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Asia Confronts the Impossible Trinity

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Abstract

In this paper, we examine capital account openness and exchange rate flexibility in 11 Asian economies. Asia has made slow progress in *de jure* capital account openness, but has made much more progress in *de facto* capital account openness. While there has been a gradual increase in exchange rate flexibility, most Asian economies continue to have largely inflexible exchange rates. This combination of advancing *de facto* capital account integration without greater exchange rate flexibility has led to procyclical monetary policy, when capital flows are procyclical. This paper emphasises the need for a consistent monetary policy framework.

JEL Classification: E40, E60, F41

Contents

1. INTRODUCTION

A core idea in modern macroeconomics is that of the 'impossible trinity,' the notion that a country can have only two of the following at any given time: an open capital account, a fixed exchange rate, and an autonomous monetary policy. With the exception of the Eurozone countries, most developed countries have an open capital account, a floating exchange rate, and an autonomous monetary policy.[1]

In Asia, a few polar examples like Hong Kong, China have a fixed exchange rate, an open capital account, and no monetary policy autonomy. In general, however, Asian economies tend to lack a well-defined monetary policy framework, with most having a combination of some capital controls and exchange rate inflexibility. This raises interesting questions about the current state and possible evolution of monetary policy in Asia, and highlights the need for a consistent monetary policy framework.

In this paper, we focus on 11 major economies in Asia: India; the People's Republic of China (PRC); Hong Kong, China; Taipei,China; Singapore; Malaysia; Thailand; Indonesia; Philippines; Viet Nam; and Republic of Korea (hereafter Korea). This is a highly heterogeneous group, ranging from city-states like Singapore to giants like the PRC, and poor economies like India to rich economies like Taipei,China or Korea. We refer to these economies as the Asia-11.

We examine where the Asia-11 stand with respect to the three corners of the impossible trinity: capital controls, the exchange rate regime, and monetary policy autonomy. We obtain summary statistics for each of the eleven economies, and also focus on numerical values for the three largest economies: India, PRC, and Korea.

Since countries sometimes fail to do as they say, this paper focuses on *de facto* rather than *de jure* capital controls, exchange rate regimes, and monetary policy frameworks. More specifically, we focus on *de facto* conditions for capital account openness and exchange rate flexibility, and their implications for monetary policy as measured by the short-term real interest rate.

We find that while the Asia-11 have undergone some degree of *de jure* capital account liberalization, in most economies restrictions on capital flows are still in place. However, this has not impeded gradual capital account integration at the *de facto* level, assisted by a growing sophistication of the financial system.

Alongside this, Asia is characterized by substantial exchange rate inflexibility. Although exchange rate flexibility increased after 2000, this remains low by world standards. Even Korea's highly flexible exchange rate continues to lag the floating exchange rate.

Counter-cyclical monetary policy is one of the strategies by which monetary authorities achieve the objective of stabilizing inflation and output. We focus on this objective in the context of inconsistencies arising from the impossible trinity. Today, most of Asia is characterized by growing *de facto* capital account integration with substantial *de facto* exchange rate inflexibility. To the extent that capital flows are procyclical, the currency trading of central banks will convert procyclical capital flows into procyclical monetary policy. The PRC and India are interesting test cases of this phenomenon, given the limited extent of *de facto* capital account opening in both countries and their relatively weak financial systems. Yet, even in these two countries, we find that monetary policy has been fairly procyclical.

We argue that there are potential difficulties facing economies which have moved towards substantial *de facto* integration while continuing to have limited exchange rate flexibility. This

[1] The euro is a flexible exchange rate with respect to other currencies. Eurozone countries have an open capital account and follow a Eurozone autonomous monetary policy.

is particularly a concern for Malaysia and Taipei,China, which combine (i) sophisticated financial systems that erode the effectiveness of capital controls; (ii) substantial *de facto* openness; and (iii) rigidity in the exchange rate. Since pursuing counter-cyclical monetary policy becomes more difficult when economies with pegged exchange rates experience procyclical capital flows, the paper makes a case for a consistent monetary policy framework.

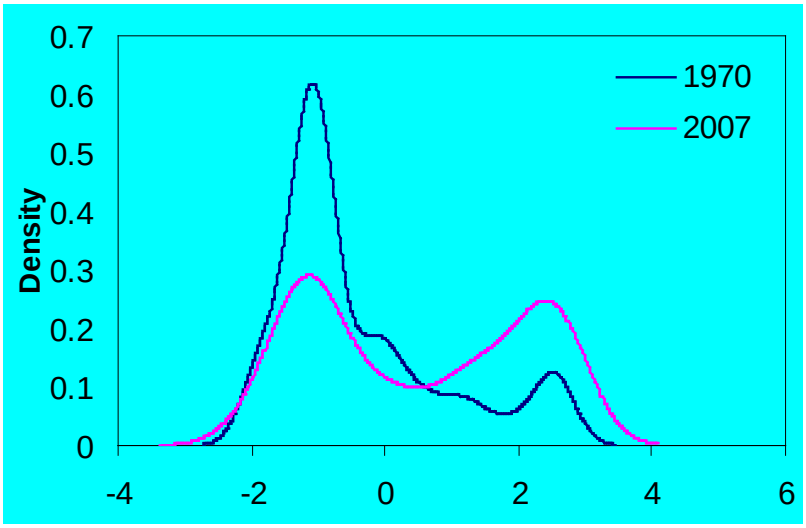
2. CAPITAL CONTROLS

2.1 *De jure* Controls: the Chinn-Ito Database

We start with a description of *de jure* capital controls in the Asian-11 economies, compared to the rest of the world. Using principal component analysis, Chinn and Ito (2008) have constructed a database of *de jure* capital controls based on information supplied by economies to the International Monetary Fund's (IMF) AREAR database. The database yields an annual score for each economy, with values ranging from -1.81 for economies with completely closed capital accounts, to +2.53 for those with fully liberalized capital accounts.[2] Although the database is often used for analyzing *de jure* capital controls, it does have certain limitations. First, it does not adequately capture the gradual easing of capital controls, since it continues to give the same score unless all restrictions are removed. Second, the index rose significantly for most industrial countries in recent years, as they introduced prudential measures related to anti-money laundering, anti-terrorist financing, and the like.

Figure 1: Density of the Chinn-Ito Measure Across All Economies: 1970 and 2007

This graph shows the kernel density plot of the Chinn-Ito measure of *de jure* capital account openness for all economies. The blue and red lines show conditions in 1970 and 2007, respectively. Both distributions are bimodal, with a clump of economies which are mostly open and a clump of economies which are mostly closed. There has been a marked shift in the probability mass from the left hump (mostly closed) to the right hump (mostly open). This graph gives us a frame of reference for interpreting information from the Chinn-Ito database.



Source: Chinn and Ito (2008) and authors' calculations

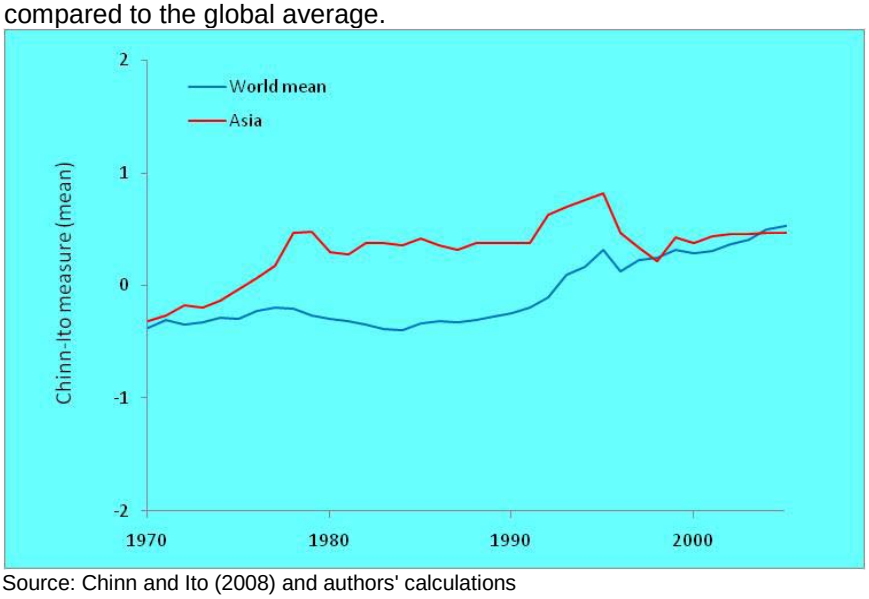
The Chinn-Ito database shows that over the years, substantial capital account decontrol has taken place worldwide. Figure 1 shows the kernel density plot of the Chinn-Ito measure

[2] For instance, France, which was one of the last industrial countries to open up, went from a value of -1.27 in 1970 to a value of 2.53 in 1995. In another example, Israel shifted from a value of -1.13 in 1997 to 2.53 in 2004.

across all economies, for 1970 and 2007. In both years, the density is bimodal, with a cluster of economies with largely open capital accounts and a cluster of economies with largely closed capital accounts. This conveys a general shift away from being mostly closed to being mostly open. The distribution in 1970 had a sharp bump around a score of -1. This bump had come down sharply by 2007. Today, the distribution is more even, with roughly equal numbers of economies with high and low openness.

Figure 2: Evolution of the Average Chinn-Ito Measure for Asia-11

For each year, the average value of the Chinn-Ito measure across economies was computed. The blue line shows the global average, while the red line shows the average for Asia-11. The results suggest that in recent years, average *de jure* controls in Asia-11 have moved closer to the world average. This reverses the trend which prevailed in previous decades, where Asia-11 was (on average) more open compared to the global average.



Source: Chinn and Ito (2008) and authors' calculations

The Chinn-Ito database has information for all the Asia-11 economies except Taipei,China. Since Taipei,China's capital account is largely convertible, information about Asia-11 drawn from this database is somewhat biased in the downward direction. Figure 2 shows trends in the average value of the Chinn-Ito measure for Asia-11 (excluding Taipei,China) and the world. At both the starting and end points, *de jure* controls in Asia-11 were similar to the world average. However, there was an intermediate period when decontrol in Asia-11 had advanced more rapidly than the world average. While the Asia-11 economies encouraged long-term capital flows like foreign direct investment, some imposed restrictions on short-term flows. One example is India, which imposed restrictions on short term debt.

Table 1 shows the numerical values of the Chinn-Ito index for India, PRC, Korea, and the Asia-11 average. While the index has stayed the same for PRC and India at -1.13, the trend in Korea has been more erratic. Capital account liberalization prior to the 1997 Asian Financial Crisis led to a drop in the index from -1.13 to -0.09 in 1995. In 1996, however, the index dropped back to -1.13, and there was no change until the country got back to liberalizing the capital account in 2001. By 2007, Korea had attained a value of 0.18. This achievement notwithstanding, it continues to lag behind other OECD countries in terms of capital account openness.

The average openness of the Asia-11 rose sharply from -0.07 in 1970 to 0.96 in 1985.[3] After the Asian financial crisis, *de jure* controls resurfaced, and the average score dropped to 0.41 in 1998. The pre-crisis value of 0.96 has not been attained since. However, some of the

[3] The average openness for Asia-11 was higher in 1970 than that of the PRC and India in 2007.

recent progress made by Asian economies in *de jure* openness may not have been reflected in the Chinn-Ito measure due to a change in the measure's definition, as well as its inability to capture easing in controls that do not involve the complete removal of restrictions.

Table 1: Evolution of the Chinn-Ito Measure

This table shows the evolution of the Chinn-Ito measure for India, PRC, and Korea, compared with the Asia-11 mean.

The index for India and PRC has stayed constant at -1.13, which corresponds to the 'mostly closed' mode of the density seen in Figure-1. In Korea's case, *de jure* capital controls have changed several times. In the aftermath of the Asian Financial Crisis, Korea was also at -1.13 till 2000. It has since engaged in considerable *de jure* capital account liberalization, and by 2007 its measure had risen to 0.18.

Year	India	PRCKorea, Republic of	Asia-11 mean	
1970	-1.13	-1.13	-1.13	-0.07
1975	-1.13	-1.13	-1.13	0.12
1980	-1.13	-1.13	-0.09	0.45
1985	-1.13	-1.13	-1.13	0.96
1990	-1.13	-1.81	-0.09	0.74
1995	-1.13	-1.13	-0.09	0.96
1996	-1.13	-1.13	-1.13	0.76
1997	-1.13	-1.13	-1.13	0.56
1998	-1.13	-1.13	-1.13	0.41
1999	-1.13	-1.13	-1.13	0.56
2000	-1.13	-1.13	-1.13	0.49
2001	-1.13	-1.13	-0.09	0.49
2002	-1.13	-1.13	-0.09	0.49
2003	-1.13	-1.13	-0.09	0.49
2004	-1.13	-1.13	-0.09	0.49
2005	-1.13	-1.13	-0.09	0.49
2006	-1.13	-1.13	-0.09	0.49
2007	-1.13	-1.13	0.18	0.36
Change 2000-2007	**0**	**0**	**1.31**	**-0.13**

Source: Chinn and Ito (2008) and authors' calculations

2.2 *De facto* Capital Account Openness

2.2.1 Evidence from Gross Flows to Gross Domestic Product (GDP)

The familiar trade/GDP ratio is defined as the sum of imports and exports, expressed as percentage of Gross Domestic Product (GDP). This measures trade openness. A simple extension of this idea is the ratio of gross cross-border financial flows in the Balance of Payments (BOP) to GDP. This measures financial integration.

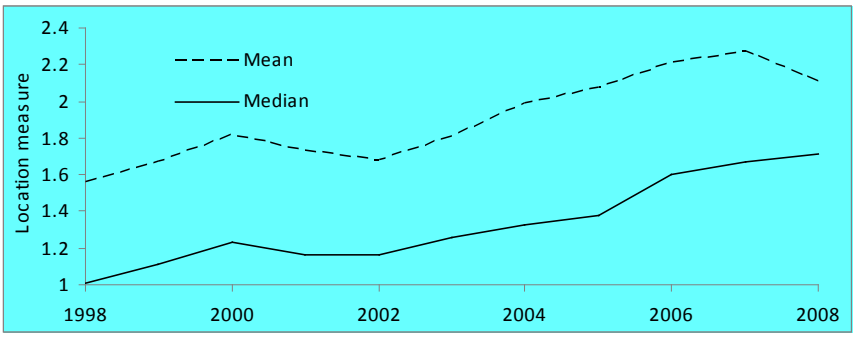
The ability of the central bank to influence the exchange rate depends on the volume of cross border flows occurring in foreign exchange markets. Even when transactions net out over the year, import payments, export earnings, and financial flows influence the exchange rate on a daily basis. In addition, while gross flows comprise both current account and capital account transactions, bigger current account transactions can imply greater capital account openness, owing to cross-border capital transfers through possible trade misinvoicing. Patnaik, Sengupta, and Shah (2009) have shown that greater trade misinvoicing occurs

when the current account is bigger, and acts as a mechanism to circumvent capital controls. Patnaik and Shah (forthcoming) have explored unexpected *de facto* capital account integration which arises once multinational corporations play a substantial role in the economy. Other related literature have emphasized the two-way links between openness on the current account and the capital account (Aizenman 2003; Aizenman and Noy 2004). We therefore look at gross flows on both the trade and capital accounts as a measure of globalization of an economy. This takes both trade and financial integration into account.

Figure 3 shows how this measure of globalization has evolved over time for Asia-11 (excluding Viet Nam, for which data was unavailable). The median openness increased from roughly 100% of GDP in 1998 to about 160% of GDP in 2008. The mean values have been skewed upwards by the presence of small and highly-open economies like Singapore and Hong Kong, China.

Figure 3: Average value of gross flows to GDP for Asia-11

This graph uses the annual ratio of gross flows to GDP as a measure of globalization. A value of 1 corresponds to gross flows which are 100% of GDP in a given year. Two location estimators (the mean and the median) of the values for Asia-11 economies are reported; both reveal a significant pace of integration into the world economy.



Source: Datastream

Table 2 takes a closer look at the Asia-11 economies. The pace of integration in both PRC and India was relatively slow until 2000, after which there was a considerable increase in the rate of change. In India's case, there was a rise of 56 percentage points of GDP, from 2000–2008. Similar trends were observed in PRC (30 percentage points of GDP), Korea (69 percentage points of GDP) and the Asia-11 average (45 percentage points of GDP).

These results suggest that while Asia might be a reluctant liberalizer when it comes to *de jure* controls, in reality, it has been rapidly integrating into the world economy, *de facto*.

Table 2: Gross flows to GDP for India, China, and the Republic of Korea

This table shows the ratio of gross flows to GDP (a measure of global integration) for India, PRC, Korea, and the Asia-11. A value of 1 corresponds to gross flows which are 100% of GDP in a given year. Between 2000 and 2008, this ratio had risen by 56 percentage points in India; 30 percentage points in PRC; 69 percentage points in Korea; and 45 percentage points in the average Asia-11 economy.

Year	India	PRC	The Republic of Korea	Mean for Asia-11
1998	0.44	0.48	0.85	1.52
1999	0.47	0.49	0.85	1.64
2000	0.56	0.58	1	1.79
2001	0.5	0.54	0.92	1.67
2002	0.53	0.56	0.76	1.63
2003	0.6	0.66	0.87	1.77
2004	0.68	0.75	0.89	1.94
2005	0.82	0.84	0.94	2.04
2006	1.00	0.89	1.01	2.16
2007	1.19	0.88	1.15	2.19
2008	1.12	0.88	1.69	2.24
Change 2000–2008	**0.56**	**0.3**	**0.69**	**0.45**

Source: Datastream

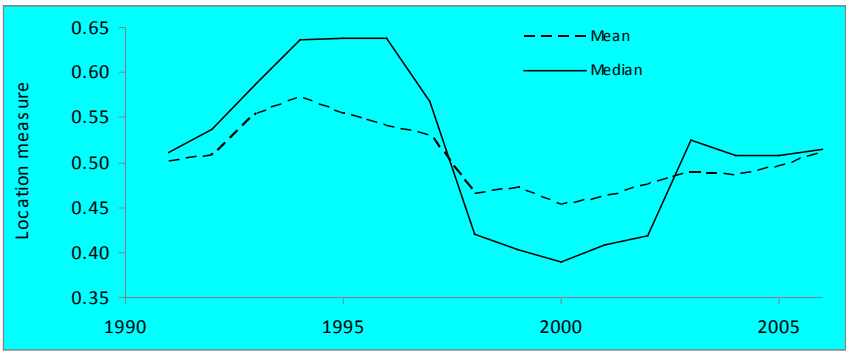
2.2.2 Financial Sector Development

The extent to which capital controls are effective has a lot to do with domestic financial sector development. Increasing sophistication in the financial system tends to erode the effectiveness of capital controls over time. When thinking about the effectiveness of *de jure* capital controls, therefore, it is important to look at the capability of the domestic financial system.

To do this, we turn to Dorrucci, Meyer-Circel, and Santabarbara (2009), who have developed a database with panel data on financial sector development in 26 emerging economies. This covers all of the Asia-11 economies, excluding Viet Nam. The values of this index range from 0 (undeveloped domestic financial system) to 1 (highly capable domestic financial system). We focus on their "narrow" measure of financial development as this measure is more frequently updated.

Figure 4: Average Value of Dorrucci, Meyer-Circel, and Santabarbara Measure of Financial Sector Development for Asia-11

Dorrucci, Meyer-Circel, and Santabarbara (2009) report a measure of financial sector development across many economies for many years. This figure reports two location estimators (the mean and the median) for the Asia-11 economies from 1990–2005. There was a notable decline in financial sector capability following the Asian Financial Crisis. From 2000 onwards, improvements are evident.



Source: Dorrucci, Meyer-Circel, and Santabarbara (2009) and authors' calculations

Figure 4 charts trends in the mean and median score of the Asia-11 economies for which Dorrucci, Meyer-Circel, and Santabarbara (2009) have information. In both cases, we see a growth in the financial system's sophistication prior to the Asian Financial Crisis, followed by a period of decline. From 2000 onwards, both measures of location show an upward trend.

Table 3 shows numerical values for this measure in India, PRC, Korea, and the average Asia-11 economy. The Asia-11 mean peaked at 0.55 in 1995. In the aftermath of the crisis, this dropped sharply to 0.45 in 2000. By 2001, however the Asia-11 were back on track, achieving an average value of 0.51 in 2006.This suggests that *de jure* controls were likely to have been more effective between 1998–2004, when the average score of financial system capability was low.

Table 3: Measure of financial system capability

Dorrucci, Meyer-Circel, and Santabarbara (2009) report a measure of financial sector development across many economies for several years. This table reports values for India, PRC, Korea, and the Asia-11 average. In all cases, there was a positive but modest improvement between 2000–2006. However, India and PRC continue to lag behind the Asia-11 mean, and even fairly advanced economies like Korea still lag behind OECD economies like the UK.

Year	India	PRC	The Republic of Korea	Asia-11
1991	0.28		0.65	0.50
1995	0.34	0.47	0.64	0.55
1996	0.34	0.45	0.65	0.54
1997	0.34	0.41	0.62	0.53
1998	0.33	0.42	0.57	0.46
1999	0.34	0.4	0.61	0.47
2000	0.34	0.38	0.57	0.45
2001	0.32	0.41	0.63	0.46
2002	0.32	0.42	0.62	0.48
2003	0.32	0.44	0.62	0.49
2004	0.35	0.43	0.58	0.49
2005	0.36	0.43	0.58	0.50
2006	0.39	0.43	0.6	0.51
Change 2000–2006	**0.05**	**0.05**	**0.03**	**0.06**

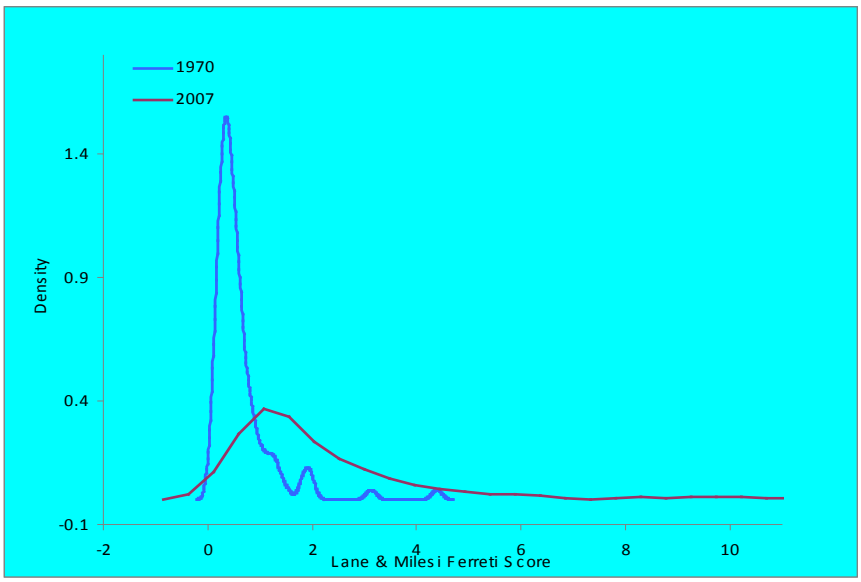
Source: Dorrucci, Meyer-Circel, and Santabarbara (2009) and authors' calculations

2.2.3 Evidence from the Lane and Milesi-Ferretti Database

The second methodology for measuring *de facto* integration into the world economy uses information from the Lane and Milesi-Ferretti database (Lane and Milesi-Ferretti 2007). This measures the stock of foreign assets and liabilities in the country, by summing up the flows on the BOP. This is a valuable database in that it measures the outcomes of capital controls as reflected in the BOP. However, it does not measure capital flows that take place through mechanisms such as trade misinvoicing, which involve evasion of capital controls and are not captured in the BOP.

Figure 5: Density of the Lane and Milesi-Ferreti Measure Across All Economies: 1970 vs. 2007

This graph shows the kernel density plot of the Lane and Milesi-Ferreti measure of *de facto* capital account openness for all economies. The blue and red lines show conditions in 1970 and 2007, respectively. Unlike the results reported in Figure 1 for the Chinn-Ito measure of capital account openness, the distributions, are not bimodal: most economies were largely closed in 1970, but by 2007, this trend had been reversed. This graph gives us a frame of reference for interpreting information on Asia-11 from the Lane and Milesi-Ferreti database.



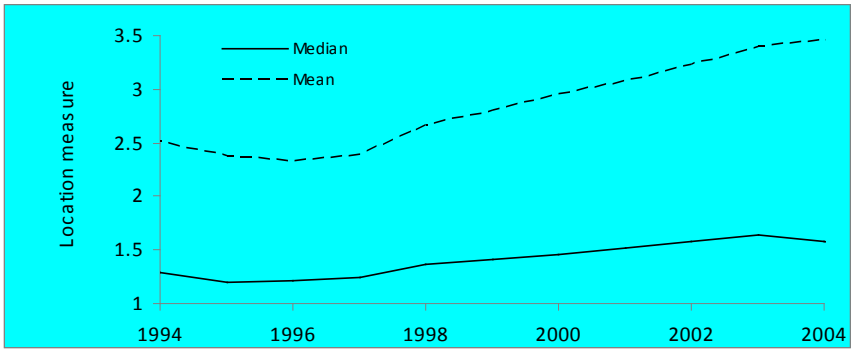
Source: Lane and Milesi-Ferretti 2007 and authors' calculations

This database reveals that over the years, substantial *de facto* capital account decontrol has taken place worldwide. Figure 5 shows the kernel density plot of the Lane and Milesi-Ferreti measure across all economies. Contrary to the results reported in Figure 1, this density plot is not bimodal: all economies have moved from closed capital accounts to varied levels of open capital accounts. Furthermore, there is no congregation of economies at any one level of openness, suggesting that there is no broad consensus regarding the "appropriate" level of openness. Economies that have *de facto* liberalized have continued to do so rapidly.

Figure 6 shows trends in the average value of the measure for Asia-11, from 1994-2004 (data after 2004 are unavailable). Similar to the results reported in Figure 6, the sample mean is skewed upwards by the presence of a few small and highly-open economies. The median therefore is a better measure of location. The time-series of the median shows relatively little change after 2000.

Figure 6: Average Value for Asia-11 of Lane and Milesi-Ferretti Measure of *de facto* Integration

The Lane and Milesi-Ferretti (2007) database measures the external assets and liabilities of economies, expressed as a ratio of GDP. This figure reports two location estimators (the mean and the median) for Asia-11 across time. While the mean value has risen sharply, the median has not. This suggests that a small group of economies have been actively integrating into the world economy, while others have not.



Source: Lane and Milesi-Ferretti 2007 and authors' calculations

Table 4: Lane and Milesi-Ferretti Measure

The Asia-11 mean of 356% of GDP in 2004 is partly due to the presence of small and highly-open economies such as Hong Kong and Singapore. In the case of India, PRC, and Korea, more modest values are reported at 58%, 103%, and 109% of GDP, respectively. Greater international economic integration led to significant increases between 2000–2004, with changes of 16%, 18%, 26% and 55% of GDP for India, PRC, Korea, and Asia-11, respectively.

Year	India	PRC	The Republic of Korea	Asia-11 mean
1995	0.4	0.59	0.51	2.46
1996	0.4	0.63	0.57	2.44
1997	0.39	0.72	0.61	2.43
1998	0.41	0.77	1.05	2.81
1999	0.41	0.82	0.94	3.12
2000	0.42	0.85	0.83	3.01
2001	0.44	0.88	0.91	3.04
2002	0.5	0.92	0.9	2.99
2003	0.56	0.99	1.01	3.35
2004	0.58	1.03	1.09	3.56
Change 2000–2004	**0.16**	**0.18**	**0.26**	**0.55**

Source: Lane and Milesi-Ferretti 2007 and authors' calculations

Table 4 shows a significant improvement in *de facto* integration by India, PRC and Korea after 2000. Within seven years, the Lane and Milesi-Ferreti measure for each country had increased by 43, 28, and 56 percentage points of GDP, respectively.

3. EXCHANGE RATE REGIME

3.1 Methodology

In the last decade, the literature has revealed that in many economies, the *de jure* exchange rate regime announced by the central bank differs substantially from the *de facto* regime in operation.This has motivated a small literature on data-driven methods for classifying exchange rate regimes (Reinhart and Rogoff 2004; Levy-Yeyati and Sturzenegger 2003; Calvo and Reinhart 2002). This literature has attempted to create datasets identifying *de facto* exchange rate regimes across all countries in recent decades, using a variety of alternative algorithms. While these databases are useful for many applications, they have limited usefulness in measuring the finer characteristics and structures of intermediate regimes. For instance, Reinhart and Rogoff classify the Indian rupee as a single exchange rate regime from 1993 onwards, but as this paper will subsequently show, India has had an intermediate regime since 1993, which yields fresh insights into the drivers and consequences of the exchange rate regime and monetary policy framework.

A valuable tool for understanding the *de facto* exchange rate regime is a linear regression model based on cross-currency exchange rates (with respect to a suitable numeraire). Used at least since Haldane and Hall (1991), this model was popularized by Frankel and Wei (and is hence also called the Frankel-Wei model). Recent applications of this estimation strategy include Bénassy-Quéré, Coeuré, and Mignon (2006), Shah, Zeileis, and Patnaik (2005) and Frankel and Wei (2007). In this approach, an independent currency such as the Swiss Franc (CHF) is chosen as an arbitrary 'numeraire'. If estimation using the Indian rupee (INR) is desired, the model estimated is:

$$d\log\left[\frac{INR}{CHF}\right] = \beta_1 + \beta_2 d\log\left[\frac{USD}{CHF}\right] + \beta_3 d\log\left[\frac{JPY}{CHF}\right] + \beta_4 d\log\left[\frac{DEM}{CHF}\right] + \varepsilon$$

This regression picks up the extent to which the INR/CHF rate fluctuates in response to fluctuations in the US$/CHF rate. If there is pegging to the US Dollar (US$), then fluctuations in the Japanese Yen (JPY) and the German Deutsche Mark (DEM) will be zero. If there is no pegging, then all the three betas will be different from 0. The $R^2$of this regression is also of interest; values near 1 would suggest reduced exchange rate flexibility.

To understand the *de facto* exchange rate regime in a given country for a given time period, researchers and practitioners can easily fit this regression model to a given data window, or use rolling data windows. However, such a strategy lacks a formal inferential framework for determining changes in the regimes. This has motivated an extension of the econometrics of structural change, for the purpose of analyzing structural change in the Frankel-Wei model (Zeileis, Shah and Patnaik 2008). This involves extending the familiar Perron-Bai methodology (Bai and Perron 2003) for identifying the dates of structural change in an OLS regression. Through this, dates of structural change in the exchange rate regime are identified. We focused on the period after 1976, and utilized weekly changes in exchange rates for these estimations. Values shown in brackets are *t*-statistics.

For each country, a set of sub-periods were identified. In each sub-period, the R^2 of the regression served as a summary statistic of exchange rate flexibility. Values near 1 convey tight pegs. Floating rates have values of between 0.4–0.5.

Using this classification scheme, we were able to do the following:

- Measure and quantify the fine structure of intermediate regimes using a real-value measure of exchange rate inflexibility (the regression R^2), which naturally suggests a real-value measure of exchange flexibility.
- Specify dates at which the exchange rate regime changed. We implemented these methods using weekly percentage changes in exchange rates, which yielded break dates to the resolution of the week. Through this, a time-series of exchange rate flexibility was obtained for each country, of the value of the R^2, which prevailed at a point in time.
- Determine the number of breaks and the placement of breaks based on sound inference procedures.

3.2 Evidence on Exchange Rate Flexibility of Asia-11

We applied this methodology to examine the *de facto* exchange rate regimes of the Asia-11 economies. For each country, a time-series of currency flexibility was obtained, providing summary statistics on exchange rate flexibility.

In India, the rupee began its life as a 'market-determined exchange rate' in March 1993. However, this date is not identified as a structural break in the data analysis. Instead, a sub-period for the exchange rate regime is found, from 1976– 1998. During this period, the rupee was *de facto* pegged to the dollar with a certain degree of exchange rate flexibility, with an $R^2$of 0.84.

After the Asian Financial Crisis, India embarked on a tight rupee-dollar peg. From 28 September 1998 to 19 March 2004, the US$ coefficient reverted to 1.01. The other coefficients were not statistically significant. The R^2 rose to 0.97. During this period, the exchange rate regime in India was similar to PRC's after July 2005.

Table 5: India's *de facto* Exchange Rate Regime

The methodology developed by Zeileis, Shah and Patnaik (2008) was applied to identify dates of structural break in the exchange rate regression:

$$d\log\left[\frac{INR}{CHF}\right]=\beta_1+\beta_2 d\log\left[\frac{USD}{CHF}\right]+\beta_3 d\log\left[\frac{JPY}{CHF}\right]+\beta_4 d\log\left[\frac{DEM}{CHF}\right]+\varepsilon$$

In the Indian case, three distinct sub-periods are evident. The first and second sub-periods clearly show pegging to the US dollar; after March 2004, however, other currencies started to matter. Exchange rate inflexibility is measured by the R-squared of these regressions. It shows a value of 0.81 in the third regime. The values in brackets are standard errors.

In the last period, India returned to significant exchange rate flexibility. Coefficients for non-dollar currencies have started achieving significant values. The R^2 dropped to 0.81. The change in the exchange rate regime which took place in March 2004 was both statistically and economically significant.

Period	US$	EUR	GBP	JPY	σe	R2
09 Jan 1976 –						
21 Aug 1998	1.15	0	-0.15	-0.02	0.73	0.84
	-0.05	-0.03	-0.02	-0.02		
28 Sep 1998 –						
19 Mar 2004	1.01	0	0	-0.01	0.26	0.97
	-0.01	-0.01	-0.02	-0.01		
26 Mar 2004 –						
29 May 2009	1.24	-0.35	-0.15	-0.05	0.77	0.81
	-0.05	-0.08	-0.04	-0.03		

Table 6 shows the results of this estimation strategy for the Chinese Renminbi. It finds that the first period runs from 9 Jan 1981 until 1 November 1985. This was a period with bigger currency flexibility by Chinese standards, with the R^2 at 0.89. Subsequently, PRC moved to a tight US dollar peg. While there have been some minor changes in the exchange rate regime, it remains primarily a simple peg, with a US$ coefficient of 1 and an R-squared ≈ 1.

In some respects, these results are consistent with official announcements and a simple examination of the exchange rate. The break date of 22 July 2005 that is derived from the regression is consistent with that announced by the authorities. The results for PRC therefore suggest that the econometric analysis is broadly on the right track.

At the same time, it is noteworthy that after 22 July 2005, no further structural changes were evident from the econometric analysis. This contradicts a variety of official claims regarding the evolution of the exchange rate away from the US dollar peg towards a basket peg, and towards greater exchange rate flexibility.

Table 6: PRC's *de facto* Exchange Rate Regime

The dating methodology of Zeileis, Shah, and Patnaik (2008) reveals a series of break dates for the Chinese exchange rate regime. However, for all intents and purposes, the Chinese exchange rate regime remains a *de facto* peg to the US dollar, with a near-zero exchange rate flexibility at all times. The values in brackets are standard errors.

Period	US$	EUR	GBP	JPY	σe	R2
09 Jan 1981 – 01 Nov 1985	0.76	0.33	-0.1	-0.06	0.72	0.89
	-0.13	-0.06	0.04	0.05		
08 Nov 1985 – 05 Apr 1991	1	0	0	0	0	1
12 Apr 1991 – 19 May 1995	0.97	0.04	0.02	-0.01	0.29	0.97
	-0.04	-0.02	0.02	0.02		
02 Jun 1995 – 15 Jul 2005	1	0	0	0	0	1
22 Jul 2005 – 29 May 2009	1.05	-0.04	0	0	0.23	0.98
	-.015	-.025	.013	.012		

The regression results suggest that remarkably little has changed in the actual prevailing exchange rate regime. The US$ coefficient has dropped to 0.949. A statistically significant Euro coefficient has emerged, with a small value of 0.06 where the null hypothesis of zero can be rejected. The residual standard deviation has more than doubled to 0.243, but the R^2 has dropped only slightly to 0.974. While there was more exchange rate flexibility in this period, the change in the exchange rate regime was extremely small.

Finally, Table 7 shows the evolution of the exchange rate regime in Korea. From 1981 until early 1995, the country ran a *de facto* peg to the US dollar. In 1995, a big increase in currency flexibility came about and the R^2 dropped to 0.65. This is a regime with greater flexibility than India's.

Table 7: The Republic of Korea's *de facto* exchange rate regime

Applied to Korea, the dating methodology of Zeileis, Shah, and Patnaik (2008) reveals two periods. From 1981 until early 1995, the *de facto* exchange rate regime was a pure US$ peg. After that, exchange rate flexibility went up considerably; the R-squared dropped to 0.65. The values in brackets are standard errors.

Period	US$	EUR	GBP	JPY	σe	R2
24 Apr 1981 – 20 Jan 1995	0.97	0.03	0	0	0.25	0.98
	-0.02	-0.01	-0.01	-0.01		
27 Jan 1995 – 29 May 2009	1.25	-0.07	-0.17	-0.18	1.12	0.65
	-0.04	-0.03	-0.04	-0.03		

Figure 7: The evolution of exchange rate inflexibility in Asia

For each of the Asia-11 economies, the dating methodology of Zeileis, Shah, and Patnaik (2008) was applied. This reveals the *de facto* exchange rate regime prevailing at different points in time. The R-squared values across all economies are summarized in this graph. Two location estimators, the mean and the median, are reported. This yields a summary statement of how exchange rate flexibility in Asia has evolved through time. The graph clearly reveals extreme exchange rate inflexibility in the decade preceding the Asian Financial Crisis, which is now understood to have been a key contributor to the crisis. In the immediate aftermath of the crisis, there was greater flexibility for a brief period, but then 'fear of floating' resurfaced, as pointed out by Calvo and Reinhart (2002). However, this graph suggests that exchange rate inflexibility in Asia did not go all the way back to pre-crisis levels. While Dooley, Folkerts-Landau, and Garber (2003) have emphasized the emergence of an Asian-led 'Bretton Woods II' regime, throughout the last decade, exchange rate inflexibility in Asia has declined at a slow pace.

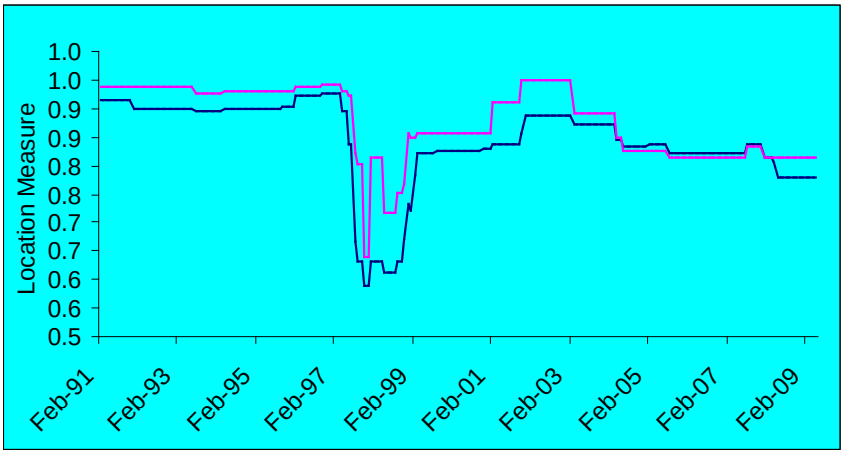


Figure 7 shows the average and the median value of the R^2 for the Asia-11 economies. At each point in time and for each country, the *de facto* exchange rate regime was identified, and the R^2 value from that sub-period was utilized.

The average R^2started out with a high value of 0.9. There was a small increase in flexibility in 1980 and 1981. Subsequently, however, there was a sustained period of exchange rate rigidity. From 1982 until 1997, the average R^2 was above 0.9. This exchange rate inflexibility, coupled with increasing *de facto* capital account openness, helped trigger the Asian Financial Crisis, which involved firms and banks borrowing in foreign currency based on expectations of exchange rate rigidity.

During the crisis, exchange rate flexibility increased. In 1998, the average R^2dropped to 0.61. However, immediately after that, exchange rate rigidity went up. This empirical fact was brought to prominence by Calvo and Reinhart (2002), who emphasised that after the crisis, little had changed with exchange rate regimes in Asia. This perspective was further amplified by the 'Bretton Woods II' hypothesis, which tried to rationalize this exchange rate rigidity (Dooley, Folkerts-Landau, and Garber 2003).

Our evidence offers a somewhat different perspective in two respects. First, while exchange rate inflexibility in Asia-11 rose after the crisis subsided, it reverted to lower values when compared to what prevailed before the crisis. The mean R^2 was 0.93 in 1997; post-crisis, this changed to 0.88 over the 2002–2004 period.

The second interesting observation is that since 2002, exchange rate flexibility in Asia-11 has been slowly rising. The mean R^2 dropped slightly from 0.886 in 2002–2004 to 0.85 in 2009. This suggests that while Asia-11 economies continue to have considerable exchange rate inflexibility, there has been a gradual movement towards greater flexibility. With a mean

R^2 of 0.85 in 2009, the environment has improved when compared with the mean of 0.93 in 1997.

4. POLICY ANALYSIS

Table 8 summarizes where Asia stands with regard to exchange rate regime choice and capital account openness. Two aspects are particularly important to our analysis: the distinction between *de jure* and *de facto* capital account restrictions, and the extent to which monetary policy autonomy is ceded.

4.1 Asia and the impossible trinity

The 'impossible trinity' asserts that a country can only have two of three things: exchange rate flexibility, capital account openness, and monetary policy autonomy. In the extreme, a country with a completely open capital account and a completely fixed exchange rate must give up monetary policy autonomy.[4] In the typical Asian setting, increasing *de facto* openness has come about through *de jure* liberalization coupled with domestic financial sector development, and the evasion of capital controls that become possible with a large current account. Under these conditions, exchange rate inflexibility can lead to distortions in monetary policy. Even though a country might try to regain monetary policy autonomy through financial repression, imposition of capital controls, or sterilization, the logic of the impossible trinity suggests that exchange rate pegging comes at the cost of autonomy in monetary policy.

Table 8: Asia and the impossible trinity

This table summarizes key results for the Asia-11 discussed in Section 4, with data on each economy for the most recent observed year. Data on exchange rate inflexibility for 2009 drew on the methodology in Section 3.1. The Chinn-Ito database was used to measure *de jure* capital controls prevailing in 2007. The Lane and Milesi-Feretti measure was used to measure *de facto* capital account openness in 2007.

	Exchange rate	Capital account openness	
Country	Inflexibility (2009)	De jure (2007)	De facto (2007)
China, People's Republic of	0.98	-1.13	1.13
Hong Kong	1	2.53	23.91
India	0.81	-1.13	0.71
Korea, Republic of	0.65	0.18	1.35
Malaysia	0.92	-0.09	2.22
Philippines	0.78	0.14	1.32
Taipei,China	0.9	N.A.	3.37
Viet Nam	0.87	-1.13	1.3
Mean	0.85	0.195	4.08
Median	0.87	0.025	1.58

Sources: Chinn and Ito (2008), Lane and Milesi-Feretti (2007) and authors' calculations

In an emerging market setting, the procyclicality of capital flows is particularly important. When times are good and business cycle conditions are buoyant, capital tends to move into the country. To prevent exchange rate appreciation, the central bank will buy dollars, a move which while ultimately lower domestic interest rates. Conversely, when the economy is in a downturn, capital tends to leave the country. The central bank combats this by selling

[4] In a recent paper, Aizenman, Chinn, and Ito (2008) find empirical support for the impossible trinity.

dollars, which in turn raises domestic interest rates. Procyclical capital flows therefore interact with exchange rate pegging to induce procyclical monetary policy. This is the sense in which monetary policy is distorted in an emerging market setting.

Asia-11's response to the impossible trinity has been diverse; economies such as Singapore and Hong Kong, China have opted for high capital account openness and low or no exchange rate flexibility, while economies like India and PRC has opted for low capital account openness and inflexible exchange rates. Between 2000–2008, Asia-11 economies have moved towards greater *de facto* capital account openness, with the exception of Malaysia, the Philippines, and Indonesia. Meanwhile, exchange rate flexibility remained unchanged in most economies, except in Indonesia where it decreased, and Malaysia, India, and PRC, where it increased.

In the impossible trinity framework, a country could have a fixed exchange rate and give up independent monetary policy. An open capital account with a fixed exchange rate leads to the loss of monetary policy autonomy, as has been experienced in Hong Kong, China. The currency board of Hong Kong, China is a consistent monetary policy framework, with domestic interest rates fluctuating as a result of the exchange rate peg.

A floating exchange rate with an open capital account is also consistent with the impossible trinity framework. Economies with floating exchange rates turn out to have an R^2 in the exchange rate regression of 0.4 to 0.5. These economies are able to achieve open capital accounts and monetary policy autonomy. The Asian country which is closest to this configuration is Korea; India, meanwhile, has made the biggest strides towards adopting the same configuration.

The interesting questions involve those economies with low capital account openness and inflexible exchange rates. If a country had an inflexible exchange rate and a *de facto* closed capital account—with gross flows on the BOP of well below 40% of GDP—then it could obtain monetary policy autonomy. For instance, in the late 1980s, India was able to have monetary policy autonomy since exchange rate inflexibility was combined with gross flows to GDP of roughly 25%. None of the Asia-11 economies occupied that region of the graph in 2000 and 2008.

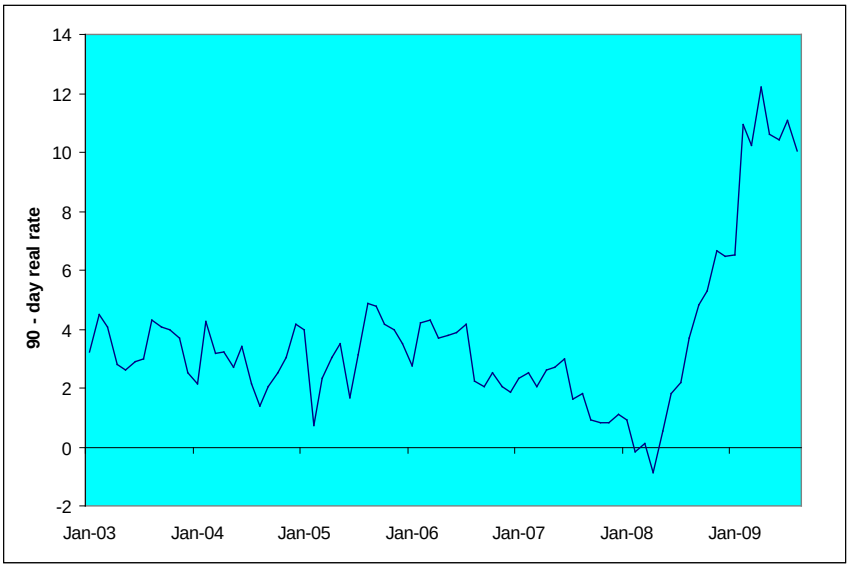
The country that was closest to this configuration in 2008 was PRC, which has been striving for very little exchange rate flexibility coupled with considerable capital account openness. This prompts us to ask: *Has PRC been able to preserve monetary policy autonomy?*

Many authors have examined Chinese monetary policy with a focus on issues such as the mechanisms for sterilization, the measurement of sterilization coefficients, and the interplay between sterilization and the banking system. However, these issues are not directly essential to analyzing the procyclicality of monetary policy. In our analysis, therefore, we treat these issues as intermediate factors that influence the outcome of monetary policy: the domestic short-term interest rate. We re-expressed the short-term interest rate in PRC in real terms, and juxtaposed it against business cycle conditions. This allowed us to assess the extent to which interest rates were high in a business cycle expansion and vice versa, and examine whether monetary policy was counter-cyclical.

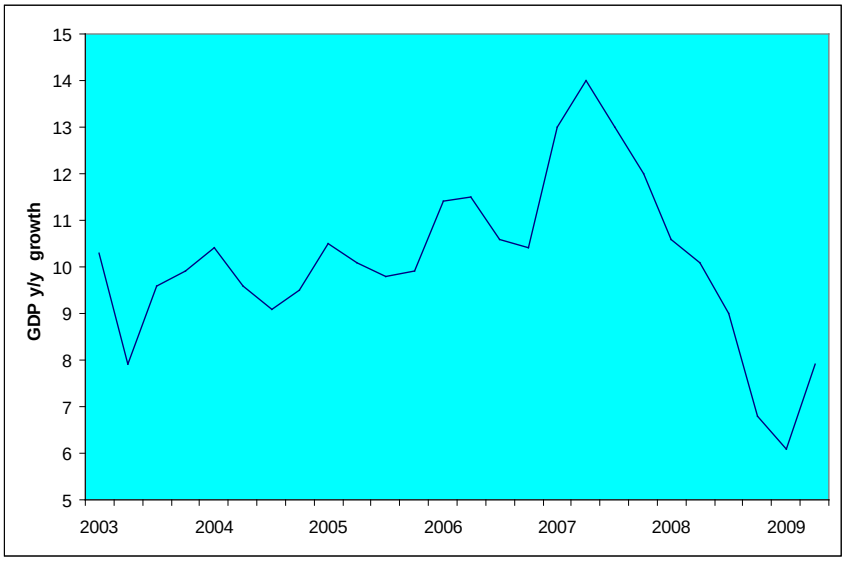
Figure 8 examines the extent to which monetary policy in PRC became procyclical in the recent business cycle expansion. The graph—which uses quarterly GDP growth to measure business cycle conditions—reflects an enormous boom from 2002–2007. Juxtaposing this against the 90-day treasury bill rate (expressed in real terms), we see that from 2002 until early 2008, the real interest rate dropped by an enormous 800 basis points. This suggests that monetary policy was expansionary during periods of growth. This is consistent with the idea that exchange rate pegging converts procyclical capital flows into procyclical monetary policy. The use of loose monetary policy during an unprecedented business cycle expansion helped induce an acceleration in inflation and an asset price boom.

Figure 8: Chinese monetary policy and the Chinese business cycle

The time-series of quarterly GDP growth was used as a measure of business cycle conditions. To obtain the time-series of the real rate, the short-term nominal rate was re-expressed in real terms using current inflation rates. In general, real interest rates attained low values in an unprecedented business cycle expansion.



Source: Datastream



Source: Datastream

The 800-basis point decline in the real interest rate during an unprecedented business cycle expansion suggests that PRC was unable to avoid the impossible trinity, through sterilized intervention or other techniques based on either capital controls or financial repression. While a wide variety of these measures were attempted, they failed to prevent the outcome: the only way to obtain the pegged exchange rate was to have a very low interest rate in real terms.

A similar analysis was conducted for India, with similar results. Even though India had more exchange rate flexibility than PRC, monetary policy was ultimately forced to yield negative

real rates in the expansion and switch around to positive real rates in the downturn.[5] In Asia, PRC and India are in the best position to preserve monetary policy autonomy despite having exchange rate inflexibility, given relatively modest values of *de facto* openness and an underdeveloped domestic financial system. However, the evidence suggests that even in these two economies, exchange rate pegging resulted in procyclical monetary policy.

The constraints of the impossible trinity are likely to be even more acute in Malaysia, Taipei,China, and Thailand, which have more *de facto* openness and better developed financial systems than PRC and India, but also less exchange rate flexibility than India.

Among the Asia-11 economies, Korea has made the most progress towards the mainstream configuration of industrial economies. Korea has high capital account openness, and the most flexible exchange rate in Asia. It has also made considerable progress in establishing the institutional capability of its central bank. However, the Korean exchange rate regime, with an R^2 of 0.65, lags the flexibility seen with floating rates, where the R^2 attains values of 0.4 to 0.5.

Financial sector development and *de facto* openness in the Philippines and Indonesia are low. In principle, these economies could have chosen exchange rate pegging with monetary policy autonomy. Among the Asia-11 economies, these are the two economies where the monetary policy distortions associated with exchange rate inflexibility would be the lowest. Despite this, these economies have chosen to have considerable exchange rate flexibility.

5. CHOICE OF REGIME

There are many reasons for choosing a tight peg over a more flexible exchange rate regime. For instance, the central bank may want to prevent depreciation in the context of high exchange rate pass-through, to keep inflation under control. Alternatively, if a large number of firms have large dollar borrowings (the problem of the 'original sin'), the central bank may want to prevent large depreciations to protect the balance sheet of these companies. Under such conditions, the central bank may lean against the wind when there is downward pressure on the exchange rate, and prevent depreciation by selling foreign exchange reserves.

Conversely, central banks may want to prevent currency appreciation. Capital inflows to emerging economies since the early 2000s have put pressure on their exchange rates to appreciate. During this period, many emerging economies, including some in Asia, have been pursuing policies of export led growth (Rodrik 2007). Allowing the exchange rate to appreciate can put export-led growth at risk; not surprisingly, the exchange rate regimes of most emerging markets in this period have been *de jure* managed floats, with central banks intervening in foreign exchange markets to prevent currency appreciation. Ramachandran and Srinivasan (2007) and Pontines and Rajan (2008) find evidence to support the hypothesis that Asian economies have intervened in the foreign exchange market to prevent currency appreciation. The rationale for doing so may lie in the large share of exports to GDP in many of these economies.

6. CONCLUSION

The main argument of this paper is that it is more important to avoid an inconsistent monetary policy framework than it is to avoid capital account liberalization. While Asia has avoided *de jure* capital account liberalization, integration into the world economy has continued *de facto*.

[5] For a detailed analysis of the procyclicality of monetary policy in India, see Patnaik and Shah (2009); Bhattacharya, Patnaik, and Shah (2008); Patnaik (2007).

Asia-11 economies have moved forward with domestic financial sector liberalization. The average value of the Dorrucci, Meyer-Cirkel and Santabarbara (2009) measure of domestic financial system capability went up from a low of 0.45 in 2000 to 0.51 in 2006. The effectiveness of capital controls is diminished when the financial system is sophisticated, and growing current account integration gives economic agents the opportunity to engage in illegal transfers of capital. With the exception of Indonesia, Philippines, and Malaysia, the Asia-11 economies increased *de facto* capital account openness from 2000–2008.

Increasing *de facto* integration poses questions about the possible evolution of the exchange rate regime. On average, Asian exchange rate regimes have moved towards greater flexibility when compared with the 'fear of floating' which immediately succeeded the Asian Financial Crisis. At the same time, *de facto* arrangements show considerable exchange rate pegging. None of the Asia-11 economies have a floating exchange rate—not even Korea, which has the most flexible exchange rate in Asia. From 2000 to 2008, Malaysia and India moved towards greater flexibility; PRC has likewise moved slightly towards more flexibility. Apart from this, Asia-11 largely appears to be on a trajectory of increasing *de facto* openness, coupled with a lack of reform in the monetary policy regime.

Increasing *de facto* capital account openness while maintaining exchange rate rigidity has two consequences:

- Central banks seeking exchange rate rigidity may have to distort the policy rate in order to achieve exchange rate targets. To the extent that capital flows are procyclical, exchange rate pegging would generate procyclical monetary policy. Of particular interest would be the extent of procyclicality in PRC and India, which have weaker financial systems and lower *de facto* openness than most of Asia. If these economies, despite their enviable position, are unable to avoid procyclical monetary policy in the presence of exchange rate inflexibility, then other Asian economies are likely to experience procyclicality to a far greater extent.
- Systemic crises could also arise. Asian economies continue to experience clashes between speculators and central banks, problems with unhedged foreign currency borrowing by corporations, and other consequences of an inconsistent monetary policy regime. Bigger problems in the future cannot be ruled out, particularly in Malaysia and Taipei,China, where there is an awkward combination of (i) considerable *de facto* openness, (ii) sophisticated domestic financial systems and (iii) exchange rate inflexibility comparable to PRC.

From the viewpoint of systemic crises, the key source of problems lies in households, banks, and corporations which count on exchange rate rigidity. When it is felt that exchange rate fluctuations will not take place, substantial exchange rate exposures build up. This leads to difficulties when large exchange rate movements do take place. Hence, the first stages of reform should emphasize exchange rate flexibility and the development of currency derivatives markets. Exchange rate flexibility would give economic agents the incentive to undertake risk management, while currency derivatives markets would give them the ability to execute desired trades. Asia is, by and large, disregarding this advice on sequencing, by moving forward with *de facto* capital account openness before bringing in the currency flexibility.

APPENDIX: EXCHANGE RATE REGIME ANALYSIS

In the main text of the paper, we have shown the results for three economies, namely India, PRC and the Republic of Korea. Results for the remaining eight economies are in this appendix.

Hong Kong, China

Hong Kong, China's *de facto* Exchange Rate Regime

Start Date	End Date	R-squared	US$	DUR	GBP	JPY	Variance
11-01-1991	20-01-1995	1.00	1.02	-0.02	0.00	-0.01	0.01
			75.38	-2.38	0.39	-0.88	
27-01-1995	15-12-2000	1.00	1.00	0.00	0.00	0.00	0.00
			441.65	0.25	0.92	3.83	
22-12-2000	19-09-2003	1.00	1.00	0.00	0.00	-0.00	0.00
			1822.53	0.96	0.10	-0.10	
26-09-2003	29-05-2009	1.00	0.98	0.01	0.00	0.01	0.01
			218.94	1.33	0.01	2.54	

Indonesia

Indonesia's *de facto* Exchange Rate Regime

Start Date	End Date	R-squared	US$	DUR	GBP	JPY	Variance
15-11-1991	11-07-1997	0.98	1.03	0.00	-0.02	-0.01	0.05
			35.03	0.15	-1.65	-1.23	
18-07-1997	09-11-2001	0.16	1.10	-0.22	0.00	-0.13	12.68
			4.40	-2.12	0.01	-0.87	
16-11-2001	29-05-2009	0.68	1.35	-0.32	-0.14	-0.08	1.55
			22.72	-2.79	-2.33	-1.57	

Philippines

The Philippines' *de facto* Exchange Rate Regime

Start Date	End Date	R-squared	US$	DUR	GBP	JPY	Variance
1991-11-15	1995-12-29	0.65	0.86	0.07	-0.02	-0.03	1.49
			4.64	0.73	-0.24	-0.49	
1996-01-05	1997-07-04	1.00	1.01	0.01	-0.01	-0.01	0.00
			49.36	0.69	-1.82	-2.23	
1997-07-11	1998-11-20	0.30	-1.14	0.83	0.27	-0.45	4.63
			-1.94	2.67	0.91	-3.89	
1998-11-27	2009-05-29	0.78	1.12	-0.01	-0.08	-0.02	0.69
			33.29	-0.51	-2.40	-0.83	

Singapore

Singapore's *de facto* Exchange Rate Regime

Start Date	End Date	R-squared	US$	DUR	GBP	JPY	Variance
11-01-1991	11-07-1997	0.94	0.98	-0.12	0.02	0.10	0.11
			23.26	-5.58	1.09	6.47	
18-07-1997	08-01-1999	0.31	0.17	-0.04	0.44	0.21	1.52
			0.98	-1.15	2.33	3.07	
15-01-1999	29-0-2009	0.84	0.63	0.26	0.08	0.09	0.25
			31.39	6.80	3.83	5.92	

Thailand

Thailand's *de facto* Exchange Rate Regime

Start Date	End Date	R-squared	US$	DUR	GBP	JPY	Variance
11-01-1991	16-05-1997	0.99	1.02	-0.09	0.01	0.07	0.02
			65.31	-11.39	1.18	12.36	
23-05-1997	25-09-1998	0.06	0.73	-0.42	-0.01	0.21	4.82
			0.98	-1.16	-0.03	1.06	
02-10-1998	29-05-2009	0.67	0.71	0.10	0.08	0.12	0.81
			20.53	3.87	2.31	4.75	

Taipei,China's *de facto* Exchange Rate Regime

Start Date	End Date	R-squared	US$	DUR	GBP	JPY	Variance
11-01-1991	25-07-1997	0.93	1.02	-0.07	0.03	0.05	0.17
			20.24	-2.82	1.49	2.52	
01-08-1997	30-10-1998	0.35	0.90	-0.26	0.20	0.23	1.32
			2.29	-1.38	1.21	3.68	
06-11-1998	29-05-2009	0.86	0.77	0.02	0.11	0.06	0.29
			35.75	1.09	5.40	3.55	

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