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Abhijit Sen Gupta and Rajeswari Sengupta

Asian Development Bank, Indira Gandhi Institute of Development  
Research

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# Capital Flows and Capital Account Management in Selected Asian Economies\*

Rajeswari Sengupta<sup>†</sup>      Abhijit Sen Gupta<sup>‡</sup>

September 29, 2014

## Abstract

Gross capital inflows and outflows to and from emerging market economies (EMEs) have witnessed a significant increase since early 2000s. This rapid increase in the volume of flows accompanied by sharp swings in volatility has amplified the complexity of macroeconomic management in EMEs. While capital inflows provide additional financing for productive investment and offer avenues for risk diversification, unbridled flows could also exacerbate financial instability. In this paper we focus on the evolution of capital flows in a few select emerging Asian economies, and analyze surge and stop episodes as well as changes in the composition of flows across these episodes. We also provide a comprehensive description of the capital account management policies adopted by the host countries and evaluate the efficacy of these measures by analyzing whether they achieved the desired goals. This kind of an analysis is highly relevant especially a time when EMEs around the world are about to face the repercussions of a potential Quantitative Easing (QE) tapering by the US or launch of fresh QE measures by the Euro-zone, either of which could once again heighten the volatility of cross-border capital flows thereby posing renewed macroeconomic challenges for major EMEs.

*JEL Classification:* F32; F38 and F41

*Keywords:* Capital flows, Exchange market pressure, Impossible Trinity, Sterilized intervention, Capital controls, Global financial crisis.

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\*The views expressed in this paper are those of the author and do not necessarily reflect the views and policies of the Asian Development Bank (ADB) or its Board of Governors or the governments they represent.

<sup>†</sup>Visiting Fellow, Indira Gandhi Institute of Development Research, Mumbai (Email: rajeswari@igidr.ac.in)

<sup>‡</sup>Senior Economics Officer, India Resident Mission, Asian Development Bank, New Delhi (Email: asengupta@adb.org)

# 1 Introduction

Emerging economies witnessed a sharp increase in capital flows in the period during the last two decades. From around 2.6% of GDP in 2000, gross capital inflows increased to a peak of 12.5% of GDP in the second quarter of 2007. During the same period, net capital inflows surged from 1.25% of GDP to over 6.5% of GDP. After collapsing during the 2008 global financial crisis (GFC), capital flows to the emerging economic experienced a sharp rebound in late 2009 and 2010. These created a number of macroeconomic challenges and financial stability concerns to emerging market, forcing them to undertake capital account management and macroprudential measures to stem the flow of capital. The situation had reversed again by the end of 2011 and 2012, with the worsening of the global outlook driven by sovereign debt rating downgrade of the United States in August 2011 and the exacerbation of the Eurozone crisis. This resulted in capital flows receding rapidly, withering away the recent exchange rate gains and reserve accumulation.

This volatility in capital flows to emerging countries has again the reignited the debate on allocation of flows to these economies. The drivers of these capital flows are diverse, ranging from global, regional, contagion to domestic factors. For example, [Forbes and Warnock \(2012\)](#) conclude that global factors were a major driver of capital flows. In particular, global risk plays a very important role in determining the periods of extreme capital flows by domestic and foreign investors. Global risk impacts capital flows mainly through changes in economic uncertainty, although changes in risk aversion is also an important factor during periods of dramatic slowdown of foreign capital. Apart from these, global growth also plays an important role in driving capital flows, especially by foreign investors. [Ghosh et al. \(2014\)](#) also find evidence of global factors such as U.S. interest rates and risk aversion to be more important factors driving capital flows to emerging economies than growth differentials of these countries viz-a-viz advanced economies.

Another important factor in explaining capital flow is related to contagion, which occurs through trade and financial linkages as well as regional connections. Contagion helps explain episodes during which investors tend to reduce investment abroad and return more money home. Finally, domestic factors also play a role in influencing episodes of capital flows but these tend to be lower than others. Among domestic factors, domestic growth shocks are usually most important in determining the behavior of foreign investors. However, for some selected Asian economies, [Balakrishnan et al. \(2013\)](#) argue that there is not a strong association between growth differentials of these economies with advanced countries and equity inflows. Many of the Asian economies faced equity outflows, implying that the favourable effect of sizeable growth differentials was offset by the uncertainty related to the

global outlook. In contrast, some of the selected Asian countries witnessed a stronger relationship between bond flows and interest rate differentials. Finally, there is little evidence of a significant effect of capital controls on the likelihood of experiencing any type of extreme capital flow movement.

In this paper, we focus on the trend of capital inflows and outflows in selected Emerging Asian Economies (EAEs) by analyzing the “waves” in capital flows. We also evaluate the composition of these waves, i.e. were the flows driven by FDI flows, portfolio flows, bank and non bank flows, derivative flows or government flows. We then focus on the response of the host countries to these waves of flows focusing both on the capital account management and macroprudential measures. Finally, we evaluate the efficacy of these measures by analyzing if these measures achieved their desired goals.

## 2 Identifying Surge and Stop Episodes

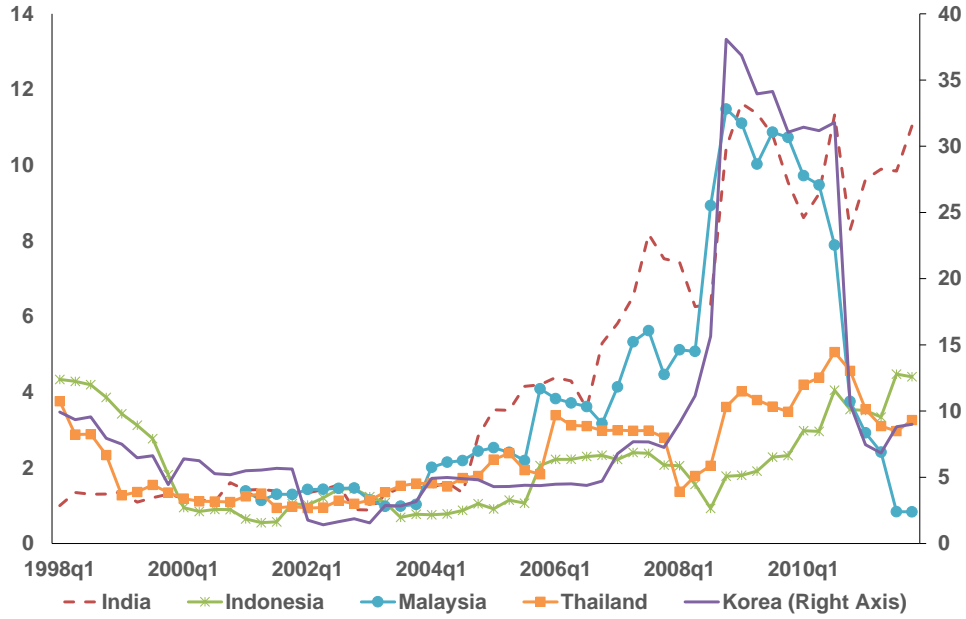
In this section we document the broad trends in capital flows in selected Asian emerging markets. We focus our analysis on five major emerging economies of the region viz. India, Indonesia, Republic of Korea (henceforth, Korea), Malaysia and Thailand. We focus on the period 1995q1 to 2011q4, which provides us with a time series spanning 84 quarters.

Gross capital inflows have been extremely volatile in recent years in many Asian economies. For example, inflow of foreign capital on account of net purchase of Korean assets by foreigners through direct and portfolio investment, financial derivatives and other investment reversed from +\$25.7 billion in Q2 2007 to -\$22.6 billion (net sales) in Q3 2008. Similarly, even in India, an economy used to relatively low fluctuations in capital inflows due to limited capital account openness, net purchase of assets went down from +\$29.2 billion in Q4 2007 to -\$1.6 billion (net sales) in in Q4 2008. Following [Forbes \(2014\)](#) we formally assess the increase in volatility by calculating the standard deviation of quarterly gross capital inflows over the last eight quarters for our sample of countries. The results are shown in [Figure 1](#). Given Korea’s significantly higher degree of volatility, compared to the other economies, it has been measured on a different axis. It is quite evident that for all the countries we are focusing on, the period of the GFC was characterized by significantly higher volatility in capital flows, compared to earlier years. There was a steady increase in the volatility from early 2006, and it reached a peak in the second half of 2008.

The volatility in the capital inflows have been driven both by periods of “waves” of capital inflows. We use the methodology introduced by [Forbes and Warnock \(2012\)](#) to identify the both periods of sharp changes in inflows. We focus on “surges” and “stops”. While a surge is defined as a sharp

increase in gross capital inflows, a stop implies a sharp decline in gross capital inflows. Both these events are driven by foreigners buying or selling domestic assets.

Figure 1: Volatility in Capital Inflows in Asia



Source: IMF's Balance of Payment Statistics & Authors' Estimates

We compute episodes of capital flow surges and stops using the methodology of [Forbes and Warnock \(2012\)](#) for the period 1995 to 2011. Details of the calculations are in the Appendix in Section 4.1 at the end of the paper. The various episodes of surges and stops, with their start and end dates are tabulated in Table 1.

Table 1: Surge and Stop Episodes for Selected Countries

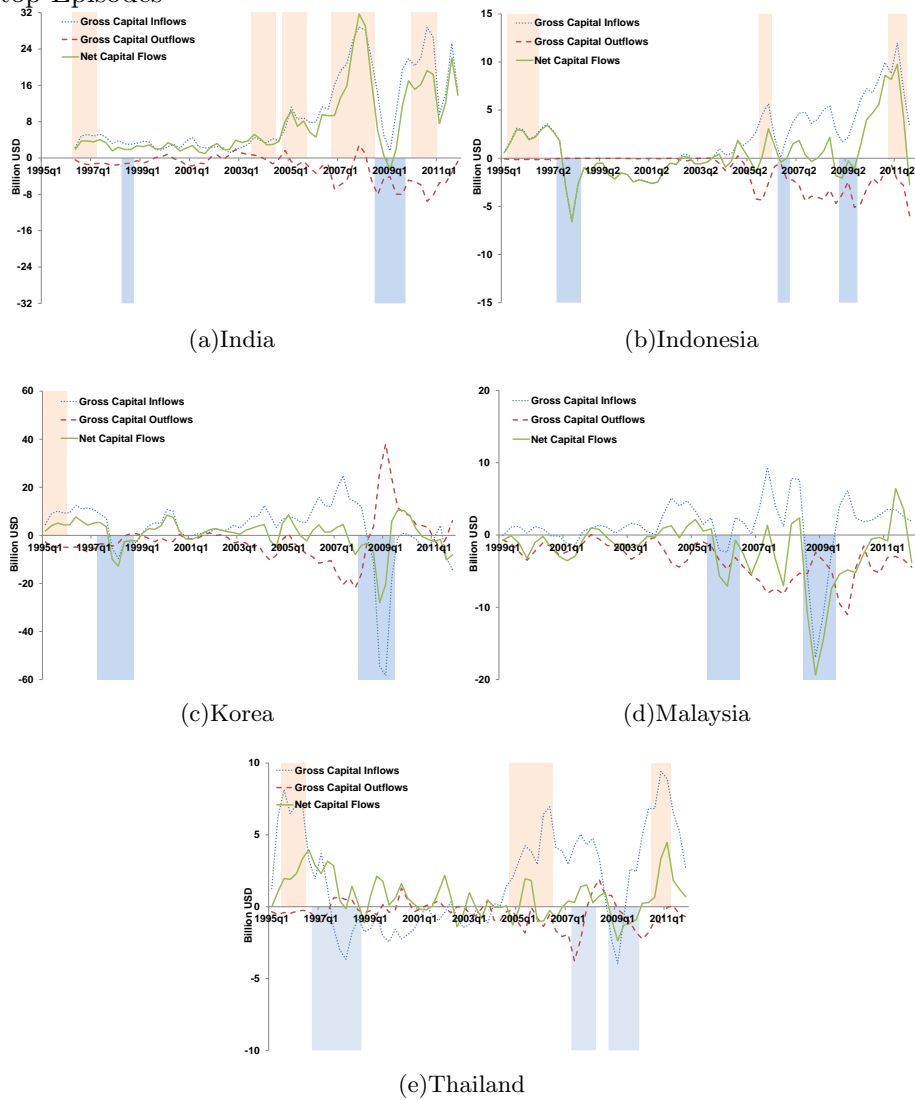
	Surges			Stops		
	Start	End	Quarters	Start	End	Quarters
India	Q2 1996	Q1 1997	4	Q2 1998	Q3 1998	2
	Q3 2003	Q2 2004	4	Q3 2008	Q3 2009	5
	Q4 2004	Q3 2005	4			
	Q4 2006	Q2 2008	7			
	Q1 2010	Q4 2010	4			
Indonesia	Q2 1995	Q3 1996	6	Q4 1997	Q3 1998	4
	Q4 2005	Q1 2006	2	Q4 2006	Q1 2007	2
	Q4 2010	Q2 2011	3	Q1 2009	Q3 2009	3
Korea	Q3 1994	Q4 1995	6	Q2 1997	Q3 1998	6
				Q1 2008	Q2 2009	6
Malaysia				Q4 2005	Q3 2006	4
				Q3 2008	Q2 2009	4
Thailand	Q2 1995	Q1 1996	4	Q3 1996	Q2 1998	8
	Q3 2004	Q1 2006	7	Q1 2007	Q4 2007	4
	Q3 2010	Q1 2011	3	Q3 2008	Q3 2009	5

Source: [Forbes \(2014\)](#), IMF's International Financial Statistics and Authors' Estimates.

In addition, Figure 2, superimposes these episodes with the evolution of gross capital inflows and outflows as well as net inflows. Table 1 shows that on aggregate these five Asian economies experienced an equal number of 12 surge as well as stop episodes. Broadly, the surge episodes can be divided into three periods. First was the period preceding the Asian financial crisis (AFC) while the second took place prior to the GFC, while most of the surge episodes were confined to these two crises periods. However, there were differences at the individual country level. While, at five, India experienced the most number of surge episodes, Malaysia did not witness any surge episode. The stop episodes were more symmetrically distributed with Indonesia and Thailand experiencing three episodes each and India, Korea and Malaysia encountering two episodes each. India and Thailand witnessed the longest surge episodes spanning over 7 quarters during the period before the GFC, while Thailand witnessed the longest stop episode during the AFC.

Figure 2 shows that during the longest surge episodes experienced in India between Q4 2006 and Q2 2008, there was an inflow in excess of \$150 billion or an average of 7.6% of GDP. Similarly, though the surge episode between Q3 2004 and Q1 2006 in Thailand was much more modest in volume,

Figure 2: Net and Gross Flows to Asian Economies along with Surge and Stop Episodes



Source: Forbes (2014), IMF's Balance of Payment Statistics and Authors' Estimates.

resulting in capital inflow of only \$30 billion, these capital flows accounted for nearly 9.3% of GDP. The stop episodes were equally diverse. While the longest stop episode among these five economies involving Thailand during the AFC led to sale of Thai assets by foreigners worth \$4 billion or 2.4% of GDP, Korea experienced sale of assets worth \$130 billion or 11.5% of GDP during the GFC.

Next, we focus on the composition of the gross inflows to get an idea of what kind of flows influenced the surge and stop episodes. Figure 3 decomposes

the gross capital inflows (as a percentage of GDP) received by an economy into FDI flows, portfolio debt flows, portfolio equity flows, bank and non-bank flows, derivative flows and government flows. We focus on the period Q1 1995 to Q4 2011. While for Indonesia, Korea and Thailand, the data is available for the entire period, for India, the data begins in 1996, and for Malaysia, the data begins in 1999.

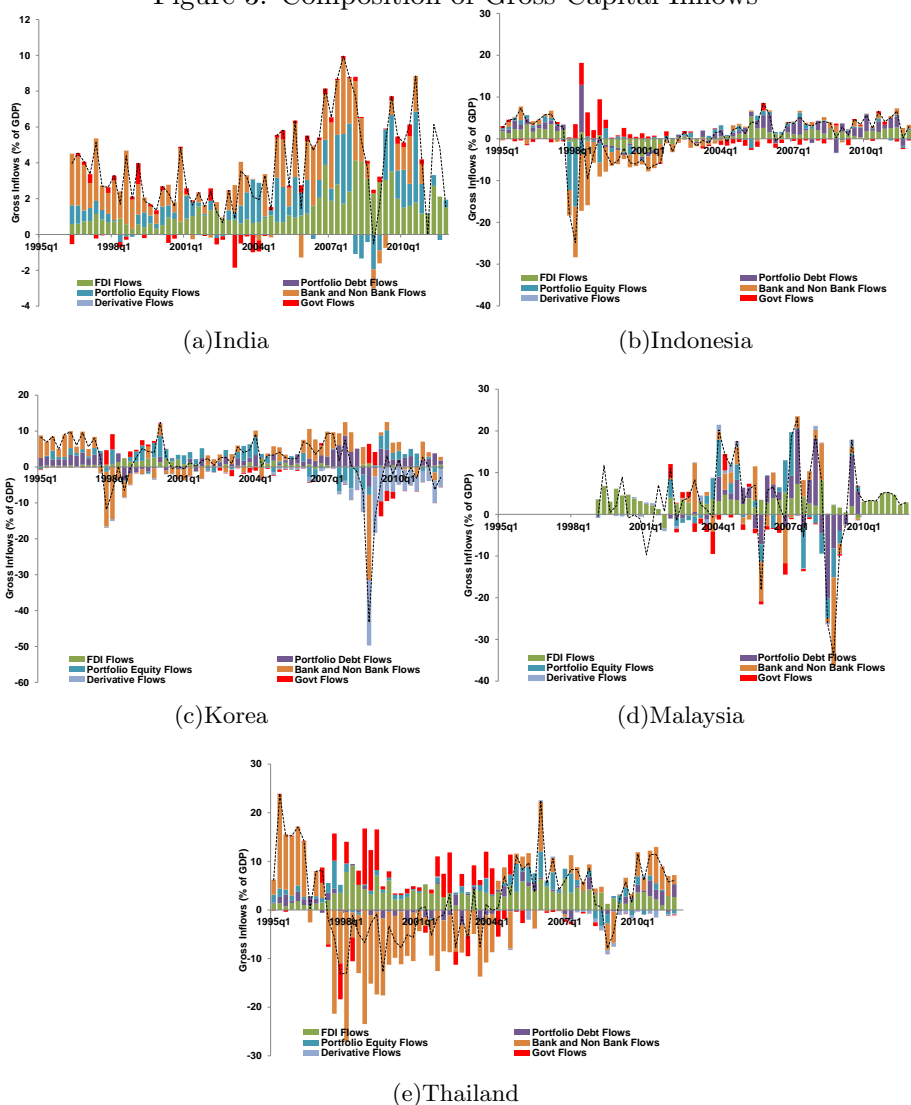
In India, the first surge episode in the mid-1990s were primarily driven by bank and non-bank flows, which accounted for nearly 60% of the gross inflows coming into the country. This was driven by commercial borrowings by Indian corporate sector, short-term trade credits and deposits by non-resident Indians. These flows also played an important role in driving capital flows during the surge episodes of Q4 2004 to Q3 2005 and Q4 2006 to Q2 2008, when they accounted for more than 40% of total inflows. These flows have been primarily encouraged by widening interest rate differential between India and the advanced economies as well as greater liberalization of borrowing norms. The other two surge episodes in 2000s, i.e. the ones during Q3 2003 to Q2 2004 and Q1 2010 to Q4 2010 were driven by portfolio equity flows, which accounted for 59.1% and 41% of the total flows. While FDI inflows accounted for 25% to 30% of flows during these two episodes, its contribution peaked at 38% during the longest surge episode that took place from Q4 2006 to Q2 2008. Improved macroeconomic fundamentals and easy global liquidity led to flow of global capital into India during 2003 to 2008, and again in 2010.

In Indonesia, FDI inflows were a big driver of capital flows, explaining nearly 50% of the capital inflows during the surge episodes of Q2 1995 to Q3 1996 and Q4 2010 to Q2 2011. In comparison, FDI inflows accounted for only 30% of total inflows during the short episode from Q4 2005 to Q1 2006. In 1989, Indonesia switched from a positive list for FDI to a negative list, which was further pruned during the early 1990s. Indonesia experienced a boom in FDI during 1995 and 1996, with FDI doubling over previous years. Portfolio debt flows also played an important role, accounting between one-quarter to one-half of the total capital inflows. Again, similar to India, with domestic interest rates tending to be much higher than foreign interest rates, there were inducements for foreign borrowing and capital inflows. However, expected depreciation of the currency as well as country risk considerations tempered some of the inflows. The post GFC period saw private international investors engaging into purchases of government bonds and Bank Indonesia securities, with portfolio debt flows rising accounting for 38% of aggregate capital inflows.

The only surge episode witnessed in Korea was in the mid-1990s, prior to the onset of the AFC. This was driven mainly by bank and non-bank flows and portfolio debt flows, which explained 56.9% and 28.3% of capital inflows



Figure 3: Composition of Gross Capital Inflows



Source: Forbes (2014), IMF's Balance of Payment Statistics and Authors' Estimates.

during Q3 1994 to Q4 1995. Portfolio equity flows accounted for 10.5% of aggregate inflows. The worsening of the current account deficit in the early 1990s along with the requirements to join OECD resulted in the Korean government significantly relaxing its control over the financial sector and liberalizing management of the capital account. In particular, foreign investors were allowed to invest directly in Korea stock markets with some ownership caps, foreigners were allowed to purchase government and public bonds issued at international interest rates and equity-linked bonds could be issued by small and medium firms. Norms for foreign commercial loans were

also significantly eased, which led to an increase in short-term borrowing.

While Malaysia did not experience a surge episode during the period of the study, Thailand witnessed three such episodes. The first one in the mid 1990s was driven exclusively by bank and non bank flows. This was a result of progressive capital account liberalization in the early 1990s, with measures such as increasing commercial banks' net foreign liabilities from 20% to 25% and allowing residents to undertake foreign exchange transactions directly with commercial banks. In the second episode, lasting from Q3 2004 to Q1 2006, FDI inflows accounted for nearly half of the aggregate inflows, while another 40% of inflows were in the form of portfolio equity flows while the final episode was driven bank and non bank flows and portfolio debt flows.

The stop episodes were primarily concentrated during the periods of the AFC (1997-98) and GFC (2008-2009). Barring India, all the other Asian economies witnessed a significant sale of assets by foreigners during the AFC. Much of the outflow of foreign capital took place through bank and non-bank flows and portfolio debt flows. [Radelet and Sachs \(2000\)](#) point out that these 4 East Asian economies, along with Philippines, witnessed net private flows dropping from \$93 billion in 1996 to -\$12 billion in 1997, a swing of \$105 billion or 9% of GDP. Out of this decline of \$105 billion, over \$77 billion was due to commercial bank lending, while portfolio equity and non-bank lending accounted for \$24 billion and \$5 billion.

In Thailand, the AFC resulted in massive outflow of foreign capital and caused a dramatic depreciation of the Thai Baht. In the immediate aftermath of the crisis, FDI inflows continued to remain relatively robust and averaged 4.5% of GDP between 1998 and 2001. However, there was a decline from 2002 onwards, and FDI inflows recovered only in 2005. Portfolio equity flows remained at a consistent low level between 1998 to 2004, averaging only 0.6% of GDP. The magnitude of these flows increased after 2005 and averaged more than 2% of GDP between 2005 and 2007. Portfolio debt flows experienced a negative trend between 1999 and 2005. These increased after 2005, but continued to remain volatile and low. The imposition of Unremunerated Reserve Ratio in December 2006 led to a drop in these flows. The biggest fall in capital inflows came from bank and non-bank inflows, which remained negative till 2004.

Unlike the AFC, India was significantly impacted by the GFC of 2008-2009, along with the other EAEs. From \$100.6 billion in 2007, private capital inflows to India dropped to \$33.2 billion in 2008. Cumulatively, these five economies witnessed private capital inflows declining from \$223.7 billion to -\$15.6 billion. Of the reversal of \$239.3 billion between 2007 and 2008, nearly \$150 billion was on account of bank lending while portfolio equity witnessed a reversal of \$67 billion. Non-bank lending also experienced a reversal of \$23 billion. Thus both during the AFC and GFC, bank and non-bank inflows

as well as portfolio equity inflows were the major channels of capital flow reversal. FDI inflows remained fairly constant during these two crises. The increase in global liquidity in the aftermath of the GFC as well as initial signs of decoupling of emerging economies of Asia from the advanced economies led to a revival of capital flows in later part of 2009, which continued till 2011. From a cumulative negative inflow of -\$15.6 billion of in 2008, private inflows to these 5 EAEs jumped to -\$1.94 trillion in 2009, and further to \$2.15 trillion in 2010, before dropping to \$1.89 trillion in 2012.

### 3 Policy Response to Manage Capital Inflows

Policymakers' desire to prevent sharp surges in capital inflows stems from the myriad of risks associated with these surges. These include macroeconomic risks, financial stability risks, and finally risks associated with capital flow reversal. [Subramanian and Rajan \(2005\)](#) and [Prasad et al. \(2007\)](#) show that excessive capital inflows could result in rapid exchange rate appreciation, which can hurt exports of emerging markets. Even a short-term appreciation can have lingering implications in the form of permanent loss of export market share and reductions in manufacturing capacity. Thus capital flow surges can influence macroeconomic variables in a way that is inconsistent with policy objectives such as price stability, exchange rate stability and export promotion.

Capital inflows can also push up asset prices, reduce the quality of assets and adversely affect maturity and currency composition of corporate balance sheets, contributing to enhanced financial fragility. [Prasad and Rajan \(2008\)](#) contend that in an underdeveloped financial system, foreign capital is likely to be channeled towards easily collateralized, non-tradable investments like real estate, leading to asset price booms, with subsequent busts severely disrupting the economy. Foreign portfolio investment into shallow equity markets also cause sharp valuation swings.

Finally, capital inflows can reverse themselves leading to a costly balance of payments crisis. [Schadler \(2010\)](#) show that about 15% of capital inflow episodes over the past two decades have resulted in a crisis.

In the case where capital flows are being driven largely by economic fundamentals, policymakers need to reconcile to the inevitability of allowing a real exchange rate appreciation as it would result in a fundamental revaluation of domestic assets relative to foreign assets. However, policymakers tend to be reluctant to allow the real exchange rate to appreciate for a variety of reasons. The most important concern tends to be loss of international price competitiveness resulting in adverse balance of payments situation.

In general, policymakers can resort to three broad macroeconomic measures to counter the surge in capital inflows. These involve (i) enhancing exchange rate flexibility, (ii) undertaking sterilized intervention, and (iii) imposing controls on capital inflows. Below, we analyse the experience of the 5 selected EAEs on these measures.

### 3.1 Enhancing Exchange Rate Flexibility

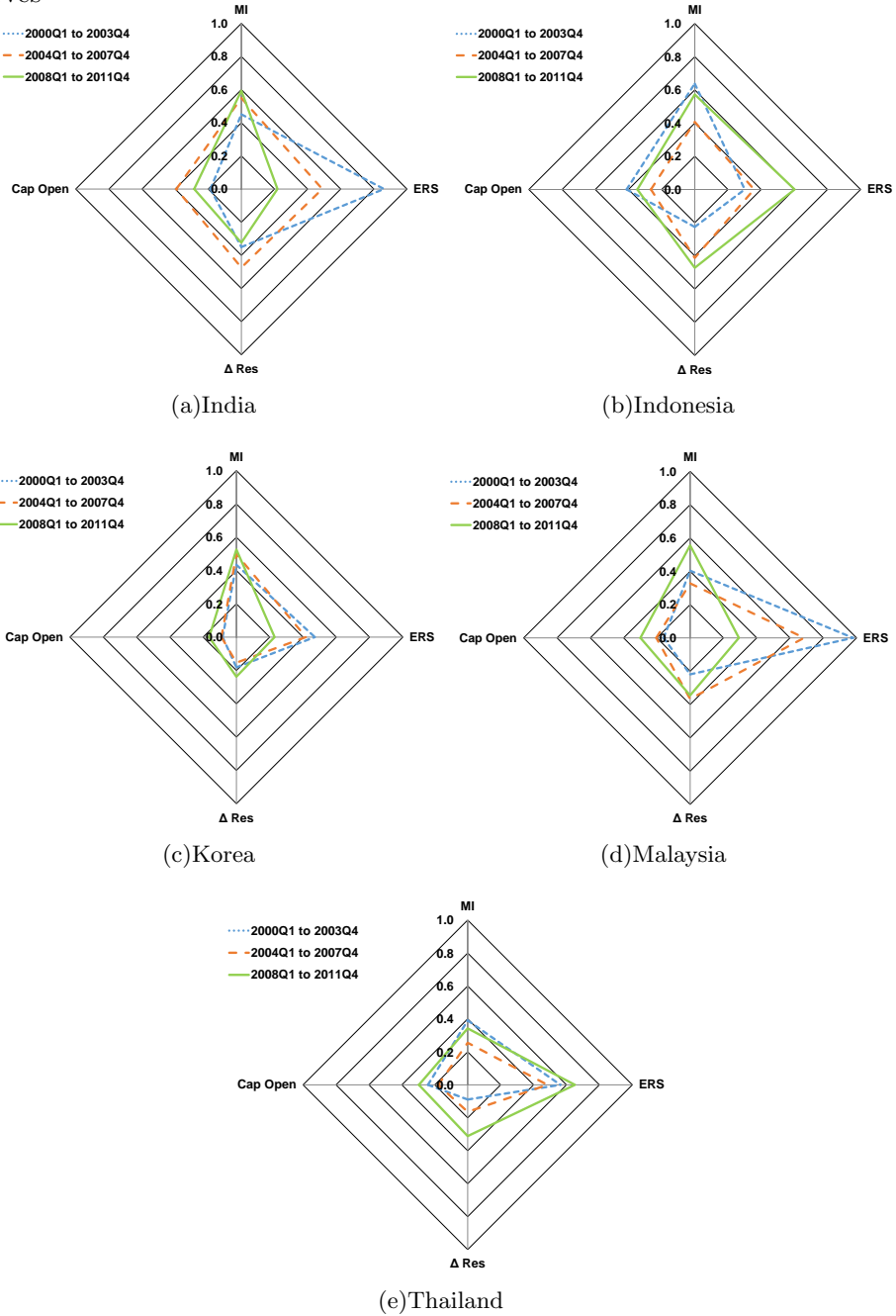
Enhancing exchange rate flexibility does not necessarily imply nominal exchange rate appreciation, something which the policymakers are reluctant to allow. It refers to introducing two-way risks, and thereby discourage speculative capital inflows. If a central bank responds to a capital inflows over a period of time by continuing to intervene in the foreign exchange market it can encourage more capital flows by introducing a one-way bet. It signals investors that the domestic currency will appreciate in the near future as and when the central bank cannot afford further intervention and allows freer movement of the currency. At the same time, large stockpile of reserves provides an assurance that large depreciation will not take place.

Introduction of two-way risks involve widening the band of fluctuation in the case of *de facto* peg or a tightly managed float. The need to allow greater freedom to the exchange rate in the face of enhanced capital inflows is driven by the desire to retain monetary autonomy to be able to stabilize the economy in the face of domestic and exogenous shocks. This trade-off stems from the classic open economy trilemma, which argues that it is impossible to attain monetary policy independence, exchange rate stability and capital market integration simultaneously. Only two of the three objectives can be obtained at a particular point in time. We use empirical methods following [Aizenman et al. \(2010\)](#) to briefly describe the experience of the EAEs with the impossible trinity, using quarterly data from 2000 Q1 to 2013 Q4. Details of the calculations are given in the Appendix, in section 4.2.

With three indices across 5 countries, it is difficult to identify events that would have resulted in a structural shift in these indices across all the economies. Hence, to better understand the evolution of these indices, we break the entire sample into three equal periods. While Period 1 lasts from 2000 Q1 to 2003 Q4, Period 2 covers 2004 Q1 to 2007 Q4, and Period 3 includes 2008 Q1 to 2011 Q4. We plot the means of the indices across these periods in Figure 4.

Next, we examine the validity of the trilemma framework by testing whether the weighted sum of the three trilemma policy variables adds up to a constant, here set to be 2. The relevant equation is given in the Appendix in

Figure 4: Configuration of the Trilemma Objectives and International Reserves



Source: Authors' Estimates.

section 4.2.1 and the results are given in Table 4<sup>1</sup>. We estimate the relationship for the entire period 2000 Q1 to 2011 Q4. While the estimates for exchange rate stability and capital account openness are significant across all the specifications, it is not the case with monetary independence.

To obtain the contribution of each trilemma policy orientation we multiply the coefficients with the average for each phase. The results are outlined in Figure 5. The high goodness of fit implies that the contributions add up to being close to 2 across all the phases for all the EAEs, barring Thailand.

We find that the 5 EAEs have managed the conflicting objectives of trilemma in very different ways. Across the periods India has put greater emphasis on monetary independence, whose weight increased from 22.4% in Period I to over 70% in Period III as monetary policy was calibrated to manage domestic inflationary pressures. This was offset by relinquishing exchange rate stability whose weight steadily declined from 76.3% to 20.3%. Another economy, which witnessed a decline in the exchange rate stability index was Malaysia. From a weight of 92.6% in Period I when the Ringgit was pegged to the US Dollar, the weight on exchange rate stability declined to below 60%. Like India, the decline in exchange rate stability was associated with an increase in monetary independence. In both these economies, capital account openness witnessed an increase in Period II, helped by loose global liquidity and strong domestic macro fundamentals. However, the GFC, followed by crisis in Europe, and deterioration in domestic macro indicators led to a slump in capital flows in Period III.

Among the other EAEs, Korea has consistently put the most weight on retaining monetary independence, followed by exchange rate stability. There was some decline in the emphasis given to monetary independence in Period II, when the economy experienced a rush of capital inflows prior to the GFC resulting in an increase in capital account openness. The emphasis on exchange rate stability has been fairly consistent across the periods.

In contrast, in Indonesia policymakers imparted greater weight to exchange rate over time with a view to retain competitiveness, despite BI committing to an inflation targeting framework in 2005. The dichotomy between monetary and exchange rate management was achieved to some extent through BI's frequent intervention in the foreign exchange market to keep its exchange rate somewhere near what the central bank perceived to be equilibrium. This is evidenced from the  $\Delta Res$  index, which is highest for Indonesia among the 5 EAEs. This was associated with a declining weight on monetary independence across the period. In the case of Thailand, there was

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<sup>1</sup>If the Trilemma is indeed binding then a country, which chooses to implement any 2 of the 3 policy objectives perfectly will have to completely forego the third objective. Hence in our analysis where all the trilemma objectives are normalized to lie between 0 and 1, the maximum combined value of the Trilemma indices can be 2.

a decline in the weight given to exchange rate stability in Period II compared to Period I, but increased considerably thereafter. These shifts were offset by weights on monetary independence moving in the opposite directions. While the weight on capital account openness declined overtime in Indonesia, it remained fairly constant in Thailand.

To summarize, the 5 EAEs have negotiated the trilemma in very different manner as they were confronted with rising and volatile capital flows. Instead of adopting corner solutions, all the 5 EAEs adopted intermediate approach in negotiating the conflicting approaches of the well know Trilemma. However, there is a distinct difference to the weights accorded to these objectives by the policymakers of these economies. While India and Malaysia have chosen to sacrifice exchange rate stability in more recent years to have greater freedom to exercise monetary policy, Indonesia and Thailand have put greater emphasis on managing the exchange rate at the cost of monetary policy. Korea has remained fairly consistent in managing the Trilemma, focusing on monetary independence followed by exchange rate stability. All the 5 EAEs witnessed an increase in capital account openness in Period II, which led to a drop in the other two indices.

### 3.2 Sterilized Intervention

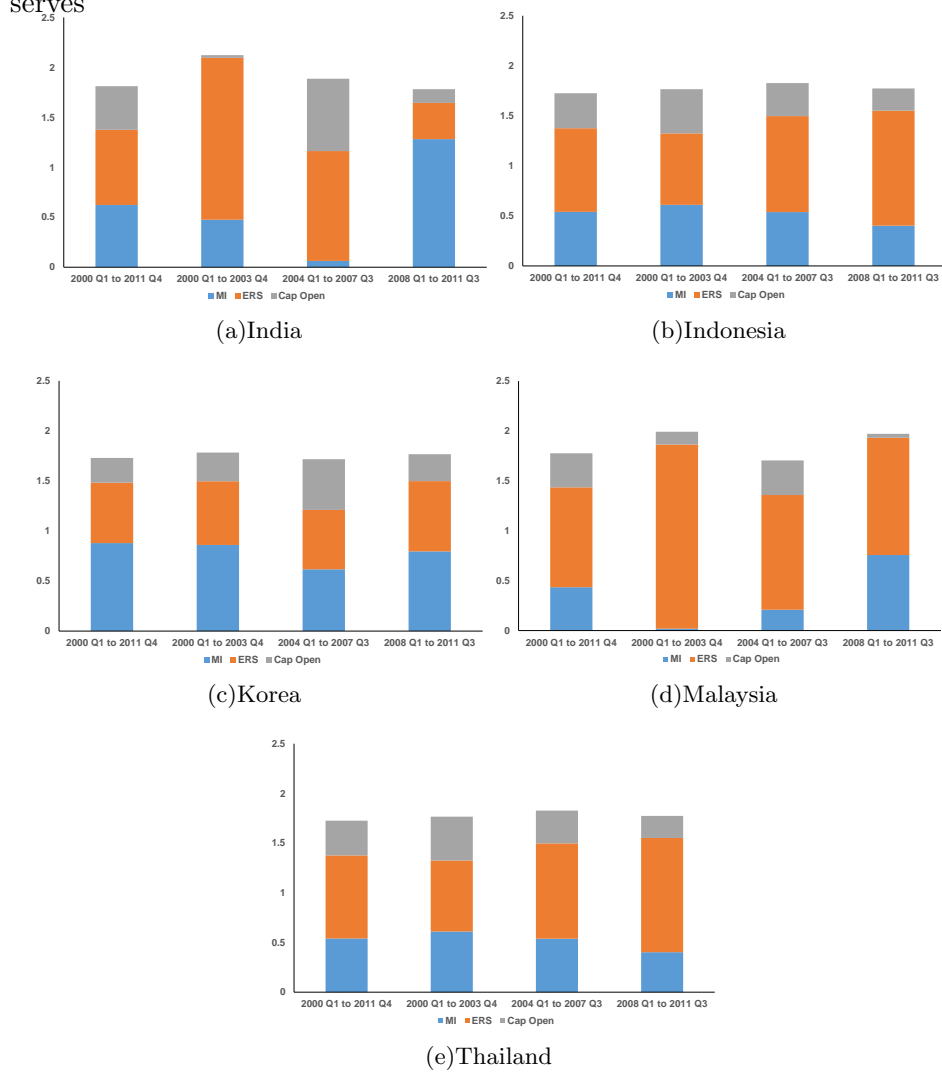
One of the most commonly used instrument to counter a surge in capital flows is sterilized intervention. This involves the central bank purchasing the foreign capital inflows to resist an appreciation of the domestic currency, and then exchanging domestic assets with foreign assets to neutralize the increase in monetary base, arising from purchase of foreign capital. Thus sterilized intervention allows countries experiencing a surge in capital inflows to maintain nominal exchange rate while also preventing the capital inflow from increasing the base money. [Reinhart and Reinhart \(1998\)](#) refer to sterilized intervention as the “policy of first recourse”.

The central banks of the 5 Emerging Asian Economies have also resorted to intervention. The surge episodes identified in [Table 1](#) were associated with significant accumulation of reserves. Focusing on the episodes during the 2000s, [Table 2](#) indicates the extent of reserve accumulation or decumulation during the these episodes.<sup>2</sup> All the surge episodes were associated with accumulation of reserves. While India had built 78% of its end-2011 reserve holdings during these surge episodes, Indonesia and Thailand accumulated 39.5% and 26.7% of their reserves during such episodes.

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<sup>2</sup>Data on actual intervention by the central bank would be a better indicator to exclude valuation change. However, such data is not available for all the economies in our sample. Hence we use the change in reserves as a proxy for intervention.

Figure 5: Configuration of the Trilemma Objectives and International Reserves



Source: Authors' Estimates.



Table 2: Reserve Accumulation During Surge and Stop Episodes

	Surge				Stop			
	Episode Start	Episode End	Reserve Accumulation Growth (%)	Reserve Accumulation Absolute (\$ Billion)	Episode Start	Episode End	Reserve Accumulation Growth (%)	Reserve Accumulation Absolute (\$ Billion)
India	Q3 2003	Q2 2004	45.2%	35.93	Q3 2008	Q3 2009	-10.6%	-32.02
	Q4 2004	Q3 2005	19.9%	22.96				
	Q4 2006	Q2 2008	90.4%	143.77				
	Q1 2010	Q4 2010	3.8%	10.09				
Indonesia	Q4 2005	Q1 2006	32.8%	9.47	Q4 2006	Q1 2007	11.9%	4.84
	Q4 2010	Q2 2011	39.1%	32.64	Q1 2009	Q3 2009	20.9%	10.38
Korea					Q1 2008	Q2 2009	-11.6%	-30.49
Malaysia					Q4 2005	Q3 2006	-0.5%	-0.44
					Q3 2008	Q2 2009	-27.4%	-34.33
Thailand	Q3 2004	Q1 2006	27.1%	11.45	Q1 2007	Q4 2007	30.5%	19.93
	Q3 2010	Q1 2011	23.1%	33.15	Q3 2008	Q3 2009	25.1%	25.90

Source: IMF's International Financial Statistics and Authors' Estimates.

Table 2 also shows that the stop episodes were not universally associated with depletion of reserves. In fact, in only 4 out of the 8 stop episodes the EAEs used reserves to counter the stop of capital inflow. This raises a question as to whether the EAEs central banks have been intervening in an asymmetric manner in the foreign exchange market i.e. accumulating reserves during increase in capital flows to stem appreciation of the domestic currency but adopting a hands-off approach during stops of capital flows, and allowing the currency to depreciate. In order to empirically investigate this, we frame a loss function of the central bank following [Pontines and Rajan \(2011\)](#) and [Sen Gupta and Sengupta \(2014\)](#), and then use GMM methodology to estimate the asymmetric preference parameter for all the EAEs in our sample for the period 2000-2011. Details of the model, estimation strategy and results are described in the Appendix in Section 4.3.

We find that the effect of interventions in the foreign exchange markets was sought to be sterilized by the central banks of these EAEs with varying results. In India, the Reserve Bank of India (RBI) initially conducted open market sales of government securities to neutralize the effect of reserve accretion on monetary base. However, by end of 2003, the RBI had exhausted its stock of government securities, and in January 2004 introduced the Market Stabilization Scheme (MSS) bonds. The RBI could sell these bonds on the behalf of the government for the purpose of sterilization. As a share of GDP, outstanding MSS bonds reached a peak of nearly 4% in 2007. However, during the GFC, the amount of outstanding MSS bonds was drawn down rapidly to inject liquidity. An useful feature of these bonds were that they made the cost of sterilization more transparent as the interest payments had to be reported in the federal budget. Apart from these bonds, the RBI also raised the reserve requirements to restrain the expansion of money supply.

Like India, Korea also attempted to use the central bank's own Monetary Stabilization Bonds (MSBs) to offset the impact of intervention in the foreign

exchange market. However, a rising stock of MSBs due to several years of intervention resulted in making these interventions more and more costly. The Korean government assisted in sterilization of the capital inflows by selling the government securities and depositing the proceeds with the Bank of Korea (BOK). The ratio of outstanding MSBs to GDP reached a peak of 20% in 2005 before declining to around 11% in 2011. Like RBI in India, BOK also raised the average reserve requirements for the commercial banks to contain the growth in money supply.

Indonesia also attempted to partially sterilize its interventions in the foreign currency market. It used the one month and three month Bank Indonesia Certificates (SBI) to sterilize the interventions. However, the high interest rate on these SBIs, made them an attractive instrument, especially as non-residents were allowed to invest in SBIs. Thus sterilized intervention in Indonesia resulted in attracting more portfolio inflows. The share of central bank securities to GDP reached a peak of 2% in 2007. However, during the GFC the stock of these bonds were quickly drawn down. In 2010 and 2011 there has been again some increase in issuance of such bonds.

Both Malaysia and Thailand resorted to a number of instruments for liquidity management. Massive inflow of foreign capital through portfolio investment also necessitated Bank Negara Malaysia conducting sterilization to prevent inflationary pressures. In Malaysia, the interventions were sterilized using direct borrowing, repos and the issuance of Bank Negara Malaysia Monetary Notes (BNMNs). As a share of GDP, the volume of outstanding central bank securities reached a peak of 13% just before the onset of the GFC. Like most other EAEs, there was a decline in the ratio during the GFC, before a sharp increase in 2010 and 2011 to pre-crisis peak levels.

The Bank of Thailand had also been intervening in the foreign exchange market intensively during the 2000s to resist appreciation of the domestic currency. The principal absorption instrument used by Thailand in the Bank of Thailand (BOT) bond. Thailand used these bonds alongwith repo transactions and foreign exchange swaps to manage overall liquidity. The stock of central bank securities have steadily increased as a share of GDP, and stood close to 10% in 2011.

### **3.3 Capital Controls and Impact**

Apart from Trilemma management and sterilized intervention, an alternative macroeconomic policy tool to deal with capital flows is using capital controls i.e. residency-based restrictions on the cross- border movement of capital. Capital controls hardly constitute a new topic in the international finance arena and have been discussed by academics and policy makers alike

over a fairly long period of time. A distrust of hot money was behind James Tobin's initial proposal to throw sand in the wheels of international finance as noted in his seminar paper ([Tobin \(1978\)](#)).

In recent times emerging economies have begun using controls-both on inflows and outflows, to manage volatile and potentially disruptive capital flows. Typically, emerging economies encourage capital inflows during their recovery from a financial crisis; however, as they continue to grow and experience rising appreciation pressures on their domestic currency, managing large scale volatile capital flows begins to pose serious challenges and subsequently capital controls re-appear in the policy discussions ([Magud et al. \(2011\)](#)).

There are usually two types of controls: administrative and market-based, of which the latter happen to be more transparent, and instead of directly prohibiting capital flows, they discourage cross-border transactions by increasing transaction costs. There has so far been no clear and unanimous evidence on the overall effectiveness of capital controls. The recent GFC has been a turning point in the world-view on capital controls, just as a similar reassessment was done in the aftermath of the AFC of 1997-98. The issue of regulation of capital flows has slowly but steadily moved to the center stage from earlier being confined to the periphery of mainstream policy discourse. Ex-ante management of capital flows is now accepted as a legitimate instrument of in countries macroeconomic policy toolkit.

The IMF, a one-time proponent of complete liberalization of the capital account, has also shifted in favor of the idea that capital controls can be useful as a last resort when a country faces a net capital inflow surge and after other macroeconomic policy options have been exhausted ([Ostry et al. \(2011\)](#)). The IMF position ([Ostry et al. \(2010\)](#)) goes further in suggesting that capital controls be used in the pursuit of macroeconomic management. The impact of controls on the magnitude and composition of capital flows, on transactional frictions, monetary policy, rates in different financial markets, asset prices etc., have been a subject of enormous debate with very little consensus on the issue. Effectiveness of capital controls varies with initial conditions as well as across countries and time periods. To the extent that there are country specific characteristics that make capital controls effective, understanding individual country experiences with capital controls gains significance ([Patnaik and Shah \(2012\)](#)).

For the five EAEs in our sample, the decade of the 2000s running up to the GFC was characterized by a series of common factors both global as well as domestic such as the Great Moderation, abundance in global liquidity, low interest rates in advanced economies, stronger domestic macroeconomic fundamentals in the aftermath of the AFC, emphasis upon accumulation of reserves to insulate against adverse external shocks, and renewed interest

among foreign institutional investors to invest in emerging economies in general, in search of better yields. The capital controls used by the EAEs during the period 2000-2011 were largely a function of these factors. In most cases, these economies were seen relaxing controls on inflows as well as outflows to take advantage of the surge in global liquidity during their crisis-recovery period on one hand and on the other hand, relaxing outflow controls to mitigate the concomitant effects of inflows on domestic financial markets. In what follows, we provide a concise description some of the major capital controls used by the five EAEs between 2000 and 2011 and try to connect the same with the surge and stop episodes identified earlier in this paper.<sup>3</sup> Subsequently, we also assess the impact of capital controls on exchange market pressure (EMP) indices, real and nominal effective exchange rates and stock market returns.

There is significant heterogeneity across the four South East countries in our sample as regards their policy responses to the AFC of 1997-98. While Malaysia rejected the conventional policies proposed by the IMF and imposed a series of comprehensive capital controls on short-term capital inflows as well as outflows and pegged the Ringgit to the dollar, Korea went to the other extreme by adopting the prescriptions of the IMF and the World Bank and lifted all capital account and foreign exchange restrictions in a big-bang move, thereby taking the capital account openness of the country to the same level as advanced economies.

In Malaysia, the capital controls introduced in the immediate aftermath of the AFC were successively relaxed and eventually removed by the early 2000s and the transition was made to a managed floating exchange rate regime by July 2005 ([Athukorala and Jongwanich \(2012\)](#)). Over the next several years (especially from 2004 onwards), the BNM gradually liberalized restriction on both capital inflows and outflows. For instance in April 2004, resident individuals with foreign currency funds were allowed to invest freely in any foreign currency product offered by onshore licensed banks and the limit for banking institutions on loans to non residents was raised from RM200,000 to RM10,000,000. From around this time gross capital outflows picked up and continued going up till the GFC, as shown in Figure 2. In April 2005, another series of outflow controls were relaxed. Residents were allowed to invest abroad in foreign currency and those with domestic credit

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<sup>3</sup>By now there is a sizeable literature that has looked into the responses of the South East Asian economies to the Asian financial crisis and analyzed the impact of the capital controls in the immediate aftermath of the crisis. See for instance, [Ariyoshi et al. \(2000\)](#), [Tamirisa \(2004\)](#), [Reinhart and Edison \(2001\)](#), [Dornbusch \(2001\)](#), among others. Hence we decided to focus on the decade of 2000-2011. Also we have detailed information on the capital controls used by these countries for this period and not beyond that. Furthermore, the period after 2011 becomes more complex and volatile to study, with the onset of quantitative easing policies adopted by advanced economies followed by tapering announcements made by the US Federal Reserve in the summer of 2013.

facilities were permitted to convert Ringgit up to RM100,000 per annum. Likewise corporations were allowed to convert Ringgit up to RM10 million per annum for investment in foreign currency assets. Residents were also free to open a foreign currency account (FCA) onshore or offshore, without any prior permission and no limit on the amount of foreign currency funds to be retained. Alongside this, the aggregate limit for foreign currency borrowing by individuals was increased from RM5 million to RM10 million equivalent ([Athukorala and Jongwanich \(2012\)](#)). Although capital inflows declined sharply during the GFC, no new capital control was imposed to deal with the Stop episode from 2008Q3 to 2009Q2.

As mentioned earlier, in the aftermath of the AFC, Korea went to the other extreme compared with Malaysia and adopted measures to completely liberalize capital flows. As a result of the extensive capital market opening undertaken by the Korean government, inflows increased significantly from 1999 onwards and Korea ended up having a fully liberalized capital account. In early 2000s there was a surge in short-term borrowing by foreign banks and in 2003, foreign investment in the domestic stock market reached a record high of USD14.4 billion ([Kim and Yang \(2012\)](#)). However no surge episode was recorded during this period as seen in Figure 2. IN order to mitigate the adverse impact of the massive inflows of short-term capital into the domestic financial markets, Korean government adopted measures to liberalize capital outflows. For instance in 2006, the limit on outward FDI by domestic residents was relaxed to include purchase of real estate and in 2007, a temporary tax exemption for 3 years was applied to capital gains generated from overseas stock investment by domestic companies. As a result as can be seen in Figure 2 gross capital outflows kept increasing from 2006 onwards running into the GFC.

In somewhat similar lines Indonesia, instead of adopting strict capital controls to counter the massive capital flight during and after the AFC, relaxed restrictions on FDI inflows and shifted to a managed floating exchange rate regime abandoning the pre-crisis peg to the dollar. Until mid 2000s, macroeconomic policies were constrained by agreements with IMF and the country was experiencing major macroeconomic turbulence, persistent capital outflows, high currency volatility, depreciation pressures on the exchange rate, inflationary pressures and so on. From the mid 2000s onwards, favorable changes in the political climate, transition into a functioning democracy and reforms in financial and banking institutions triggered a gradual process of economic recovery ([Jayasuriya and Chen-Yu Leu \(2012\)](#)) and capital inflows began increasing. Several measures were adopted to check the influx of short-term capital flows. In 2004, BI introduced a Rupiah stabilization package under which new prudential regulations on net open foreign exchange positions of commercial banks hindered their ability to speculate in the swap market. Around the same time, deposit accounts in Rupiah

were subjected to a reserve requirement in the 5-8% range depending on the total amount of deposits. In 2005Q1, short-term borrowings by banks were limited to 20% of bank capital. These restrictions adopted primarily to restrain destabilizing short-term inflows and guard against potential instability in the capital markets by restricting the activities of the commercial banks, could have led to the stop episode recorded in 2006Q4 as seen in Figure 2. Once the economy recovered from the initial shock of the GFC in 2008-09, large portfolio inflows resumed again; excessive short-term inflows resulted in real exchange rate appreciation. Indonesia experienced a second surge episode in 2010Q4. Once again, restrictions were imposed on speculative transactions and new capital control measures (prudential regulations) were introduced to redirect the inflows towards longer maturity assets (Jayasuriya and Chen-Yu Leu (2012)).

Thailand had a similar experience with imposing market based capital restrictions in response to a surge in short term inflows. Rising global liquidity, sluggish economic growth in advanced countries and improving domestic macro fundamentals in the aftermath of the AFC led to a surge in capital inflows in the middle of the last decade. A fairly long surge episode was recorded starting 2004, as seen in Figure 2 and there was also a noticeable appreciation of the exchange rate. Bank of Thailand (BOT) announced a series of controls to curb speculative capital inflows, primarily in debt securities but no significant restrictions were placed on equity investments. For instance, in September 2003, the amount of Thai baht that onshore financial institutions could borrow short-term (less than 3 months) from non-residents was limited to a maximum of B50 million per entity (Jongwanich and Kohpaiboon (2012)) and in October of the same year, all onshore financial institutions were required to limit total daily outstanding balance on nonresident baht accounts to a maximum of B300 million per nonresident and were prohibited from paying interest on such current and savings accounts. This was done to reduce the incentive for deposits in nonresident baht accounts. When in spite of these measures, short-term inflows continued unabated and appreciation pressures on the Thai baht still did not subside, BOT implemented a market-based restriction in December 2006. This involved a requirement to deposit 30% of foreign exchange as unremunerated reserve requirement (URR) for all foreign transactions, except those related to trade, FDI and repatriation of investment abroad by residents. If funds remained within Thailand for 1 year, then the full amount of capital would be refunded and if funds were repatriated earlier, only two-thirds would be refunded. This kind of a market-based capital inflow restriction that raises the costs of financial transactions without directly prohibiting the same, belongs to the category of implicit taxation on cross-border financial flows. Imposition of the URR immediately caused panic amongst foreign investors in financial markets. The adverse reaction led BOT to exempt 10

categories of capital inflows from URR the following day. In January 2007, provisions of additional option were announced for certain type of inflows to either withhold URR or hedge against foreign exchange risks. Right after the URR was imposed, a stop episode was recorded in Thailand in 2007Q1. Net capital outflows increased substantially reaching USD17 billion in 2007. So it seems that the URR introduction in Thailand succeeded in reducing the overall volume of capital inflows. When capital inflows reacted adversely to the URR imposition, in December 2007, foreign currency borrowings not exceeding USD1 million and with a maturity of least 1 year were exempted from the URR and hedging requirements; eventually the URR measures were lifted in March 2008 (Jongwanich and Kohpaiboon (2012)). At the same time, during the early and mid 2000s, capital outflows were progressively liberalized in FDI, equity and debt, in order to promote domestic residents foreign investments, open up alternative investment opportunities and also to ease the rising appreciation pressure on the Baht. Institutional investors were allowed to invest more in foreign securities. In January 2007 for instance, the amount of Thai direct investment or lending to a business abroad was increased from a maximum of USD10 million per year to USD50 million per year and the scope and number of institutional investors were expanded as well. Furthermore, in December 2007, the scope for investment and lending abroad for Thai companies was raised and the limit for purchase of properties abroad was increased from USD1 million to USD5 million. The relaxation of outflow controls continued during the GFC as well as after the crisis. In the aftermath of the GFC, Thai residents resumed overseas investments in 2009 encouraged by Thailand's economic recovery. Capital outflows were primarily bank loans, debt securities and FDI reflecting the trend in rest of the South East Asian economies (Jongwanich and Kohpaiboon (2012)).

India, like several other emerging market economies, has long had a complex and extensive system of administrative controls to deal with volatile capital flows. While India has been gradually opening up to capital inflows since the liberalization reforms of 1991, it is still much less open than other major emerging countries. During the last two decades India followed a gradual, albeit cautious approach towards financial integration with rest of the world, prioritizing non-debt creating flows such as portfolio investment flows over debt flows. Currently, barring a few sectors, FDI is universally allowed. Portfolio flows have also witnessed significant liberalization, although there exist separate investment caps on sub accounts of foreign institutional investors (FIIs), individual FII and aggregate FII investment in a company. In contrast, debt flows are subject to numerous restrictions including borrowers and lenders having to satisfy eligibility conditions, minimum maturity period, cap on all-in-cost payments made by corporate and end-use restrictions (Sen Gupta and Sengupta (2014)). When emerging economies witnessed a universal capital surge in the 2000s, India received amongst the



highest capital inflows, to the extent that India recorded as many as three surge episodes in the run up to the GFC as seen in Figure 2. Capital flows to India increased steadily from around USD10 billion a year in the early 2000s, to USD100 billion a year by early 2008. [Abiad et al. \(2010\)](#) show that restrictions on the capital account were eased between 1999 and 2004, though since then the process of liberalization seems to have slowed down ([Patnaik and Shah \(2012\)](#)). While controls on capital outflows were eased after 2006, restrictions on inflows were further tightened, especially after the 3rd surge episode was recorded in 2006Q4. In January 2007, the ceiling on interest rates on non-resident bank deposits were reduced; in May of the same year, external commercial borrowings (ECB) by real estate companies were banned and interest rate ceiling on ECB were reduced; and in August, companies borrowing more than USD20 million in ECB were stopped from remitting funds. However, despite the measures announced to reduce the volume of capital inflows, the surge episode lasted seven quarters till 2008Q2 right before the onset of the GFC. With net capital flows of USD98 billion during 2007, India was the biggest recipient of capital flows amongst emerging markets during this period ([Patnaik and Shah \(2012\)](#)). Thus in a way it can be concluded that for India the comprehensive set of legal capital controls were not sufficient to restrict the influx of capital. On the other hand outflow controls have been successively and significantly liberalized since 2006. The most visible manifestation of this policy has been the increasing cross-border acquisitions by Indian companies.

To formally assess the impact of selected capital controls on the exchange rate and stock market we undertake means comparison test before and after the introduction of capital controls. This involves looking at the difference in the means of the variables before and after the introduction of controls. In particular, we focus on movements in exchange rate and stock prices as a primary reason for imposition of controls is to restrain increase in the value of the domestic currency and stock prices. To be deemed effective these measures must reverse or at least slowdown the rate of appreciation and increase in stock prices observed prior to their introduction.

We focus on 4 selected measures aimed to curb inflow of foreign capital.<sup>4</sup> These include

- India – Imposition of restrictions on ‘participatory notes’ in October 2007 to curb portfolio investment inflows. These are over-the-counter derivatives sold by a Foreign Institutional Investment registered financial firm to an investor, who is not registered [Patnaik and Shah \(2012\)](#).
- Indonesia – The required holding period on foreign capital inflows and

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<sup>4</sup>We focus on capital controls imposed in India, Indonesia, Korea and Thailand.



central bank notes in July 2010 were increased to 1 month, and central banks instruments with longer maturity of 6 months and 9 months were introduced (Magud et al. (2013)).

- Korea – In August 2007, the government restricted the use of foreign borrowings by allowing such funds only for real demand and investment in the manufacturing sector (Kim and Yang (2012)).
- Thailand – In December 2006 Bank of Thailand required all foreign transactions, barring those related to trade in goods and services, repatriation of investment abroad by residents, and FDI, had to deposit 30% of foreign exchange with the BOT as URR. If these funds remained within Thailand for one year, 30% of capital was refunded. If funds repatriated before a year, only two-thirds of the amount was refunded (Jongwanich and Kohpaiboon (2012)).

Table 3 highlight the efficacy of the capital controls in restricting exchange rate appreciation and stock price increase. To look at the short term and longer term effect of these measures, we focus on periods covering one-month and six-month before and after the imposition of these controls.

Table 3: Testing the Validity of the Trilemma Framework

	Exchange Rate					
	Before	One Month After	Difference	Before	Six Months After	Difference
India (October 2007)	1.050%	-0.066%	1.116%** [1.993]	0.269%	-0.089%	0.36% [1.494]
Indonesia (July 2010)	0.123%	0.043%	0.080% [0.551]	0.029%	0.006%	0.023% [0.355]
Korea (July 2007)	0.073%	-0.123%	0.195%** [1.832]	0.019%	-0.028%	0.047% [1.255]
Thailand (December 2006)	0.174%	0.003%	0.171% [0.847]	0.069%	0.077%	-0.008% [-0.076]
	Stock Market					
	Before	One Month After	Difference	Before	Six Months After	Difference
India (October 2007)	1.050%	-0.066%	1.116%** [1.993]	0.269%	-0.089%	0.358% [1.494]
Indonesia (July 2010)	0.274%	0.111%	0.163% [0.581]	0.107%	0.222%	-0.115% [-0.711]
Korea (July 2007)	0.632%	-0.494%	1.123%** [1.692]	0.304%	-0.119%	0.423%** [2.218]
Thailand (December 2006)						

Notes: Standard errors in parentheses. \*, \*\*, and \*\*\* indicate correlations significant at 10%, 5%, and 1% respectively Source: Authors Calculations

In the short-term we find some evidence on the efficacy of capital controls in restraining exchange rate appreciation in India and Korea. In both these economies there was a significant reversal in the trend of exchange rate appreciation witnessed before the imposition of the control. However, we do not find similar evidence for controls imposed in Thailand and Indonesia. There was a drop in the pace of appreciation but the difference was not significant. Moreover, when we extend our window to six months we find that the difference between pre- and post capital control period drops out. We find similar evidence for the impact of the capital account management measures on stock price increase. Again, in case of both India and Korea, we

find that the measures were able to reverse the trend of stock price increase when we consider the one-month window. However, when we increase the period under study to six-months the difference is significant only in case of Korea.

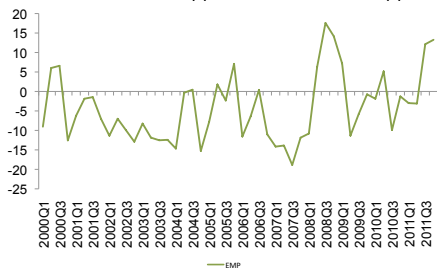
It seems from the above discussion that by and large for these EAEs, while capital controls did not succeed in controlling surge episodes, once the surge was recorded and new capital controls were implemented, there was moderate success in lowering the volume of gross inflows in some cases such as in Thailand and Indonesia in 2006-07 but the success was not perceptibly evident in other cases such as India. Moreover, these controls were able to reverse the trend of strengthening currency and rising stock prices only in a couple of countries. Furthermore, the effect lasted only for a short-term and disappeared over a longer horizon. Hence the overall impact of capital controls on managing the volume of gross flows appears to be a mixed bag.

### 3.3.1 Exchange Market Pressure Index (EMPI)

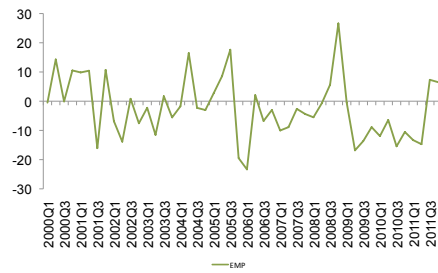
A central banks management of capital account could be driven by a desire to moderate certain types of capital inflows or to manage exchange rate stability. In the context of the trilemma trade offs faced by these EAEs during the period under consideration, it may be reasonable to conjecture that the goal was the latter. Accordingly in this section we measure the exchange market pressure (EMP) for all five EAEs, and discuss the evolution of the series over time. EMP is a combination of exchange rate depreciation and international reserves loss-a concept pioneered by [Girton and Roper \(1977\)](#), and applied frequently in the analysis of EMEs ([Frankel \(2009\)](#)). A positive (negative) EMP indicates a net excess demand (supply) for foreign currency, accompanied by a combination of reserve loss (gain) and currency depreciation (appreciation). In order to measure EMP, we follow the methodology of [Aizenman et al. \(2012\)](#) who investigate the factors explaining EMP in emerging markets during the 2000s. The simplest measure of EMP is the un-weighted sum of percentage nominal depreciation and percentage loss of reserves. For this we use the nominal bilateral exchange rate of each country against the US dollar and international reserves minus gold. Figure 6 shows the evolution of the EMP series in each of the five EAEs from 2000 to 2011.

For India, for a large part of the sample period EMP has been negative till the GFC of 2008Q3 when EMP series of all five EAEs display a jump reflecting capital outflows and exchange rate depreciation triggered by a sharp rise in global macroeconomic volatility in the wake of the collapse of the Lehman Brothers in September 2008. A negative EMP in India from 2000Q4 to 2008Q1 implying net excess supply of foreign currency, is consistent with the surge in capital inflows experienced by the economy during this

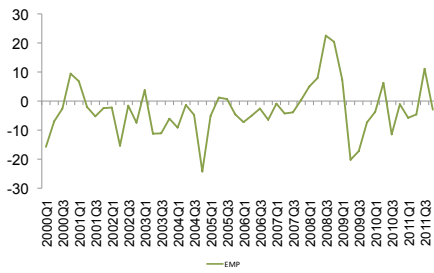
Figure 6: Exchange Market Pressure Indices



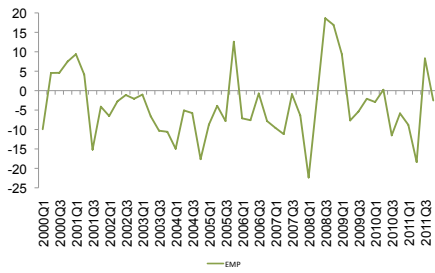
(a) India



(b) Indonesia



(c) Korea



(d) Malaysia



(e) Thailand

Source: Authors' Estimates.

period, accompanied by exchange rate appreciation and a remarkable rise in the stock of international reserves. During this period the Indian economy experienced on average a 7% combined nominal currency appreciation and gains in international reserve holdings. This also coincides with the period of Great Moderation in the global economy during which all emerging economies in general were experiencing nominal currency appreciation and massive accumulation of international reserves (Sen Gupta and Sengupta (2014)). The downward/negative trend in the EMP through the early and mid 2000s gets interrupted by a sharp upward movement between 2008Q2 and 2009Q1 the period of global economic and financial turbulence centering around the collapse of Lehman Brothers in the US. Between 2008Q1 and 2008Q4, India went from an average 11% combined nominal appreciation and gains in international reserve holdings to a 14% combined nominal depreciation and international reserve loss. EMP in India came down by 2009Q2 and switched back to net nominal currency appreciation combined with hoarding international reserves. This trend continued in India till the end of 2010. Since then however the EMP has been on the rise again given the capital outflows and massive currency depreciation that India experienced in the wake of the Euro-zone sovereign debt crisis.

In case of Indonesia the EMP series is seen to be a lot more volatile towards the start of the sample period when the EMP was off and on in the positive range. This is reflective of the fact that during the aftermath of the AFC Indonesian economy was experiencing continuing political instability, persistent net capital outflows, rising inflationary pressures and heightened exchange rate volatility accompanied by frequent foreign exchange market intervention by the BI. This was the period when Indonesias macroeconomic policies were determined and hence constrained by an agreement with the IMF that entailed maintaining an open capital account, and floating the exchange rate. By 2003 inflationary pressures were controlled through targeting base money and rate of capital outflows decelerated (Jayasuriya and Chen-Yu Leu (2012)); the EMP can be seen to have declined around this time. However currency pressures still continued and in 2004 the Rupiah began depreciating again as reflected in an upward movement in the EMP series in Figure 6. The BI intervened to control currency speculation and announced a Rupiah stabilization package in June 2004 as mentioned earlier. Consequently, the currency volatility was somewhat curbed, capital inflows recovered and by end 2005 Indonesia experienced a surge episode in capital flows as reflected in negative EMP values running up to the GFC. EMP shot up during the crisis period due to renewed pressure on the Rupiah. However the economy rebounded strongly and fairly quickly after the crisis and began to grow again from 2009 onwards. Around this time EMP declined as well till of course the Euro zone crisis hit and 2011Q3 onwards EMP went up again. The crisis and post crisis trends in EMP between 2008Q3 and 2011Q4

are quite similar across the countries in our sample. Talking of similarity, the EMP series of Korea is almost exactly like that of India reflecting the common phenomenon both these economies experienced during the decade of the 2000s—massive inflows of foreign capital triggered by abundant global liquidity, high interest rate differential with the advanced countries of the West, and consistently robust growth registered by these economies, reflecting the general trend around this time of capital from the developed world chasing yields in the emerging world. During 200Q1-2007Q4, the Korean economy experienced on average a 5% combined nominal currency appreciation and gains in international reserve holdings. Like the other EAEs this trend was interrupted by the GFC and associated liquidity crunch worldwide, worsening risk perceptions and capital flight, all of which resulted in a sharp upward movement in the EMP index. Consequently the Korean government adopted measures in the aftermath of the crisis to insulate the domestic financial markets from further instability. Supervision of foreign bank branches was strengthened, the liquidity of domestic financial firms was more tightly regulated than the pre-crisis period, and risk management of foreign transactions was improved. Once the economy recovered from the initial shock, capital inflows resumed and the exchange market pressure was somewhat reduced until the currency came under renewed strains owing to the Euro zone crisis towards the end of our sample period.

The EMP story for Malaysia and Thailand are also more or less similar to the other EAEs; on average in the first half of the sample period, the EMP indices were negative implying exchange rate appreciation and reserves accumulation owing to capital inflows and economies recovering from the AFC and hoarding of precautionary savings to guard against further economic shocks; this trend continued till the GFC when EMP went up due to these economies like others, experiencing capital stop episodes, currency depreciation and loss of reserves. Finally as the economies recovered from the GFC and started attracting foreign capital back, EMP improved though only to come under renewed pressure when the sovereign debt crisis got triggered in the peripheral states of the Euro zone. In case of Malaysia one difference was that till 2005Q3, all changes in the EMP were reflective of change in the international reserves stock since the Ringgit was pegged to the US dollar till then. In Thailand while the BOT imposed the URR restriction on capital inflows in December 2006 to control the influx of short-term volatile capital, it did not seem to have much of an impact on the EMP index, which continued to be negative even after this. Thus one could say that even though some of these EAEs experimented with capital controls from time to time to prevent capital inflow surges, the impact of these controls on the EMP index was hardly significant. The EMP indices of all five EAEs display a remarkably symmetric trend during this time period.

## 4 Conclusion

Gross capital inflows and outflows to and from emerging market economies (EMEs) have witnessed a significant increase since early 2000s. This rapid increase in the volume of flows accompanied by sharp swings in volatility has amplified the complexity of macroeconomic management in EMEs thereby exacerbating overall financial instability. It has been widely agreed that the rise in the volatility of capital flows that the EMEs have been subjected to in recent years was not so much a consequence of developments in these countries. During the pre-global financial crisis period, foreign capital poured into several EMEs driven by their encouraging growth prospects, easy global liquidity and declining home bias in the advanced economies. This exuberance however turned out to be short-lived. The outbreak of the subprime crisis and collapse of the Lehman Brothers in the USA in the second half of 2008 led to a sharp decline in the risk appetite of global investors and prompted a large scale flight to safety of international capital from EMEs. The subsequent reverse surge in capital flows back to EMEs in late 2010 and early 2011 was a result of widening interest rate differentials owing to near-zero interest rates prevailing in advanced economies. However, the deepening of the Euro-zone sovereign debt crisis and a downgrade of US sovereign rating in the second half of 2011 caused investor sentiment to deteriorate once again and net capital flows to plunge across most EMEs.

While capital inflows provide additional financing for productive investment and offer avenues for risk diversification, unbridled flows could also inflate asset price bubbles, and lead to exchange rate overshooting, contributing to financial fragilities; in particular sudden surges and stops could pose serious macroeconomic challenges. In this paper we focus exclusively on five major emerging Asian economies (EAEs), namely India, Indonesia, Korea, Malaysia and Thailand and evaluate the role and effectiveness of the various measures and policies implemented by these countries to manage capital flow surges and stops over the period 2000-2011. In doing so the paper attempts to enrich the current debate ongoing in global policy circles on the efficacy of such measures. This kind of an analysis is highly relevant especially at a time when EMEs are about to face the repercussions of a potential Quantitative Easing (QE) tapering by the US or launch of fresh QE measures by the Euro-zone, either of which could once again exacerbate the volatility of cross-border capital flows thereby resulting in renewed complexities in macroeconomic management in major EMEs.

While we analyze specific country case studies, it is also worthwhile to note in this context that individual countries managing destabilizing capital flows through their unilaterally decided policies without taking into consideration the impact on other countries in the region, can also have potential disrupt-

tive consequences in the medium run. For instance, as each capital-receiving country introduces measures to reduce volatile capital flows in support of domestic financial stability, it may deflect some capital flows towards other recipient countries, exacerbating their inflow problem and policies in originating countries, to the degree they increase the volume of capital flows, may aggravate problems faced by capital-receiving countries. Hence it is important for multilateral organizations and groups such as the IMF, World Bank, G20, OECD, and the like to think of global solutions that involve regional co-operation and co-ordination across countries in the implementation of such policy measures such that the interests of the originators and recipients of capital as well as other countries affected by these policies can be taken into consideration. The scope of alternative policies to deal with capricious capital flows should also be explored in further detail such as developing domestic financial and banking institutions through robust and sustained reforms, and stimulating domestic private investment in countries with low investment and private consumption in countries with excess savings.

## Appendix I: Computing Surge and Stop Episodes

Let  $C_t$  be the four-quarter moving sum of gross capital inflows (GINFLOW), and compute annual year over year changes in  $C_t$ . Thus

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

and  $\Delta C_t = C_t - C_{t-4}$ . Next, we compute the rolling means and standard deviations of  $\Delta C_t$  over the last 5 years. [Forbes and Warnock \(2012\)](#) identify surge as an episode, which starts in the month when  $\Delta C_t$  increases more than one standard deviation above its rolling mean. The episode ends once  $\Delta C_t$  falls below one standard deviation above its mean. Similarly, a “stop” episode covers the period when gross inflows decline one standard deviation below its mean. Furthermore, for the period to qualify as a surge episode, there must be at least one quarter when  $\Delta C_t$  increases by a minimum of two standard deviation above its rolling mean. Similarly, a stop episode is defined as the period over which gross capital inflows fall one standard deviation below its rolling mean, and provided it reaches two standard deviations below at some time during the period.

## Appendix II: Computing Trilemma Indices

**Monetary Independence:** The extent of monetary independence is measured as the inverse of the quarterly correlation of the interest rates between EAEs and their base country. Here, the base country is defined as the country that a home country's monetary policy is most closely linked with. [Aizenman et al. \(2010\)](#) indicate that the base country for all these 5 EAEs is the United States. The quarterly indices are calculated using weekly 3-month Treasury Bill yields for India and the US. The index of Monetary Independence is given by

$$MI = 1 - \frac{\text{corr}(i_j, i^{US}) - (-1)}{1 - (-1)} \quad (2)$$

where  $i_j$  refers to the interest rate prevailing in the EAEs,  $i^{US}$  refers to the US interest rates and  $\text{corr}(i_j, i^*)$ , refers to the correlation of these interest rates over a quarter, and provides evidence on co-movement of domestic and foreign interest rates. By definition,  $\text{corr}(i_j, i^{US})$ , can take a maximum value of +1 and a minimum value of -1. The monetary independence index (MI) is thus a min-max normalization of this correlation. It is obtained by



subtracting the minimum value ( $-1$ ) from the observed correlation and then divided by the range of values, which is a difference between the maximum and the minimum value. Thus the monetary independence index can theoretically take a value between 0 and 1 with a higher value indicating greater degree of monetary independence.

**Exchange Rate Stability:** We make use of the methodology introduced by Frankel and Wei (1994) to create an index of exchange rate stability. The degree of influence that major global currencies have on Indian Rupee can be estimated using the following estimation model.

$$\Delta \log \epsilon_{j,t}^{SDR} = \alpha_0 + \beta_{j,USD} \Delta \log \epsilon_{USD,t}^{SDR} + \beta_{j,EUR} \Delta \log \epsilon_{EUR,t}^{SDR} + \beta_{j,JPY} \Delta \log \epsilon_{SDR,t}^{CHF} + \nu_t \quad (3)$$

Where  $\epsilon_{j,t}^{SDR}$  is the value of the 5 EAEs' currency  $j$  against the numraire currency, which in this case is the IMF's Special Drawing Rights. The three major global currencies, US Dollar, Japanese Yen and the Euro, can be viewed as making up the implicit currency basket, which the different EAEs are targeting to a different degree. Here  $\hat{\beta}_{j,k}$  where  $k = \text{USD, EUR and JPY}$ , which is the estimated coefficient on the rate of change in the exchange rate for major global currency, represents the weight of currency  $k$  in the implicit basket. In the case where the EAE currency is pegged to a particular currency or a basket of currency, either  $\hat{\beta}_{j,k} = 1$  or  $\sum_{k=1}^K \hat{\beta}_{j,k} = 1$  for  $K$  currencies that are a part of the basket. Moreover, pegging to an individual or a basket of currencies implies a higher goodness of fit.

Under this estimation, which is the estimated coefficient on the rate at which currency  $i$  depreciates against the numraire currency indicates the weight of currency  $i$  in the basket. In the case where the currency under observation is pegged to a particular currency or a basket of currency we will have or for  $i$  currencies that are a part of the basket. Moreover, pegging to an individual or a basket of currencies implies a higher goodness of fit. In our estimation we use daily data, with the data being sourced from the Database on the Indian Economy, Reserve Bank of India and Global Financial Database. We apply the estimation over a quarter and take the goodness of fit, or the adjusted  $R^2$  as the measure of exchange rate stability (ERS). A higher  $R^2$  indicates greater pegging to an individual or a basket of currencies.

**Capital Account Openness:** We use a *de facto* measure of capital account openness for the reason that as it is the actual volume of flows that creates a conflict between monetary independence and exchange rate stability as opposed to controls governing the movement of capital. A country with high *de jure* openness can have low capital flows and hence be able to

simultaneously stabilize exchange rate and retain monetary autonomy. Alternatively, a country with low *de jure* openness can experience large flows due to low enforcement of capital controls, and face a trade-off between ensuring monetary independence and exchange rate stability. Hence, the index of capital account openness is based on net capital flows. The index is constructed as the ratio of absolute value of net capital flows to GDP. The index is normalized to lie between 0 and 1.

$$CapOpen = \frac{|NKF|}{GDP} \quad (4)$$

Finally, as pointed out in [Aizenman et al. \(2010\)](#), policymakers can garner greater flexibility vis-a-vis monetary and exchange rate management in the short run by accumulating or depleting reserves. Consequently we also focus on  $\Delta Res$ , the absolute change in reserves (as a percentage of GDP). Like the capital account openness index we also normalize  $\Delta Res$  to lie between 0 and 1

#### 4.0.2 Testing Validity of Trilemma Framework

$$z = \alpha MI_t + \beta ERS_t + \gamma CapOpen_t + \mu_t \quad (5)$$

Table 4: Testing the Validity of the Trilemma Framework

	2000 Q1 to 2011 Q4	2000 Q1 to 2003 Q4	2004 Q1 to 2007 Q4	2008 Q1 to 2011 Q4
India				
Monetary Independence	1.174*** [3.560]	1.055* [1.774]	0.115* [1.661]	2.159*** [3.645]
Exchange Rate Stability	1.439*** [7.608]	1.880*** [12.002]	2.250*** [6.458]	1.662 [0.892]
Capital Account Openness	1.512*** [3.065]	0.145** [1.993]	1.844*** [3.472]	0.484 [0.545]
Observations	48	16	16	16
R-squared	0.906	0.983	0.943	0.891
Indonesia				
Monetary Independence	1.003*** [4.687]	0.957** [2.302]	1.321*** [5.106]	0.703* [1.785]
Exchange Rate Stability	1.989*** [8.557]	2.372*** [6.803]	2.685*** [4.885]	1.909*** [4.204]
Capital Account Openness	1.026*** [3.538]	1.073* [2.088]	1.250** [2.518]	0.642* [1.887]
Observations	48	16	16	16
R-squared	0.863	0.883	0.914	0.887
Korea				
Monetary Independence	1.809*** [8.006]	1.983*** [5.536]	1.239* [1.699]	1.514*** [3.669]
Exchange Rate Stability	1.618*** [5.041]	1.349** [2.896]	1.422* [1.775]	3.058** [2.446]
Capital Account Openness	2.204*** [4.780]	3.459** [2.770]	5.631** [2.242]	1.641*** [6.942]
Observations	48	16	16	16
R-squared	0.865	0.892	0.859	0.884
Malaysia				
Monetary Independence	1.013*** [4.712]	0.047* [1.677]	0.638* [1.764]	1.362*** [9.250]
Exchange Rate Stability	1.535*** [12.049]	1.885*** [20.586]	1.679*** [4.766]	4.012*** [6.859]
Capital Account Openness	1.547*** [4.178]	0.807* [1.743]	1.705** [1.987]	0.134* [1.738]
Observations	48	16	16	16
R-squared	0.888	0.996	0.852	0.946
Thailand				
Monetary Independence	1.039*** [3.788]	0.765* [1.709]	1.812*** [4.836]	0.792* [1.795]
Exchange Rate Stability	1.901*** [11.268]	1.644*** [7.111]	1.314** [2.944]	1.909*** [6.627]
Capital Account Openness	1.445*** [4.335]	1.533*** [3.076]	2.525*** [3.854]	1.044 [1.755]
Observations	48	16	16	16
R-squared	0.882	0.938	0.865	0.912

Notes: Standard errors in parentheses. \*, \*\*, and \*\*\* indicate correlations significant at 10%, 5%, and 1% respectively Source: Authors Calculations

## Appendix III: Estimating Asymmetric Forex Intervention by Central Banks

A representative central bank's loss function is given as follows:

$$L_t = \frac{1}{2} (R_t - R^*)^2 + \frac{\phi}{2} \left( (\tilde{\varepsilon}_t - \varepsilon^*)^2 + \frac{\theta}{3} (\tilde{\varepsilon}_t - \varepsilon^*)^3 \right) \quad (6)$$

Here  $\tilde{\varepsilon}_t$  is the percent change in exchange rate with the exchange rate being defined as the foreign currency price of the domestic currency while  $R_t$  is the reserves level. The central bank's objective is to minimize the deviation of reserves as well as the exchange rate from their respective target values  $\varepsilon^*$  and  $R^*$ . Moreover,  $\phi$  is the relative weight the central bank puts on stabilizing exchange rate vis-a-vis reserves. The right most term introduces the asymmetry in the loss function. With  $\theta > 0$ , an appreciation ( $\tilde{\varepsilon} > 0$ ) increases the central banks loss while depreciation ( $\tilde{\varepsilon} < 0$ ) reduces the extent of loss.

The central bank faces a trade-off between stabilizing reserves and exchange rate simultaneously as interventions can reduce the extent of exchange rate deviation.

$$\tilde{\varepsilon}_t - \varepsilon^* = \alpha_0 + \alpha_1 R_t + \eta_t \quad (7)$$

where  $\alpha_1 > 0$  and  $\eta_t$  is independent and identically distributed with zero mean and variance. Minimizing equation (6) by choosing  $R_t$ , subject to the constraint given in equation (7) yields the following optimality condition.

$$R_t = R^* - (\phi\alpha_1) \tilde{\varepsilon}_t - \frac{\phi\theta}{2} \alpha_1 \tilde{\varepsilon}_t^2 \quad (8)$$

The optimality condition can be reduced to an empirically testable formulation

$$R_t = \beta_0 + \beta_1 \tilde{\varepsilon}_t + \beta_2 \tilde{\varepsilon}_t^2 + v_t \quad (9)$$

where  $\beta_1 = -\phi\alpha_1$  and  $\beta_2 = -\frac{\phi\theta}{2}\alpha_1$ .

The reduced form parameters provide information on the degree of asymmetry in exchange rate stabilization with  $\theta = -\frac{2\beta_2}{\beta_1}$ .

We empirically estimate Equation (9) by using monthly data on nominal exchange rate and reserves (minus gold) over the period 2000 to 2011. The data is sourced from IMF's International Financial Statistics.

We use the Generalized Method of Moments (GMM) to estimate Equation (9). The orthogonality conditions implied by the intertemporal optimization and rational expectations paradigm make the GMM approach appealing. Moreover, the GMM approach does not require strong assumptions about the distribution of shocks. We follow Hansen (1982) and use an optimal weighting estimate of the covariance matrix, which accounts for auto correlation and heteroskedasticity in the error term. We employ a variable lag Newey West estimate of the covariance matrix.

In the GMM estimation, a larger set of instruments improves the estimation performance by including more moment restrictions. However, in relatively small samples, this comes at the cost of the precision of the weighting matrix. Hence, in our analysis the optimal set of instruments is decided by Hansen (1982) over-identifying restriction test (J statistics) with a rejection of these restrictions indicating that some of the variables fail to satisfy the orthogonality conditions. We use 1 to 12 and 15 lags of  $R_t$  and  $\tilde{\varepsilon}_t$ , as well as the current value of federal funds rate and its four lags as instruments.

The estimates of the intervention reaction function and the asymmetric preference parameter are reported in Table 4. The J-statistic indicates that the null hypothesis of valid over-identifying restrictions cannot be rejected at the conventional significance level. We find  $\theta$  to be positive and significant across for all 5 EAEs implying that the central banks did pursue asymmetric intervention in the foreign exchange market to counter surges and stops of capital flows. The standard error for  $\theta$  are calculated using the Delta Method.

Table 5: Asymmetric Intervention by EAE Central Banks

	Full Sample (2000 to 2011)				
	India	Indonesia	Korea	Malaysia	Thailand
Constant	2.112*** [0.111]	1.137*** [0.095]	1.021*** [0.063]	2.176*** [0.097]	0.846*** [0.089]
$\beta_1$	-0.419*** [0.042]	-0.357*** [0.031]	-0.425*** [0.030]	-1.169*** [0.055]	-0.772*** [0.050]
$\beta_2$	-0.205*** [0.021]	-0.014*** [0.003]	-0.027*** [0.004]	-0.864*** [0.038]	0.124*** [0.037]
$\theta$	0.978*** [0.045]	0.078*** [0.013]	0.127*** [0.014]	1.478*** [0.037]	0.321*** [0.032]
Observations	128	128	128	128	128

Notes: Standard errors in parentheses. \*, \*\*, and \*\*\* indicate correlations significant at 10%, 5%, and 1% respectively Source: Authors Calculations

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