-cum-Exchange Rate Regime: What Works Best for Emerging Market Economies, October.

Husain, A. M., A. Mody, and K. S. Rogoff. 2005. Exchange Rate Regime Durability and Performance in Developing Countries Versus Advanced Economies. *Journal of Monetary Economics* 52: 35–64.

Helpman, E., M. Melitz, and Y. Rubinstein. 2008. Estimating Trade Flows: Trading Partners and Trading Volumes. *The Quarterly Journal of Economics* 123(2): 441–487.

Huang, Y., and K. Tao. 2010. Causes and Remedies of China's External Imbalances. China Center for Economic Research Working Paper No. E2010002. Beijing: Peking University Press.

International Monetary Fund (IMF). 2010. *World Economic Outlook: Rebalancing Growth*. Washington, DC: International Monetary Fund.

Jorap, L. 2009. Are Real Exchange Rates Mean Reverting? Evidence from a Panel of OECD Countries. *Applied Economics Letters* 16: 23–27.

Kawai, M. 2002. Exchange Rate Arrangements in East Asia: Lessons from the 1997–98 Currency Crisis. Discussion Paper 2002-E-17. Tokyo, Japan: Institute for Monetary and Economic Studies, Bank of Japan.

Kirkpatrick, C., and A. Barrientos. 2004. The Lewis Model After Fifty Years. Development Economics and Public Policy Working Papers No.9/2004. University of Manchester.

Korinek, A., and L. Serven. 2010. Real Exchange Rate Undervaluation: Static Losses, Dynamic Gains. World Bank Policy Research Working Paper No.5250, May. Washington, DC: The World Bank.

Lardy, N. 2008. Financial Repression in China. Policy Brief No.PB08-8. Washington, DC: Peterson Institute for International Economics.

Levy-Yeyati, E. L. and F. Sturzenegger. 2007. Fear of Floating in Reverse: Exchange Rate Policy in the 2000s. Unpublished mimeo.

Mohanty, M. S., and P. Turner. 2005. Intervention: What are the Domestic Consequences? In Foreign Exchange Market Intervention in Emerging Markets: Motives, Techniques

and Implications. BIS Papers No. 24: 56–81. Basel, Switzerland: Bank for International Settlements.

OECD. 2010. *OECD Economic Surveys: China*. Paris, France: Organisation for Economic Cooperation and Development.

Ogawa, E., and T. Ito. 2002. On the Desirability of a Regional Basket Currency Arrangement. *Journal of the Japanese and International Economies* 16: 317–334.

Ouyang, A., and R. S. Rajan. 2008. Reserve Stockpiling and Managing its Liquidity Impact: The Case of India. *Macroeconomics and Finance in Emerging Market Economies* 1: 75–91.

Ouyang, A., R. S. Rajan, and T. D. Willett. 2010. China as a Reserve Sink: Estimating Offset and Sterilization Coefficients. Forthcoming in *Journal of International Money and Finance*, 29: 951 - 972.

Park, Y. C. 2006. Global Imbalances and East Asia's Policy Adjustments. Unpublished mimeo. Seoul National University.

Parsley, D. 2007. Accounting for Real Exchange Rate Changes in East Asia. *Journal of International Money and Finance* 26(8): 1355–1377.

Peaple, A. 2010. China's Rising Workers. *Wall Street Journal*. 31 May.

Pontines, V., and R. S. Rajan. 2011. Foreign Exchange Market Intervention and Reserve Accumulation in Emerging Asia: Is there Evidence of Fear of Appreciation? *Economics Letters*, 111: 252 – 255.

Powell, A., and J. F. Martinez. 2007. On Emerging Economy Spreads and Ratings. Unpublished. Washington, DC: Inter-American Development Bank.

Qiao, H., and Y. Song. 2009. China's Savings Rate and its Long-term Outlook. Global Economic Paper No.191. Goldman Sachs, October.

Rajan, R. S. 2002. Exchange Rate Policy Options for Southeast Asia: Is there a Case for Currency Baskets? *World Economy* 25: 137–163.

Rajan, R. S. 2010. The Evolution and Impact of Asian Exchange Rate Regimes. ADB Working Paper No.208, July.

Rajan, R. S. and J. Beverinotti. 2011. Real Exchange Rate Undervaluation, Resource Allocation and East Asian Growth. Journal of International Development, forthcoming.

Ramachandran, M., and N. Srinivasan. 2007. Asymmetric Exchange Rate Intervention and International Reserve Accumulation in India. *Economics Letters* 94: 259–265.

Reinhart, C. M., and K. S. Rogoff. 2004. The Modern History of Exchange Rate Arrangements: A Reinterpretation. Qu*arterly Journal of Economics* 119(1): 1-48. More country specific information is available in the Working Paper version (Working Paper No.8963, NBER, 2002).

Rodrik, D. 2006. The Social Cost of Foreign Exchange Reserves. *International Economic Journal* 20(3): 253–266.

Rodrik, D. 2008. The Real Exchange Rate and Economic Growth. *Brookings Papers on Economic Activity*, Fall: 365–412.

Roger, S. 2009. Inflation Targeting at 20: Achievements and Challenges. IMF Working Paper No.09/236. Washington, DC: International Monetary Fund.

Schnabl, G. 2007. Exchange Rate Volatility and Growth in Emerging Europe and East Asia. CESIFO Working Paper No. 2023, June.

Srinivasan, N., V. Mahambare, and M. Ramachandran. 2008. Preference Asymmetry and International Reserve Accretion in India. *Applied Economics Letters* 16(15): 1–14.

Surico, P. 2008. Measuring the Time Inconsistency of US Monetary Policy. *Economica* 75: 22–38.

Wang, T. 2004. Exchange Rate Dynamics. In E. Prasad, ed. *China's Growth and Integration into the World Economy Prospects and Challenges*. Washington, DC: International Monetary Fund.

Wang, Y. 2009. An Estimation of the Effectiveness of China's Capital Controls and Sterilizations. International Trade and Investment Services No.09008. Beijing: Chinese Academy of Social Sciences.

Williamson, J. 2005. A Currency Basket for East Asia, Not Just China. Policy Briefs in International Economics, No. PB05-1. Institute for International Economics.

World Bank. 2005. *Global Development Finance 2005*. New York: Oxford University Press.

Wyplosz, C. 2010. Is an Undervalued Renminbi the Sources of Global Imbalances? *VOX-EU,* 30 April.

Zhao, S. 2010. Rural Labour Migration in China: Challenges for Policies. *MOST-2 Policy Paper No.10*. UNESCO