



About the Paper

Ramkishan S. Rajan revisits the issue of evolution and choice of exchange rate regimes in Asia. The paper argues that the Asian exchange rate policy is better viewed as “fear of appreciation” rather than “fear of floating” per se.

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**The Evolution and Impact
of Asian Exchange Rate Regimes**

Ramkishan S. Rajan
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The Evolution and Impact of Asian Exchange Rate Regimes

Ramkishan S. Rajan
July 2010

Ramkishan S. Rajan is Associate Professor in the School of Public Policy, George Mason University. This paper was initially prepared as a background material for the Asian Development Bank's (ADB) *Asian Development Outlook 2010* (www.adb.org/Economics/). The paper draws on and builds upon joint work by the author with Tony Cavoli and Victor Pontines. Excellent research assistance by Sasidaran Gopalan is also gratefully acknowledged. The usual disclaimer applies.

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Abstract

This paper revisits the issue of the evolution and choice of exchange rate regimes in Asia. The paper first compiles and discusses the *de jure* or official exchange rate regimes in various developing and emerging Asian economies. It then goes on to offer a simple empirical estimation of the degree of influence of the G3 currencies in selected Asian currencies over the past decade. The paper finds some evidence of evolution of Asian exchange rate policies toward an apparent “fear of appreciation” rather than “fear of floating” per se. The broader point though is 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 paper examines some of the concerns with exchange rate flexibility that persist, and offers an extended discussion on the appropriate exchange rate regimes for Asia in the future.





I. Introduction

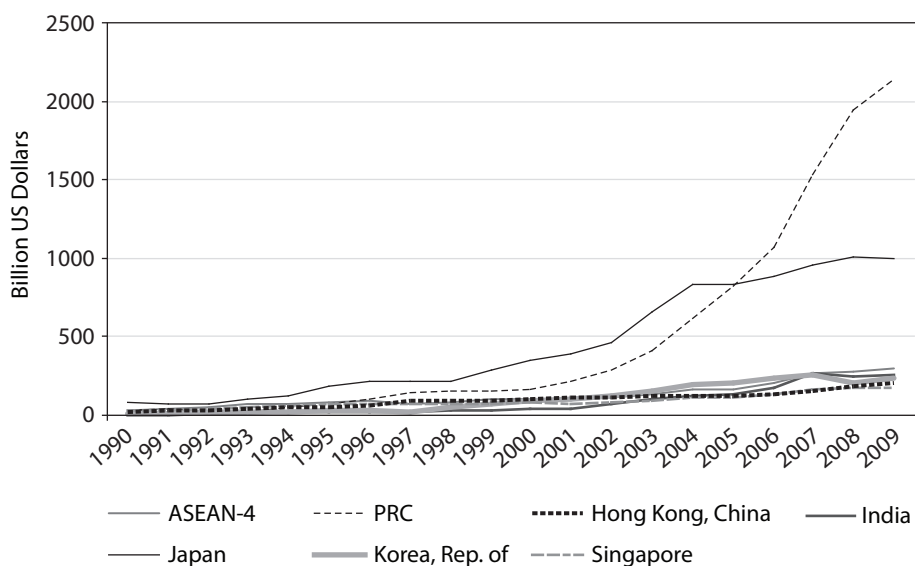
Following the 1997–1998 Asian financial crisis, there have been two broad strands of literature on Asian exchange rate regimes. One strand has attempted to examine to what extent the regional currencies have become more flexible, particularly vis-à-vis the United States (US) dollar, but also versus other currencies including the trade-weighted exchange rate. The other strand has attempted to categorize *de facto* Asian exchange rate regimes using various methodologies (see for instance, Frankel et al. 2000, Calvo and Reinhart 2002, Levy-Yeyati and Sturzenegger 2002, Reinhart and Rogoff 2004, Shambaugh 2004).

A distinct but related body of work has focused on trying to rationalize the causes and consequences of reserve build-up in developing and emerging Asian economies and elsewhere especially since 1999 (Figure 1). Apart from valuation changes due to currency composition of reserve stocks, the three main rationales often suggested for reserve accumulation are insurance (preventing a crisis); mercantilism (stimulating growth); and reducing exchange rate volatility. The last rationale (managing exchange rate volatility), while often used by central bankers, is rather unconvincing as it should imply that, on average, international reserves do not change much. The fact that reserves are being accumulated on a sustained basis suggests that intervention has involved more than just minimizing exchange rate volatility.

Regardless of the motivations behind the reserve accretions in Asia, whether one looks at commonly used benchmarks of reserve adequacy (Bird and Rajan 2003; Wijnholds Onno de Beaufort and Kapteyn 2001), or compares reserves holdings against some benchmark model like the Buffer stock model (Aizenman and Marion 2003), most studies conclude that Asia holds more than enough precautionary reserves, at least prior to the US and global financial crisis of 2008–2009.¹ This in turn strongly implies that the sustained reserves accretion has been because of a desire to keep exchange rates from appreciating significantly.

¹ There is, however, no properly developed yardstick to account for the potential reversibility of these other types of capital flows (see Bird and Rajan 2003; Wijnholds Onno de Beaufort and Kapteyn 2001). A promising yardstick appears to be overall gross external liabilities of a country that are reversible as of the beginning of that year plus any projected current account deficit for that year itself. This is important as a country with a sizeable current account surplus is not necessarily immune if it has an accumulated stock of gross external reserves that is potentially reversible. *Gross* rather than *net* is appropriate because if foreigners choose to withdraw their funds, it is unclear whether a country is able to coordinate things in such a way to remit its gross external assets back to the country simultaneously (particularly if the investments to and from the country are done by unconnected parties). The issue of reserve adequacy needs to be revisited in light of the global financial crisis.

**Figure 1: International Reserve Accumulation in Asia (excluding Gold), 1995–2009
(US\$ billion)**



Note: Data for 2009 is up to July 2009.
Sources: CEIC database and national sources.

The remainder of the paper is organized as follows. Section II compiles and discusses the *de jure* or official exchange rate regimes in various developing and emerging Asian economies.² Recognizing that countries do not always follow their policy pronouncements, the section also focuses on *de facto* classifications of Asian exchange rate regimes by the International Monetary Fund (IMF). Section III offers a simple empirical estimation of the degree of influence of the G3 currencies in selected Asian currencies to understand the evolution of exchange regimes in selected Asian economies over the past decade.

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 gradual movement toward 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, particularly in terms of managing against a currency basket (i.e., stable nominal effective exchange rate [NEER]). So does there still exist a fear of floating in Asia *a la* Calvo and Reinhart (2002)? 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 appreciation than to depreciation.

² The focus of this paper is on Asia defined to include North, South, and Southeast Asian economies. West Asia, the Pacific island economies, or Australia and New Zealand are not considered.

Section IV explores in more depth this particular issue of asymmetry in exchange rate intervention in developing and emerging Asia, where evidence of evolution of an Asian exchange rate policy toward an apparent “fear of floating in reverse” or “fear of appreciation” (Levy-Yeyati and Sturzenegger 2007) is found. The broader point though is 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. Section V examines the concerns with exchange rate flexibility that persists, focusing specifically on both the issue of real exchange rate undervaluation as well as volatility and their impact on inflation and growth. Section VI synthesizes the arguments with an extended discussion on the appropriate exchange rate regimes for Asia in the future. Section VII concludes the paper with a few (tentative) observations on Asia and the global financial crisis, asset price reflation, and appropriate policy responses.

II. Exchange Rate Regimes in Developing and Emerging Asia³

A. *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 Fund staff.⁴ 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 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 1.⁵

³ This section draws on and significantly updates Rajan (2006).

⁴ The data has since been applied retroactively to 1990.

⁵ The descriptions in Table 1 are mostly direct quotes from official sources and not paraphrased by the author.

**Table 1: De jure Exchange Rate Regimes in Asia
(per country central bank websites unless otherwise stated)**

| Economy | Official Policy Pronouncements (direct quotes) |
|--------------------------------------|---|
| Bangladesh | The exchange rates of the taka for inter-bank and customer transactions are set by the dealer banks themselves, based on Demand and-supply interaction. The Bangladesh Bank is not present in the market on a day-to-day basis and undertakes purchase or sale transactions with the dealer banks only as needed to maintain orderly market conditions. |
| Bhutan | Except for the Indian rupee to which the ngultrum is pegged at parity, and which circulates freely in Bhutan, paying or receiving payments in any other foreign currency for transactions in Bhutan is illegal. The Government may, by order, at any time, on the recommendation of the Board, declare an external value for the ngultrum, having due regard for the obligations which Bhutan has assumed in accordance with the provisions of any international monetary agreement to which it is a party, or to which it has adhered. |
| Brunei-Darussalam¹ | A currency interchangeability agreement was established between Singapore and Brunei Darussalam, which remains in effect till today and continues to play a central role in relations between the two countries. This agreement allows both countries to interchange their currencies at par without either country running the risk of currency exchange rate fluctuations which thus further facilitates trade and commerce between the two countries. The individual currencies are acceptable as customary tender when circulating in the country in which they are not legal tender. |
| Cambodia² | Cambodia has adopted a market-oriented exchange rate policy with the official exchange rate adjusting to movements in the parallel market rate. The objective of the exchange rate policy is to maintain price stability. The management of floating rate has been targeted to a stabilization vis-à-vis the US dollar so as to maintain the confidence in the national currency and to reduce currency substitution. The dollar-riel market exchange rates are taken every working day from three markets in Phnom Penh, and the official rate is set the same day on this basis. Since 1995, the official exchange rate has not differed by more than ± 1 percent from the market rate. |
| People's Republic of China | [The PRC] announced on July 21, 2005 the adoption of a managed floating exchange rate regime based on market supply and demand with reference to a basket of currencies. Since then, the new exchange rate system has operated stably, and the RMB exchange rate has been kept basically stable at an adaptive and equilibrium level. The exchange rate of the RMB against the US dollar has been moving both upward and downward with greater flexibility. |
| Hong Kong, China | Since 1983 the Hong Kong dollar has been linked to the US dollar at the rate of HK\$7.8 to US\$ 1. The link is maintained through the operation of a strict and robust Currency Board system which requires both the stock and the flow of the Monetary Base to be fully backed by foreign reserves. Any change in the size of the Monetary Base has to be fully matched by a corresponding change in the foreign reserves. |
| India | The exchange rate policy in recent years has been guided by the broad principles of careful monitoring and management of 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. |
| Indonesia | In July 2005, Bank Indonesia launched a new monetary policy framework known as the Inflation targeting framework, which has four basic elements as follows: (1) use of the BI rate as a reference rate in monetary control in replacement of the base money operational target, (2) forward looking monetary policymaking process, (3) more transparent communications strategy, and (4) strengthening of policy coordination with the Government. The rupiah exchange rate is determined wholly by market supply and demand. However, Bank Indonesia is able to take some actions to keep the rupiah from undergoing excessive fluctuation. |

¹ Based on information available from Brunei Ministry of Finance (see www.finance.gov.bn/bcb/bcb_index.htm).

² Bonnang (2009).

continued.

Table 1: *continued.*

| Economy | Official Policy Pronouncements (direct quotes) |
|-----------------------------|--|
| Republic of Korea | Inflation targeting is an operating framework of monetary policy in which the central bank announces an explicit inflation target and achieves its target directly. This is based on the recognition that to achieve sustainable economic growth, it is important above all else those inflation expectations, which have a great effect on wage and price decisions, should be stabilized. In this regard, inflation targeting places great emphasis on inducing inflation expectations to converge on the central bank's inflation target level by the prior public announcement and successful attainment of that target level. The exchange rate is, in principle, decided by the interplay of supply and demand in the foreign exchange markets. However, the Bank of Korea implements smoothing operations to deal with abrupt swings in the exchange rate caused by temporary imbalances between supply and demand, or radical changes in market sentiment. |
| Lao PDR | The Bank of Lao PDR announces the exchange rate derived from the market and officially adjusted, based on the daily average trading rate of the inter-bank market to the commercial banks and the foreign exchange bureaus as a reference to determine their own daily trading rates. In case of necessity the Bank of Lao PDR determines the exchange rate on its own for the commercial banks and foreign exchange bureaus for implementation. |
| Malaysia | On 21 July 2005, Malaysia shifted from a fixed exchange rate regime of US\$1 = RM 3.80 to a managed float against a basket of currencies. Under the managed float system, the ringgit exchange rate is largely determined by ringgit demand and supply in the foreign exchange market. The Central Bank does not actively manage or maintain the exchange rate at any particular level —economic fundamentals and market conditions are the primary determinants of the level of the ringgit exchange rate. In this regard, the Central Bank intervenes only to minimize volatility, and to ensure that the exchange rate does not become fundamentally misaligned. |
| Myanmar | The Myanmar Kyat is officially pegged to the SDR at Ks. (8.50847) per SDR 1. Myanmar applies margins of 2 percent to spot exchange transactions, based on the fixed Kyat-SDR rate. The exchange rates of the Kyat for the Euro, Singapore Dollar, Pound Sterling, Japanese Yen, United States Dollar, Indian Rupee, Pakistan Rupee, Sri Lanka Rupee and Swiss Franc are determined by daily calculations on the basis of the value of these currencies against the SDR issued by the IMF. For the other currencies are determined on the basis of the daily foreign exchange rates of Singapore Market. |
| Nepal | In the review year, the exchange rate of the Nepalese rupee vis-à-vis the Indian rupee remained constant, and NRB intervened 44 times in the foreign exchange market. Currently, Nepal is adopting a dual exchange rate arrangement. It is dual because the Nepali currency is pegged to the Indian currency (IC), whereas it floats with the convertible currencies. This system of exchange rate was introduced on February 12, 1993. |
| Pakistan³ | Pakistan has adopted the floating inter-bank exchange rate as the preferred option since 2001. State Bank of Pakistan has attempted to maintain real effective exchange rate at a level that keeps the competitiveness of Pakistani exports intact. But, like other Central Banks, it does intervene from time to time to keep stability in the market and smooth excessive fluctuations. The current framework of monetary-cum-exchange rate policies and the underlying economic analysis in Pakistan can, thus, be broadly characterized as judgment- and discretion-based rather than model- or rule-based. |
| Philippines | The primary objective of Bangko Sentral ng Pilipinas' monetary policy is to promote a low and stable inflation conducive to a balanced and sustainable economic growth. The adoption of inflation targeting framework for monetary policy in January 2002 is aimed at achieving this objective. The Monetary Board determines the exchange rate policy of the country, determines the rates at which the Bangko Sentral buys and sells spot exchange, and establishes deviation limits from the effective exchange rate or rates as it deems proper. |

³ Based on a speech by Pakistan's former central bank governor (Husain 2005).

continued.

Table 1: *continued.*

| Economy | Official Policy Pronouncements (direct quotes) |
|---------------------|--|
| Singapore | Since 1981, monetary policy in Singapore has been centred on the management of the exchange rate. (1) The Singapore dollar is managed against a basket of currencies of its major trading partners and competitors. (2) The Monetary Authority of Singapore operates a managed float regime for the Singapore dollar. The trade-weighted exchange rate is allowed to fluctuate within an undisclosed policy band, rather than kept to a fixed value. (3) The exchange rate policy band is periodically reviewed to ensure that it remains consistent with the underlying fundamentals of the economy. (4) The choice of the exchange rate as the intermediate target of monetary policy implies that MAS gives up control over domestic interest rates (and money supply). |
| Sri Lanka | The Central Bank continues to conduct its monetary policy under an independently floating exchange rate regime within a framework of targeting monetary aggregates with reserve money (i.e., high powered money) as the operating target and broad money (M2b) as the intermediate target. |
| Taipei,China | Prior to February 1979, management of foreign exchange in [Taipei,China] was characterized by a central clearing and settlement system. Following the establishment of the Taipei Foreign Exchange Market in February 1979, a flexible exchange rate system was formally implemented. Since then, the NT dollar exchange rate has been determined by the market. However, when the market is disrupted by seasonal or irregular factors, the Bank will step in. |
| Thailand | Since July 2, 1997, Thailand has adopted the managed-float exchange rate regime, in which the value of the baht is determined by market forces, namely demand and supply in both on-shore and off-shore foreign exchange market, to let the currency move in line with economic fundamentals. The Bank of Thailand will intervene in the market only when necessary, in order to prevent excessive volatilities and achieve economic policy targets. Under the inflation targeting framework, the Bank of Thailand implements its monetary policy by influencing short-term money market rates via the selected key policy rate, currently set at the 14-day repurchase rate. |
| Viet Nam | Vietnam has adopted a crawling peg with the US dollar for its exchange rate. The State Bank of Vietnam sets the official exchange rate daily, and commercial banks set their dealing rate within a trading band of plus or minus 0.25 percent. The State Bank of Vietnam tends to keep the dong depreciated against the US dollar by keeping the exchange rate on an upward trend. |

Sources: Compiled by the author with the assistance of Sasidaran Gopalan and Nicola Virgill from websites of various central banks, finance ministries, and other official sources with minor modifications. See www.bis.org/cbanks.htm for most central bank websites.

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 peg. This is true of Hong Kong, China (whose currency board arrangement is pegged to the US dollar); Brunei Darussalam (pegged to the Singapore dollar); Bhutan and Nepal (pegged to the Indian rupee); and Myanmar (pegged to the Special Drawing Rights [SDR]). In contrast, Bangladesh and Sri Lanka in South Asia and the East Asian economies of Indonesia, the Republic of 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 also operates an inflation targeting arrangement although it defines itself officially as a managed floater. Table 2 summarizes some key components of the inflation targeters in Asia.⁶

⁶ 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.

Table 2: Key Components of Inflation Targeters in Asia

| Country | Effective IT Adoption Date | CPI Inflation Rate at Start of Stable Targeting | Stable IT Period | Legislated Goal | Target Specification ³ | Publication of Policy Minutes | Testimony/Reporting to Parliament | Monetary Policy Report | Specific Reporting on Large Target Misses | Use of Escape Clauses |
|-----------------------------|----------------------------|---|------------------|--------------------|-----------------------------------|-------------------------------|-----------------------------------|------------------------|---|-----------------------|
| | | | | | | | | | | |
| Indonesia ¹ | 2005M7 | - | - | Currency Stability | G+CB | No | Yes | Quarterly | Yes | No |
| Korea, Rep. of ¹ | 2001M1 | 2.8 | 2001M1-Present | Price Stability | G+CB | No | Yes | Semi-Annual | No | No |
| Philippines ¹ | 2002M1 | 1.8 | - | Price Stability | G+CB | Yes | Yes | Quarterly | Yes | Explicit Description |
| Thailand ¹ | 2000M5 | 0.8 | 2000M5-Present | Monetary Stability | CB | No | No | Quarterly | Yes | No |
| Others: | | | | | | | | | | |
| Australia ² | 1993M4 | 2.0 | 1993Q2-Present | Multiple Goals | G+CB | Yes | Yes | Quarterly | No | No |
| New Zealand ² | 1990Q1 | 1.8 | 1993Q1-Present | Price Stability | G+CB | No | Yes | Quarterly | Yes | Explicit Description |
| United Kingdom ² | 1992M10 | 4.0 | 1992M10-Present | Price Stability | G | Yes | Yes | Quarterly | Yes | No |

- means not available.

G = government, CB = central bank.

Note: 1) Low-income countries, based on World Development Indicators classification (World Bank 2010).

2) High-income countries, based on World Development Indicators classification (World Bank 2010).

Source: Roger (2009).

A number of other Asian countries have adopted a variety of intermediate regimes (currency baskets, crawling bands, adjustable pegs, and such). For instance, according to the Reserve Bank of India website (<http://www.rbi.org.in/home.aspx>), 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”.⁷ 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.⁸ While Singapore’s currency basket regime follows a more strategic orientation, both the People’s Republic of China (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). The remaining Asian economies, namely, Cambodia, Pakistan, and Lao People’s Democratic Republic (Lao PDR), seem to operate rather ad hoc adjustable pegs. Overall, therefore, it is apparent that one size does not necessarily fit all when it comes to the choice of exchange rate regimes in Asia.

B. *De facto* Classifications

As noted, the IMF has replaced its compilation of the *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.⁹ Table 3a summarizes the definitions of various IMF exchange rate classifications. As is apparent, the IMF has eight exchange rate categories. Table 3b reclassifies the original IMF definitions into three broad categories, viz., “hard peg”, “soft peg”, and “floating regimes”.¹⁰ Table 4 categorizes Asian exchange rates based on the new IMF classifications as of April 2008.

⁷ See Cavoli and Rajan (2008a) for an analysis of India’s exchange rate regime.

⁸ See Cavoli and Rajan (2007b) for an analysis of Singapore’s exchange rate regime.

⁹ Bubula and Ötoker-Robe (2002) appear 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 rate regimes.

¹⁰ See Rajan (2006) for IMF specifications of Asian exchange rate regimes from 1998 to 2004. Taipei, China is not included as it is not a member of the IMF. However, Taipei, China is included in the empirical Section III.

Table 3a: IMF Descriptions of Exchange Rate Regimes

| Type | Description |
|--|--|
| Exchange Arrangements with No Separate Legal Tender | The currency of another country circulates as the sole legal tender (formal dollarization), or the member belongs to a monetary or currency union in which the same legal tender is shared by members of the union. Adopting such regimes implies the complete surrender of the monetary authorities' independent control over domestic monetary policy. |
| Currency Board Arrangements | A monetary regime based on an explicit legislative commitment to exchange domestic currency for a specified foreign currency at a fixed exchange rate, combined with restrictions on the issuing authority to ensure the fulfilment of its legal obligation. This implies that the domestic currency will be issued only against foreign exchange and that it remains fully backed by foreign assets, eliminating traditional central bank functions, such as monetary control and lender-of-last-resort, and leaving little scope for discretionary monetary policy. Some flexibility may still be afforded, depending on how strict the banking rules of the currency board arrangement are. |
| Other Conventional Fixed Peg Arrangements | The country (formally or de facto) pegs its currency at a fixed rate to another currency or a basket of currencies, where the basket is formed from the currencies of major trading or financial partners and weights reflect the geographical distribution of trade, services, or capital flows. The currency composites can also be standardized, as in the case of the SDR. There is no commitment to keep the parity irrevocably. The exchange rate may fluctuate within narrow margins of less than ± 1 percent around a central rate, or the maximum and minimum value of the exchange rate may remain within a narrow margin of 2 percent for at least three months. The monetary authority stands ready to maintain the fixed parity through direct intervention (i.e., via sale/purchase of foreign exchange in the market) or indirect intervention (e.g., via aggressive use of interest rate policy, imposition of foreign exchange regulations, exercise of moral suasion that constrains foreign exchange activity, or through intervention by other public institutions). Flexibility of monetary policy, though limited, is greater than in the case of exchange arrangements with no separate legal tender and currency boards because traditional central banking functions are still possible, and the monetary authority can adjust the level of the exchange rate, but relatively infrequently. |
| Pegged Exchange Rates within Horizontal Bands | The value of the currency is maintained within certain margins of fluctuation of at least ± 1 percent around a fixed central rate or the margin between the maximum and minimum value of the exchange rate exceeds 2 percent. It also includes arrangements of countries in the exchange rate mechanism (ERM) of the European Monetary System (EMS) that was replaced with the ERM II on January 1, 1999. There is a limited degree of monetary policy discretion, depending on the bandwidth. |
| Crawling Pegs | The currency is adjusted periodically in small amounts at a fixed rate or in response to changes in selective quantitative indicators, such as past inflation differentials vis-à-vis major trading partners, differentials between the inflation target and expected inflation in major trading partners, and so forth. The rate of crawl can be set to generate inflation-adjusted changes in the exchange rate (backward looking), or set at a pre-announced fixed rate and/or below the projected inflation differentials (forward looking). Maintaining a crawling peg imposes constraints on monetary policy in a manner similar to a fixed peg system. |
| Exchange Rates within Crawling Bands | The currency is maintained within certain fluctuation margins of at least ± 1 percent around a central rate—or the margin between the maximum and minimum value of the exchange rate exceeds 2 percent—and the central rate or margins are adjusted periodically at a fixed rate or in response to changes in selective quantitative indicators. The degree of exchange rate flexibility is a function of the bandwidth. Bands are either symmetric around a crawling central parity or widen gradually with an asymmetric choice of the crawl of upper and lower bands (in the latter case, there may be no pre-announced central rate). The commitment to maintain the exchange rate within the band imposes constraints on monetary policy, with the degree of policy independence being a function of the bandwidth. |

continued.

Table 3a: *continued.*

| | |
|--|--|
| Managed Floating with No Predetermined Path for the Exchange Rate | The monetary authority attempts to influence the exchange rate without having a specific exchange rate path or target. Indicators for managing the rate are broadly judgmental (e.g., balance of payments position, international reserves, parallel market developments), and adjustments may not be automatic. Intervention may be direct or indirect. |
| Independently Floating | The exchange rate is market-determined, with any official foreign exchange market intervention aimed at moderating the rate of change and preventing undue fluctuations in the exchange rate, rather than at establishing a level for it. |

Source: Taken directly from the IMF's *De Facto Classification of Exchange Rate Arrangements and Monetary Framework* (IMF 2006).

Table 3b: Broad Categorizations of Exchange Rate Regimes

| Hard Pegs | Soft Pegs | Floating Regimes |
|---|--|------------------------------------|
| Exchange Arrangements with No Separate Legal Tender (includes dollarization and currency union) | Conventional fixed peg Horizontal band Crawling peg Crawling band | Independent float Managed float |
| Currency Board | | |

Source: IMF *de facto* classifications (IMF 2006) recategorized based on Bleaney and Francisco (2005).

As is apparent from a comparison of Tables 1 and 4, there is no discrepancy between the *de jure* and *de facto* regimes of Bhutan; Brunei Darussalam; Hong Kong, China; and Nepal, all of which operate fixed exchange rates to a single currency. Similarly, Cambodia, India, Lao PDR, Malaysia, Pakistan, Singapore, and Thailand are categorized as managed floaters, broadly consistent with their official pronouncements. The Republic of 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 pronouncement of the PRC authorities the exchange rate regime is based on a currency basket while the IMF classifies the PRC as a crawling peg.¹¹ Myanmar, which is officially pegged to the SDR, is defined by the IMF as operating a managed float. 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.¹² *Overall, with a few exceptions, most developing and emerging Asian exchange rate regimes are, according to the IMF, either completely fixed (soft and hard) or managed.*

¹¹ See Eichengreen (2006) who provides a broader discussion of issues surrounding the PRC's currency and its exchange rate regime.

¹² 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).

In their seminal paper, Reinhart and Rogoff (2004) develop a so-called “natural classification” based on market information such as black market or parallel rates (rather than official rate); the statistical behavior of exchange rate, reserves, and interest rates; as well as country chronologies using a 5-year window (to prevent sporadic exchange rate changes). The authors apply the methodology to 153 countries from 1946 to 2001 and find, among other things, that nearly half of the “official pegs” are better characterized as managed or freely floating arrangements, or with limited flexibility.¹³ More generally, once one uses *de facto* classifications, the bipolar view on exchange rate regimes that was based largely on *de jure* exchange rate classification is no longer obvious. This is also borne out in the case of *de facto* IMF coding for Asia.

Table 4: *De facto* IMF Exchange Rate Classifications as of April 2008

| Economy | As of April 31, 2008 |
|-------------------|---|
| Bangladesh | Other conventional fixed peg arrangement |
| Bhutan | Other conventional fixed peg arrangement. |
| Brunei Darussalam | Currency board arrangement. |
| Cambodia | Managed floating with no pre-determined path for the exchange rate. |
| PRC | Crawling peg. |
| Hong Kong, China | Currency board arrangement. |
| India | Managed floating with no pre-determined path for the exchange rate. |
| Indonesia | Managed floating with no pre-determined path for the exchange rate. |
| Japan | Independently floating. |
| Korea, Rep. of | Independently floating. |
| Lao PDR | Managed floating with no pre-determined path for the exchange rate. |
| Malaysia | Managed floating with no pre-determined path for the exchange rate. |
| Myanmar | Managed floating with no pre-determined path for the exchange rate. |
| Nepal | Other conventional fixed peg arrangement. |
| Pakistan | Managed floating with no pre-determined path for the exchange rate. |
| Philippines | Independently floating. |
| Singapore | Managed floating with no pre-determined path for the exchange rate. |
| Sri Lanka | Other conventional fixed peg arrangement. |
| Thailand | Managed floating with no pre-determined path for the exchange rate. |
| Viet Nam | Other conventional fixed peg arrangement. |

Source: IMF data on *De Facto Classification of Exchange Rate Arrangements and Monetary Frameworks* (IMF 2008).

Unlike the new IMF classification, Reinhart and Rogoff are careful to distinguish between a flexible exchange rate regime and one that is freely falling rate *per se*. They

¹³ There are two other notable *de facto* exchange rate classifications. One is by Levy-Yeyati and Sturzenegger (2003 and 2005) who use rather broad exchange rate categories, i.e., fixed, floating, and intermediate using cluster analysis. The second is by Shambaugh (2004) who closely follows Reinhart-Rogoff, except that the former uses a 1-year window while the latter uses a 5-year window. Also see discussion in Genberg and Swoboda (2005).

define the latter as episodes in which the 12-month rate of inflation equals or exceeds 40% unless there is some type of a preannounced or narrow band. The authors also define the 6-month period immediately after a crisis as being freely falling if there is a sudden transition from a fixed or quasi-fixed to a more flexible exchange rate regime. Thus, in 1998, while the IMF codes Indonesia, the Republic of Korea, and Thailand as “independently floating”, Reinhart-Rogoff more accurately characterize them as “freely falling.”¹⁴ Notwithstanding this difference, by and large, the IMF and Reinhart-Rogoff reach the same conclusion regarding the Asian currency arrangements. While the more detailed classifications of Reinhart-Rogoff make it preferable to the IMF coding, the latter is far more frequently updated than the former.¹⁵

III. Degree of Influence of G3 Currencies on Asian Exchange Rates¹⁶

This section presents an analysis of the degree of *de facto* exchange rate flexibility in the exchange rate regimes for eight developing and emerging Asian economies that the IMF states are managed floaters, viz., Bangladesh, India, Indonesia, Malaysia, Pakistan, Singapore, Sri Lanka, and Thailand. The supposed independent floaters, the Republic of Korea and the Philippines, are also included since both countries’ central banks have clearly also been intervening in the foreign exchange markets and have built up reserves.¹⁷

A. Methodology

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 method (Frankel and Wei 1994) for inferring implicit basket weights involving the major G3 currencies.

Consider the following:

$$\textit{Intervention_Index} = \Delta e + \Delta r \quad (1)^{18}$$

¹⁴ One needs to refer to the earlier NBER working paper version for country-specific exchange rate arrangements (Reinhart and Rogoff 2002).

¹⁵ However, neither classification is able to capture the most recent changes in exchange rate regimes in the PRC and Malaysia. Hakura (2005) briefly compares the IMF *de facto* classification with the Reinhart-Rogoff one.

¹⁶ This section builds upon and updates Cavoli and Rajan (2009b).

¹⁷ The low-income managed floaters in Southeast Asia of Cambodia, Myanmar, and Lao PDR are excluded due to data limitations.

¹⁸ This is the same index used by Frankel and Wei. However, they use the term “exchange market pressure (EMP) index” as opposed to “intervention index”. The use of the first term can be confusing as the index used is not the conventional exchange market pressure index commonly used in the literature.

where, in order to facilitate the estimation of exchange rate regimes using Frankel-Wei, Δe is defined as the local currency per some independent numeraire—here the SDR is used,¹⁹ and Δr is the monthly change in net foreign assets (IFS line 11 – line 16c) scaled by lagged money base (line 14).²⁰

To see how it relates to the choice of exchange rate regime, an *intervention_index* is needed to augment the Frankel-Wei method as follows:

$$\Delta e_t = \alpha_0 + \alpha_1 \Delta US_t + \alpha_2 \Delta JP_t + \alpha_3 \Delta EU_t + \gamma \text{ Intervention_Index} + \mu_t \quad (2)$$

The α coefficients in equation (2) are often interpreted as implicit currency weights. The G3 currencies of US dollar, euro, and yen (all per the SDR) are chosen as they represent world currencies deemed to exert sufficient influence on the local currency such that it is worthy of consideration in these estimates. 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. The reason for this is that it is very difficult to say whether a high and significant coefficient value implies a pegged currency, or merely market-driven correlations.²¹ As $\gamma \rightarrow 1$, the exchange rate per local currency becomes more flexible; equation (2) 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 as the situation where reserve movements overshadow exchange rate movements is reflective of a sustained exchange rate intervention, and the extent of fixity to various major currencies is captured by the α coefficients.^{22, 23}

B. Data and Results

Monthly data for the period February 1999 and September 2009 (or some subperiods thereof depending on data availability) are used. Keep in mind that reserve values could change because of currency fluctuations.²⁴ Ideally these effects should be excluded before estimation but have not been since data are lacking on the currency composition

¹⁹ 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 been the Swiss franc, but there are concerns that its strong correlation with the euro may bias parameter estimates. Some might quibble that after the global crisis SDR may be not a completely independent numeraire, but it remains the best of all possible choices.

²⁰ 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. Data for Taipei, China are from national sources.

²¹ It is also for this reason that the restriction that all the currency weights should add up to 1 is not imposed, or for that matter, why the parameters were not restricted to take values between 0 and 1 (as there may be more complex correlations known a priori). For practical purposes, a negative coefficient should be interpreted as effectively being zero.

²² Note that Frankel-Wei constructed the EMP so that a high correlation tells you there is exchange rate flexibility (if $\Delta r = 0$ then the two exchange rates on the left and right hand sides equal each other, which implies a floating exchange rate). In the sample there is sufficient noise in the Δr to make the intervention index nowhere near unity.

²³ In the estimations no constraints are imposed on the γ coefficient, thus it could exceed 1 or be negative.

²⁴ Lower-frequency data are preferred in terms of month-to-month changes as there is too much noise in high-frequency data (day-to-day or month-to-month). High-frequency data tend 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 this choice as well.

of reserves. This may impact the precision of the results in some cases. Despite this caveat, some interesting results stand out (Table 5). With the exception of the Republic of Korea, the US dollar remains the currency that has the greatest degree of influence on the local currency. The US dollar weights range from 0.2 but statistically insignificant for Indonesia to over 0.9 and strongly statistically significant for the South Asian economies of Bangladesh, Pakistan, and Sri Lanka. The Republic of Korea and to a lesser extent the Indonesian and Indian cases are quite interesting. Both currencies underwent the sharpest depreciations in 2008 as their respective central banks seemed to stop intervening for a period as capital started leaving their countries (Rajan and Gopalan 2010, Rajan 2009).

Thus there may be some noise from this depreciation and the subsequent alteration in regime. Accordingly, the model is reestimated for a smaller sample as of end-2007. The results in Table 5 for the full sample, the Republic of Korea 1, show negative and insignificant values. In sharp contrast, in the results for the Republic of Korea 2 (where the sample finishes at the end of 2007), the US dollar weight is 0.40 while the yen weight is 0.32, and both are highly significant, implying a more systematic regime of managed exchange rates pre-global crisis. Similarly, the US dollar weights for the Indian rupee and Indonesian rupiah were much higher in the subperiod that excludes the global financial crisis.²⁵

²⁵ More generally these models are reestimated with a global financial crisis time dummy, taking the value 1 for the period 2008m3 to the end of the sample and zero otherwise. The dummy is significant in many cases, only failing to be significant in the more developed countries in the sample, i.e., the Republic of Korea; Singapore; and Taipei,China. However, the remaining coefficients did not change materially in value or significance and thus the dummy is left out of the regressions. In any case, recursive estimates are run later in this section to capture some of these changes over time.

Table 5: Frankel-Wei Estimates with Intervention Index*Dependent Variable: Local Currency per SDR*

| | Bangladesh | PRC | Indonesia 1 | Indonesia 2 | India 1 | India 2 | Korea, Rep. of 1 | Korea, Rep. of 2 |
|--------------------|------------------------------|-------------------------------|--------------------------------|--------------------------------|-------------------------------|--------------------------------|-------------------------------|-------------------------------|
| Constant | 0.10 (0.30) | -0.02 (0.53) | -0.51 (0.001) | -0.60 (0.001) | -0.38 (0.00) | -0.37 (0.002) | 0.08 (0.70) | -0.30 (0.02) |
| Dollar | 0.93 (0.00) | 1.00 (0.00) | 0.19 (0.31) | 0.33 (0.22) | 0.36 (0.002) | 0.60 (0.00) | -0.23 (0.38) | 0.40 (0.01) |
| Yen | -0.001 (0.98) | -0.01 (0.68) | -0.20 (0.06) | -0.06 (0.75) | -0.09 (0.42) | 0.03 (0.70) | -0.19 (0.35) | 0.32 (0.04) |
| Euro | 0.08 (0.40) | -0.001 (0.97) | -0.03 (0.87) | -0.06 (0.84) | -0.02 (0.83) | 0.09 (0.22) | -0.33 (0.03) | -0.15 (0.25) |
| Intervention Index | 0.11 (0.08) | -0.05 (0.03) | 0.36 (0.00) | 0.35 (0.00) | 0.25 (0.00) | 0.19 (0.00) | 0.001 (0.92) | 0.02 (0.09) |
| Adj R ² | 0.70 | 0.96 | 0.77 | 0.76 | 0.63 | 0.68 | 0.13 | 0.28 |
| DW | 1.69 | 2.32 | 2.40 | 2.44 | 2.13 | 2.00 | 1.89 | 1.79 |
| Sample | 02m1: 09m3 | 01m3: 09m8 | 99m2: 09m9 | 99m2: 07m12 | 99m2: 09m7 | 99m2: 07m12 | 99m2: 09m6 | 99m2: 07m12 |
| | Malaysia | Pakistan | Philippines | Singapore | Sri Lanka | Taipei,China | Thailand | Viet Nam |
| Constant | -0.04 (0.47) | 0.06 (0.42) | -0.05 (0.71) | -0.02 (0.01) | 0.19 (0.10) | -0.32 (0.001) | -0.29 (0.01) | 0.11 (0.39) |
| Dollar | 0.77 (0.00) | 0.98 (0.00) | 0.80 (0.00) | 0.32 (0.00) | 0.94 (0.00) | 0.45 (0.00) | 0.38 (0.00) | 0.78 (0.001) |
| Yen | -0.05 (0.17) | -0.02 (0.74) | 0.004 (0.96) | 0.04 (0.39) | -0.05 (0.48) | 0.06 (0.11) | 0.16 (0.04) | 0.02 (0.49) |
| Euro | 0.08 (0.26) | 0.07 (0.54) | 0.08 (0.41) | 0.09 (0.10) | 0.06 (0.56) | 0.04 (0.48) | 0.07 (0.43) | -0.04 (0.68) |
| Intervention Index | 0.01 (0.24) | 0.01 (0.75) | 0.07 (0.004) | 0.03 (0.00) | 0.05 (0.05) | 0.10 (0.00) | 0.07 (0.00) | 0.05 (0.40) |
| Adj R ² | 0.65 | 0.64 | 0.39 | 0.30 | 0.62 | 0.52 | 0.36 | 0.67 |
| DW | 1.84 | 1.61 | 2.11 | 2.03 | 1.66 | 1.45 | 1.87 | 2.09 |
| Sample | 99m2: 09m4 | 01m3: 08:m6 | 99m2: 08m12 | 99m2: 09m8 | 01m3: 08m12 | 99m3: 09m9 | 99m2: 09m9 | 99m2: 09m2 |

Note: Includes lagged dependent variable. Figures in parentheses are p-values and those parameters significant at 10% or better are in bold. Sample 1999m1 to 2008m9. Any deviation from this reflects the availability of data at the time of its acquisition. A 1-month lag dependent variable is included in all regressions and a 1-month lag term for the US dollar per SDR is included for the PRC, India, Malaysia, Pakistan, the Philippines, Sri Lanka, and Thailand if its inclusion helps to reduce serial correlation.

Source: Based on joint work with Tony Cavoli.

With the exception of the Republic of Korea, Malaysia, Pakistan, and Viet Nam, the intervention index is highly statistically significant. The values are all at or under 0.1 in the case of the PRC, the Philippines, Singapore, Sri Lanka, and Thailand, 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.²⁶

C. Market-Driven versus Policy Targets

The pertinent question here, as mentioned above, is to what extent are these weights market-driven versus policy targets? This can be answered by summarizing the interaction between the currency weights and the intervention index. Focusing first on those currencies with intervention indices that are at or close to zero and are statistically significant, the PRC case is the most clear-cut, with the US dollar weight at 1, implying continued heavy exchange rate management.²⁷ The US dollar weights for the Bangladesh taka, Sri Lankan rupee, and Philippine peso are surprisingly large (0.9, 0.9, and 0.8, respectively), 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 odds with the Philippines being described as operating an "independent floating" arrangement. Taipei, China; 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, as well as an often-noted desire for currency basket pegging by the Bank of Thailand. Both are broadly defined by the IMF as being managed floaters. Of course, what is unclear in the Thai case is whether the exchange rate stability is a violation of an inflation targeting regime per se; or a reflection of the pursuit of an open economy inflation target where there is scope to include exchange rate stability as a policy objective in and above its impact on output and inflation (see Roger et al. 2009; Cavoli and Rajan 2007a; Cavoli and Rajan 2009a, chapter 3; Cavoli and Rajan 2008b).

Two other currencies characterized as managed floaters by the IMF are India and Indonesia. As noted, both have relatively higher intervention indices, suggestive *a priori* 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 the Republic of Korea, Malaysia, and Pakistan are all statistically

²⁶ To verify these results equation (2) was reestimated without the intervention index (i.e., Frankel and Wei 2004). *A priori* one would expect the estimates to be very close to each other with the exception of India and Indonesia where the intervention indices, as noted, are economically significant. Results confirm this. The coefficients on the G3 currencies are comparable across all countries except India and Indonesia. In India, the US dollar coefficient is much higher when the intervention index is excluded, while both the US dollar and Euro coefficients are much higher for Indonesia without the intervention index. This suggests that both currencies are partly flexible, and that failure to account for this partial flexibility could severely bias upward the estimated degree of influence of the G3 currencies. Therefore, an important agenda for future research is to develop a better way to account for partially managed/flexible regimes.

²⁷ The weight on the US dollar declines marginally if the subperiod from 2006 is considered. The dynamic time path of the US dollar peg is discussed later. The focus here is on point estimates.

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 nonexistent influence of the other currencies for Malaysia and Pakistan, suggesting that both countries manage their currencies against the US dollar.²⁸

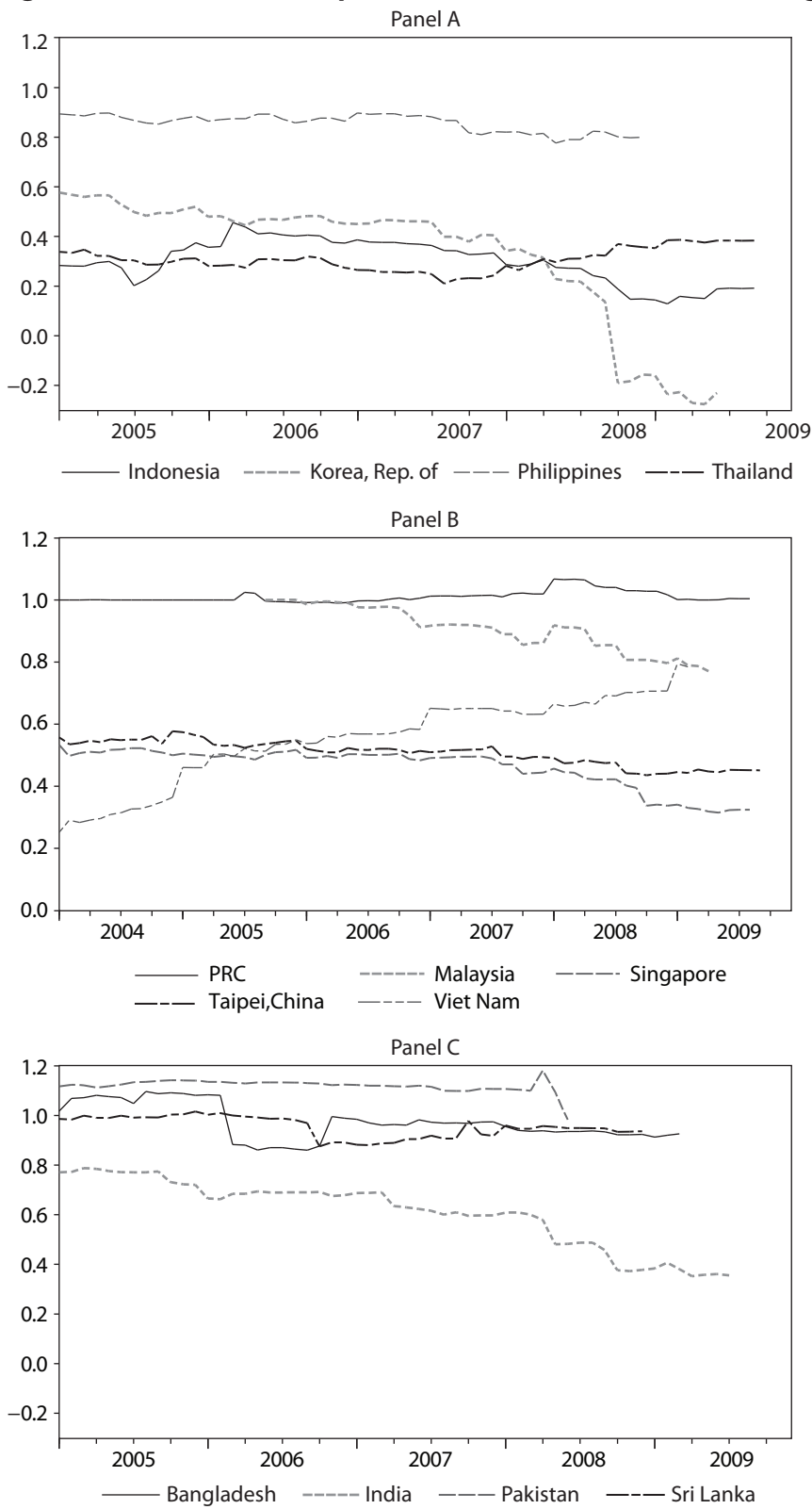
D. Estimates over Time

Figure 2 presents the recursive least squares estimates for the US dollar coefficient, α_1 .²⁹ They are derived by running the regressions as in Table 5, but to avoid cluttering up the diagrams and to highlight any possible influence of the recent global crisis, only the sample 2005–2009 is shown. In order to provide as much clarity as possible to allow comparison, Figure 3 is split into three panels. The first shows those countries commonly regarded as officially operating inflation targets (Indonesia, the Republic of Korea, the Philippines, and Thailand). The second panel shows countries widely regarded as not explicitly targeting inflation, although they are different mechanically (the PRC; Malaysia; Singapore; Taipei, China; Viet Nam). The third panel is split along geographical lines and represents a sample from South Asia (Bangladesh, India, Pakistan, and Sri Lanka).

²⁸ Of course, a single point estimation fails to capture changes in the exchange rate regimes over time, including Malaysia's move to a managed float beginning September 2005 along with the PRC. These dynamics are captured later in this section in the estimation of recursive least squares.

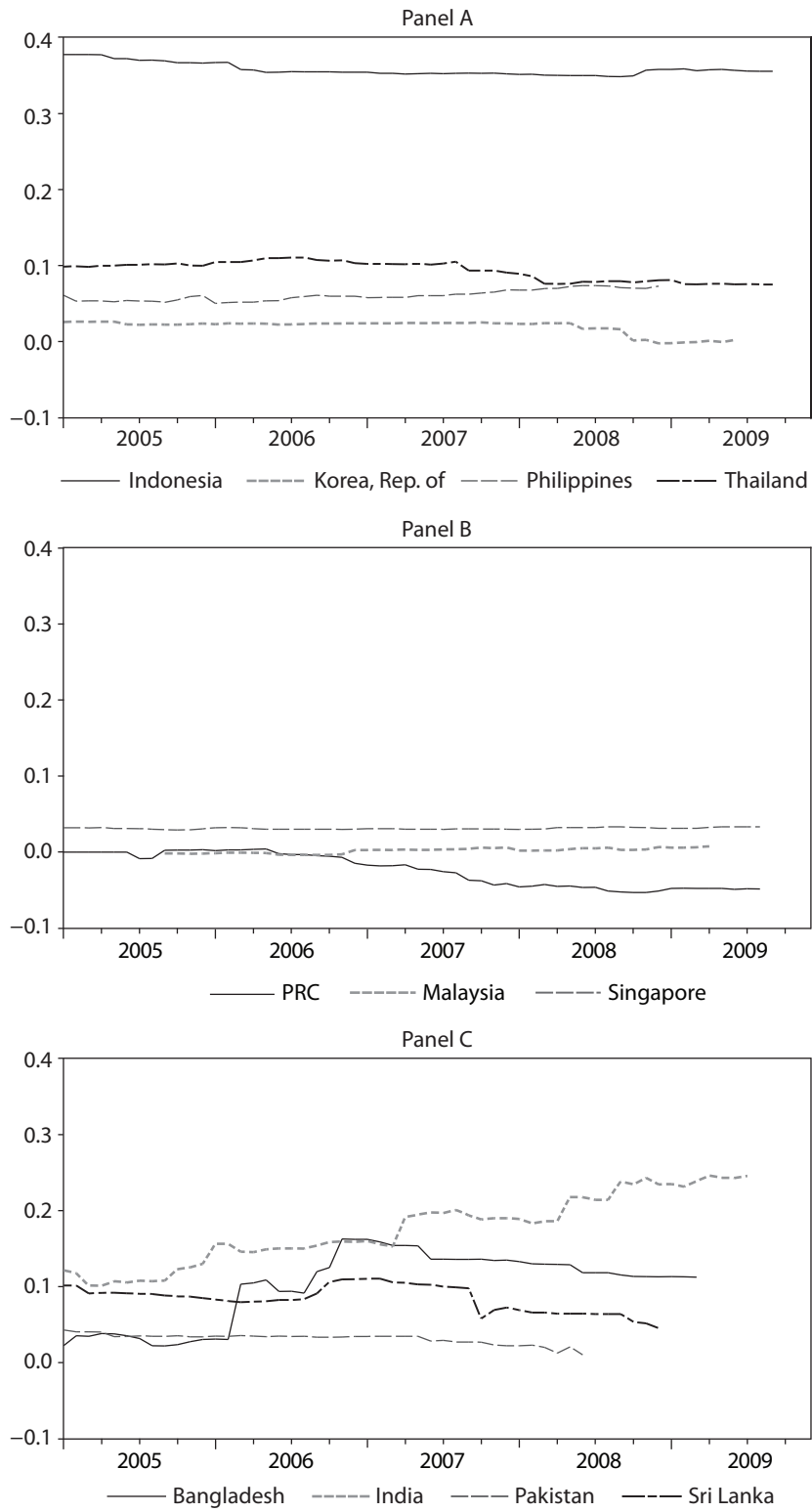
²⁹ The recursive estimates are generated by running the regression for equation (2) iteratively—beginning with a few observations, and recording the coefficient values until the full sample is reached. Due to insufficient degrees of freedom, the first 18 coefficient values are discarded. Recursive ordinary least squares 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.

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



Source: Author based on joint work with Tony Cavoli (see Cavoli and Rajan 2009b).

Figure 3: Recursive Least Squares Estimates for the Intervention Index



Source: Author based on joint work with Tony Cavoli (see Cavoli and Rajan 2009b).

At a broad level, the results show that there appears to be a general trend downward in the recursive series. This is suggestive of a lowering of the degree of influence of the US dollar for each local currency. It can also be seen that the inflation targeting sample (Panel 3a) generally returns lower degrees of influence of the US dollar than most other Asian currencies (with the notable exception of the Philippines). This should be the case if the central banks of these countries implement the inflation target in keeping with its normative literature; that is, with a high level of exchange rate flexibility. While the Thai baht's US dollar peg has remained fairly constant, that for the Republic of Korea and Indonesia have declined sharply since 2008 with the onset of the global financial crisis and reversal in capital flows. The same appears to be true albeit to lesser extent in the case of Singapore and Taipei, China in Panel 3b. Panel 3b also shows that the PRC and Malaysia maintained a complete US dollar peg until late 2005, after which there is a gradual but discernible decline in the influence of the US dollar in Malaysia (falling to about 0.8 by 2008). The PRC appears to operate a *de facto* US dollar peg with minor fluctuations. Like the PRC, Panel 3c shows that all the South Asian currencies are effectively pegged solely to the US dollar. The notable exception is India where the weight of the US dollar has declined sharply from 0.8 in 2005 to 0.3 by 2009. Like Indonesia and the Republic of Korea, there has been a distinct decline in the US dollar weight in India following the onset of the global financial crisis and the Reserve Bank of India's allowing the rupee to decline in response to the capital flow reversals. Interestingly Viet Nam was the only case where the US dollar's role appears to have grown steadily over the years. Similar results are obtained upon computing the point estimates for the subperiod ending before the crisis. Specifically, as noted earlier, the US dollar coefficient fell sharply after the crisis for India, the Republic of Korea, and Indonesia. It fell marginally for Malaysia, Singapore, and Thailand; increased for Viet Nam; and remained fairly constant for most others.

IV. Asymmetry in Asian Exchange Rate Policies

The foregoing analysis makes apparent that many Asian currencies remain fairly heavily managed against the US dollar mainly, 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 the ongoing global macroeconomic imbalances. While this is a reasonable conjecture, some might argue that it ignores the concerns of small and open economies in Asia and elsewhere about a currency that is "too weak". During the Asian financial crisis of 1997–1998 and its immediate aftermath, there was a great deal of discussion on the problems associated with a weak currency, i.e., a rise in unhedged foreign currency liabilities (Rajan and Shen 2006). This was the reason for the so-called "fear of floating", both in terms of appreciation (competitiveness) and depreciation ("balance sheet effects").

While some corporates and financial institutions in Asia remain vulnerable to their home currency depreciation, in aggregate, as these economies have moved from running current account deficits to surpluses and stockpiled reserves in US dollars and euros, they are arguably more concerned about loss in capital values with a sharp appreciation rather than depreciation of their currencies (Levy-Yeyati and Sturzenegger 2007).³⁰

Hence, what remains is the tentative conclusion that many emerging economies desire some sort of exchange rate management with a strong bias toward preventing appreciation than depreciation. In other words, whereas Calvo and Reinhart (2002) noted that exchange rate policy in the 1990s in emerging economies is best characterized as “a fear of floating”, this paper conjectures that the Asian exchange rate regimes in the 2000s can be more precisely described as being a “fear of appreciation” or “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 of *de facto* exchange rate regimes in Asia, a gap that this section attempts to fill.³¹ A simple model is outlined of optimal central bank behavior that derives a simple central bank intervention reaction function, which is the estimating equation.

A. Central Bank Intervention Reaction Function³²

As noted, the focus here is on managed floaters in Asia, 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 (i.e., India, Indonesia, the Republic of Korea, the Philippines, Singapore, and Thailand). More formally, the central bank is assumed to have full and direct control over a proxy measure of intervention defined as the percentage change in foreign exchange reserves (r_t). The central bank intervenes in the foreign exchange market to minimize the following intertemporal criterion:³³

$$\min_{(R_t)} E_{t-1} \sum_{\tau=0}^{\infty} \delta^{\tau} L_{t+\tau} \quad (3)$$

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

$$L_t = \frac{1}{2}(r_t - r^*)^2 + \frac{\lambda}{2} \left\{ (e_t - e^*)^2 + \frac{\gamma}{3}(e_t - e^*)^3 \right\} \quad (4)$$

³⁰ There may also be a more persistent problem of currency depreciation passing through into domestic inflation, i.e., exchange rate pass-through (see Section V).

³¹ Two notable exceptions are Ramachandran and Srinivasan (2007), and Srinivasan et al. (2008) who find evidence in the Indian context that support the existence of asymmetric foreign exchange intervention (Indian rupee per US dollar).

³² This section is based on Pontines and Rajan (2010).

³³ Data on actual central bank intervention are not available for the countries considered.

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 zero in this case. If $\gamma < 0$, deviations of the same size but opposite sign yield different losses, thus, appreciations are weighted more heavily than depreciations of the same magnitude, i.e., $\partial L_t / \partial(e_t) = \lambda[e_t + (\gamma/2)(e_t)^2] > 0$, for $e_t > 0$.

It is assumed that interventions can impact the exchange rate. Accordingly,

$$e_t - e^* = a_0 + a_1 r_t + \varepsilon_t \quad (3)$$

where $a_1 > 0$ and the error term, ε_t , is independent and identically distributed (i.i.d.) with zero mean and variance σ_ε^2 . Minimizing equation (2) by choosing r_t subject to the constraint (3), leads to the following intervention reaction function of the central bank:

$$r_t = r^* - \lambda a_1 E_{t-1} \left\{ e_t + \frac{\gamma}{2} (e_t)^2 \right\} \quad (4)$$

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

$$r_t = c + \alpha e_t + \beta (e_t)^2 + v_t \quad (5)$$

where $\alpha = -\lambda a_1$, $\beta = -\lambda a_1 \gamma / 2$. 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 the empirical exercise in the next section (Surico 2008; and Srinivasan, Mahambare, and Ramachandran 2008).

B. Empirical Results

Our estimation is based on monthly data for the sample period between 2000:m1 and 2009:m7, for six emerging Asian economies, namely, India, Indonesia, the Republic of Korea, the Philippines, Singapore, and Thailand (i.e., largely the same set as in Section III 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; as well as Viet Nam, which also has a strong and growing de facto US dollar peg).³⁴ This was the period of rapid stockpiling of reserves in the region (i.e., post-Asian crisis of 1997–1998), including the global financial crisis of 2008–2009, which started to have an impact on developing and emerging Asian balance of payments by early to mid-2008.

³⁴ Taipei, China is excluded because of lack of comparable data on NEER.

The variables used in the estimation are as follows: the US federal funds rate, $r_t = (\Delta \log \text{Reserves}_t) * 100$ and $e_t = (\Delta \log \text{exchange rate}_t) * 100$ (US dollar per domestic currency) and the 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 earlier implied, equation (5) is the main equation of interest in the empirical test.³⁵ Table 6 reports the estimates of the intervention reaction function as well as the asymmetric preference parameter. For each country two sets of results are presented: *Row (1)* using the nominal bilateral exchange rate (US dollar per domestic currency), and *Row (2)* presenting those using the NEER. The *J* test indicates that the hypothesis of valid overidentifying restrictions is never rejected. The parameters on e_t and α , are statistically different from zero in all cases. Of primary interest to us is the parameter on the squared 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 prior expectations of the γ (the asymmetric preference parameter)? As noted in Section IVA, a rise in the nominal bilateral exchange rate or 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 in these countries appear to react differently to appreciation and depreciation pressures. More to the point, the responses of central banks in these countries to rates of appreciation are much stronger than to rates of depreciation of the same value.³⁶

³⁵ The orthogonality conditions implied by the intertemporal optimization-rational expectations paradigm make the generalized method of moments the appropriate method of estimating equation (4). Following Hansen (1982), an optimal weighting estimate of the covariance matrix that accounts for both serial correlation and heteroskedasticity in the error terms is used. Hence, robust standard errors are reported. For the most part, a constant, lagged value (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.

³⁶ The estimations were tried for smaller subperiods, i.e., preglobal financial crisis (or until early or mid-2008), and the results remain intact.

Table 6: Intervention Reaction Function and Policy Preference Estimates, January 2000–July 2009^{a,b}

| Country | c | α | β | $\gamma = 2\beta/\alpha$ | J-test |
|-----------------------|---------------------|----------------------|----------------------|--------------------------|--------|
| India | | | | | |
| Row (1) | 1.958*** (0.160) | -2.663*** (0.231) | -0.308*** (0.050) | 0.232*** (0.025) | 15.45 |
| Row (2) | 1.202*** (0.089) | -0.432*** (0.102) | -0.148*** (0.035) | 0.687*** (0.123) | 16.25 |
| Korea, Rep. of | | | | | |
| Row (1) | 0.479*** (0.092) | -0.447*** (0.045) | -0.104*** (0.013) | 0.467*** (0.074) | 14.78 |
| Row (2) | 0.568*** (0.086) | -0.131*** (0.032) | -0.019** (0.007) | 0.291* (0.155) | 14.58 |
| Philippines | | | | | |
| Row (1) | 0.459*** (0.169) | -0.872*** (0.127) | -0.284*** (0.070) | 0.651*** (0.113) | 14.15 |
| Row (2) | 1.328*** (0.138) | -1.014*** (0.093) | -0.132** (0.054) | 0.259*** (0.103) | 14.05 |
| Singapore | | | | | |
| Row (1) | 0.589*** (0.123) | -0.297*** (0.90) | -0.105*** (0.037) | 0.707** (0.360) | 12.94 |
| Row (2) | 0.991*** (0.144) | -0.923*** (0.302) | -0.716*** (0.236) | 1.551*** (0.529) | 12.66 |
| Thailand | | | | | |
| Row (1) | 0.552*** (0.159) | -0.571*** (0.114) | -0.165*** (0.041) | 0.578*** (0.196) | 13.95 |
| Row (2) | 0.506*** (0.084) | -0.437*** (0.086) | -0.997*** (0.078) | 4.567*** (0.647) | 13.69 |
| Indonesia | | | | | |
| Row (1) | 0.681*** (0.200) | -0.894*** (0.166) | 0.062*** (0.017) | 0.140*** (0.020) | 11.66 |
| Row (2) | 1.621*** (0.151) | -0.722*** (0.104) | -0.041*** (0.012) | 0.113*** (0.022) | 16.62 |

***, **, and * denote rejection of the null hypothesis that the true coefficient is zero at the 1%, 5%, and 10% significance levels, respectively.

^a Specification: $r_t = c + \alpha(e_t) + \beta(e_t)^2 + v_t$

^b Standard errors using a four-lag Newey-West covariance matrix are reported in parentheses. Row (1) denotes that e_t is measured using the nominal exchange rate of the US dollar per local currency, while Row (2) denotes that e_t is measured using the nominal effective exchange rate. J-test refers to the Hansen's test of overidentifying restrictions, which is distributed as a $\chi^2(m)$ under the null hypothesis of valid overidentifying restrictions. A 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 Fund Rate. The standard error of γ are obtained using the delta method.

Source: Based on joint work with Victor Pontines (Pontines and Rajan 2010).

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 (India,

Singapore, Thailand). For these three countries, the asymmetric preference parameter γ ranges from 0.23 for India and up to 0.71 for Singapore when the nominal bilateral exchange rate is used; whereas it ranges from 0.69 for India and up to 4.57 for Thailand when the NEER is used. The estimates of the asymmetric preference parameter for these three countries are larger by about two (Singapore), three (India), and seven (Thailand) times when the NEER is employed as the regressor in the intervention reaction function compared to when the nominal bilateral exchange rate is used. This in turn 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 III). While this finding for Singapore is consistent with the fact that it officially pursues a band basket and crawl regime, with a basket essentially referring to the NEER, two other countries in the region, India and Thailand, are also believed to operate a *de facto* currency basket arrangement.

V. Some Concerns with Exchange Rate Flexibility

While some corporates and financial institutions in Asia may remain vulnerable to their home currency depreciations, in aggregate, these economies have moved from running current account deficits to surpluses and stockpiled reserves in US dollars and euros. Accordingly, the analysis suggests that many of the Asian economies have been far more circumspect about allowing currency appreciation than depreciation, at least in terms of a broad currency basket. This said, there remains a more persistent problem of currency depreciation passing through into domestic inflation, i.e., exchange rate pass-through. While there is some evidence that exchange rate pass-through into developing and emerging economies has been declining over time, it does not seem to have fallen as rapidly as in the case of developed economies (Ghosh and Rajan 2007). In other words, there is less evidence of pricing-to-market or local currency pricing of imports to developing and emerging economies in Asia and elsewhere.³⁷

Nonetheless, since rigidly pegging the exchange rate also constrains monetary independence,³⁸ and both theory and lessons of experience with nominal anchors have shown that pegging loses credibility over time and induces booms followed by

³⁷ However, the heavy dependence of Asia—primarily East Asia—on production sharing may dampen the extent of pass-through (see Ghosh and Rajan 2007).

³⁸ Using *de facto* exchange rates for 100 developing and industrial countries between 1973 and 2000, Shambaugh (2004) finds that the interest rates of the countries that operated pegged regimes followed the base country far more closely than those that did not. In a closely related paper, Di Giovanni and Shambaugh (2005) find that small countries with fixed exchange rates are most directly affected by interest rate changes in large countries. All this suggests that the loss of monetary policy autonomy can have significant costs.

inevitable busts and crises episodes,³⁹ many developing and emerging Asian economies have recognized the need to move away from a rigid US dollar peg. This has historical precedence, with Japan having successfully moved from a US dollar peg to a managed float since August 1971. Analysis by Eichengreen and Hatase (2005) suggests that the corresponding appreciation of the yen that followed did have a significant negative impact on exports and investment, but the overall economy still continued to grow robustly (until the first oil shock) because of a generally strong world economy and significant fiscal policy stimulus by the government.

Like Japan, many emerging Asian economies remain circumspect about allowing for a freely floating regime and continue to manage their currencies heavily, both leaning against the wind (at least in NEER terms discussed previously) as well as to manage short-term currency volatility.⁴⁰ These issues of currency undervaluation and currency volatility are tackled below.

A. Real Exchange Rate Undervaluation

To understand the issue of real exchange rate undervaluation it would be useful to remind ourselves that the real exchange rate 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 nontradables within a country. The (log) aggregate price index can be expressed as a weighted average of the price of tradables (T) and nontradables (NT):

$$p = (1 - \alpha)p^T + \alpha p^N, \text{ for the domestic country} \quad (6)$$

and

$$p^* = (1 - \beta)p^{T*} + \beta p^{N*}, \quad (7)$$

for the foreign country.

Then the real exchange rate, $q = s + p^* - p$ can be written as the sum of the relative price of traded goods (a) and the relative price of nontraded goods (b) where $\alpha = s + p^{T*} - p^{T*}$, and $b = \beta(p^{N*} - p^{T*}) - \alpha(p^N - p^T)$.

³⁹ See Willett (1998) for a detailed exploration of the nominal anchor debate. Bleaney and Francisco (2005) find that even after controlling for endogeneity and using both *de jure* and *de facto* regimes, there is still some evidence that hard pegs are associated with lower inflation rates than soft pegs (classification based on Table 3b).

⁴⁰ 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.

Given the high degree of openness of many Asian economies to international trade flows, it is likely that the Law of One Price in traded goods holds over time (at least among the East Asian economies). Thus, persistent real exchange rate undervaluation is primarily a reflection of internal imbalance, i.e., nontradables price, and thus has implications for internal resource allocation with consequent repercussions on global imbalances.⁴¹ To be sure, it appears that many (East) Asian economies have chosen to consciously keep the price of exportables relatively high so as to transfer resources to the exportables sector at the expense of the nontradables sector. While this has helped boost production of exportables compared to nontradables, it has also had the perverse effect of reducing domestic consumption (given that by definition all nontradables domestically produced must be domestically consumed). Assuming a reduction in trend growth in the US and developed world over the medium term, it is unclear how this strategy in the PRC and the rest of Asia to favor the production of exportables at the expense of nontradables can be effectively sustained, if in fact it should.⁴² It is not clear if the so-called Bretton Woods II model of the world economy (Dooley et al. 2003) “which is essentially a story about the external consequences of the adoption of a competitive real exchange rate as a growth strategy by [the PRC] and other developing countries” (Eichengreen 2009, 2–3) is sustainable or desirable.

B. Exchange Rate Volatility

Distinct from the issue of the level or trend of the real exchange, countries with flexible regimes have experienced “excessive” nominal volatility over the last few decades.⁴³ Given relative price rigidities in the near term, this implies a corresponding fluctuation in the real exchange rate as well. It is admittedly difficult to define what exactly is meant by the term “excessive”. However, a reading of the relevant empirical literature reveals that evidence of excessive exchange rate variability comes in a number of forms (see Bird and Rajan 2001a and 2001b, and the references cited within). For instance, a number of

⁴¹ Chinn (1999) finds some East Asian real exchange rates (Japan, the Republic of Korea, the Philippines, and Singapore) to be cointegrated with relative prices, while others (the PRC, Indonesia, Thailand) are not. While results on this nexus are mixed, the absence of precise proxies for tradables and nontradables should give one some pause before drawing firm conclusions from these empirical studies.

⁴² Of course, on the supply side there may be some positive externalities in the exportables sector. Eichengreen (2009, 21–22) tackles this issue by noting the following:

How long it pays to stick with a policy mix favouring export-oriented manufacturing depends on the prevalence of non-pecuniary externalities and on whether learning pullovers and other externalities are also present in other sectors. And here, as earlier discussion has emphasized, the evidentiary base is limited. Better documenting the presence or absence of the relevant externalities should be the priority for research. What form do the relevant externalities take—demonstration effects, other learning effects, labour market effects, improvements in the supply of inputs? In what activities specifically are they concentrated? Better answers to these questions are valuable in general, but they also will help to inform decisions regarding the exit problem in particular.

See also Rodrik (2008).

⁴³ It is true that virtually no country has maintained a completely free (or pure) float, with authorities intervening intermittently to smoothen market fluctuations. New Zealand is often held up as an example of a free floater. However, even the Reserve Bank of New Zealand has announced plans to “broaden its foreign exchange intervention capacity” by holding additional foreign exchange reserves (see Orr 2004).

surveys of foreign exchange (forex) market participants clearly indicate that short-term/high-frequency exchange rate movements are caused by “speculative” or “trend-following” elements rather than underlying macroeconomic fundamentals. The problem of destabilizing speculation appears to be particularly problematic in developing countries with thin markets (Indonesia’s postcrisis experience being a good case in point).

Of course, even if it were accepted that flexible exchange rates often appear to exhibit greater volatility than would be warranted by underlying fundamentals, why might such excessive volatility be of concern? In a comprehensive survey of the literature on the impact of exchange rate volatility on trade flows, McKenzie (1999) concludes that recent empirical studies of the 1990s (as opposed to earlier periods) have had somewhat greater success in finding a statistically significant [negative] relationship between exchange rate volatility and international trade. Calvo and Reinhart (2000) review a more limited set of such studies and draw a similar conclusion.⁴⁴ Beyond trade, Bénassy-Quéré, Fontagné, and Lahrèche-Révil (2001) show that exchange rate volatility could have a detrimental impact on foreign direct investment (FDI), comparable to the distortions created by currency misalignments. Also see Kiyota and Urata (2004) who find that the volatility of the host currency (developing East Asia) and yen bilateral rates have an adverse impact on FDI, and go on to suggest that a “flexible but stable exchange rate system is needed to successfully attract FDI” (Kiyota and Urata 2004, 1531). There is also a small body of evidence suggesting that higher real exchange rate volatility lowers a country’s risk ratings or raises its sovereign spreads (Powell and Martinez 2007; Barajas, Erickson, and Steiner 2008).

Overall, 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 the currency volatility, trade, investment, and growth is not unambiguous (Eichengreen 2009, Schnabl 2007)^{45, 46}. With regard to some recent empirical studies

⁴⁴ Another set of empirics by Andrew Rose, based on gravity models using both cross-sectional and time-series data, suggests that institutionally fixed exchange regimes (i.e., common currency, currency boards, or dollarization) stimulate trade (see Frankel and Rose 2002, Glick and Rose 2002, Rose 2000).

⁴⁵ There are technical issues in terms of how exchange rate volatility is measured such as whether certain outliers drive the results; differentiating between volatility and valuations; underlying causes of volatility, etc.

⁴⁶ For instance, the IMF recently undertook a comprehensive analysis of exchange rate volatility and trade. It has examined exchange rate variability over the past 30 years for all countries and reached the following conclusion (see Clark et al. 2004):

...The current study does not find a robustly negative effect. To be more precise, the study reports some evidence that is consistent with a negative effect of volatility on trade. However, such a relationship is not robust to certain reasonable perturbation of the specification.... Changes in the volatility of the exchange rate may reflect changes in the volatility of the underlying shocks and/or changes in the policy regime. For example, trade liberalization undertaken together with a move to greater exchange rate flexibility could well be associated with increased trade flows as well as increased exchange rate volatility. This possibility is a reason for the ambiguity of the theoretical results as well as the difficulty in finding consistent and robust empirical results regarding the impact of volatility on trade. An additional implication is that the empirical results do not provide clear policy guidance.... There do not appear to be strong grounds to take measures to reduce exchange rate movements from the perspective of promoting trade flow.

on the issues in Asia, Thorbecke (2008) finds that exchange rate volatility (defined as the coefficient of variation of the monthly nominal exchange rate during the year) decreases the flow of electronic components within East Asia, and goes on to advocate the need for more stable regional currency arrangements to promote East Asian production networks. His finding, while interesting, is limited to a single year (2005) based on data from the CEPII-CHELEM database for ASEAN-5 plus the PRC, the Republic of Korea, and Japan (Thorbecke 2008).

In another interesting recent study, Schnabl (2007) finds that emerging economies with fixed exchange rates seem to enjoy relatively faster growth rates. Using a long sample for East Asia since 1980 with nine East Asian countries, namely the PRC; Hong Kong, China; Indonesia; the Republic of Korea; Malaysia; the Philippines; Singapore; Taipei, China; and Thailand, the author estimates the impact on exchange rate volatility and exchange rate appreciations/depreciations on economic growth while controlling for other factors. All exchange rates are vis-à-vis the US dollar in nominal terms. The author uses two measures of volatility, standard deviations and z-scores. Results are shown in Table 7. The negative impact of exchange rate volatility on growth in East Asia is robust across most specifications while a currency appreciation also appears to deter growth. Most of the other controls variables have the expected signs. Schnabl (2007, 20) concludes from the study:

Despite the strong evidence in favour of a positive impact of exchange rate stability on growth the relationship between exchange rate stability and growth is not a linear.... Favourable conditions for international investment may encourage speculative capital inflows and overheating as experienced in the case of the Asian crisis. This does not imply, however, that countries should per se adopt flexible exchange rate regimes to reduce the likelihood of crisis because the price would be a considerable lower level of growth due to increasing macroeconomic instability under flexible exchange rate regimes.

Table 7: Generalized Least Squares Estimation Results for Growth in East Asia, 1980–2005 (per US dollar)

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
|---------------------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|
| Standard Deviation ^a | −0.627*** (0.116) | | −0.687*** (0.115) | | −0.547*** (0.109) | | −0.654*** (0.106) | |
| Yearly Change ^b | 0.071*** (0.017) | | 0.080*** (0.017) | | 0.071*** (0.017) | | 0.061*** (0.020) | |
| Z Score ^c | | −0.323*** (0.098) | | −0.338*** (0.099) | | −0.257*** (0.091) | | −0.425*** (0.088) |
| Interest Rate | 0.126* (0.074) | 0.099 (0.076) | 0.046 (0.059) | −0.028 (0.062) | | | | |
| Export Growth | 0.154*** (0.016) | 0.152*** (0.017) | 0.145*** (0.016) | 0.141*** (0.017) | 0.158*** (0.016) | 0.155*** (0.017) | | |
| Inflation | −0.091* (0.049) | −0.124** (0.051) | | | −0.038 (0.039) | −0.082** (0.040) | | |
| Inflation Target | 0.003 (0.008) | −0.007 (0.008) | 0.001 (0.007) | −0.011 (0.008) | −0.004 (0.007) | −0.012 (0.007) | −0.007 (0.008) | −0.013* (0.008) |
| Crisis | −0.027*** (0.008) | −0.025*** (0.008) | −0.025*** (0.008) | −0.022*** (0.008) | −0.026*** (0.008) | −0.025*** (0.008) | −0.036*** (0.009) | −0.034*** (0.009) |
| Constant | 0.044*** (0.006) | 0.049*** (0.006) | 0.048*** (0.006) | 0.056*** (0.006) | 0.051*** (0.004) | 0.054*** (0.004) | 0.071*** (0.003) | 0.071*** (0.003) |
| Obs. | 210 | 210 | 216 | 216 | 218 | 218 | 234 | 234 |
| R2 Within | 0.534 | 0.487 | 0.509 | 0.444 | 0.526 | 0.482 | 0.284 | 0.242 |
| R2 Between | 0.313 | 0.526 | 0.272 | 0.383 | 0.423 | 0.509 | 0.069 | 0.128 |
| R2 Overall | 0.481 | 0.478 | 0.456 | 0.434 | 0.500 | 0.481 | 0.250 | 0.223 |

*Significant at the 10% level; **significant at the 5%; ***significant at the 1%.

^a Standard deviation of percent exchange rate changes (σ) is a proxy for uncertainty and transaction costs for international trade and short-term capital flows.

^b Yearly change refers to the long-term exchange rate fluctuations (μ) measured as percentage annual changes of the exchange rate level.

^c A Z-score, $Z_t = \sqrt{\mu_t^2 + \sigma_t^2}$, where σ is defined in (a) and μ is defined as (b) above.

Sources: Schnabl (2007), based on data from IMF and national central banks.

While many industrial countries have operated fairly flexible exchange rates quite effectively, they have well-developed and diversified financial systems that are able to minimize real sector disruptions due to transitory exchange rate variations (abstracting from the resource-allocation costs of misalignments noted previously). In contrast, hedging instruments and markets are relatively underdeveloped in many developing and emerging Asian economies. In a review of the operational ingredients of a durable exit to a flexible exchange rate regime, the IMF has stressed the need to develop a “deep and liquid foreign exchange market” (Ötoker-Robe et al. 2007).⁴⁷ Of course, to some extent there may be a degree of endogeneity in that these markets may develop faster when there is greater currency flexibility and agents understand the exchange risks and

⁴⁷ This notwithstanding, the IMF economists note the need for an alternative nominal anchor, formulation of intervention policies, and ensuring managing exchange rate risks.

corresponding need to buy cover. This said, even if there is an ability to hedge, the transaction costs can be too high to make it an attractive option, especially for small- and medium-size enterprises over short horizons.

VI. Exchange Rate Implications for Asia

According to the IMF's de facto exchange rate classifications, most developing and emerging Asian economies appear to operate managed or fixed exchange rate regimes. Levy-Yeyati and Sturzenegger (2007) conjectured that exchange rate policy have evolved toward 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 appreciation versus depreciation in many developing and emerging Asian economies, particularly in the case of NEERs. This in turn rationalizes the relative exchange rate stability as well as the sustained reserve accumulation in the region.

This is not to suggest that the policy was implemented mechanically at all times. Countries in Asia (India, Indonesia, and the Republic of Korea most notably) allowed for greater currency flexibility during the 2007–2008 period when there were concerns of commodity-induced inflation. Similarly, a number of commentators have expressed concern 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 (preglobal 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 toward external demand as

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.

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 the rest of the industrialized world over the medium term.

Many observers have pointed out that the export-oriented nature of the Asian economies, especially those in East Asia, has given rise to a collective action problem (the so-called “prisoner’s dilemma”) whereby the fear of losing competitiveness leads each of them to heavily manage their respective currencies, particularly in view of the limited flexibility of the PRC currency. Of course, 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 renminbi would benefit some other Asian economies with broadly similar comparative advantage, allowing them to gain global market share (e.g., India, Viet Nam), it could also hurt others in the region since 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).

In relation to the foregoing, Subramanian (2010, 1) stresses the following point:

Higher tradable goods production in [the PRC] results in lower traded goods production elsewhere in the developing world—entailing a growth cost for these countries. Of course, some of these costs may have been alleviated by [the PRC’s] rapid growth and the attendant demand for other countries’ goods. But [the PRC’s] large current account surpluses suggest that the alleviation is only partial. These emerging market victims of [the PRC’s] exchange rate policy have remained silent because [the PRC] is simply too big and powerful for them to take on. And this is despite the fact that disaffected constituencies now encompass not just companies but also central bankers, who have found macroeconomic management constrained by renminbi policy. Hence the third consequence. By default, it has fallen to the US to carry the burden of seeking to change renminbi policy. But it cannot succeed because [the PRC] will not be seen as giving in to pressure from its only rival for superpower status. Only a wider coalition, comprising all countries affected by [the PRC’s] undervalued exchange rate, stands any chance of impressing upon [the PRC] the consequences of its policy and reminding it of its international responsibilities as a large, systemically important trader.

Rather than singling out the PRC, though, another way of thinking about the issue is that 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.⁴⁹ 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, some observers have suggested that East Asian economies gradually move toward pegging to a currency basket, starting with individual currency weights and varying extents of flexibility around the pegs with a gradual convergence over time (see for instance, Rajan 2002). Others have maintained that the region move collectively to a common currency basket rather than a more graduated approach (Kawai 2002, Ogawa and Ito 2002, Williamson 2005).

Straight-jacketing regional exchange rate regimes is not advisable given the different stages of development and the region being unlikely to agree on more substantive steps to coordinate monetary policies. In fact, what the recent debt debacle in Greece and Portugal and consequent drag on the rest of the Euro zone members suggest is that as economies and capital markets become more globalized, countries looking to form monetary unions cannot afford to ignore the fiscal side. A single currency union is likely to be incompatible with fiscal fragmentation over time, something that the European Union has hitherto tried to maintain. From the perspective of individual well-run economies, though, this fiscal harmonization will further tie their hands, making them less able to deal with country-specific shocks, and making the costs of membership in a monetary union prohibitively high. Meanwhile, those with weaker policies and rising unemployment may be tempted at times of acute stress to use competitive devaluations by leaving the union.

Given that the regional economies are likely to go it alone for the time being as far as exchange rate and monetary policies are concerned, is there anything one can recommend with regard to the pursuit of exchange rate regimes? Theory is, unfortunately, of limited help in this regard. However, in an important paper that uses the Reinhart-Rogoff natural classification, Husain, Mody, and Rogoff (2005) conclude that for developing countries with limited access to international capital flows, pegged exchange rate regimes appear to be relatively more durable and are associated with higher growth. The Asian countries of this category in the Husain-Mody-Rogoff database are Bangladesh, Myanmar, Nepal, and Sri Lanka.⁵⁰ As these countries become more financially developed and have greater access to international capital markets, there may be benefits (in terms of both higher growth and lower inflation) from permitting increased exchange rate flexibility. The Asian economies considered high-income in the Husain-Mody-Rogoff database are Japan; Hong

⁴⁹ Park (2006, 15–16) elaborates on the prisoner's dilemma in East Asia and the central role played by the PRC:

There is little disagreement that an across-the-board appreciation of East Asian currencies constitutes an important component of the resolution of global imbalances. However, as noted earlier, if [the PRC] insists on maintaining its limited flexibility, other East Asian countries are not likely to let their currencies strengthen vis-à-vis the Renminbi as [the PRC] has emerged as their export competitor in regional as well as global markets.... What is significant about [the PRC's] move to an intermediate regime is that it will broaden the scope of coordination of exchange rate policy among some of the ... East Asia economies and revive the discussion of establishing a new modality of cooperation for monetary integration in the region.

⁵⁰ They also include Viet Nam in this category though its inclusion is rather dubious given the large-scale foreign capital interest in the country in recent years. There is clearly room to debate the logic of other country categorizations as well. For instance, it could quite reasonably be argued that Sri Lanka ought to be classified as an emerging economy (particularly when compared with Pakistan, for instance).

Kong, China; and Singapore. Interestingly, for emerging markets, i.e., those with access to international capital flows, there is not much difference (in terms of growth or inflation effects) from either a pegged or flexible exchange rate regime, though the former is somewhat less durable and exposes the country to higher risk. The Asian countries in this category are those included in the Morgan Stanley Capital International index, namely, the PRC, India, Indonesia, the Republic of Korea, Malaysia, Pakistan, the Philippines, and Thailand.

VII. Going Forward: Beyond the Financial Crisis

A decade after the 1997–1998 Asian financial crisis, Asia has, once again, been hurt by the global financial crisis that emanated from the financial sectors in the US and Western Europe. The high degree of openness of Asia to international trade, investment, and capital flows inevitably meant that the regional economies would be impacted, though they coped admirably well until September 2008, even leading many analysts to talk about the possible decoupling of the region from the West. Such talk quickly vanished upon the bankruptcy of Lehman Brothers, which led to the skyrocketing of emerging market spreads and extreme tightening of credit markets worldwide. The sharp curtailment in export demand; freezing of credit markets, including trade financing and wholesale funding; as well as the abrupt reversal in capital flows to emerging markets, worked in tandem to curtail near-term growth in Asia quite heavily (Rajan 2009, IMF 2009).

The massive turnaround in capital flows into Asia during this period in turn led to broad-based asset price declines and moderate exchange rate depreciations, which would have been even larger if not for some degree of foreign exchange intervention (Figures 4 and 5).⁵¹ While exchange rate depreciation was most apparent in the case of countries with current account deficits, namely India, Indonesia, and the Republic of Korea, even countries with current account surpluses such as Singapore and Malaysia experienced downward exchange rate pressure as apparent from a drop in their reserves. Interestingly, the PRC and Hong Kong, China were exceptions to this trend, as both economies continued to accumulate reserves even during the height of the global crisis.

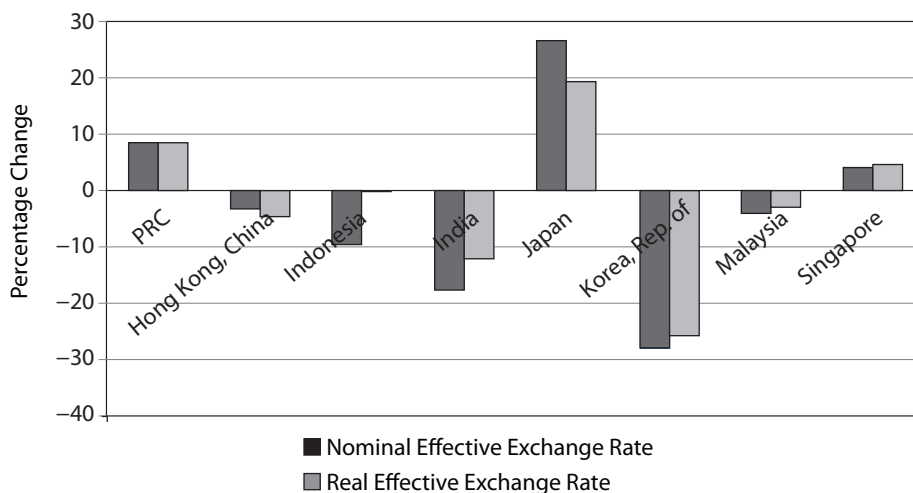
While the spillovers from the global financial crisis to Asia were sudden and rather dramatic, once credit markets started thawing by March 2009, Asia looked poised to emerge most rapidly from the global economic contraction compared to many other regions.⁵² No doubt, the painful deleveraging and restructuring of the corporate and financial sectors that the region went through placed the regional economies in good

⁵¹ See Rajan (2009) and Rajan and Gopalan (2010) for a discussion of the dynamics of capital flows to Asia since the 1990s including the global financial crisis.

⁵² This is not to suggest that risks to the outlook of the region do not exist.

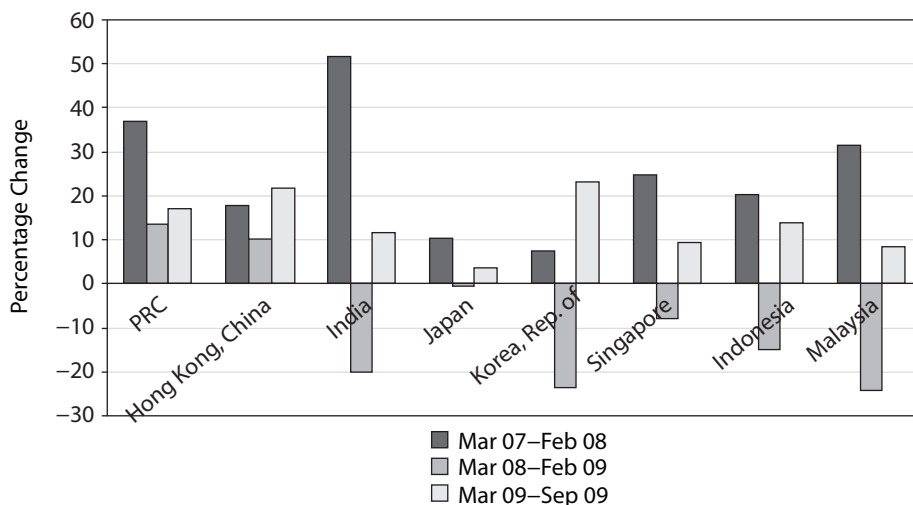
stead. Many have also argued that the more transparent monetary policy frameworks and introduction of relatively greater degrees of exchange rate flexibility also played an important role in helping the region manage—if not bounce back from—the sharp downturn experienced in late 2008 to early 2009.

Figure 4: Nominal and Real Effective Exchange Rate Changes in Selected Emerging Asian Economies, 2007–2009 (between August 2007 and September 2009)



Note: A negative (positive) change implies depreciation (appreciation). The effective exchange rate is the weighted average of 58 trading partners reported by the Bank for International Settlements.
 Source: Bank for International Settlements.

Figure 5: Change in International Reserves of Selected Emerging Asian Economies, 2007–2009



Note: A negative (positive) change implies depreciation (appreciation). The effective exchange rate is the weighted average of 58 trading partners reported by the Bank for International Settlements.
 Source: Bank for International Settlements.

The near-term challenge for the region will be to time the withdrawal of fiscal and liquidity policy support in such a way so as to ensure that the growth momentum does not get derailed (i.e., not to withdraw too soon),⁵³ while at the same time keeping inflation and asset price bubbles in check and maintaining fiscal sustainability. The medium-term challenge for developing and emerging Asia is that if it hopes to return to a period of *sustained* robust growth, it must place greater emphasis on generating domestic and regional demand. Among other things, this would require a reconfiguration of real exchange rates somewhat toward the production and consumption of nontradables as well as a focus on recycling current account surpluses intraregionally. Going forward, as the Asian economies become more open and the types of shocks that hit an economy become more complex; and in the absence of the ability to coordinate macroeconomic policies more effectively, they ought to introduce a greater degree of exchange rate flexibility to also allow some autonomy in the operation of monetary policy.

With the pick-up in capital flows and infusion of domestic liquidity, an immediate near-term consideration for many Asian economies will be how to respond to concerns about asset price bubbles in the future. There is a school of thought that argues that as long as the country's inflation outlook remains consistent with the medium term inflation target range (i.e., the policy reference period), the central bank has space to use its decision to judiciously meet other objectives and respond effectively to various shocks and obvious asset price misalignments in the interim.⁵⁴ This suggests a degree of discretion in being able to prick asset price bubbles, including exchange rate and housing ones (or better still, be preemptive so as to prevent bubbles from forming in the first instance).

To be sure, there is a significant difference between keeping an eye on asset price changes as offering information on the underlying economy compared to explicitly targeting them. The former is rather uncontroversial; the latter is not.⁵⁵ There is a concern that central banks are not able to estimate bubbles or misalignments (wouldn't they be rich if they could?) and there could also be instances where various asset prices give conflicting signals (Mishkin 2008).⁵⁶ The fact remains, though, that central banks often intervene during asset price busts to limit the damage to the real sector. If they are willing to act to limit the incidence and extent of asset price busts through massive emergence

⁵³ See Morgan Stanley (2009) for a discussion on the exit strategy of the Asian economies from the expansionary policy support.

⁵⁴ One might call this the "Australian view" of inflation targeting. See Debelle (2009).

⁵⁵ Similarly, many central banks in Asia and elsewhere also keep an eye on the so-called "Monetary Conditions Index" or MCI, a weighted average of interest rate and exchange rate that is not controversial. But if they attempt to explicitly target the MCI it would be much more controversial. For a discussion on the MCI in the context of Hong Kong, China, see Hong Kong Monetary Authority (2000).

⁵⁶ Also see Bean (2003). That said, not everyone is convinced by such concerns, offering the counterargument that monetary policy needs to be cautious but not "paralyzed". For instance, Cecchetti, Genberg, and Wadhvani (2002, 19) have opined:

...We are not persuaded that one should ignore asset price misalignments simply because they are difficult to measure. The standard response to noisy data is to use econometric methods to extract the signal. This is common practice in the use of statistics in a policymaking environment. If central bankers threw out all data that was poorly measured, there would be very little information left on which to base their decisions.

support, should not the authorities then be willing to respond effectively to obvious asset price misalignments in the upturn using both monetary policy as well as appropriate prudential regulations? Surely, monetary policy response needs to be symmetric (i.e., proactive or passive) to both booms and busts, failing which there could be obvious moral hazard concerns (Dudley 2009). Policymakers in Asia would be wise not to underestimate credit and related risks during future credit and asset booms, and to use a combination of prudential measures, currency appreciations, and interest rate hikes to curb or stave off such pressures.

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