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# **Is Soft Pegging to the Dollar Irrational? The East Asian Monetary Experience**

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## **Abstract**

Before the crisis of 1997-98, the East Asian economies—except for Japan but including China—pegged their currencies to the US dollar. To avoid further turmoil, the IMF now argues that these currencies should float more freely. However, our econometric estimations show that the dollar’s predominant weight in East Asian currency baskets has returned to its pre-crisis levels. By 2002, the day-to-day volatility of each country’s exchange rate against the dollar has again become negligible. Domestic interest-rate and exchange-reserve policies have been subordinated to the need for exchange stability. In addition, most governments are rapidly accumulating a “war chest” of official dollar reserves, which portends that this exchange rate stabilization will come to extend over months or quarters. From the doctrine of “original sin” applied to emerging-market economies, we argue that this fear of floating is entirely rational from the perspective of each individual country. And their joint pegging to the dollar, particularly China’s stabilization of the yuan/dollar rate, benefits the East Asian dollar bloc as a whole. However, the untethered yen/dollar rate remains an important—and potentially disruptive—outlier.

F3, F31, F32, F33

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## 1 More Exchange Rate Flexibility in East Asia?

Before the 1997-98 Asian crisis, East Asian economies Hong Kong, Indonesia, Korea, Malaysia, Philippines, Singapore, Taiwan, and Thailand had pegged their exchange rates to the dollar. Although these smaller East Asian countries used a variety of exchange rate systems, their common peg to the dollar provided an informal common monetary standard that enhanced macroeconomic stability in the region. China joined the system in 1994 when it unified its foreign exchange market and adopted a stable peg to the dollar. (Only Japan was a “pure” floater with wide fluctuations in the yen/dollar exchange rate.)

With the advent of the 1997-98 Asian crisis, the common East Asian monetary standard fell apart. Although China and Hong Kong retained their dollar pegs, the debtor countries Indonesia, Korea, Malaysia, Philippines and Thailand were forced to float, i.e., let their currencies fall precipitately when they were attacked. Even the creditor countries which were not attacked, Taiwan and Singapore, engineered moderate depreciations. And, Japan, as the outlier, let the yen float downward substantially over 1997 through mid 1998 and thus aggravated the crisis for the other East Asian economies (McKinnon and Schnabl, 2002).

The lesson drawn from the currency attacks on the debtor economies by the International Monetary Fund (IMF) and many other commentators was (is) that the pre-1997 system of “soft” dollar pegs itself was at fault. Before 1997, because of high risk premia, the interest rates in the East Asian debtor economies were much higher than on dollar or yen assets. Thus, in order to make loans in, say, Thai baht, Thai banks were tempted to accept low-interest dollar (or yen) deposits instead of relatively high-interest baht deposits. And this temptation to risk foreign exchange exposure was all the greater because the baht/dollar exchange rate was (softly) fixed. So, this critique runs, if the exchange rates of the debtor economies had been fluctuating more randomly, the Thai (or Korean, or Indonesian, or Malaysian, or Philippines) banks would see greater risk and be less prone to short-term overborrowing in foreign exchange in the first place. Further, by introducing more flexibility in exchange rates *ex ante*, the critics of soft dollar pegging contend that large discrete depreciations become less likely *ex post*, i.e., after some political or economic disturbance that provokes an attack.

This line of reasoning against restoring soft dollar pegs has been so persuasive that academic commentators and international agencies fear a return to the pre-1997 regime. Post-crisis the IMF has warned of “an important danger [...] in slipping back into *de facto* pegging of exchange rates against the U.S.

*dollar*” (Mussa et al. 2000: 33). For emerging markets open to international capital flows, Stanley Fischer (2001: 5-10) has argued that soft pegs are not sustainable. Post-crisis, he sees most emerging markets moving towards more flexible exchange rates. Indeed, Fischer sees movement towards a bipolar world where a few emerging markets such as Hong Kong adopt hard pegs, while all the others move toward greater exchange rate flexibility:

In the last decade, there has been a hollowing out of the middle of the distribution of exchange rate regimes in a bipolar direction, with the share of both hard pegs and floating gaining at the expense of soft pegs. This is true not only for economies active in international capital markets, but among all countries. A look ahead suggests this trend will continue, certainly among the emerging market countries. The main reason for this change, among countries with open capital accounts, is that soft pegs are crisis-prone and not viable over long periods. (Fischer 2001: 22)

Similarly, based on monthly observations, Hernández and Montiel (2001) find that Indonesia, Korea, Philippines, Singapore, Taiwan, and Thailand have more flexible (but not purely flexible) exchange rates than in the pre-crisis period.

The IMF position in favor of more exchange rate flexibility in East Asia is reflected in its official classification of East Asian exchange rate arrangements shown in Table 1. As of June 2001, all East Asian countries that had *not* adopted clearly visible pegs (China, Hong Kong, and Malaysia) were classified as managed or independent floaters.<sup>1</sup> Going one step further, the IMF sometimes pressures countries to announce an internal monetary standard—such as inflation targeting—as a substitute for relying on the exchange rate as their nominal anchor.

Against this by-now-conventional wisdom, we shall argue in favor of dollar pegging—at least for East Asia. Indeed, we argue that the IMF’s “worst” fears could well be realized: low-frequency dollar pegging (as in Malaysia) will follow the path of high-frequency pegging, and exchange rate volatility will diminish. The informal East Asian dollar standard could be accidentally resurrected by national central banks acting independently. Our analysis has both an empirical and a theoretical dimension.

First, we rationalize why developing countries with incomplete domestic financial markets use (soft) dollar pegging to mitigate short-term domestic payments risk on the one hand, while providing a useful nominal anchor for national monetary policies on the other. What underlying theories could explain soft dollar pegging as optimizing behavior?

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<sup>1</sup> Since as of September 2000, Thailand and Indonesia have been re-classified from “independently floating” to “managed floating”.

Second, we show empirically that, Japan aside, the East Asian dollar standard is re-establishing itself in the post crisis period. But to get a balanced view of the extent of this reformation, we distinguish “high-frequency”, i.e., day-to-day or week-to-week dollar pegging, from “low-frequency”, i.e., month-to-month or quarter-to-quarter, dollar pegging. We question whether the IMF’s system of classifying which countries have floating exchange rates in Table 1 corresponds to reality—particularly at high frequencies of observation.

**Table 1: East Asian Exchange Rate Arrangements According to the IMF Classification**

<b>Country</b>	<b>Classification</b>
China	Other conventional fixed peg arrangement
Hong Kong	Currency board arrangement
Indonesia	Managed floating (monetary aggregate target)
Korea	Independently floating (inflation targeting framework)
Malaysia	Other conventional fixed peg arrangements
Philippines	Independently floating (monetary aggregate target)
Singapore	Managed floating
Taiwan	Managed floating*
Thailand	Managed floating (inflation targeting framework)
Japan	Independently floating

Source: IMF: IFS (September 2002) and \* Fischer (2001: 8).

## **2 Low-Frequency Dollar Pegging and the Common Nominal Anchor**

To discuss the rationale for the return to the pre-crisis exchange rate arrangements, let us discuss low-frequency dollar pegging first. Based on monthly observations from 1980, Figure 1 shows that all East Asian countries except Japan stabilized the dollar values of their currencies up to the 1997-98 crisis—and, with the major exception of Indonesia, could be returning to such pegging in the near future. With base 100, the various country panels in Figure 1 use the same vertical scale for dollar

exchange rates (except for Indonesia) so that the observer can more easily compare proportional changes.

East Asian countries used a variety of exchange rate systems ranging from a currency board hard peg in Hong Kong to a sliding or crawling peg in Indonesia before 1997. Although these pegs were often not openly admitted or were disguised as currency baskets, the common adherence to the dollar is easy to recognize. After a series of official devaluations before 1994, China has since maintained a hard, if informal, peg of 8.3 yuan to the dollar and a unified foreign exchange market.<sup>2</sup> Malaysia introduced a fixed exchange rate of 3.8 ringgit to the dollar in September 1998.

[Figure 1]

## 2.1 Trade Invoicing

The rationale for low-frequency dollar pegging does not primarily arise because of strong trade ties with the United States. The US accounts for only about 21% of overall exports of the smaller East Asian economies—and for considerably less of their imports. Instead, we focus on the fact that most of East Asian commodity trade is invoiced in dollars (McKinnon 2000). The next section, on high-frequency pegging, analyzes the importance of dollar-denominated debt in the region.

To show the predominance of dollar invoicing in East Asia, Table 2 displays Korea's invoicing practices. In the 1990s, the percentage of imports invoiced in US dollars was about 80%, while the proportion of dollar invoicing of Korean exports was even higher. Because the other smaller economies countries are less industrialized than Korea, their currencies are even less likely to be used in foreign trade, with the proportion of dollar invoicing being correspondingly greater.

In striking contrast, yen invoicing in Korean trade is surprisingly small. In 2000, Table 3 shows that only 5.4% percent of Korean exports were invoiced in yen—and only 12 to 13% of Korean imports. This is “surprising” because Japan is at least as important a trading partner with Korea as is the United States—and direct investment by Japan in Korea has been much higher. Table 3 also shows that the use of European currencies is negligible.

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<sup>2</sup> Before the 1990s, China's official exchange rate against the dollar was often changed, and different rates existed for commercial transactions. Only the official exchange rate is reported in Figure 1, but the foreign exchange market has been unified since 1994.

**Table 2: Invoice Currencies in Korean Trade, 1980-2000 (percent)**

	Exports (receipts)					Imports (payments)				
	\$	¥	DM	£	other	\$	¥	DM	£	other
1980	96.1	1.2	2.0	0.4	0.3	93.2	3.7	1.7	0.5	0.9
1985	94.7	3.7	0.6	0.3	0.7	82.4	12.3	2.0	0.5	2.8
1990	88.0	7.8	2.1	0.5	1.7	79.1	12.7	4.1	0.9	3.4
1995	88.1	6.5	2.4	0.8	2.2	79.4	12.7	3.8	0.7	3.4
2000	84.8	5.4	1.8	0.7	7.3	80.4	12.4	1.9	0.8	4.4

Source: Bank of Korea: Monthly Statistical Bulletin. Trade in services is not included.

The use of the yen in invoicing intra-Asian trade is of particular interest because the economic linkages with Japan are particularly strong. From Table 3, which summarizes how different currencies are used in overall Japanese trade, we draw two conclusions. First, in contrast to other industrial countries, the dollar—and not the domestic currency, i.e., not the yen—dominates. In 2000, 52.4% of Japan’s worldwide exports and 70.7% of Japan’s aggregate imports were invoiced in dollars—while only 36.1% of world exports and 23.5% of imports were invoiced in yen.

Second, although Japan’s currency is a bit more important in trade with Asian neighbors, the differences are surprisingly small. In 2000, 48.2 % of Japan’s exports to Asia and 24.8% of her imports from Asia were invoiced in yen. By comparison, 50.0% of Japanese exports to Asia and 74.0% of Japanese imports from Asia were invoiced in US dollars (Table 4).

Although Japan is the world’s second largest industrial economy, the dollar is more widely used in Japanese trade with East Asia than is the yen. As Sato (1999: 574) puts it, the East Asian countries are unlikely to use the yen in their foreign trade except when that trade is with Japan. We conclude that the US dollar predominates in invoicing East Asian trade in general and intra-East Asian trade in particular. Thus, despite lively discussions as in Kwan (2001) about the possibility of a yen zone in East Asia, the revealed invoicing preferences of Asian importers and exporters indicate the contrary: the area has been, and is, a strong dollar zone—from which the dollar shows no signs of being displaced. This dollar invoicing helps explain why the smaller East Asian economies including China are so anxious to peg to the dollar at both low and high frequencies.

**Table 3: Invoice Currencies in Japanese Trade, 1980-2000 (percent)**

<b>Exports</b>												
	World			US			Asia			EU		
	\$	¥	other	\$	¥	other	\$	¥	other	\$	¥	other
1980	66.3	28.9	4.8									
1987	55.2	33.4	11.4	84.9	15.0	0.1	56.5	41.1	2.4	8.2	44.0	47.8
1990	48.8	37.5	13.7	83.7	16.2	0.1	48.1	48.9	3.0	6.4	42.1	51.5
1995*	52.5	36.0	11.5	82.9	17.0	0.1	53.4	44.3	2.3	12.2	34.9	52.9
2000*	52.4	36.1	11.5	86.7	13.2	0.1	50.0	48.2	1.8	13.0	33.5	53.5

<b>Imports</b>												
	World			US			Asia			EU		
	\$	¥	other	\$	¥	other	\$	¥	other	\$	¥	other
1980	93.1	2.4	4.5									
1987	81.7	10.6	7.7	90.6	9.2	0.2	87.6	11.5	0.9	19.5	27.3	53.2
1990	75.5	14.6	9.9	88.2	11.6	0.2	78.8	19.4	1.8	16.3	26.9	56.8
1995*	70.2	22.7	7.1	78.4	21.5	0.1	71.9	26.2	1.9	16.1	44.8	39.1
2000*	70.7	23.5	5.8	78.7	20.8	0.5	74.0	24.8	1.2	17.5	49.7	32.8

Source: Sato (1999), MITI: Yushutsu (Yu'nyû) Kessai Tsûka-date Dôkô Chôsa, and Ministry of Finance: Bôeki Torihiki Tsûka-betsu Hiritsu. Asia = 19 to 22 Asian Countries. \* September.

## 2.2 The Macroeconomic Rationale for Low-Frequency Pegging

Using a much bigger data set going on beyond East Asia, Guillermo Calvo and Carmen Reinhart (2002), showed what they called “fear of floating” in developing countries on a worldwide scale. Although a small number of Eastern European transitional economies and ex colonies peg to the euro, the rest of the developing world pegs “softly” to the dollar. From monthly data, they showed that exchange rates in developing countries were much less volatile—and interest rates as well as exchange reserves much more volatile—than in the industrial countries.

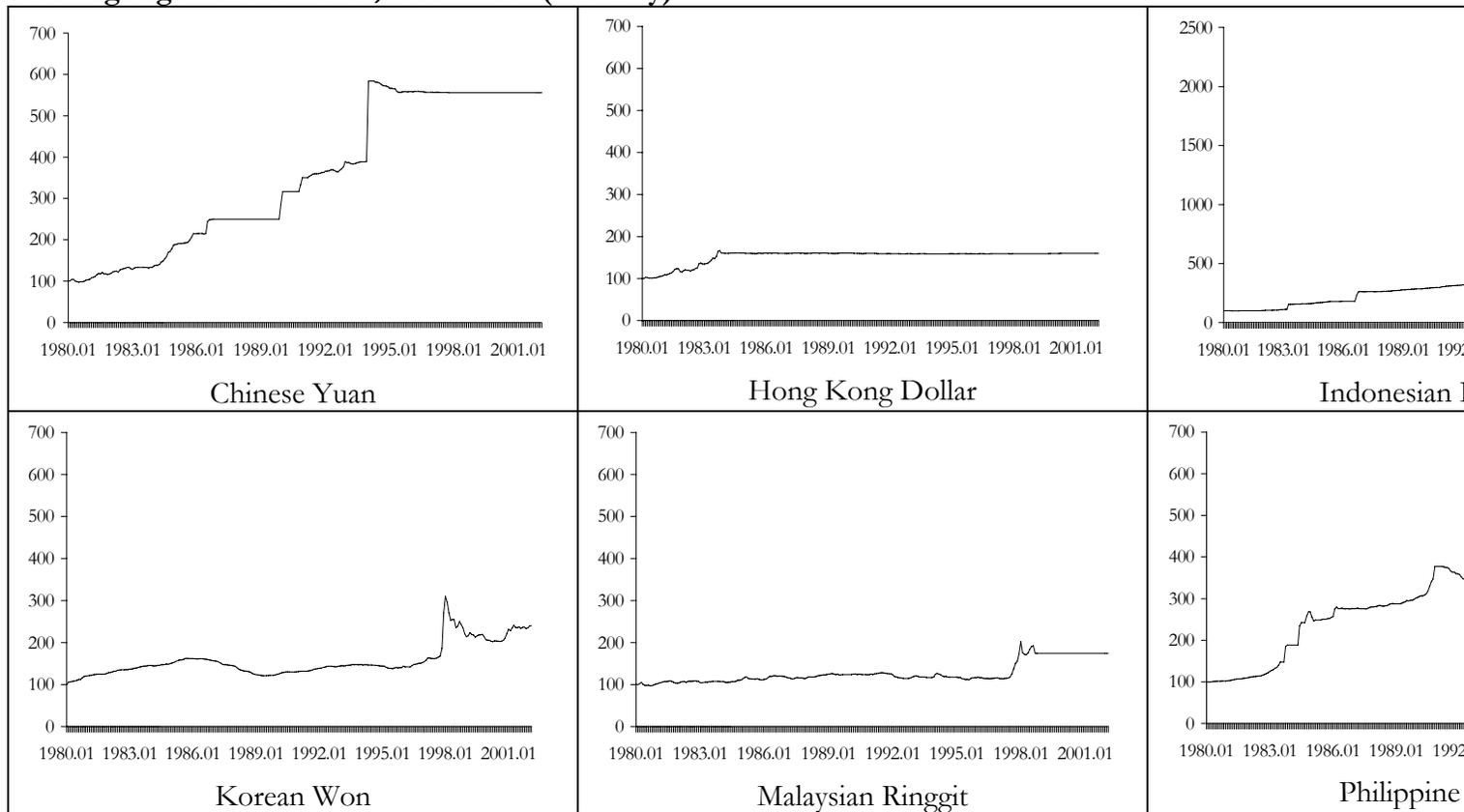
Their rationale for the low frequency—i.e., month-to-month, or quarter-to-quarter—pegging they observed is nicely summarized by Reinhart (2000, p. 69) thus.

The root causes of the marked reluctance of emerging markets to float their exchange rates are multiple. When circumstances are favorable (i.e., there are capital inflows, positive terms of trade shocks, etc.) many emerging markets are reluctant to allow the nominal (and real) exchange rate to appreciate. ... When circumstances are adverse, the fear of a collapse in the exchange rate comes from pervasive liability dollarization. Devaluations are associated with recessions and inflation, and not export-led growth.

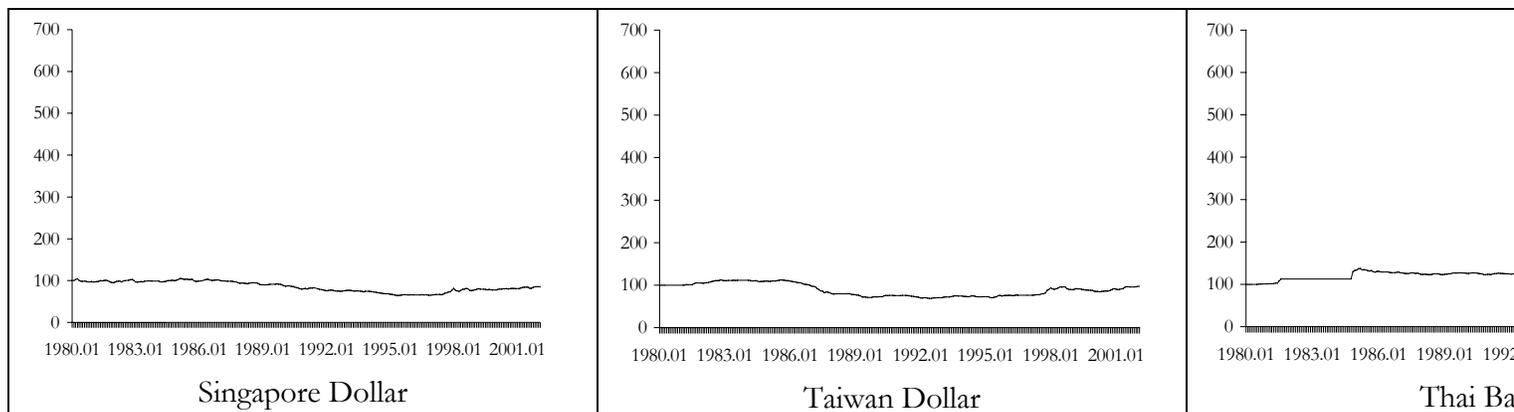
There are two related aspects to their argument explaining fear of floating. Both are macroeconomic in nature. First, in the absence of capital controls, volatile net capital flows could sharply affect nominal exchange rates and, because the domestic price level is relatively sticky, could otherwise lead to large changes in a country's real exchange rate. Its international competitiveness could fluctuate sharply from one month to the next.

Second, the common low-frequency peg to the dollar can anchor any one country's price level because such a high proportion world trade is invoiced in dollars. In non-crisis periods, price increases in the traded goods sector are pinned down. The upward drift of prices in the nontradables (service) sector is muted because of substitution relationships.<sup>3</sup>

How successful was the dollar anchor in East Asia? Figure 1 and **Figure 1: East Asian Exchange Rate Pegs against the Dollar, 1980 – 2002 (Monthly)**

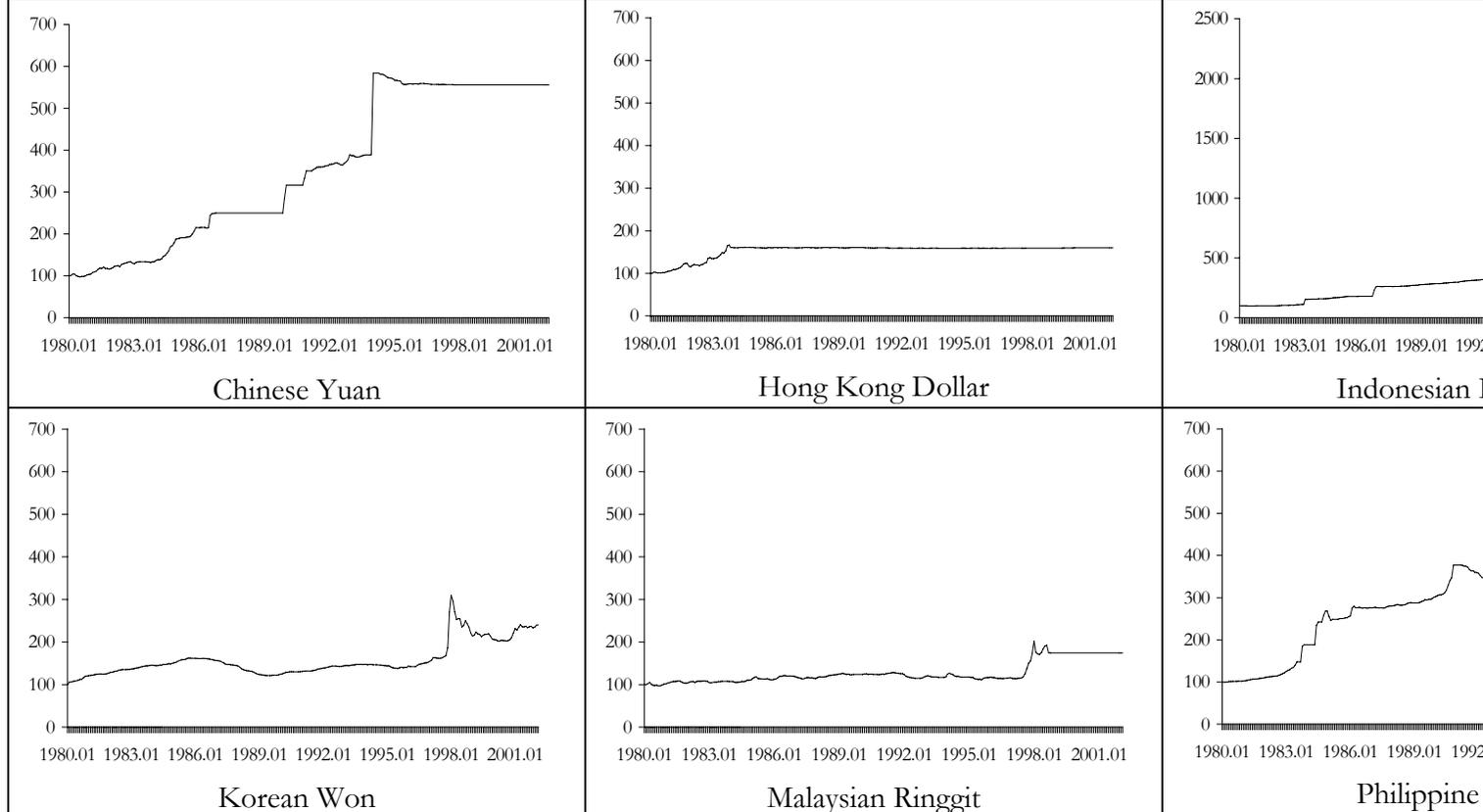


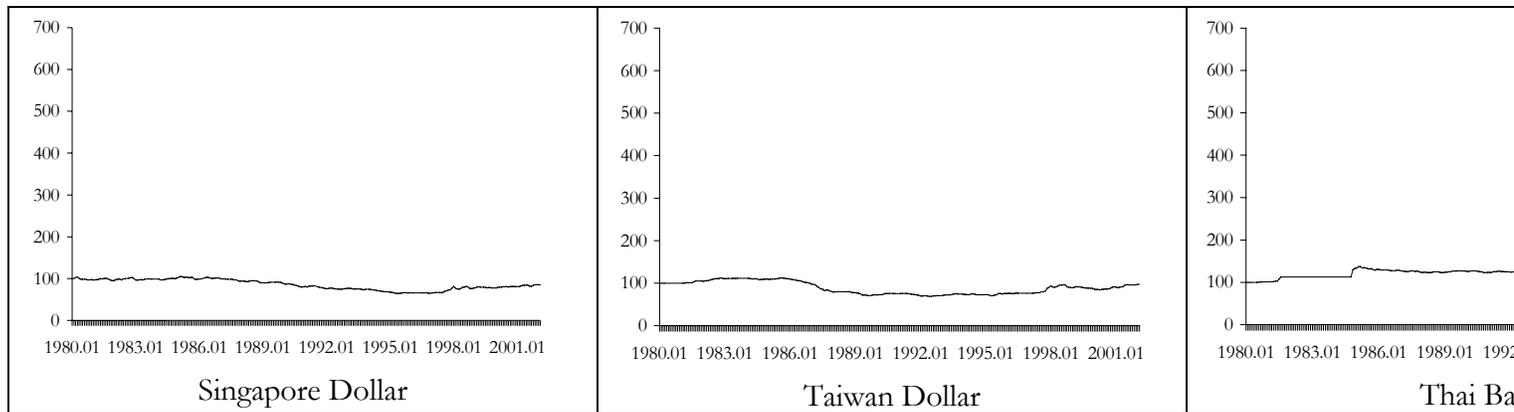
<sup>3</sup> The difference between the price level for traded and nontraded goods (the Balassa-Samuelson effect) is only significant for Hong Kong and Korea.



Source: IMF: IFS, Central Bank of China. Index 1980.01=100. Note different scale for Indonesia.

Figure 2 show the close link between exchange rate stability and price stability for tradable goods (wholesale prices). From 1980 to 1997, the various country panels in **Figure 1: East Asian Exchange Rate Pegs against the Dollar, 1980 – 2002 (Monthly)**





Source: IMF: IFS, Central Bank of China. Index 1980.01=100. Note different scale for Indonesia.

Figure 2 shows that only the wholesale price indices of Indonesia and the Philippines rose significantly. Both countries had allowed their currencies to continually depreciate against the dollar albeit in a controlled fashion. In contrast the wholesale prices of the all other smaller East Asian countries which did not depreciate, or depreciated very little, are grouped around the wholesale price index of the United States. Before 1997, Singapore had allowed its currency to float gently upward against the dollar, and thus had slightly less wholesale price inflation than did the United States. Thanks to this collective pegging to the dollar, the developing countries of East Asia had low or moderate inflation.

[Figure 2 ]

This common dollar anchor was more robust because all East Asian countries except Japan were on it. Then international commodity arbitrage within the whole East Asian dollar zone, and not just with the United States, could better pin down the domestic price level of any one participating country. Indeed, in the great 1997-98 crisis when Indonesia, Korea, Malaysia, Philippines, and Thailand were suddenly forced to devalue—and curtailed imports while trying to stimulate exports—this forced a deflation in the *dollar* prices of goods traded in the region (McKinnon 2001). Thus China and Hong Kong which did not devalue experienced significant deflation in their domestic prices.

Pre-1997 exchange rate targeting was consistent with fiscal discipline and the absence of excessive monetary expansion. As stressed by the World Bank’s (1993) report on the East Asian Miracle and by the IMF in the aftermath of the Asian crisis, government budgets in the smaller East Asian economies had been virtually balanced. Before the crisis, the small East Asian countries had low budget deficits or were even running budget surpluses. Inflation was moderate. Their budget deficits

were even low by the standards of industrialized countries.<sup>4</sup> Instead of currency overvaluation in the usual sense arising from uncontrolled domestic inflation, the currency attacks in the formerly crisis economies were mainly provoked by an undue build up of short-term dollar indebtedness over 1994-96 and the “extraneous” sharp depreciation of the yen in 1997-98 (McKinnon and Schnabl, 2002).

### 3 High-Frequency Dollar Pegging and “Original Sin”

Unlike the nominal anchor argument for low-frequency pegging, we hypothesize that the rationale for high-frequency pegging on a daily or weekly basis is because the capital markets of emerging markets are incomplete—the doctrine of “original sin” as put forward by Barry Eichengreen and Ricardo Hausmann (1999: 3):

“Original sin” ... is a situation in which the domestic currency cannot be used to borrow abroad or to borrow long term, even domestically. In the presence of this incompleteness, financial fragility is unavoidable because all domestic investments will have either a currency mismatch (projects that generate pesos will be financed with dollars) or a maturity mismatch (long-term projects will be financed by short-term loans).

Critically, these mismatches exist not because banks and firms lack the prudence to hedge their exposures. The problem rather is that a country whose external liabilities are necessarily denominated in foreign exchange is by definition unable to hedge. Assuming that there will be someone on the other side of the market for foreign currency hedges is equivalent to assuming that the country can borrow abroad in its own currency. Similarly, the problem is not that firms lack the foresight to match the maturity structure of their assets and liabilities; it is that they find it impossible to do so. The incompleteness of financial markets is thus at the root of financial fragility.

In developing countries, in what sense are financial markets incomplete? In the first place, a fixed-interest bond market is typically absent. The reasons are many. On the private side, domestic firms tend to be small, without well developed accounting systems, and cannot issue bonds on their own name. Firms with longer term projects cannot issue fixed-interest bonds or mortgages for finance at comparable terms to maturity. Instead, they must roll over short-term bank loans—or, at best, borrow at medium term with variable interest rates tied to short rates.

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<sup>4</sup> In developing countries, fiscal and monetary discipline are closely linked because the domestic bond markets are underdeveloped. With the access to domestic and international bond markets restricted, printing money is the common means to finance public expenditure unless revenue from traditional taxes is substantial. A fixed exchange rate deprives the government of the inflation tax as revenue because undue monetary expansion would depreciate the domestic currency. Fiscal discipline is the only way to ensure the exchange rate’s stability (Chin/Miller 1998).

Even on the government side, developing countries may well have shaky financial histories, inflation and interest rate volatility coupled with exchange controls, that inhibits potential buyers of government bonds from making medium or long term commitments. Insofar as a market in government bonds exists into the medium term, interest rates are typically adjusted to reflect some very short term rate. An ostensible “one-year” bond might have its interest rate tied to that on overnight treasuries.

In the second place, an active forward market in foreign exchange against the dollar—or any other currency—is also absent in most developing countries. While a missing domestic bond market is obviously bad for domestic capital markets, why should it affect forward transacting by risk-averse traders wanting to hedge their open positions in foreign exchange? Potential market makers such as banks traders cannot easily cover transactions involving selling the domestic currency forward for, say, dollars because they can’t hold a convenient array of interest-bearing domestic bonds liquid at different terms to maturity. Indeed, domestic interest rates (*vis-à-vis* foreign) are not available for determining what the proper premium on forward dollars should be.

(In contrast, forward exchange transacting between any two industrial countries can thrive because each has a well developed domestic bond market denominated in its domestic currency. Long term forward markets, with a well defined forward premium equal to the interest differential between the two national bond markets at each term to maturity, can thrive at much lower cost.)

### **3.1 The Microeconomic Rationale for High-Frequency Pegging to the Dollar**

Absent an efficient forward market in foreign exchange, risk-averse importers and exporters cannot conveniently hedge. Nor can banks easily cover open positions in foreign exchange.

Suppose first that the private sector of our underdeveloped economy was *not* a net debtor to the rest of the world and its imports and exports were more or less balanced. Then domestic importers could possibly buy dollars forward from domestic exporters at shorter terms to maturity—although such matching would be difficult (high transaction costs) because the domestic forward market for foreign exchange lacks liquidity. Absent liquid domestic money-market instruments at all terms to maturity, banks—who typically act as agents for domestic importers and exporters in the forward exchange markets—could not easily cover themselves.

Now suppose that the private sector is a net short-term debtor, largely in dollars, to the rest of the world. Then, notwithstanding the country's government having positive official dollar reserves, the hedging problem for private traders is compounded. Collectively, domestic debtors with future foreign exchange obligations should buy dollars forward to cover themselves. But foreigners collectively are unwilling to sell dollars forward net because they cannot find liquid interest-bearing domestic-currency assets, i.e., bonds, to hold in the interim. Whence the inevitable currency mismatch: economic agents with net foreign exchange (dollar) exposure—usually very short term—cannot hedge even if they wanted to.

So what are the implications for official foreign exchange policy? To offset the non-existent private market in forward exchange, the government is induced to provide an informal hedge by keeping the exchange rate stable in the short to medium term. Private banks and enterprises can then repay their short-term foreign currency debts, which are largely denominated in dollars, with minimal exchange rate risk. If a country's financial markets are condemned by original sin, its regulatory authorities have strong incentives to undertake high frequency exchange rate pegging in order to mitigate payments risk (McKinnon 2001). And the emerging market countries in East Asia are no exception, as we shall show empirically.

Alternatively, the same missing-domestic-bond-market argument could be used to justify official intervention to create a “market” in forward exchange. Presuming that the government has plentiful dollar reserves, it could risk selling dollars forward to individual importers, or to financial institutions, which have forward exchange exposure. Even if the government has the best of intentions, however, this leaves open the question of what the appropriate forward premia on dollars should be for these various individualized contracts. Worse, a government could easily use such contracts to subsidize its “friends” in the private sector. All around the world, patronage scandals erupt when governments have tried to simulate forward markets. At the outset of the East Asian crisis in June 1997, suddenly it was discovered that the central bank of Thailand had sold forward most of the country's foreign exchange reserves to finance companies and other “deserving” Thai business men. Similarly, late in 1997, the new incoming Korean government found that the Bank of Korea had committed much of its official dollar reserves to the overseas subsidiaries of Korean commercial banks.

So, a more neutral and more visible second-best strategy (the first best being to create a domestic bond market!) for reducing foreign exchange risk is for the government to keep the exchange rate from moving much on a day-to-day or week-to-week basis. At higher frequencies of observation

than those considered by Calvo and Reinhart (2002), there is “fear of floating”. Except for the small economies in Eastern Europe attached to the euro, the dollar is the natural currency to which to peg. It is the principal invoice and vehicle currency in East Asia and elsewhere in the developing world. And later we shall show that East Asian countries do peg softly to the dollar at high frequencies.

But pegging to the dollar to limit exchange risk still leaves open two big problems in risk management. The first is the question of extraneous exchange rate fluctuations between the dollar and other major currencies. The second is moral hazard in the sense that economic agents, whether domestic banks or firms, prefer to gamble rather than to hedge their bets in the foreign exchanges. Let us discuss each in turn.

### **3.2 Extraneous Exchange Rate Risk and Double Hedging**

The first problem is that of "extraneous" exchange rate changes between major currencies—as in East Asia when the yen fluctuates against the dollar. For example, from Table 2, we know that a small but significant (about 12 to 13 percent) proportion of Korean imports are invoiced in yen. Let us suppose that in the short and medium terms that these yen prices are sticky. Similarly, all dollar prices that Korean importers (or exporters) face are sticky and invariant to fluctuations in the yen/dollar rate. Thus, if the won is pegged to the dollar, Korean importers of yen-invoiced goods are at risk.

Suppose a Korean importer is obligated to pay 100 yen in 60 days. Then any random appreciation of the yen against the dollar within the 60-day interval will increase the won cost of servicing that debt. If the won prices for which the importer can sell his Japanese goods in Korea are sticky, then he could buy forward 100 yen *for dollars* in order to hedge the transaction. Because both Japan and the United States have well developed bond markets, a well defined and highly liquid forward inter-bank market between yen and dollars is cheap to use. Thus, the Korean importer, using his bank as his agent, can buy forward all the yen he needs for dollars. And with the won kept predictably stable against the dollar in the spot markets, he can use spot won to buy the dollars 60 days hence when his yen payment is due.

So we have a theory of the optimal—albeit second-best—*double hedge* against currency risk. The bulk of the goods traded by any East Asian emerging market economy are priced to market (sticky priced) in dollars. For these goods, the government’s soft pegging against the dollar in the short and

medium terms is an informal hedge against exchange risk which compensates for the absence of a forward market between the domestic currency and dollars. However, for that subset of imports or exports which are invoiced in yen, euros, sterling, or some other major currency that fluctuates widely against the dollar, then supplementary hedging in the well-developed forward markets between dollars and the major currency in question is also necessary. As we shall show later, this strategy of reducing exchange risk by double hedging—starting with a peg to just one major international currency—dominates the trade-weighted currency-basket approach involving the developing country in question “pegging” to several major international currencies with different weights.

### **3.3 Moral Hazard**

So far, we presumed that merchants and banks were well behaved: they wanted to hedge against currency risk. But we know that deposit insurance banks and other bailout provisions for some firms creates moral hazard that makes at least some of them willing to gamble at the government’s expense. In particular, banks might actively increase their net foreign exchange exposure as well as making domestic loans with a high risk of default. (McKinnon and Pill, 1999). Thus, governments in developing countries typically try, albeit imperfectly, to constrain banks from taking open positions in foreign exchange—and these ordinary prudential regulations are sometimes supplemented with some form of capital control.

We have just shown that, under original sin, governments want to peg (albeit softly) to the dollar to allow legitimately risk-averse firms and banks to informally hedge their forward exchange exposure. But does this soft pegging not encourage badly behaved banks to overborrow by accepting dollar or yen deposits with very low interest rates to make loans at much higher interest rates in the domestic currency? After all, much of the genesis of the 1997-98 East Asian crisis came from banks overexposing themselves in dollars or yen.

Although very contentious, there are two offsetting considerations. First, the IMF contends that soft pegging took away much of the immediate risk from borrowing in dollars because “bad” banks did not have to worry about near-term exchange rate fluctuations (Fischer, 1999). Thus, in this conventional view, for any given interest differential, the moral hazard would have been better contained had the currencies of each of the Asian countries floated more freely against the dollar. Against this, however, is the view that the risk premium in domestic interest rates is a direct function of how sta-

ble the domestic money is relative to the center currency, i.e. the dollar. Thus if the domestic exchange rate against the dollar varies erratically in a free float, domestic interest rates will be higher and so will the margin of temptation to overborrow in foreign exchange (McKinnon and Pill, 1999).

In summary, one cannot say a priori whether or not soft pegging aggravates the moral hazard in badly regulated banks to overborrow. But for well-behaved banks and merchants, i.e. those that are properly risk averse, soft pegging to the dollar reduces their forward exchange risks.

### **3.4 Capital Controls versus Limits on Net Foreign Exchange Exposure by Banks**

Governments typically try to contain moral hazard in banks by various kinds of regulations. What then are implications of such regulation for optimal exchange rate policy?

The government could impose strict capital controls in the Chinese mode which ensure that private banks don't hold or owe foreign currencies. This would drive the banks out of the profitable business of accepting low-interest rate foreign exchange deposits to finance higher yield domestic-currency loans. The inflow of short-term capital and associated dollar indebtedness would be restricted, which could well be what a prudent government prefers. However, full-scale capital controls on taking any *gross* positions in foreign exchange have the unfortunate side effect of limiting double hedging. Domestic importers and exporters cannot then hedge their extraneous foreign exchange risk because their banks could not take forward positions in markets among major currencies.

Less draconian than full-scale capital controls, government regulatory agencies could still prohibit banks (and possibly other financial institutions) from taking *net* open positions in foreign exchange. In this case, banks could still do covered interest arbitrage and thus provide forward exchange cover for their retail customers. For example, if a Thai importer wanted hedge his extraneous exchange rate risk by buying yen with dollars 90 days forward, the Thai bank could sell the necessary forward yen to the importer. But the Thai bank would be required to cover itself immediately by buying yen for dollars spot or forward—most likely in the international inter-bank market for foreign exchange.

Similarly, preventing banks from having no net foreign exchange exposure need not hinder some development of the domestic bond market with a rudimentary forward exchange market between the domestic currency and the dollar. Even though the forward market was not (yet) very liquid, the banks could still sell dollars forward to importers and match this by buying dollars forward from exporters—provided that the country's private sector was not a large net dollar debtor. But domestic

banks would still be prevented from being international financial intermediaries, i.e., borrowing in foreign currencies to lend in the domestic one. For the economy overall, this would forestall a build up of net short-term foreign currency indebtedness like that preceding the 1997-98 Asian crisis.

### **3.5 The Impossibility of Freely Floating Exchange Rates?**

When governments impose tough prudential regulations against banks taking foreign exchange risks, can exchange rates float freely? With either general capital controls or prudential regulations against net foreign exchange exposure by banks in place, we hypothesize that governments have little choice but to peg their exchange rates—perhaps only “softly” from one day to the next. Why?

The interbank spot and forward exchange markets are at the center of foreign exchange trading the world over. In any country, its banks normally have direct access to this international market and are the dealers that match buy and sell orders for the domestic currency. Absent any government intervention, these dealers must continually take open positions—for or against the domestic currency—in order to “make” the foreign exchange market. In textbooks on international finance, banks are the natural “stabilizing” speculators when there is confidence in the domestic currency. In a well behaved market, expectations regarding short-term movements in exchange rates are naturally regressive. That is, when the domestic currency depreciates market makers believe that it will eventually rebound and vice versa. Then a reasonably smooth bank-based float is feasible.

Now suppose that domestic commercial banks are not allowed to take open positions in foreign exchange. Moreover, in the presence of original sin, there is no liquid market in domestic bonds. Then *foreign banks are unwilling to take open positions in the domestic currency*. Thus, with a tightly regulated domestic banking system and/or capital controls, a satisfactory free float is impossible. With no natural market makers in the system, the exchange rate would move so erratically as to be intolerable. In most developing countries, governments recognize this problem—at least implicitly. Day-to-day, , the central bank then makes the market often by simply pegging—albeit softly and informally—the domestic currency to the dollar.

In summary, we have two complementary reasons why governments in developing countries usually opt to keep their exchange rates stable on a high frequency basis:

- (1) Without a well organized market in forward exchange (original sin), the government wants to provide an informal forward hedge for importers and exporters.
- (2) But fear of overborrowing leads many prudent governments to limit net foreign exchange exposure by domestic banks—in the extreme by using capital controls. These regulatory restraints then prevent the banks from being active dealers to stabilize the exchange rate.

In the industrial countries, these problems are not so acute. Because of a well developed domestic market in forward exchange, their banks need not be so tightly regulated to prevent foreign exchange exposure. In part because of the active forward exchange market, the problem of containing moral hazard in banks is less—a virtuous circle. So the industrial countries can more easily tolerate a free float—as we shall see. But first consider the exchange rate practices of developing countries in East Asia.

#### **4 The Post-Crisis Return to High-Frequency Pegging: a Formal Empirical Test**

Our empirical analysis of high-frequency dollar pegging in East Asia proceeds in two stages. First we test whether the developing countries of East Asia really have, in non crisis periods, been keying on the dollar more than the yen or euro—and whether basket pegging, where all three currencies are given some weight, was the norm. Was this keying permanently interrupted by the great East Asian crisis of 1997-98? Second, we test for any changes in the volatility of these dollar pegs in the post crisis compared to the pre-crisis period.

With Japan being such an important trader and an even more important source of capital in East Asia, post crisis many authors have proposed pegging to a broader currency basket (Rajan 2002). For instance, Kawai and Akiyama (2000) and Kawai (2002) have proposed to increase the weight of the Japanese yen in the East Asian currency baskets. Williamson (2000) recommends a 33% weight of the Japanese yen.

## 4.1 The Composition of Currency Baskets

Using the regression model developed by Frankel and Wei (1994), we show that the smaller East Asian countries have more or less ignored these recommendations. Instead they have clandestinely returned to high-frequency dollar pegging on a day-to-day basis.

Before the crisis, a few East Asian currencies were *de jure* pegged to a basket of major currencies, but typically the weights assigned to various currencies in the official basket were not announced. To detect the weights of various currencies, Frankel and Wei use an “outside” currency—the Swiss franc—as a numéraire for measuring exchange rate volatility for any East Asian country (except Japan). These volatilities could then be partitioned among movements in major currencies against the Swiss franc. For example, if changes in the Korean won against the Swiss franc are largely explained by the changes of the US dollar against the Swiss franc, we can conclude that the Korean won is virtually pegged to the US dollar. Alternatively it could be pegged to the Japanese yen or German mark.

To show this, we regress the exchange rates of each of the nine East Asian currencies on the US dollar, the Japanese yen, and the German mark<sup>5</sup> with the Swiss franc as numéraire.<sup>6</sup> Equation 1 is the regression model.

$$e_{EA2CurrencySwissfranc_t} = \alpha_1 + \alpha_2 e_{DollarSwissfranc_t} + \alpha_3 e_{YenSwissfranc_t} + \alpha_4 e_{MarkSwissfranc_t} + u_t \quad (1)$$

The multivariate OLS regression is based on first differences of logarithms in these exchange rates. The residuals are assumed to be normal distributed and homoscedastic following  $N(0, \sigma^2)$ . The daily data are compiled from Datastream. According to Frankel and Wei, the  $\alpha$  coefficients represent the weights of the respective currencies in the currency basket. If the East Asian currency is closely fixed to one of the major currencies appearing on the right hand side of equation 1, the corresponding  $\alpha$  coefficient will be close to unity. If a coefficient is close to zero, we presume no exchange rate stabilization against that particular currency.

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<sup>5</sup> As the leading currency of the European currency system, representing the Euro since 01/01/1999.

<sup>6</sup> It can be argued that the Swiss franc is not an arbitrary numéraire with respect to the German Mark because the exchange rates of both currencies move in parallel to the US dollar (Hernández/Montiel 2002: 37-39). However, since the German mark does not play a significant role in the currency basket of the East Asian countries and since the Swiss franc moves more independently of the yen and the dollar, we can neglect this point.

As in McKinnon (2001), we run the regression for three periods: pre-crisis, crisis and post-crisis.<sup>7</sup> The pre-crisis period (869 observations) is from February 1994, when China unified its foreign exchange market, to May 1997. We specify the crisis period (415 observations) to start in June 1997 when the peg of the Thai baht came under strong pressure and was abandoned. Our crisis period ends in December 1998 when the currency attacks had ended. The post-crisis period (921 observations) starts in January 1999 and goes up to July 2002.

### Pre-Crisis

Table 4 reports the regression results for the pre-crisis period and shows the tight peg around the US dollar. The  $\alpha_2$  coefficients in equation 1 are all close to unity and reveal the strong efforts by Asian governments to keep the currencies stable against the dollar on a day-to-day basis. The  $\alpha_2$ -coefficients range from 0.82 for the Singapore dollar up to 1.00 for the Chinese yuan, Hong Kong dollar, and Indonesian rupiah. The adjusted correlation coefficients ( $R^2$ ) being close to unity indicate that fluctuations of the East Asian exchange rate against the Swiss franc can be almost fully explained by fluctuations of the dollar against the Swiss franc.

More specifically, the  $\alpha_2$  coefficients of the Chinese yuan, the Hong Kong dollar and the Indonesian rupiah are unity. Pre-crisis, Indonesia let its currency crawl smoothly downward at 4 to 5% percent per year, but nevertheless it kept the rupiah virtually fixed to the dollar on a day-to-day basis. China and Hong Kong maintained their fixed pegs to the dollar with no downward crawl. The  $\alpha_2$  coefficients of the Korean won, the Philippine peso, and the Taiwan dollar are very close to unity with lower, but still large t-statistics. For the Thai baht and the Malaysian ringgit, the  $\alpha_2$ -coefficients are still close to 0.9 with some small weight on the yen as measured by  $\alpha_3$ .

Singapore pegged less closely to dollar. Its  $\alpha_2$  was still 0.82 and highly statistically significant but some small weight was given to the yen and mark. Indeed, on a lower frequency basis, before 1997 the Singapore dollar drifted smoothly upward against the US dollar at about 1 to 2 percent per year. Singapore's somewhat different behaviour is quite consistent with its being a creditor country with longer term domestic capital markets. With a less fragile domestic financial system, the authorities

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<sup>7</sup> A more comprehensive model which aggregates the three sub-periods into one model and distinguishes the three sub-periods by dummy variables leads by and large to the same results. We report the results for the three isolated

were less concerned with pegging to the dollar and could give more weight to other currencies such as the yen.

**Table 4: Pegging on a High-Frequency Basis, Pre-Crisis (02/01/94 – 05/30/97)**

	Constant $\alpha_1$	Dollar $\alpha_2$	Yen $\alpha_3$	DM $\alpha_4$	R <sup>2</sup> Adj.
Chinese Yuan	-0.00 (-1.15)	1.00*** (142.32)	-0.01 (-0.91)	-0.02 (-1.51)	0.98
Hong Kong Dollar	0.00 (0.30)	1.00*** (411.98)	0.00 (0.28)	-0.01 (-1.37)	1.00
Indonesian Rupiah	0.00*** (3.20)	1.00*** (121.21)	-0.00 (-0.87)	0.01 (0.83)	0.97
Korean Won	0.00 (1.42)	0.97*** (79.31)	0.06*** (4.20)	0.01 (0.28)	0.93
Malaysian Ringgit	-0.00 (-1.48)	0.88*** (66.74)	0.09*** (6.31)	0.01 (0.52)	0.91
Philippine Peso	-0.00 (-0.34)	0.97*** (56.55)	0.02 (1.05)	-0.01 (-0.50)	0.86
Singapore Dollar	-0.00 (-1.32)	0.82*** (50.06)	0.14*** (7.70)	0.08*** (3.12)	0.86
New Taiwan Dollar	0.00 (0.85)	0.98*** (85.22)	0.03** (2.02)	-0.01 (-0.62)	0.93
Thai Baht	-0.00 (-0.61)	0.92*** (91.17)	0.08*** (7.45)	-0.01 (-0.51)	0.95

Source: Datastream. Daily data. T-Statistics in Parentheses. \* significant at the 10% level. \*\* significant at the 5% level. \*\*\* significant at the 1% level. 869 observations.

In contrast, Table 4 shows that the  $\alpha_3$  coefficients for the yen and the  $\alpha_4$  coefficients for the mark are small or close to zero. Small weights can be observed for the Japanese yen for Korea, Malaysia, Singapore, Taiwan, and Thailand—but in general the weights are low, ranging from 0.03 (new Taiwan dollar) to 0.14 (Singapore dollar).

Crisis: June 1997 – December 1998

During this period, attempts to stabilise East Asian currencies against the dollar broke down. Large capital outflows and high volatility in the foreign exchange markets defeated any official stabi-

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sub-periods because the respective R<sup>2</sup>s give additional information about the goodness-of-fit for every single sub-period.

lisation efforts. As shown in Figure 1, only China and Hong Kong continued with unwavering dollar pegs. All other countries abandoned their peg at low as well as high frequencies.

For high-frequency observations, Table 5 shows the estimations of the equation 1 for the crisis period. For  $\alpha_2$  the significantly smaller t-values for all countries except China and Hong Kong represent higher standard errors and thus higher volatility in the exchange rate against the dollar. The goodness-of-fit for these regressions falls completely apart:  $R^2$  (adj.) fell sharply.

The decline in  $R^2$  is particularly marked for the rupiah, won, ringgit, peso and baht. Non-crisis Singapore and Taiwan coped with the crisis by lowering the weight of the US dollar and increasing the weight of the Japanese yen, which itself had depreciated sharply. Except for China and Hong Kong, the weight of the yen, i.e., the  $\alpha_3$  coefficients, increased during the crisis.

Clearly, by refusing to devalue in the great crisis, China and Hong Kong helped contain the inadvertently beggar-thy-neighbour devaluations in Indonesia, Korea, Malaysia, Philippines, and Thailand. Indeed, Malaysia's pegging of the ringgit in September 1998—albeit at a depreciated level—also helped contain contagious exchange rate changes in the region.

**Table 5: Pegging on a High-Frequency Basis, Crisis (06/01/97 – 12/31/98)**

	Constant $\alpha_1$	Dollar $\alpha_2$	Yen $\alpha_3$	DM $\alpha_4$	$R^2$ Adj.
Chinese Yuan	-0.00 (-0.39)	0.99*** (192.60)	0.00 (0.46)	0.01 (0.84)	0.99
Hong Kong Dollar	0.00 (0.02)	1.00*** (186.43)	0.01* (1.89)	0.00 (0.10)	0.99
Indonesian Rupiah	0.00 (1.12)	0.48 (1.06)	0.64** (2.35)	-0.15 (-0.25)	0.02
Korean Won	0.00 (0.62)	1.22*** (5.86)	0.05*** (0.41)	0.05 (0.15)	0.13
Malaysian Ringgit	0.00 (1.39)	0.70*** (5.33)	0.33*** (4.19)	0.11 (0.59)	0.20
Philippine Peso	0.00 (1.42)	0.75*** (6.10)	0.25*** (3.46)	0.27 (1.53)	0.23
Singapore Dollar	0.00 (1.01)	0.69*** (10.74)	0.33*** (8.48)	0.02*** (0.19)	0.49
New Taiwan Dollar	0.00 (1.24)	0.87*** (16.77)	0.08** (2.61)	0.11 (1.44)	0.58
Thai Baht	0.00 (1.04)	0.64*** (4.11)	0.32*** (3.46)	0.21 (0.95)	0.14

Source: Datastream. Daily data. T-Statistics in Parentheses. \* significant at the 10% level. \*\* significant at the 5% level. \*\*\* significant at the 1% level. 415 observations.

Post-Crisis: January 1999 – July 2002

After the 1997-98 crisis, however, dollar pegging—at least when measured on a high-frequency, i.e. day-to-day basis—has made a remarkable return. As shown in Table 6, the  $\alpha_2$  coefficients for all countries again come close to unity as in the pre-crisis period. Except for Indonesia and to some extent the Philippines, the goodness-of-fit as measured by  $R^2$  for each country's regression equation again becomes tight. Thus the smaller East Asian crisis countries have largely returned to the pre-crisis practise of informal dollar pegging.

True, as argued by Kawai (2002) the Japanese yen seems to have assumed a certain post-crisis role in some currency baskets—particularly those of Thailand and Korea—but the yen weights are low in comparison to the US dollar. Small values for the goodness of fit of the regressions for the Indonesian rupiah and the Philippine peso indicate, however, that both countries have been less successful in stabilising their currencies after the Asian currency crisis. In particular, Indonesian foreign exchange policy and domestic inflation remain out of control.

**Table 6: Pegging on a High-Frequency Basis, Post-Crisis (01/01/99 – 07/12/02)**

	<b>Constant</b>	<b>Dollar</b>	<b>Yen</b>	<b>DM</b>	<b>R<sup>2</sup> Adj.</b>
Chinese Yuan	-0.00 (-0.09)	1.00*** (2281.36)	0.00 (1.37)	-0.00 (-0.80)	1.00
Hong Kong Dollar	0.00 (2.54)	1.00*** (1739.07)	-0.00 (-0.75)	0.00 (0.35)	1.00
Indonesian Rupiah	0.00 (0.25)	0.99*** (11.01)	0.23*** (3.32)	0.27 (1.40)	0.25
Korean Won	-0.00 (-0.12)	0.93*** (33.07)	0.15*** (7.14)	-0.01 (-0.20)	0.73
Malaysian Ringgit	0.00 (0.01)	1.00*** (706.62)	0.00 (0.08)	-0.00 (-1.19)	1.00
Philippine Peso	0.00 (1.37)	0.95*** (23.07)	0.10*** (3.18)	-0.00 (-0.10)	0.55
Singapore Dollar	0.00 (0.53)	0.80*** (51.44)	0.16*** (13.96)	0.09*** (2.76)	0.88
New Taiwan Dollar	0.00 (0.41)	0.98*** (69.64)	0.00 (0.87)	0.01 (0.38)	0.90
Thai Baht	0.00 (0.83)	0.84*** (31.60)	0.16*** (8.19)	0.12** (2.27)	0.72

Data source: Datastream. Daily Data. T-Statistics in Parentheses. \* significant at the 10% level. \*\* significant at the 5% level. \*\*\* significant at the 1% level. 921 observations.

A formal statistical test of the post-crisis return to dollar pegging at high frequencies supports our assumption. We perform the Wald test for all currencies except the Chinese yuan, the Hong Kong dollar and the Malaysian ringgit, which are now firmly pegged to the dollar for any frequency of observation. To test if the weight of the dollar in the East Asian currency baskets has changed we use the comprehensive model described in footnote 7. The null hypothesis is that the coefficient for the dollar weight  $\alpha_2$  is the same in the pre-crisis and post-crisis period. If the probability of the Wald test is low (<5%) we can not reject null hypothesis. Otherwise we accept the null hypothesis.

Table 7 reports the results. The null hypothesis is that the  $\alpha_2$  coefficient for each country is the same before and after the crisis. At the 5% level of significance, this null hypothesis can't be rejected for any country. There is no significant difference in the dollar weights of East Asian currency baskets before and after the crisis. However, at the lower month-to-month or quarter-to-quarter frequencies, Figure 1 shows more dollar exchange rate drift than before the crisis. The exceptions, of course, are China, Hong Kong, and Malaysia, all firmly fixed to the dollar at all frequencies of observation.<sup>8</sup>

**Table 7: Wald Test for Change of Dollar Weights in EA<sub>1</sub> Currency Baskets**

	Weight Pre-crisis	Weight Post-crisis	Wald test probabilities
Indonesian Rupiah	0.99	0.98	0.92
Korean Won	0.97	0.93	0.63
Philippine Peso	0.99	0.95	0.63
Singapore Dollar	0.80	0.80	0.77
New Taiwan Dollar	0.96	0.97	0.81
Thai Baht	0.87	0.84	0.65

Data source: Datastream. Pre-crisis = 02/01/94 – 05/30/97, post-crisis = 01/01/99 – 07/12/02.

Using rolling regressions, the country panels in Figure 3 summarise the dollar's weight in each East Asian currency basket during the 1990s. Based on daily data, the rolling 130-day  $\alpha_2$  coeffi-

<sup>8</sup> In a third model variation we pooled the pre-crisis and post-crisis sample and added a dummy for the post-crisis period to test if the composition of the currency baskets as a whole has changed. In this model the dummy variable gives information if the whole currency basket has changed in the post-crisis period. The dummy variable was signifi-

coefficients—representing the weights of the dollar—are plotted for each of the East Asian countries (except Japan). A window of 130 days corresponds to an observation period of six months (5 observations per week). The first window starts on January 1, 1990 and ends on June 29, 1990. The  $\alpha_2$  coefficients are calculated for the first period. Then the window is shifted by one day and the  $\alpha_2$  coefficients are calculated again, up to April 2002. A value of unity stands for a 100 percent weight of the dollar in the respective currency basket. If the coefficient rises above 1, the estimation processes are unstable.

[Figure 3]

As shown in Figure 3, China and Hong Kong have a very stable dollar weight of unity for the whole observation period. For the other countries in the pre-crisis period, the dollar weights are also close to unity and stable. However, during the 1997-98 crisis, the exchange rate stabilisation broke down in Indonesia, Korea, Malaysia, Philippines and Thailand. In these crisis economies, Figure 3 shows sharp departures of their  $\alpha_2$  coefficients from unity. Singapore lowers the dollar's weight in its currency basket during the crisis.

After the crisis, Figure 3 shows that countries have evolved somewhat differently. First, the stabilisation process seems still out of control in Indonesia. Second, Korea and Thailand seem to have slightly lowered the weight of the dollar. Third, Malaysia increased the dollar's weight to 100 percent. Finally, the Philippines and Taiwan seem to have returned to pre-crisis dollar weights. All in all, however, the dollar's weight in East Asian currency baskets has not changed significantly as proved above.

## 4.2 Reducing Daily Exchange Rate Volatility

However, knowing the dollar's  $\alpha_2$  coefficients from equation 1 is not the whole story on exchange rate volatility. In principle, the dollar could get the highest relative weight (as per Frankel and Wei

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cant only for Singapore at the ten percent level which suggests that the composition of Singapore's currency basket has changed. Indeed, the Japanese yen might have received a slightly higher weight in Singapore's currency basket.

1994) in the currency basket without the absolute day-to-day volatility of any one East Asian currency against the dollar returning to its pre-crisis level.

Thus, a more direct, but complementary test, is necessary. We measure volatility as the percentage daily change of the national currency against the dollar (first log differences) from January 1990 through July 2002. The y-axes in the different country panels in Figure 4 have the same scale of  $\pm 8\%$  against the dollar for all currencies.

But to understand what is high and what is low volatility, we need a standard of comparison. Calvo and Reinhart (2002) suggest that the only truly floating exchange rates are those of the inner group of mature industrial countries, such the United States, Japan, Germany or Switzerland. Because these countries have mature, long-term domestic capital markets, their governments have little incentive for day-to-day exchange rate stabilization. Figure 5 compares the daily dollar volatilities of the East Asian countries to those of Germany, Japan, and Switzerland.<sup>9</sup>

From Figure 4, the daily volatility of the dollar exchange rates of Germany, Japan, and Switzerland are indeed an order of magnitude higher than those of our East Asian countries in non-crisis periods. Not only is the daily exchange volatility of these industrial countries very high, but it does not change significantly over time. In contrast, the volatility of the East Asian currencies is generally much lower—but with greater variability over time.

Specifically, the hard pegs of China and Hong Kong exhibit extremely low day-to-day volatility as well as a high stability over time. Discretionary changes in the Chinese yuan in the early 1990s occurred before the introduction of the hard peg in February 1994. Since then, the yuan has been even more stable on a day-to-day basis than has the Hong Kong dollar.

[Figure 4]

For all the other East Asian economies, we observe a changing pattern of daily volatility over time. Up to 1997/98, high-frequency volatility was low except in the Philippines, which experienced higher volatility in the first half of the 1990s—although not as high as in the industrial countries. During the Asian crisis, turmoil in the capital and currency markets is reflected in much greater day-to-day volatility, which is most striking for Indonesia, Korea, Malaysia, Philippines, and Thailand.

For the post-crisis period, we observe a more heterogeneous pattern. First, Singapore and Taiwan, not as strongly affected by the crisis, returned rather fast to the pre-crisis pattern. Note that Singapore stabilizes its currency on the basis of a more diversified currency basket, and therefore its overall exchange rate volatility is smaller than Figure 4 suggests. Second, Malaysia has adopted capital controls and a hard peg to the dollar, so that its exchange rate volatility has declined to zero.

Third, Korea and Thailand have significantly reduced exchange rate volatility, but it seems still to be slightly higher than before the crisis. The larger weight of the yen in the Thai and Korean currency baskets makes a complete return to the pre-crisis level of dollar pegging more difficult. Finally, although Indonesia and the Philippines have been quite successful in reducing the day-to-day volatility of their exchange rates compared to the crisis, volatility is still much higher than before.

The evidence given in Figure 4 is supported by Table 8, which reports the standard deviations of daily exchange rate fluctuations against the dollar. In the pre-crisis period, the standard deviations of the day-to-day exchange rate volatility of all East Asian currencies are much smaller than the standard deviations of the so-called free floaters (Japan, Germany and Switzerland) which are our comparison set. The standard deviations of the hard pegs (China and Hong Kong) are close to zero during and after the crisis. For Indonesia, Korea, Malaysia, Philippines and Thailand, the standard deviations in Table 8 increase massively during the crisis period—with Singapore and Taiwan increasing less.

Since the crisis, the standard deviations of all affected countries have declined again (Table 8). Except for Malaysia, this exchange rate volatility of the crisis economies for the whole post-crisis period (1999-2002) is still larger than before the crisis. However, as depicted in Figure 4 the volatility was relatively higher at the beginning of the post-crisis period in 1999 than more recently in 2002 (Figure 4).

To underline this last point, suppose our “post-crisis” period includes only daily observations from the year 2002. Then the right hand column in Table 8 shows that most East Asian currencies are now less volatile against the dollar than they were before the crisis! In 2002, only Indonesia has still a significantly higher standard deviation. We conclude that all East Asian countries except Indonesia have more or less returned to the pre-crisis level of high-frequency pegging.

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<sup>9</sup> These countries are free floaters against the dollar, but not necessarily against other currencies. For instance before January 1999, Germany was a member of the European Monetary System, which implied a stabilization of its ex-

**Table 8: Standard Deviations of Day-to-Day Exchange Rate Fluctuations against the Dollar**

	pre-crisis	crisis	post-crisis	2002
Chinese Yuan	0.03	0.01	0.00	0.01
Hong Kong Dollar	0.02	0.03	0.00	0.00
Indonesian Rupiah	0.17	4.43	1.34	0.76
Korean Won	0.22	2.35	0.43	0.36
Malaysian Ringgit	0.25	1.53	0.03	0.00
Philippine Peso	0.37	1.31	0.60	0.26
Singapore Dollar	0.20	0.75	0.25	0.22
New Taiwan Dollar	0.19	0.50	0.21	0.12
Thai Baht	0.21	1.55	0.41	0.20
Japanese Yen	0.67	1.00	0.66	0.61
Deutsche Mark	0.60	0.58	0.64	0.51
Swiss Franc	0.69	0.66	0.65	0.53

Data source: Datastream. Percent changes. Pre-crisis = 02/01/94 – 05/30/97, crisis = 06/01/97 – 12/31/98, post-crisis = 01/01/99 – 07/12/02, 2002 = 01/01/02 – 07/12/02.

## 5 Interest Rate Fluctuations: Developing and Industrial Countries Compared

The foreign exchange and monetary policy of the smaller East Asian economies shows a fundamental difference between the foreign exchange and monetary policies of large (comparatively closed) industrial countries with highly developed capital markets and small (open) emerging markets with original sin, which are elaborated in the following section.

### 5.1 Comparative Monetary and Financial Institutions at the Center and the Periphery

Every country has to choose one target of monetary policy—the domestic interest rate or the exchange rate. This choice is strongly influenced by:

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change rate against other EMU currencies.

- (1) the degree of openness of the economy which has impact on the pass through of the exchange rate to the domestic price level and on the domestic business cycle,
- (2) the development stage of the domestic capital markets and thus the ability to hedge the foreign exchange risk of international debt and capital flows.

As shown in Table 9 there are four possible combinations of these two characteristics. First, there are a few large, rather closed industrial countries with highly developed capital markets. The output fluctuations of these economies is mainly driven by the domestic sector and exchange rate fluctuations are of secondary concern for the domestic price level. International lending is overwhelmingly invoiced in the domestic currency. The foreign exchange risk of short-term payment transactions is easy to hedge at low cost, because capital markets are highly developed. These countries are the benchmark free floaters—notably the US, the Euro Area, and Japan. Their currencies qualify as anchor currencies as monetary policy is made with respect to purely domestic targets.<sup>10</sup>

Second, there is a large number of small open development countries and emerging markets with underdeveloped capital markets in Asia, Africa, South America and Central and Eastern Europe. For the output fluctuations of these countries the external sector (exports and imports) is much more important than for the large industrial countries. Wholesale and consumer prices strongly depend on the exchange rate. Further, international debt and international capital flows are mainly invoiced in foreign currency and the foreign exchange risk is difficult to hedge due to original sin. As observed by Calvo and Reinhart these countries have a strong fear of floating.

Further, there are two hybrid groups: Third, there are small open industrialized economies with developed capital markets such as Norway, Switzerland, New Zealand etc. As in the case of the small open emerging market economies the national income and thus output fluctuations depend strongly on international trade. The impact of exchange rate fluctuations on the domestic prices is strong. In contrast to the emerging markets the capital markets are not underdeveloped. The government of these countries can issue bonds internationally in the domestic currency and the foreign risk of short-term payment transaction is easier to hedge. Nevertheless, there is a strong inclination to stabilize exchange rates due to the high pass through of the exchange rate to domestic prices.

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<sup>10</sup> The exchange rate might influence monetary policy indirectly via its impact on inflation and output. However, for large countries such as US, Japan and the Euro Area this impact is comparatively small.

Fourth, there are large rather closed economies with underdeveloped capital markets such as China or Brazil. The output fluctuations of these large emerging markets mainly depend on domestic factors. The pass through of the exchange rate to the domestic price level is comparatively low. But as the capital markets are underdeveloped the foreign exchange risk of international debt and of short-term international capital flows is difficult to hedge. For these countries the incentive to peg the exchange rate springs more from original sin than from the pass through of the exchange rate to the domestic price levels. China and Brazil might qualify for free floaters if they develop deep capital markets (potential free floaters).

**Table 9: Degree of Openness, Capital Markets and Foreign Exchange Policy**

openness / capital markets	highly developed	underdeveloped
open (small) economies	<b>fear of floating</b> Switzerland, Norway, etc.	<b>strong fear of floating</b> Thailand, Estonia, Chile, etc.
closed (large) economies	<b>free floaters</b> USA, Euro Area, Japan	<b>potential free floaters</b> China, Brazil

To compare the monetary and financial institutions at the center and the periphery we focus on the two corner solutions of large (closed) economies with highly developed capital markets and small (open) economies with original sin.

In large industrial countries such as the US, the Euro Area and Japan the domestic components of national income are the main determinants of the business cycle. The pass through of the exchange rates to consumer prices is rather weak. The central banks can focus their monetary policies on purely domestic factors such as the stabilization of inflation and output while they show “*benign neglect*” towards the exchange rate. To strengthen the performance of the domestic money markets the Federal Reserve, the European Central Bank and the Bank of Japan engage in so called interest rate smoothing and soften demand shocks for domestic base money. Due to the stable short-term interest rates the risk premium for interest rate volatility is low.

Further, the large industrial countries don’t suffer from original sin. There is a long-term bond market and the domestic currency—which enjoys the confidence of the international investors community—is widely used for international lending. As open foreign exchange positions can be

easily hedged at low cost, there is—by and large—no risk premium for foreign exchange risk on the domestic short-term interest rates.

All in all in large countries open to international capital flows, both low interest rate volatility and the comprehensive tools to hedge foreign exchange risk contribute to comparatively low interest rates.

In contrast most emerging markets are smaller and more open economies. As exports and imports make up a significant part of the national income, international trade and thus the exchange rate are important determinants of the business cycle. The pass through of exchange rate fluctuations to the domestic wholesale and consumer prices is high. Because exchange rates fluctuate sharply—and increase the volatility of domestic prices and output—the governments have a large incentive to stabilize domestic prices and the domestic business cycle by choosing the exchange rate as target of the monetary policy. Hong Kong, Estonia, Taiwan, Singapore and Argentina are prominent examples.

But with the exchange rate held constant the domestic interest rates “float freely”. If the central bank of an emerging market chooses to stabilize the exchange rate the domestic money supply is the “residual” of monetary policy. Short-term interest rates can not be smoothed and demand shocks for domestic base money are reflected in short-term interest rate movements. The short-term interest rates in small open economies with an exchange rate target tend to fluctuate sharply and the mark up for interest rate volatility is high.

Further, the underdeveloped domestic financial markets give an additional rationale to peg the exchange rate, because the foreign exchange risk of international debt and short-term payment transactions can not be hedged or only be hedged at very high cost. But as the peg is only the second-best-solution for hedging foreign exchange risk, it often incorporates the danger of moral hazard and a break down of the exchange rate arrangement. Anticipating the possible collapse of the peg, there are significant marks up on (short-term) interest rates.

As result of high interest rate volatility and the risk of sudden depreciation the interest rates in the development countries and emerging markets are significantly higher and more variable than in the industrial countries.

Figure 6 compares the absolute short-term interest rates of the East Asian emerging markets with the short-term interest rates of the large industrial countries. It shows that interest rates in the emerging markets tend to be significantly higher than in the benchmark industrial countries US, Japan and Germany. Low interest rates in China are due to interest rate controls and capital flow restrictions.<sup>11</sup>

Further, the due to the attempts to stabilize exchange rates interest rate volatility is significantly higher. Figure 7 plots the monthly absolute interest rates changes (volatility) of the East Asian Emerging Markets and the three benchmark free floaters. We clearly recognize the large difference in interest rate volatility which is high for the emerging markets and low for the free floaters. China and Malaysia (starting in 1998) are an exception as they maintain interest rate and capital controls.

The results of a more formalized test for interest rate volatility is shown in Table 10. To distinguish interest rate volatility of the large industrial countries and the small emerging markets we applied the Calvo-Reinhart interest rates criterion. We measure the probability that monthly absolute interest rate changes are larger than  $\pm 400$  basis points (4.0%)—the Calvo and Reinhart benchmark—and larger than  $\pm 40$  basis points (0.4%)—our benchmark.

Further, we measured the standard deviations of absolute short-term interest rates interest rate changes which indicate as  $\sigma$  in Table 10.<sup>12</sup> The period of observation is from January 1990—when data on nominal short-term interest rates for all countries in the sample are available—up to the present (December 2001).<sup>13</sup>

Table 10 shows the clear distinction in the interest rate volatility between the emerging markets which have pursued an exchange rate target and the benchmark free floaters. In case of the free floating currencies, for the (arbitrary) band of  $\pm 40$  basis points the probabilities range from 4.86% (Japan and Germany) up to 8.33% (US). In contrast for the small emerging economies the probabilities are from 20.83% for Malaysia<sup>14</sup> up to 75.00% for Thailand. The low probability for China (7.69%) reflects the interest rate and capital controls which are still maintained. The standard devia-

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<sup>11</sup> For the post crisis period we observe that short-term interest rates have fallen for three reasons: (1) After the crisis, there is a large surplus of liquidity in the region. (2) Exchange rates are allowed to float more freely at low frequencies. (3) After the strong depreciations of the Asian crisis there is no further danger of sudden depreciations. Nevertheless, it can be expected that these countries return to a higher interest rate level when they resume growth and exchange rate pegging.

<sup>12</sup> Calvo and Reinhart argue that their criterion is the better measure for probabilities because they avoid distortions which are caused by outliers.

<sup>13</sup> Estimations starting in January 1980 yield—if data are available—by and large the same results.

<sup>14</sup> The value for Malaysia is downward biased as Malaysia adopted capital controls in September 1998.

tions of the monthly interest rate changes by and large correspond to the Calvo-Reinhart probabilities.

**Table 10: Interest Rate Volatility in Industrial Countries and Emerging Markets**

1990:01-2001:12	$\pm 4.0\%$	$\pm 0.4\%$	$\sigma$
China	0.70	7.69	0.83
Hong Kong	1.04	52.08	1.79
Indonesia	7.64	66.67	6.40
Korea	1.39	52.08	1.35
Malaysia	0.69	20.83	0.79
Philippines	1.39	62.50	1.36
Singapore	0.00	33.33	0.65
Taiwan	0.69	43.75	0.91
Thailand	3.47	75.00	2.60
Japan	0.00	4.86	0.17
Germany	0.00	4.86	0.18
US	0.00	8.33	0.20

Source: IMF. Monthly Data.

## 5.2 Rules for Monetary Policy at the Center and on the Periphery

The different degrees of openness and the different development stages of the capital markets have a direct impact on the monetary policies of the respective countries at the center and on the periphery of the world capital markets which can be summarized as follows.

The United States, the Euro Area and Japan tailor their monetary policies with respect to their domestic markets. The Federal Reserve, the European Central Bank and the Bank of Japan set short-term interest rates for discrete intervals to smooth interest rates in the short-run, and stabilize the price level and the business cycle in the long-run. On a day-to-day basis the central banks in the large industrial countries feed the monetary base into the domestic banking system to satisfy the shifting demand for base money and thus keep short-term interest rates stable. In a longer perspective

monetary policy stabilizes domestic inflation and output as modelled by the so-called Taylor rule (Taylor 1993).

According to Taylor (2002) the exchange rate should not play a role for the monetary policy of an independent floater (*benign neglect*).<sup>15</sup> The central banks do not intervene in the foreign exchange markets in response to international portfolio shifts. With domestic interest rates held constant the exchange rate is the residual of a domestic oriented monetary policy and floats freely.

In contrast, the central banks of development countries and emerging markets in non crisis periods smooth exchange rate fluctuations. They use official foreign reserves and interest rates to limit exchange rate volatility on a day-to-day or week-to-week basis and thus to provide an informal hedge for the short-term payment transaction of banks and enterprises. At lower frequencies—months, quarters or years—the central banks can keep the exchange rate stable (hard peg) or leave some flexibility to the monetary policy (soft peg).<sup>16</sup>

In the small open emerging markets the short-term interest rate is the residual of the exchange rate oriented monetary policy and “floats freely”. The volatility of the changes in the base money are high and the short-term interest rates float sharply.

All in all in emerging markets (without capital controls) the interest rate volatility is high and exchange rate volatility is low. In the large industrial countries the situation is reversed: Short-term interest rate volatility is low and short-term variance in the exchange rates is high.

**Table 11: Foreign Reserves/GDP (both US Dollar)**

Country	Foreign Reserves/GDP
<b>China</b>	21.71%

<sup>15</sup> As outlined by Schnabl (2002) the exchange rate has played a significant role for the Bank of Japan monetary policy since 1986. To this end, Japan can not clearly be classified as pure, but more as a dirty floater.

<sup>16</sup> The currency board of Hong Kong corresponds to the first case as the exchange rate is kept stable also stable in the medium- and long term. High frequency exchange rate stability is a prerequisite for low frequency exchange rate stability. The exchange arrangements of Taiwan or Indonesia correspond to the second case (soft pgs). In the medium- or long-term the central banks of these countries allow some exchange rate adjustment to give monetary policy some freedom to respond to country specific exogenous shocks. Low frequency exchange rate fluctuations are reduced, but not totally eliminated. Thus, during the 1980s and 1990s the exchange rate of the New Taiwan Dollar fluctuated softly around its parity to the dollar. The Bank of Indonesia allowed for controlled monthly depreciations before the 1997/98 Asian crisis which corresponds to a crawling peg (Figure 1).

<b>Hong Kong</b>	67.82%
<b>Indonesia</b>	19.92%
<b>Korea</b>	27.30%
<b>Malaysia</b>	37.42%
<b>Philippines</b>	18.45%
<b>Singapore</b>	93.18%
<b>Taiwan</b>	
<b>Thailand</b>	32.08%
<b>Japan</b>	10.70%
<b>USA</b>	0.32%
<b>Germany</b>	2.37%
<b>Euro Area</b>	3.38%

Source: IMF: IFS. Foreign reserves in US dollars  
2002:9. GDP 2001 in US dollars.

## 6 The Case Against Basket Exchange Rate Pegging

A major reason of the Asian crisis was a deep devaluation of the yen in 1997-98 (McKinnon and Schnabl 2002). When the smaller East Asian economies more or less peg to the dollar, they become collectively more vulnerable to fluctuations between the dollar and yen. When the yen is high against the dollar, their exports—and inflows of foreign direct investment from Japan—boom. Then when the yen depreciates, their international competitiveness falls—sometimes precipitously as in 1997-98.

In the aftermath of the Asian crisis, many authors including Williamson (2000) and Kawai (2002) have proposed increasing the weight of the Japanese yen in the East Asian currency baskets. Because Japan and the smaller East Asian economies are closely linked in trade, they contend that a larger weight of the Japanese yen in the currency baskets of the smaller East Asian economies would reduce variance in trade flows. Japan in particular would like to reduce variance in its own international

competitiveness from fluctuations in the yen/dollar rate by having its increasingly important East Asian neighbors give more weight to the yen in setting their exchange rates. For instance, Williamson proposes to give a weight of 33% to the dollar, the yen, and the euro respectively.

However we have tried to show that unilateral pegs to the dollar might well be preferred to the currency-basket approach—certainly from the perspective of the smaller East Asian economies. First, because the dollar invoicing of trade throughout the whole East Asian region is so prevalent, collective pegging to the dollar provides a quite strong nominal anchor for the national price levels of the smaller countries—albeit in non crisis periods. Of course the success of this nominal anchor depends heavily on the stability of the US price level and US monetary policy. But in recent years, American prices have been quite stable while Japan has experienced deflationary pressure. Those advocating basket pegging are more concerned with minimizing the variance in a country's *real* effective exchange rate rather than with stabilizing its domestic *nominal* price level.

Secondly, at a more microeconomic level, pegging to just one major international currency helps individual merchants and bankers better hedge their own foreign exchange risks. Because of the missing bond and forward exchange markets in developing countries, governments provide an informal hedge by keeping the domestic currency stable against the dominant currency, i.e., the dollar in East Asia. This then exposes merchants to “extraneous” fluctuations of the yen against the dollar which, however, they can partially hedge by making use of the well-developed forward market between yen and dollars. If a Korean importer of Japanese products needs to pay 100 yen in 60 days, he can buy yen 60 days forward for dollars—and then trade won for dollars in 60 days at a presumed unchanged (soft peg of the won against the dollar) exchange rate—what we call double hedging.

However, under a basket peg, the spot exchange rate of the dollar against the won in 60 days would be more uncertain. Because the dollar is the natural intervention currency that governments use, the Korean authorities would be obligated to keep changing the won/dollar rate as the dollar fluctuates against the yen and euro. This then would confuse the Korean merchant's hedging strategy—particularly if the weights of the major currencies in the basket were somewhat uncertain, and the timing of official changes in the won/dollar rate in order to track the yen was also uncertain. In effect, people who argue that basket pegging would reduce risk are only looking at movements in spot exchange rates as if merchants could not hedge. That is, they are not accounting for the forward hedging strategies that almost all merchants use.

Finally, picking the appropriate official weights in a currency basket is problematic. A simple trade-weighted basket would not reflect the dollar's overwhelming predominance as a currency of invoice—where external dollar prices of goods and services are sticky and don't vary much with changes in the yen/dollar rate. Nor would it reflect the currency of denomination of outstanding foreign currency debts (Slavov 2002).

All in all, the best exchange rate strategy for any small East Asian economy may be the simple “corner solution” of pegging just to the dollar—as is the normal current practice by East Asian governments. However, we do not deny that large fluctuations in the yen/dollar exchange rate create serious problems of risk management for the East Asian dollar peggers (McKinnon and Schnabl 2002), and even bigger problems for Japan itself (Goyal and McKinnon forthcoming). But the straightforward solution to this East Asian exchange rate dilemma is for Japan to peg the yen to the dollar in a convincing fashion (which may require American cooperation) rather than beseeching ten or so other East Asian countries to give more weight to the yen by introducing basket pegging.

## **7 Conclusion: An Eventual Return to Low-Frequency Pegging?**

With the benefit of hindsight, this post-crisis return to high-frequency dollar pegging—Table 8 and Figure 4—is hardly surprising. For emerging markets in East Asia and elsewhere suffering from incomplete capital markets (original sin), high-frequency dollar pegging is an important tool for hedging foreign exchange risk and stabilizing exchange rates. But could this clandestine return to high-frequency pegging augur an eventual return to low-frequency pegging as well?

Stabilization at lower frequencies is not so evident in the new millenium. Table 12 supports the finding of Hernández and Montiel (2002) of greater volatility in the month-to-month exchange rate fluctuations of our East Asian currencies after the crisis than before. In Table 9, the standard deviations of month-to-month exchange rate fluctuations for Indonesia, Korea, Philippines, Singapore, Taiwan and Thailand are greater than before—although those for China, Hong Kong, and Malaysia remain close to zero. Does this indicate “purer” low-frequency floating since the crisis?

Much of the post-crisis month-to-month variation reflects continual exchange rate movements from the recovering , but uncertain, appreciations after the deep overshooting depreciations of 1997-98. At low frequencies, the market has yet to find a new set of equilibrium exchange rates. This does not preclude, however, exchange rate volatility at low frequencies also falling to its pre-crisis

level—particularly because China, Hong Kong, and Malaysia provide fixed reference points for the others. (Indonesia still seems unlikely to return to a stable exchange rate anytime soon.)

**Table 12: Standard Deviations of Month-to-Month Exchange Rate Fluctuations**

	pre-crisis	crisis	post-crisis
Chinese Yuan	0.25	0.03	0.00
Hong Kong Dollar	0.08	0.07	0.04
Indonesian Rupiah	0.26	26.54	6.14
Korean Won	1.01	11.53	2.06
Malaysian Ringgit	1.06	6.69	0.00
Philippine Peso	1.19	5.25	1.85
Singapore Dollar	0.76	2.88	1.21
New Taiwan Dollar	1.01	2.63	1.10
Thai Baht	0.43	8.88	1.71
Japanese Yen	3.66	3.64	2.61
Deutsche Mark	2.20	2.33	2.60
Swiss Franc	2.62	2.60	2.52

Data source: IMF: IFS. Percent Changes. Pre-crisis = February 1994 – Mai 1997, crisis = June 1997 – December 1998, post-crisis = January 1999 – July 2002.

Recent heavy foreign exchange intervention by East Asian central banks also portends an eventual return to smoothing exchange rates at lower frequencies. The official foreign reserves in East Asian countries have increased surprisingly fast since 1998. Figure 5 shows that China, Hong Kong, Indonesia, Korea, Malaysia, Philippines, Taiwan, and Thailand have increased their official foreign exchange reserves after the crisis. In the crisis countries Indonesia, Korea, and the Philippines, foreign exchange reserves have risen far above their pre-crisis levels. In contrast, the official foreign exchange reserves of the benchmark free floaters Germany (Euroland) and US decreased.<sup>17</sup> Only Singapore, which relies more on the domestic money market for stabilizing its exchange rate, has kept foreign reserves close to the pre-crisis level. Far beyond simply rebuilding their previous levels of

<sup>17</sup> For Japan the large increase of official foreign exchange reserve reflects the efforts of the Japanese government to shelter its ailing economy against yen appreciation.

exchange reserves, East Asian governments have evidently been intervening massively to prevent their exchange rates from appreciating.

[Figure 5]

This massive accumulation of dollar reserves could also be a “war chest” to support future official interventions to secure East Asian dollar pegs. In 1997-98, countries with large foreign reserves such as Singapore, Taiwan, and Hong Kong could successfully defend their pegs against speculative attacks—or even prevent the attacks from occurring in the first place. Thus, the increase of foreign exchange reserves in the crisis countries Indonesia, Korea, Malaysia, Philippines and Thailand implies the intent to defeat speculation in future.

Most importantly, the reduced high frequency exchange rate volatility emphasized in this paper could be predicting that low-frequency volatility will also fall. Indeed, the boundary between high- and low-frequency pegging is blurry. Monthly volatility is the aggregation of daily volatility. In a recent working paper the IMF admits that “*high frequency exchange rate data for the developing countries ... can help towards understanding what the objectives of the authorities may be with respect to the exchange rate, and how these objectives may change over time.*” (Wickham 2002)

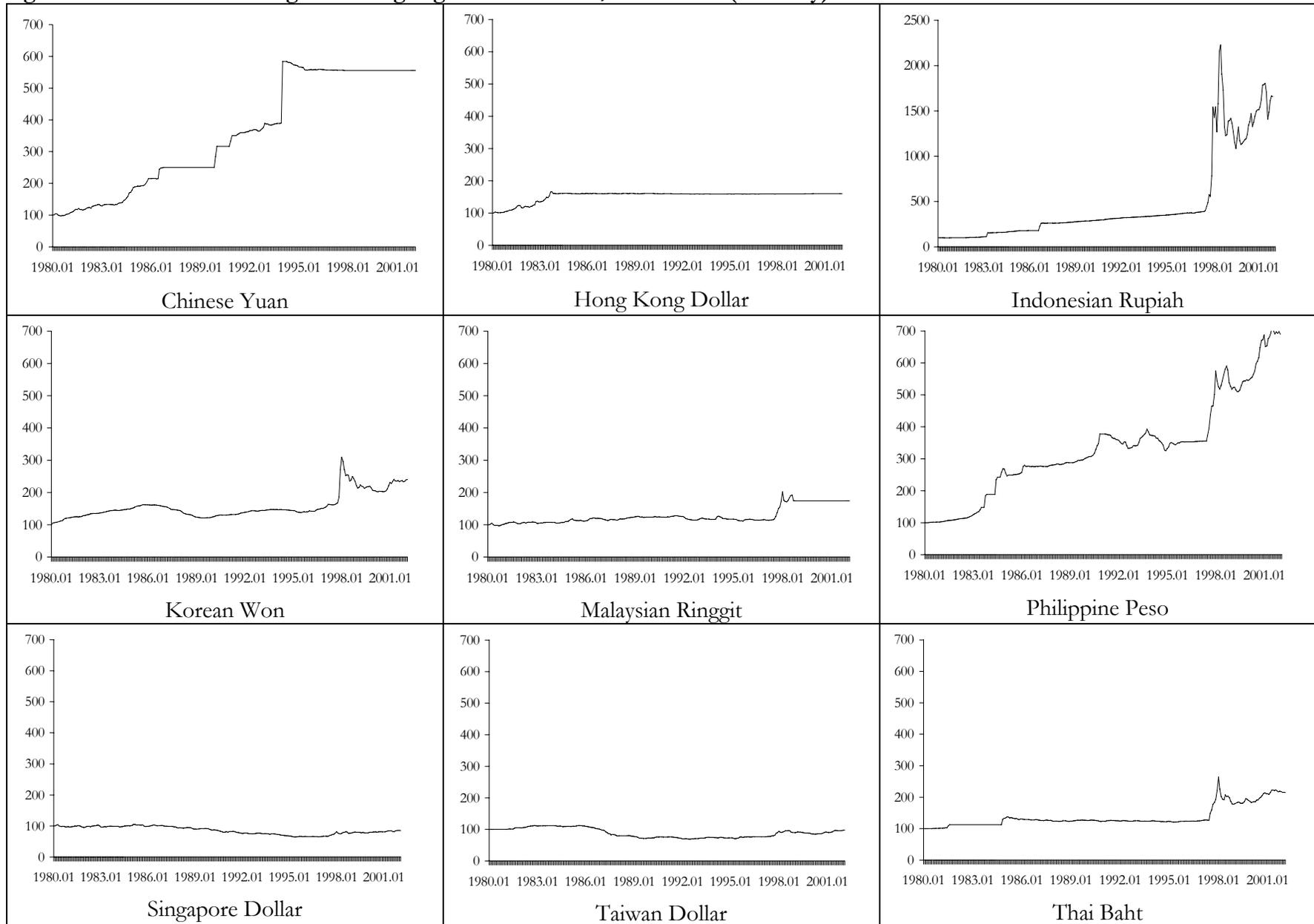
In summary, the remarkable reduction of exchange rate volatility on a day-to-day and week-to-week basis augurs that the East Asian authorities will eventually return to smoothing movements in their dollar exchange rates at lower frequencies as well. Even if Japan remains a dangerous outlier, stabilizing dollar exchange rates collectively among the increasingly integrated economies of East Asia seems more rational than the IMF’s cumulative institutional wisdom pushing for greater exchange rate flexibility—with no well-defined constraint on how any one country’s rate affects its neighbors.

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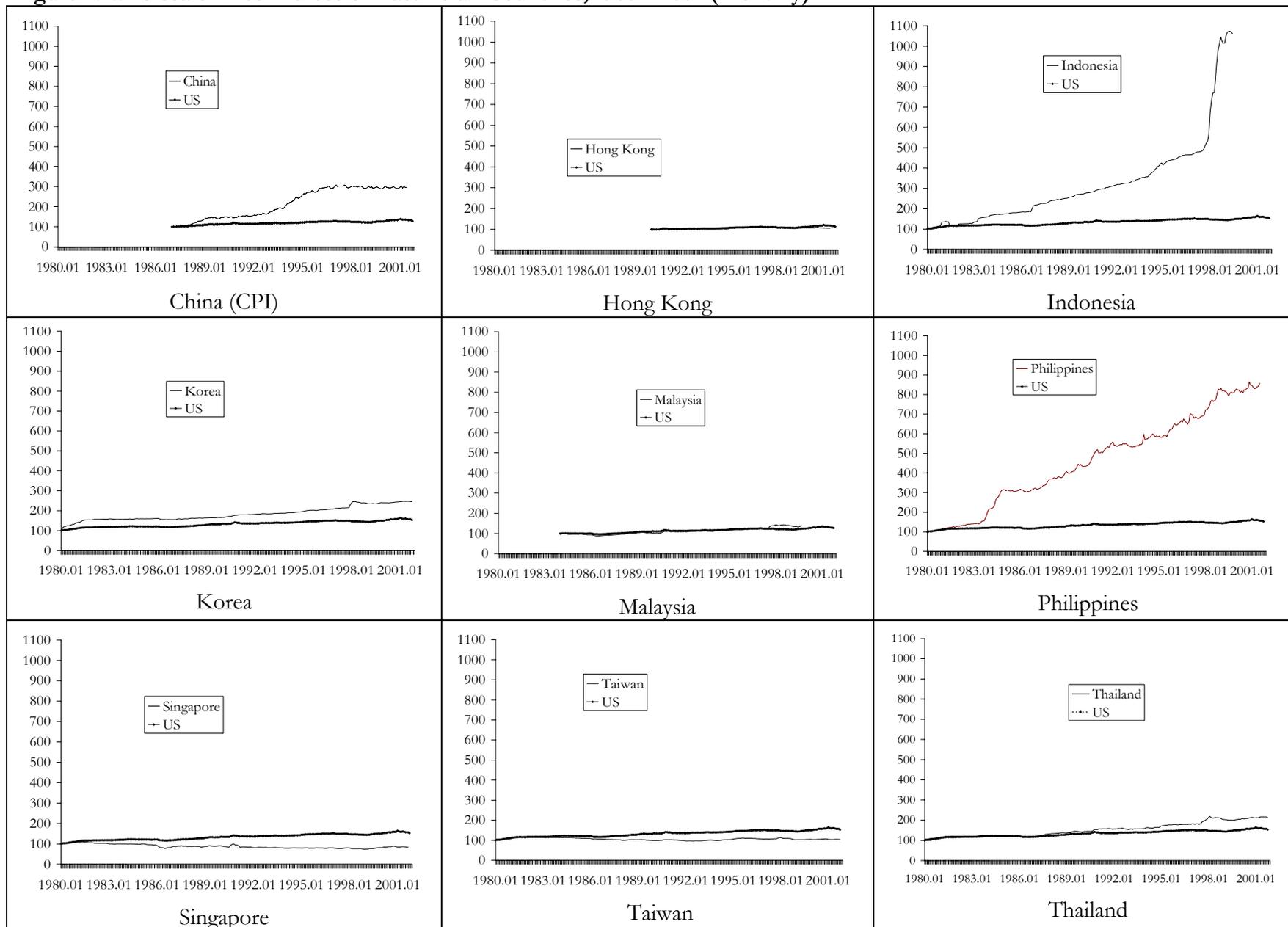
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**Figure 1: East Asian Exchange Rate Pegs against the Dollar, 1980 – 2002 (Monthly)**



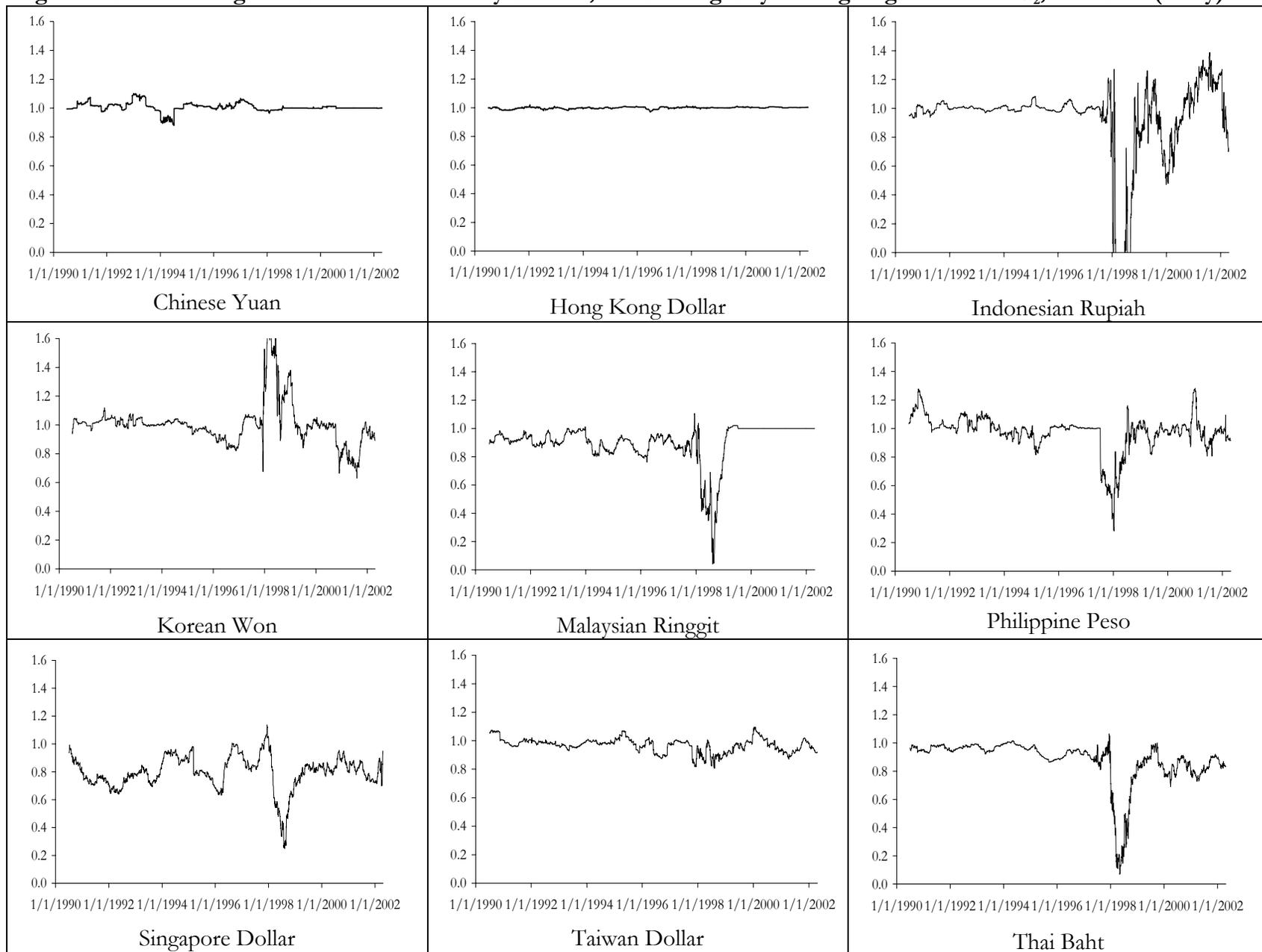
Source: IMF: IFS, Central Bank of China. Index 1980.01=100. Note different scale for Indonesia.

**Figure 2: Wholesale Price Indices of East Asian Countries, 1980 – 2002 (Monthly)**



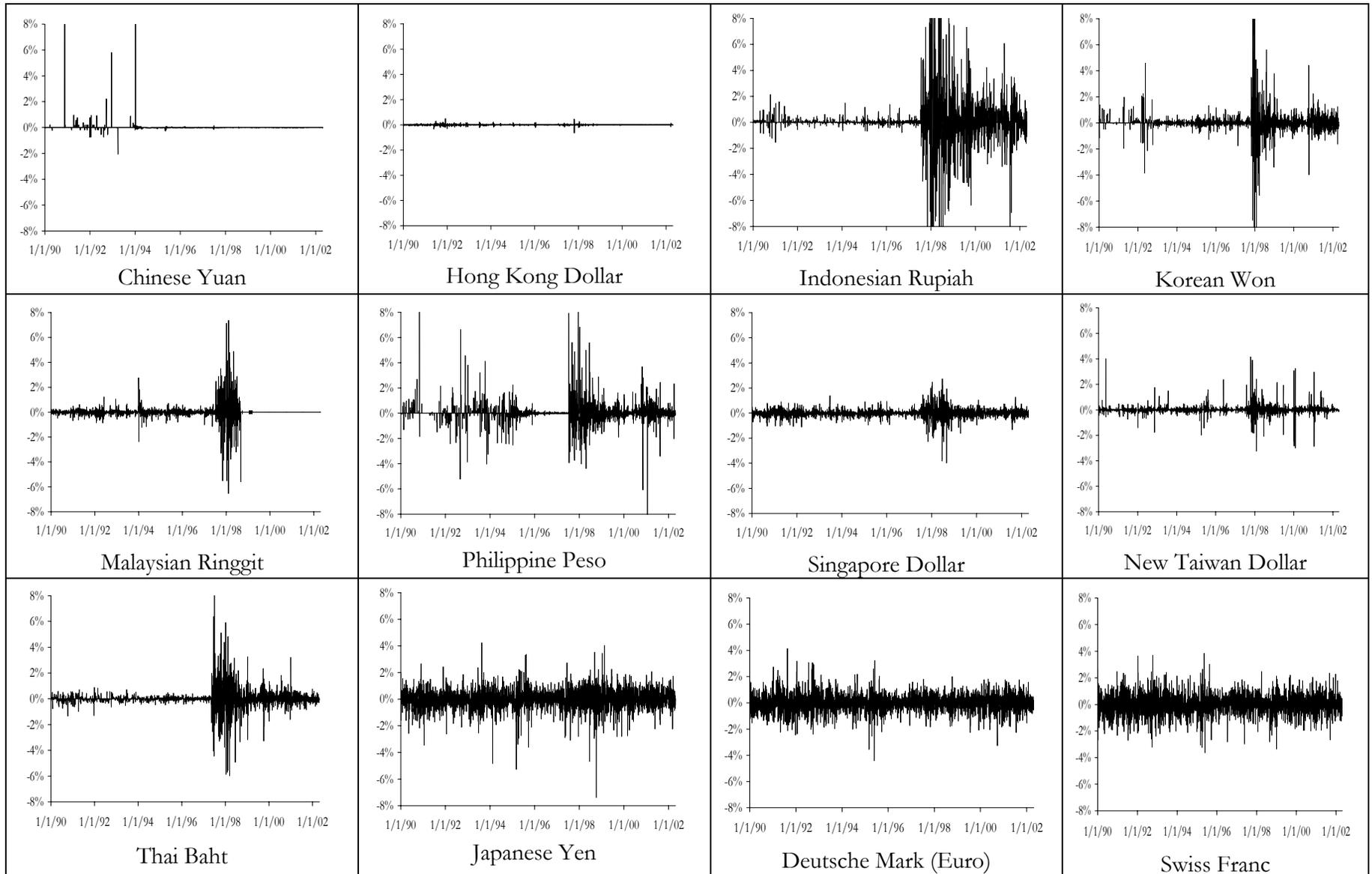
Source: IMF: IFS, Central Bank of China. Indonesia except petrol. Hong Kong 1990.01=100, Malaysia 1984.01=100. China 1987.01=100.

Figure 3: Dollar's Weight in East Asian Currency Baskets, 130-Trading-Day Rolling Regressions for  $\alpha_2$ , 1990-2002 (Daily)



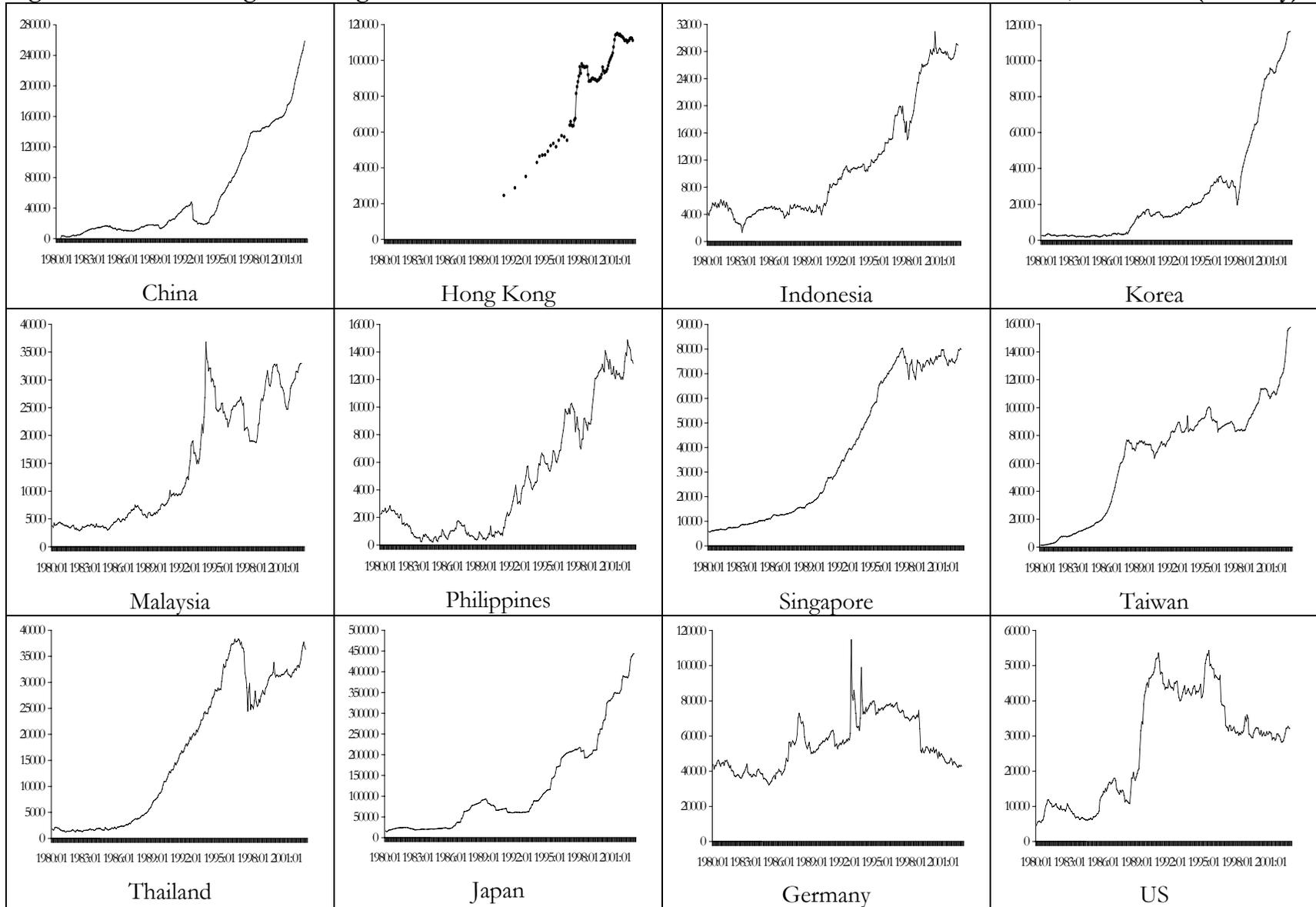
Source: Datastream. 1 corresponds to 100%. Note: A  $\alpha_2$ -coefficient close to unity shows strong dollar pegging.

Figure 4: Exchange Rate Volatility against the US Dollar of Selected Crisis and Non-Crisis Currencies, 1990 – 2002 (Daily)



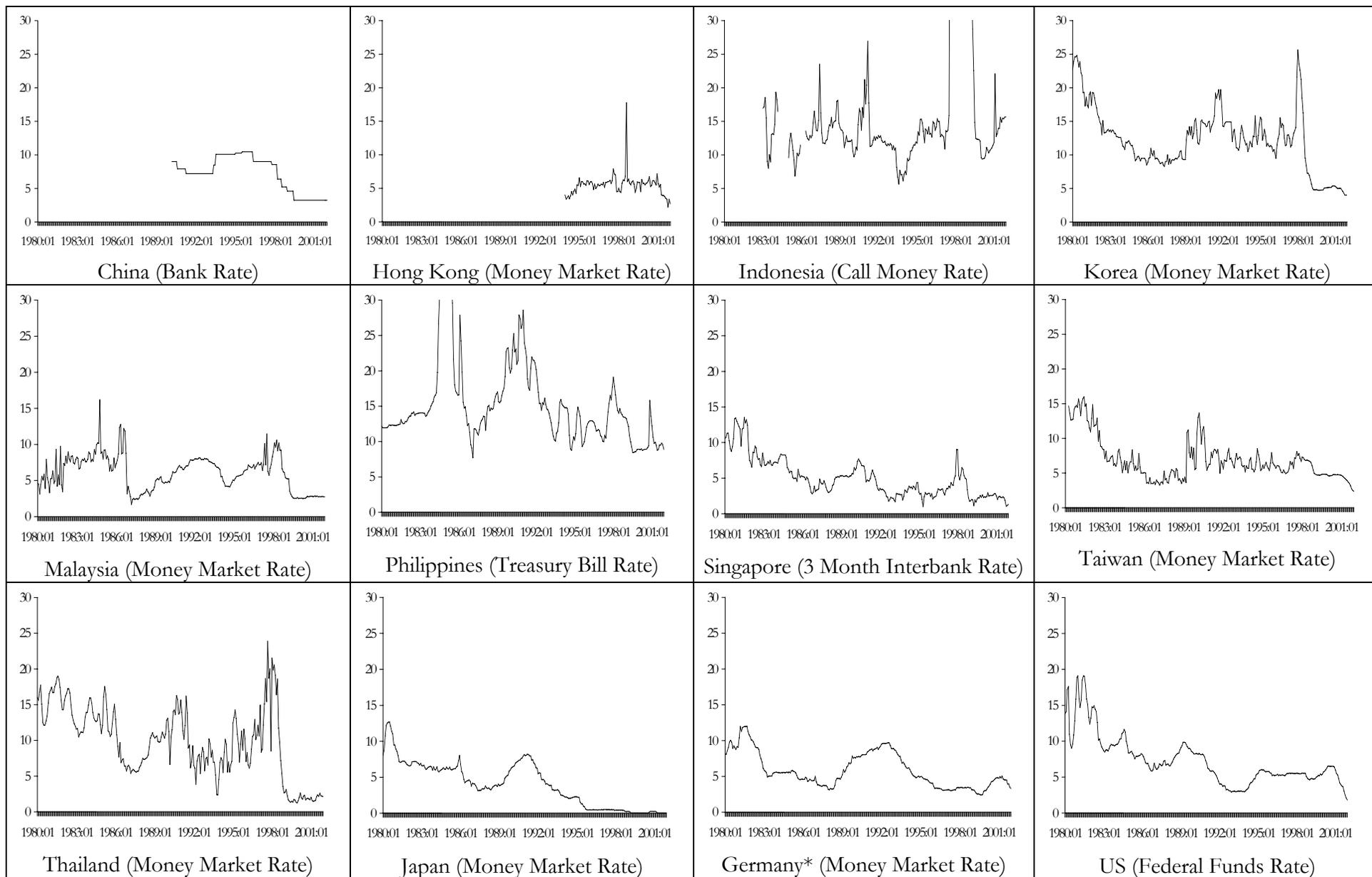
Source: Datastream. Volatility is daily percentage changes against the dollar.

**Figure 5: Official Foreign Exchange Reserves of Crisis and Non-Crisis Countries in Millions of Dollars, 1980 –2002 (Monthly)**



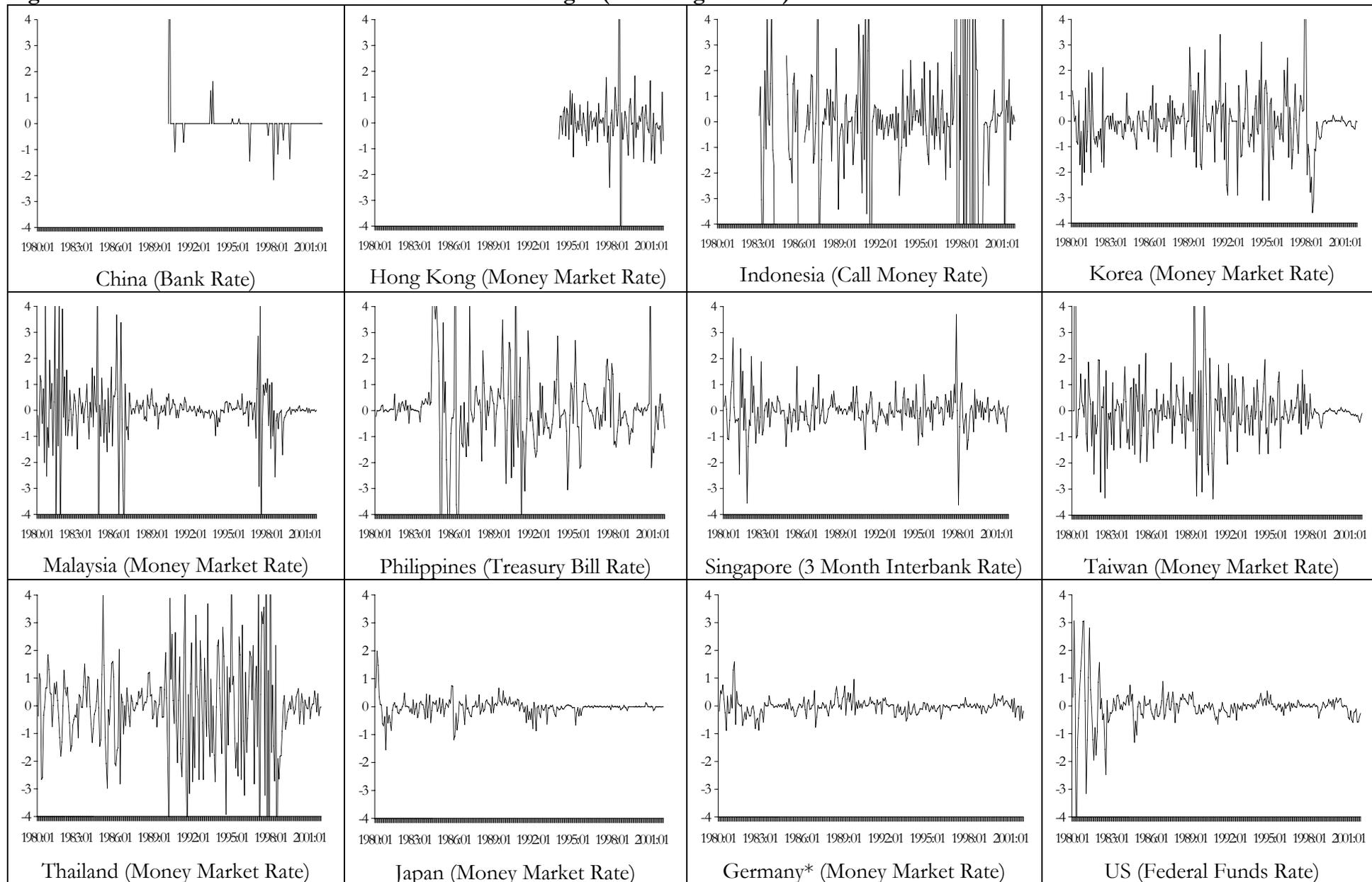
Source: IMF: IFS. Million Dollars. Note different scales on the y-axis.

Figure 6: Absolute Monthly Short-Term Interest Rates



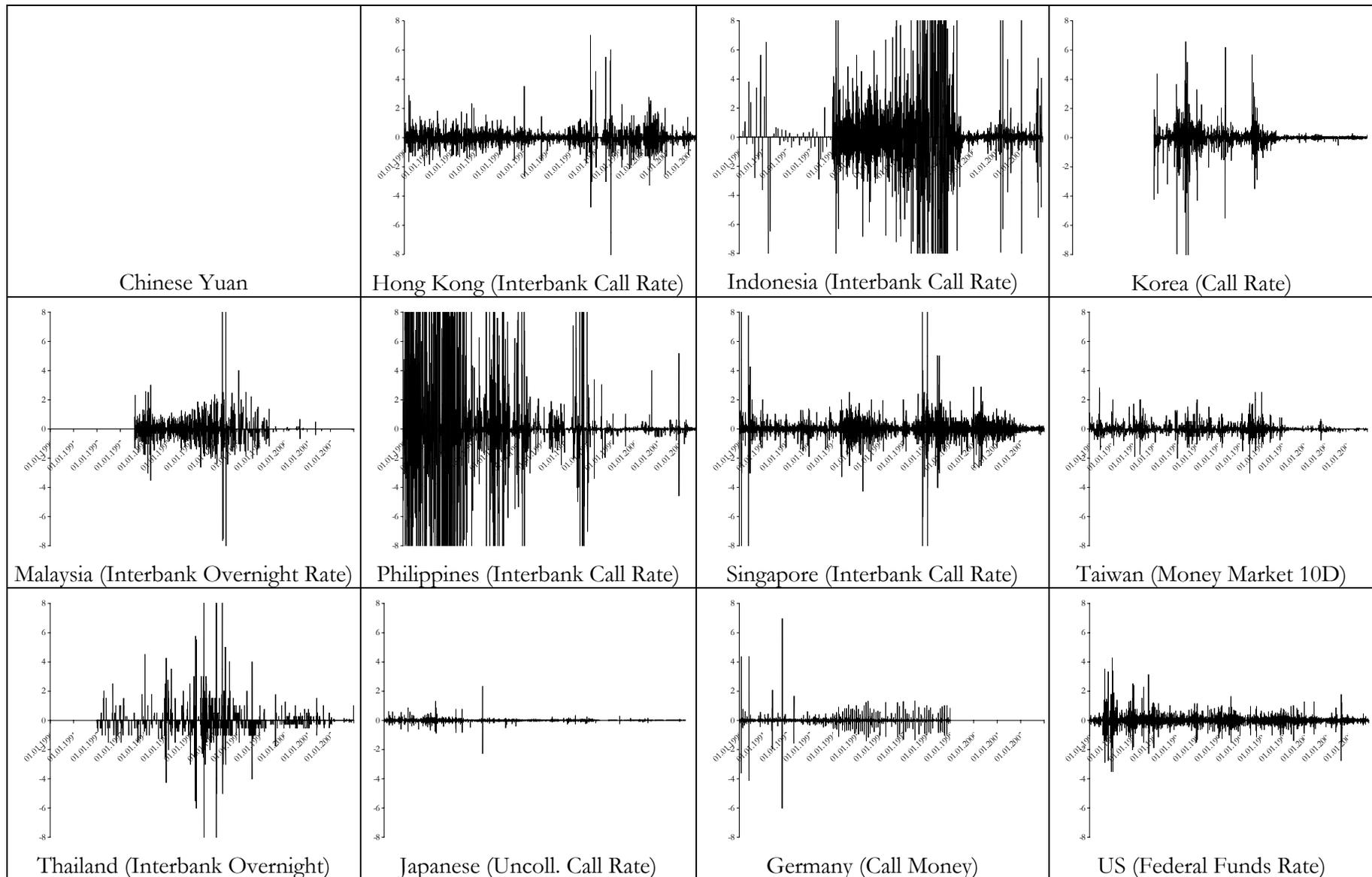
Source: IMF. \*Since January 1999 Euro Area.

**Figure 7: Month-to-Month Short-Term Interest Rate Changes (Percentage Points)**



Source: IMF. \*Since January 1999 Euroland.

Figure 8: Absolute Money Market Interest Rate Changes, 1990 – 2002 (Daily)



Source: Datastream. Volatility is daily percentage changes against the dollar.