IMF Working Paper

WP/98/170

INTERNATIONAL MONETARY FUND

Asia and Pacific Department

Monetary Policy in the Aftermath of Currency Crises: The Case of Asia[1]

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December 1998

Abstract

This paper evaluates monetary policy and its relationship with the exchange rate in five Asian crisis countries. The findings are compared with previous currency crises in recent history. The paper finds no evidence of overly tight monetary policy in the Asian crisis countries in 1997 and early 1998, nor evidence that high interest rates led to weaker exchange rates. The usual trade-off between inflation and output when raising interest rates suggested the need for a softer monetary policy in the crisis countries to combat recession. However, in some countries, corporate balance sheet considerations called for the reversal of overly depreciated currencies through firmer monetary policy.

JEL Classification Numbers: E44, E63

Keywords: Monetary policy, interest rates, inflation

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The authors thank Bijan Aghevli, Andrew Berg, Jonathan D. Ostry, David Goldsbrough, Poonam Gupta, Wanda Tseng, Prakash Loungani, Kanitta Meesook, Mark Stone, Jeromin Zettelmeyer, and seminar participants and reviewers at the International Monetary Fund. This paper is scheduled to be presented at the University of Washington conference on the Asian crisis on December 29-30, 1998.

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Summary

This paper attempts to shed light on the effect of monetary policy on the exchange rate after a collapse by analyzing a few episodes of large currency depreciations in the aftermath of currency crises, in particular, the Asian crisis cases.

The paper finds no evidence of overly tight monetary policies in the Asian crisis countries in 1997 and early 1998 based on the behavior of real interest rates. Negative real rates were encountered in Indonesia, Korea, and Malaysia in early 1998 and in Thailand in the third quarter of 1997. In addition, real interest rates in Indonesia, Malaysia, and the Philippines were below their precrisis levels in early 1998. There is also no evidence of large uncovered interest rate differentials in the Asian crisis countries in 1997 and early 1998.

The paper also finds that, in the period July 1997-July 1998, the evidence on the relationship between real interest rates and real exchange rates is mixed. Real appreciations tend to be associated with higher real interest rates in Hong Kong SAR (with a correlation of 0.55), Indonesia (0.57), Malaysia (0.42), and the Philippines (0.13). In contrast, we observe a negative correlation in Korea (-0.46) and Thailand (-0.46). In regressions using daily data, there is no evidence that higher interest rates lead to weaker exchange rates. If anything , the relationship between nominal exchange rates (domestic currency per U.S. dollar) and nominal interest rates is negative.

The analysis of the traditional trade-off between inflation and output when raising interest rates suggested the need for a softer monetary policy in the crisis countries to combat recession. However, in some countries, e.g., Indonesia, corporate balance sheet considerations suggested the need to reverse overly depreciated currencies through firmer monetary policy.

I. INTRODUCTION

What is the appropriate monetary policy in the aftermath of a currency crisis? Should interest rates be raised to appreciate the currency? The Asian crisis has put these questions at the center of economic policy making. This paper attempts to shed light on this question by analyzing a few episodes of large currency depreciations in the aftermath of currency crises, in particular the Asian crisis cases.

The paper intentionally does not aim to study the general relationship between exchange rates and interest rates. This leaves out several interesting issues but allows the paper to concentrate on the role of monetary policy in reestablishing currency stability after a large collapse.

The analysis of the appropriate monetary policy in the aftermath of currency crises has four building blocks. The first is to evaluate whether the exchange rate has overshot during the crisis, or in other words, whether the real exchange rate (RER) has become undervalued and needs to be brought back to equilibrium. The second block is to identify the mechanisms through which the RER could be corrected in case it is undervalued (or maintained in case the new level is deemed appropriate). There are two ways to reverse an undervaluation —through nominal currency appreciation or through higher inflation at home than abroad (or a combination of the two). If avoiding an inflation buildup is an important concern and/or nominal appreciation is desirable for the benefit of domestic corporate and bank balance sheets, the extent to which the reversal occurs through nominal appreciations is fundamental. A key factor in evaluating the likelihood of this reversal is to estimate the exchange rate passthrough in the economy —or in other words, the extent to which the correction is expected to occur through inflation in the economy, in the absence of major changes in policies. The third block is to identify through which policies and under what circumstances the reversal occurs through nominal appreciation. In particular, it is important to evaluate whether nominal appreciations occurs mainly in cases where interest rates are kept high. In addition, it is also important to evaluate whether other economic conditions, for example the state of the banking system and corporate sector, influence the relationship between interest and exchange rates. Finally, the fourth block is to evaluate the desirability of raising interest rates. Even if one identifies a set of policies and conditions that maximizes the effect of interest rates on the exchange rate, the costs of raising interest rates in terms of output loss, unemployment, and financial system fragility could outweigh the benefits of a more appreciated nominal exchange rate.

There is considerable debate on each of the four building blocks. The debate on the right measure of undervaluation (or overvaluation) has always been controversial, with some even doubting the notion that a currency could be fundamentally out of line. In the case of Asia, there is doubt whether the currencies were overvalued before the crisis and whether, despite the large real depreciation that followed the crisis, the currencies became undervalued (some argue that the extent of the shock justifies a much lower real exchange rate). With respect to the extent of exchange rate passthrough, initial estimates suggest that the Asian

economies have a much lower passthrough than typical developing countries, which implies that the real depreciation has persisted for longer than in other crisis cases, but also implies that the correction of the RER would likely occur through nominal appreciations (unless the current passthrough estimates reflect longer lags in Asia and we will observe much higher inflation in the future) .

An important debate has been about the relationship between interest rates and exchange rates. The traditional approach stresses that tight monetary policy is necessary to support the exchange rate and curb inflationary pressures. In the short run, higher interest rates make speculation more expensive by increasing the cost of shorting the domestic currency. Also, higher interest rates increase the return that an investor obtains from investing in the country. In the long run, higher interest rates may affect the exchange rate by reducing absorption and improving the current account. However, in the discussion of the role of monetary policy in the Asian crisis, several economists have raised the possibility that an increase in interest rates would have a negative effect on the exchange rate. Jeffrey Sachs (1998, pg. 31), for example, has been vocal in expressing his views that high interest rates would not stabilize currencies in the Asian case:

> "Despite sharply higher interest rates, currencies have not appreciated so the supposed benefits of this policy are in question. It is entirely possible that in the unique conditions of the midst of a financial panic, raising interest rates could have the perverse effect of weakening the currency . . . Creditors understood that highly leveraged borrowers could quickly be pushed to insolvency as a result of several months of high interest rates. Moreover many kinds of interest-sensitive market participants, such as bond traders, are simply not active in Asia's limited financial markets. The key participants were the existing holders of short term debt, and the important question was whether they would or not roll over their claims. High interest rates did not feed directly into these existing claims (which were generally floating interest rate notes based on a fixed premium over LIBOR). It is possible, however, that by undermining the profitability of their corporate customers, higher interest rates discouraged foreign investors from rolling over their loans."

On the opposite side of this debate Krugman (1998), also referring to the Asian crisis, writes:

> "I have heard some people propose what amounts to a sort of foreign exchange-interest rate Laffer curve: if you cut interest rates this will strengthen the economy, and the currency will actually rise. This is as silly as it sounds."

The precedence of the debate on the relationship between exchange rates and interest rates over the debate on the optimality of monetary policy in crisis cases is raised by Stiglitz (1998), a critic of the traditional approach:

> "Thus, although countries confronted with an exchange rate crisis have sometimes viewed themselves as facing a trade-off between the adverse effect of exchange rate depreciation and interest rate increases, if increases in interest rates lead to a decreased capital flow, there is no trade-off: higher interest rates weaken the economy directly, and actually exacerbate the decline in the exchange rate"

The other big debate on the role of monetary policy is on the **desirability** of increasing interest rates to support the exchange rate. Some doubt the optimality of tight policies. This line of argument takes as given that high interest rates may eventually stabilize the exchange rate but argue that the costs of doing so are very high and that letting the exchange rate float freely (and possibly become more undervalued for a while) is the least costly option. The costs of a tight monetary policy are usually identified with a large recession, unemployment, financial system bankruptcies, credit crunch and corporate failures. Of course, there are also costs in letting the exchange rate depreciate further, as argued by Goldstein (1998):

> "When market participants lose confidence in a currency and attach a high probability to further falls, it is difficult to induce them to hold the currency without higher interest rates...Moreover, halting a free fall of the currency takes on added importance when banks or corporations in the crisis country have large foreign currency obligations coming due in the short term."

This paper is organized as follows. In section II.A., the issue of the extent of undervaluation in Asia and other cases is explored. In section II.B., the paper analyzes the exchange rate passthrough in the Asian crisis cases so far and compares it with other cases in history. In section III, the paper explores the link between exchange rates and interest rates in the aftermath of the Asian crises. In section IV, the trade-offs involved in the decision to raise interest rates are analyzed.

II. Overshooting and Reversals

The effectiveness and desirability of implementing tight monetary policies to stabilize a currency crisis depends to a certain extent on the underlying causes of the crisis. A fair amount of attention has been dedicated to the question of what caused the Asian crises. There are three broad explanations:

(i) BOP crises driven by traditional fundamentals (à la Krugman 1978, Flood and Garber (1984)): overvaluation of the RER coupled with too much credit expansion resulting in excess demand and a growing balance of payments deficit that culminates in crisis and the adjustment of the RER.

(ii) Crisis as a result of panic by investors (Sachs and Radelet (1998)). Asian currency crises must be understood as a run on international reserves, i.e., as the international

equivalent of commercial bank runs. Countries were vulnerable to runs because of high ratios of short term debt to reserves.

(iii) Crises were driven by more sophisticated fundamentals and should be understood as financial crises rather than simply currency crises (Krugman, 1998). The financial crises were caused by overlending to risky and unproductive projects fueled by explicit and implicit guarantees. When the bubble burst the crisis occurred.

There is also the possibility of a combination of the explanations above. For example, one may advance the argument that fundamental reasons made the countries vulnerable to speculative attacks and that panic was an element of the crises but not their ultimate cause.

Tight monetary policy is less controversial if one believes the underlying cause for the crises is point (i) above. Increases in domestic interest rates serve simultaneously to increase the interest rate differential with respect to the rest of the world and reduce the level of activity in the economy. In contrast, the panic and financial crisis explanations are not an overheating story and, therefore, there is a *possible* trade off for policy makers between recession (or the health of the banking system) and currency stabilization.

In general, it would be futile to try to appreciate the currency if one believed the currency had not overshot. Therefore, the following section evaluates the equilibrium real exchange rates for both the Asian and some other currency crises cases.

A. Is there Overshooting?

Table 1 shows available estimates of RER overvaluation prior to the Asian crises (Indonesia, Korea, Malaysia, Philippines and Thailand) and to five other crisis cases (Mexico(1982), Chile (1982), Mexico(1994), Sweden (1992) and UK (1992)). The overvaluation estimates for the five Asian countries are taken from the literature. Goldman Sachs uses the Dynamic Equilibrium Emerging Markets Exchange Rates model (GSDEEMER) to calculate the equilibrium value for a large set of countries. For each country, they find a cointegrating relation between the multilateral real exchange rate and a set of fundamentals (using leads and lags) using quarterly data since 1980. The relationship between the real exchange rate and the fundamentals is interpreted as a long-term relationship and its predicted value the equilibrium exchange rate. The fundamentals include a large set of variables that are known to influence the equilibrium real exchange rate —including terms of trade, openness, government size, and capital flows. The exact set of fundamentals varies per country. The difference between the equilibrium value and the actual exchange rate is defined as a misalignment measure (overvaluation/undervaluation). Chinn (1998) uses the Purchasing Power Parity concept to evaluate whether seven East Asian currencies were overvalued before the crisis. He uses a simple model that uses deviations from PPP and a trend in the real exchange rate to define misalignment. For the other crisis cases, the overvaluation measures were derived in Goldfajn and Valdés (1996) using a methodology similar to Goldman Sachs' methodology.

The existence of large overvaluations would imply that one should expect large corrections of the RER in the aftermath of the crisis and would not necessarily call for policy action. The Latin-American crisis cases had clear misalignment in their RER of the order of 20-25 percent prior to the crisis. In contrast, the European cases had only mild overvaluations. Few observers indicated at the time of the ERM crises that overvaluation was at the root of the crisis. In fact, several papers advanced the hypothesis that the 1992 European crises were of the self-fulfilling nature (the so-called second generation models).[2]

In Asia, the different estimates indicate that Malaysia, Philippines, and Thailand systematically appear to have had the most overvalued currencies, while Korea and Indonesia the least overvalued (Chinn's estimate indicates that the Won was actually undervalued). The magnitude of the subsequent real devaluations were not correlated with the initial overvaluation measures. In fact, besides Thailand, the larger depreciations occurred precisely in Indonesia and Korea. In all the Asian cases the extent of the real devaluation was larger than the initial overvaluation. One could argue that the previous overvaluation estimates are not reliable or, alternatively, that the crisis altered significantly the equilibrium RER's such that a larger depreciation of the RER is justified.[3] In fact, some argue that the large terms of trade decline in Korea justifies a large equilibrium depreciation after the crisis. However, the results suggest that there was scope to believe that the currencies had overshot or, at least, that further declines in the exchange rate were not desirable.

B. RER Reversion and Exchange Rate Passthrough

There are two ways to reverse an undervaluation—through nominal currency appreciation or through higher inflation at home than abroad (or a combination of the two). If avoiding an inflation build up is an important concern and/or nominal appreciation is desirable for the benefit of domestic corporate and bank balance sheets, the extent to which the reversals occurs through nominal appreciations is fundamental. A key factor in evaluating the likelihood of this reversion is to estimate the exchange rate passthrough in the economy.

Table 2 shows nominal depreciations, inflation, and exchange rate passthrough coefficients for the 10 episodes. It is evident that the Latin American cases are different. They had larger depreciations, higher inflations, and larger passthrough coefficients (in the order of 0.4) than the European and Asian cases. The European cases had depreciation rates of about 30-50 percent but only single digit inflations in the first 12 months after the crisis, implying

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[2]See Eichengreen, Rose and Wyplosz (1994).

[3]The argument that the equilibrium RER had significantly depreciated must rely on permanent rather than transitory changes in fundamentals. For example, a post-crisis panic by foreign investors that reduces the available short-term capital to the economy should not be confused with a permanent reduction in the capital available to the economy that would require an equilibrium depreciation.

Table 1. RER Overvaluation Measures and Real Depreciations for Selected Crisis Cases
(in percent, + overvaluation)

	Overvaluation Chinn (1998) May, 1997 1/	Overvaluation Goldman Sachs (1998) June, 1997 2/	Goldfajn and Valdes (1996) Month Prior to Crisis	Real Depreciation 12 Month After Crisis 3/
Thailand	7.0	3.9		26.0
Malaysia	7.9	4.4		25.2
Philippines	19.1	5.5		22.1
Indonesia	-5.5	1.2		68.2
Korea	-9.1	3.3		26.5
Chile (82)			17.7	19.9
Mexico (82)			25.6	43.8
Mexico (94)			22.6	27.8
Sweden (92)			9.7	20.1
UK (92)			4.6	11.1

1/ PPI -based calculation.

2/ Based on J.P.Morgan Database.

3/ Based on REER from June 97 - June 98 in Asian cases.

Table 2. Inflation, Depreciation and Passthrough Coefficients for Selected Crisis Cases

	CPI Inflation 1/	Depreciation 1/ 2/	Passthrough Coefficient 3/ (After 1 year)	Passthrough Coefficient 3/ (After 2 years)
Asia:				
Thailand	10.8	47.7	0.23	
Malaysia	6.3	39.3	0.16	
Philippines	9.9	38.8	0.26	
Indonesia	59.6	394.4	0.15	
Korea	6.7	35.3	0.19	
Other Cases:				
Chile (82)	31.2	92.6	0.34	0.43
Mexico (82)	108.3	269.6	0.40	0.40
Mexico (94)	48.5	122.5	0.40	0.40
Sweden (92)	4.8	52.3	0.09	0.16
UK (92)	1.7	32.4	0.05	0.14

1/ First 12 months of the crisis. For Korea based on Sept, 97 to July, 98.

2/ Based on NEER for Asian countries and bilateral rates with respect to the dollar in the other cases.

3/ CPI inflation divided by depreciaton.

very low passthrough coefficients. The Asian crises are an intermediate case between the European and Latin American cases both in terms of inflation and passthrough coefficients.

It is interesting to note that the reversal of the real exchange rate occurred more slowly in the European cases. Inflation rates were higher in the second year after the crisis; the passthrough coefficients doubled or tripled when looking instead over the first 24 months. This suggests that if the Asian crisis cases follow the European pattern of slower but longer adjustment of RER's there was a potential role for policies to avoid inflationary reversals. (Of course, what determines the extent of the passthrough is not only the effectiveness of short-run policies but also the inflationary history and labor market institutions of the country in question.)

III. Relationship between Interest Rates and Exchange Rates

A. Theoretical Considerations

The conventional wisdom is that monetary policy tightens liquidity and stabilizes the exchange rate. In the midst of an exchange rate crisis, interest rates are raised to make speculation against the currency more costly. If borrowing (shorting) the domestic currency to invest in the foreign currency is allowed, raising interest rates directly increases the costs of speculation. Even if shorting the domestic currency is not allowed, the increase in interest rates affects the opportunity cost of an investor deciding whether to invest in the domestic economy.

The expected return in investing in the country depends on the promised interest rate and the expected depreciation. The interest differential with respect to the rest of the world should allow for both an exchange rate risk premia and a probability of default:[4]

$$E[i]=i^{*}+E[\Delta e]+R$$

where E[Δe] is the expected depreciation, E[i] is the expected return of an investment in the domestic economy, i^{*} is the safe return on an equivalent international asset and R is the risk premium that is demanded by risk averse foreign investors faced with exchange rate volatility.[5] In principle, increases in interest rates should increase the expected return, turning investing in the domestic economy more attractive relative to abroad (i.e., making the right hand side of

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[4]Default here is defined more generally including partial payment, delay of payments or introduction of exchange controls.

[5]The risk premium must include also a portion for the uncertainty induced by default probability.

the equation above larger than the left hand side) and inducing capital inflows, which would increase the supply of dollars and immediately appreciate the exchange rate up to the point where the equation holds again (in the Dornbusch (1976) model the exchange rate should actually overshoot its target such that agents expect a future depreciation).

However, interest rate increases may reduce the expected return by increasing the probability of default. Interest rates may affect the probability of default by increasing the borrowing costs of corporations, by depressing the economy and reducing profits, by altering the net worth of corporations adversely exposed to interest rate changes, or, finally, by affecting the health of the banking system that tends to be naturally exposed to interest rate changes. The latter have a compounding effect on the economy since problems in the banking system may lead to credit crunches, disintermediation, and bad allocation of credit.

Formally, the expected return on the domestic asset E[i] can be written as the product of the domestic interest rate, i, times the probability of repayment, ρ: $E[i] = \rho(i)\, i$. The equation can be rewritten in the following way:

$$\rho(i)i = i^* + E[\Delta e] + R$$

where $\rho' < 0$, $\rho'' < 0$.

Therefore, even though one should expect increases in interest rates to attract capital, there may be cases where additional increases in interest rates reduce the expected return and generate capital outflows. In such cases, raising interest rates paradoxically depreciates the currency (see Chart 1).

The level of interest rates needed to defend (or appreciate) a currency may be substantial. For example, in order to defend an **expectation** of a one percent fall in the exchange rate the next day, the overnight interest rate must be at least one percent per day (which is 3,678 percent per annum).[6] If agents are risk averse (and there is a positive risk premium, R) and the default probability is large, the required interest rate would be larger.

Proponents of tighter monetary policy argue that higher interest rates need only be temporary. Once the exchange rate has been stabilized, interest rates could be allowed to

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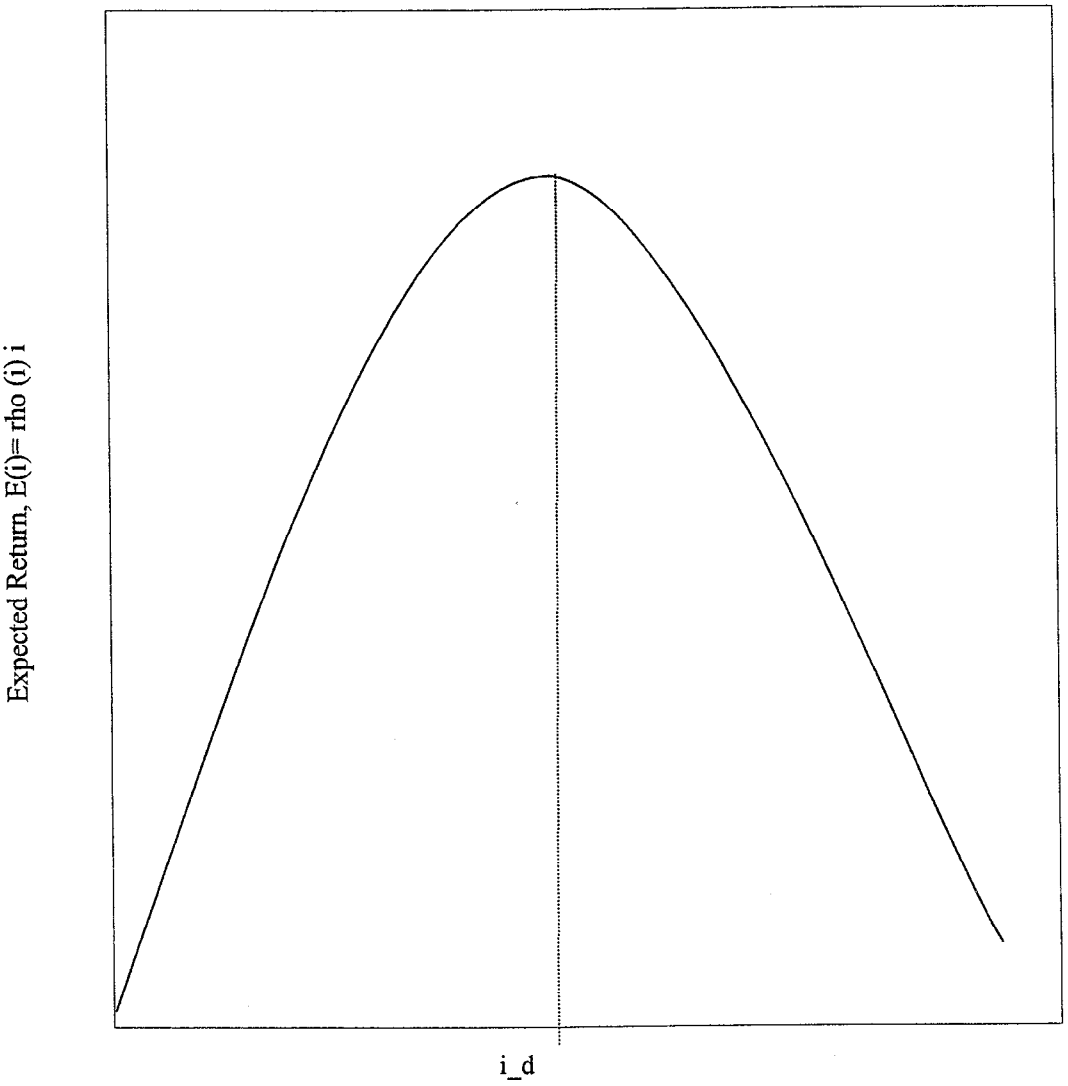
[6]This example is drawn from Stiglitz (1998).

Chart 1. Expected Returns and Interest Rates



decline. This argument is important given that the costs of persistently high interest rates could be substantial.

However, the question then is why should a *temporary* increase in interest rates lead to *permanent* effects on the exchange rate? One answer is that temporarily tight policies may signal the determination of the monetary authority to pursue exchange rate stability and low inflation. Temporary policies may then change the beliefs of investors. Even when the tight policies are withdrawn, the exchange rate would stabilize at a higher level.

Tight monetary policies do not always serve as a credible signaling device. Drazen and Masson (1994) have shown that if the costs of implementing the tight policies are too high, the temporary policy would actually reduce credibility because investors know that the policy could not be sustained. Under this theory, the relationship between interest rates and the exchange rate could be negative. When there are doubts about the determination of the authorities and temporary increases in interest rates lead to important reputational gains to the authorities, the effect of raising interest rates should be positive. However, when the reputational arguments are not essential and there are important structural problems, raising interest rates may have the opposite effect.

B. Interest Rate Policy in the Asian Crises Episodes: 1997-98

This section analyzes interest rate policy in the aftermath of the five Asian crises (Indonesia, Korea, Malaysia, Philippines and Thailand). There are several issues to consider.

The first issue is what measure of the nominal interest rate better represents the tightness of monetary policy and its effect on the exchange rate. Charts 2 and 3 show both interbank rates and "policy rates" for each of the crisis countries in 1996-98.[7] The chart suggests that for most of the countries, the major movements of monetary policy can be captured by any of the interest rates since they tend to move together. In what follows we use the "policy rates" as our representative nominal interest rate. The chart also shows the sharp increases in nominal interest rates since the crisis. Most of the countries, however, seem to have waited to raise interest rates until late in 1997 or early 1998. Indonesia initially raised interest rates substantially in July - August 1997 but reduced them subsequently, only raising them to higher levels in March - April 1998. Korea raised interest rates significantly at the end of the year, after the crisis. Thailand increased nominal rates continuously from May 1997 to March 1998.

The second issue is the appropriate expected inflation rate to be used in calculating real interest rates. The approach taken here is to calculate several measures of real interest

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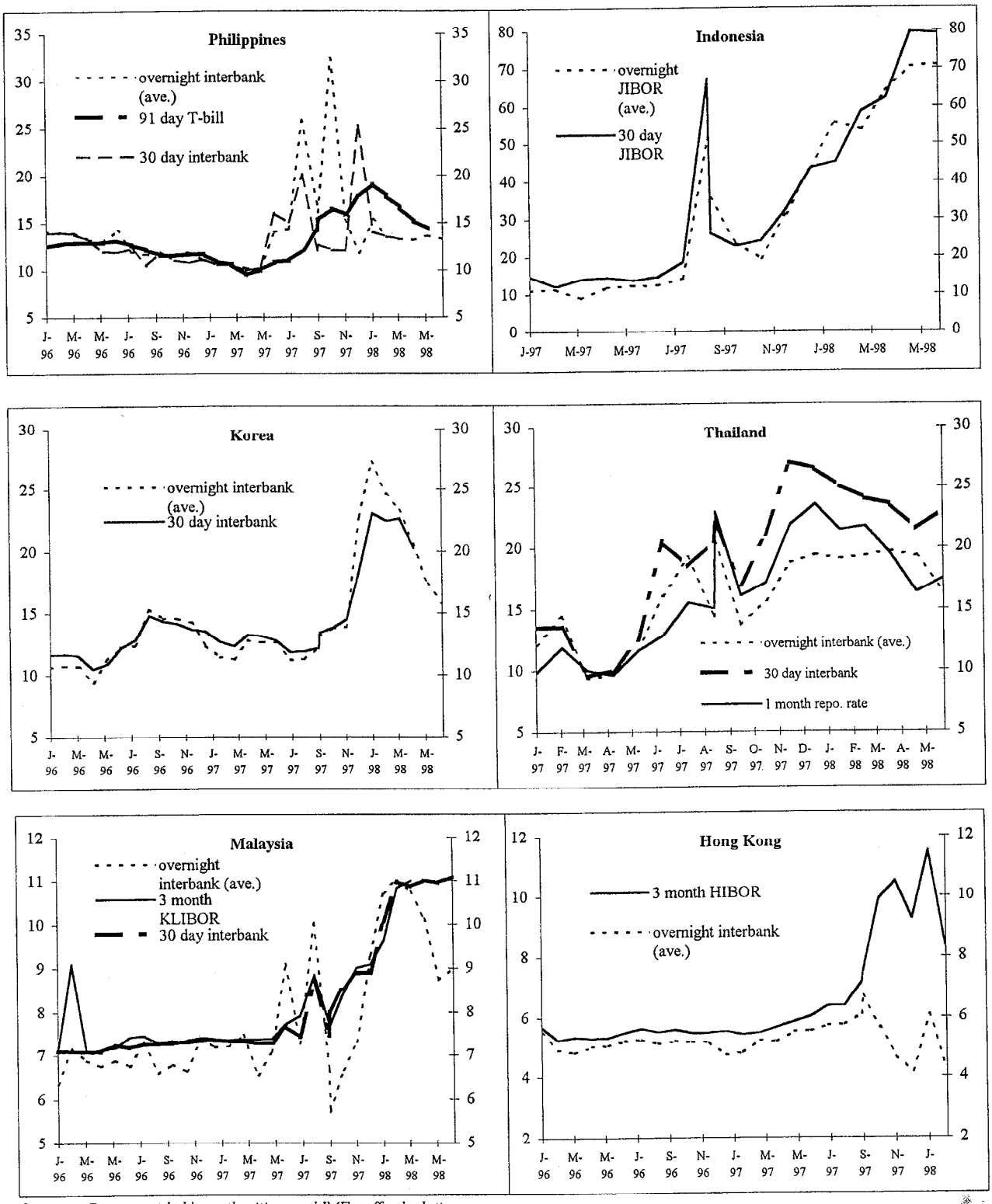
[7]The "policy rates" are the 1 month repo rate for Thailand, the 91-day T-bill rate for Philippines, the 3-Month Klibor for Malaysia, the 30-day JIBOR rate for Indonesia, and the overnight interbank rate for Korea.

Chart 2. NOMINAL INTEREST RATES

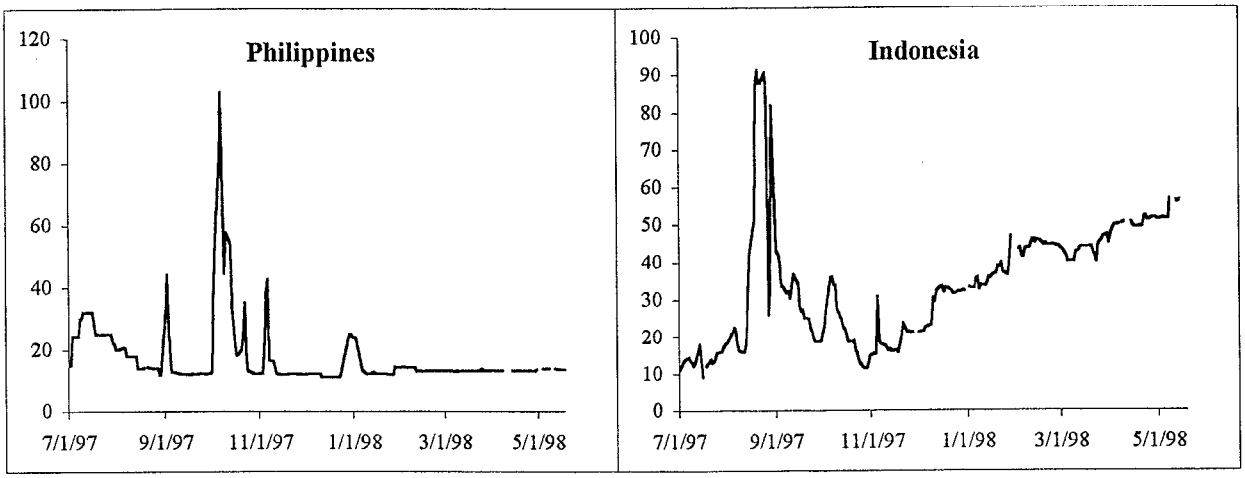
(in percent per annum)

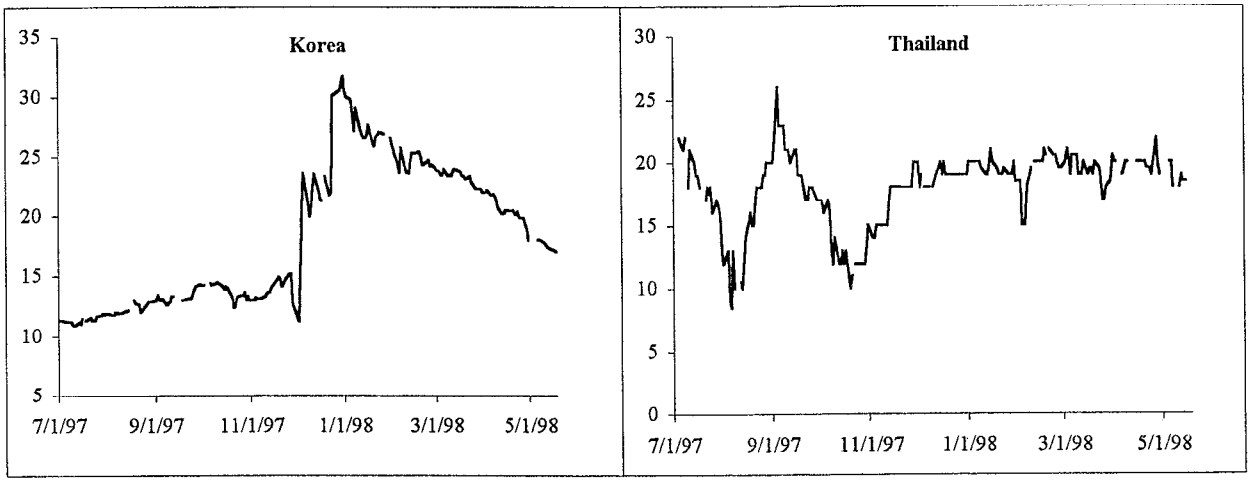


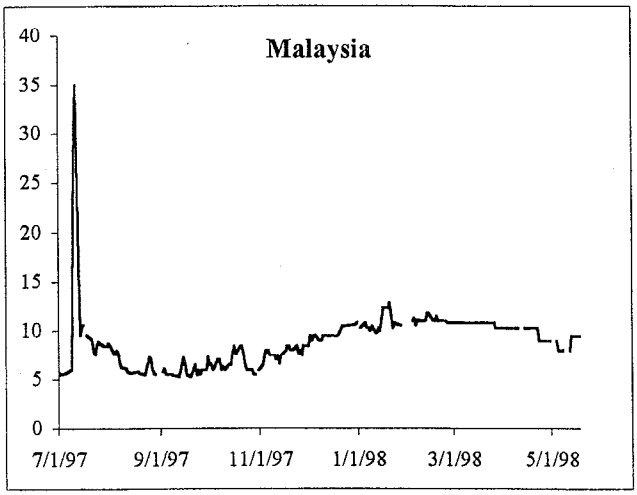
Sources: Data provided by authorities; and IMF staff calculations

Chart 3. OVERNIGHT CALL RATES (daily)

(in percent per annum)







Source: Bloomberg

rates based on different assumptions regarding expected inflation. Chart 4 shows five measures of real interest rates for each country. The measures are based on expected inflation, which in turn is proxied by: (i) the following month's inflation $\pi(t+1)$ annualized, (ii) survey forecasts from the Consensus Forecasts, (iii) the quarterly moving-average inflation centered at t, (iv) the previous month inflation $\pi(t-1)$ annualized, and (v) the previous 12-month inflation. The latter measures (iv)-(v) are based on an adaptive expectations assumption, the former ones (i)-(ii) are based on rational expectations assumptions (theoretically, the survey forecasts should be based on all the information available) and measure (iii) is a combination of the two assumptions. The main result is that for each country there are two distinct groups of real interest rates with similar paths within the group but differing substantially across them.

One group, shown in the lower panel of Chart 4 for each country, is composed of the real interest rates constructed using the past-12-month-inflation rates and the one based on survey data, which, surprisingly, implies that the forecasters in the survey probably based their forecast mainly on past information. These rates are always positive throughout the crisis and its aftermath. Some patterns emerge. Korea has the highest real rates of the five Asian countries in a range of 10-20 percent during the period, followed by Thailand at around ten percent. The rest of the countries exhibit relatively moderate rates, e.g. Malaysia (2-6 percent) or Philippines (4-12 percent).

The other group of real interest rates uses some combination of previous, current or future inflation as the measure of inflationary expectations. This group shows that Indonesia, Korea, and Malaysia had negative real interest rates in early 1998 and similarly for Thailand in the third quarter of 1997. This is probably the consequence of the fact that inflation picked up very strongly and nominal interest rates lagged behind. For Indonesia and Philippines, real interest rates have not to date reached their pre-crisis levels. The main conclusion is that there is little evidence of tight monetary policies in the Asian crisis countries in 1997 and early 1998, based on real interest rates using forward looking measures of expected inflation.

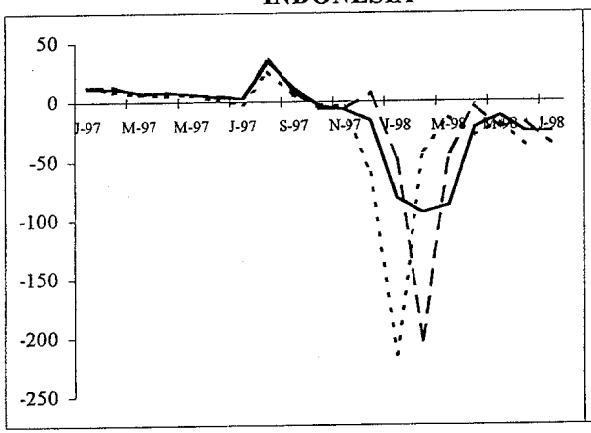
The third issue is whether real rates are the appropriate measure to evaluate the tightness of monetary policy. One of the arguments raised in the theoretical section is that high interest rates stabilize currencies by increasing the attractiveness of the economy to (foreign) investors. This means that one could look instead at uncovered interest rate differentials to evaluate the tightness of policies.[8] Again the procedure was to calculate several measures of uncovered interest rate differentials based on different estimates of expected depreciation. Chart 5 shows the results using expected depreciation calculated from the Financial Times Currency Forecaster. Similar to the real interest rate results, negative interest rate differentials are found for Malaysia, Philippines, Korea and Indonesia at the beginning of 1998 and for Thailand in July 1997. Also, very high interest rate differentials (larger than 20 percent per annum) emerge from March 1998 in all the countries. The results from the uncovered interest

[8]The residual in the uncovered interest differential is sometimes identified automatically as the risk premium.

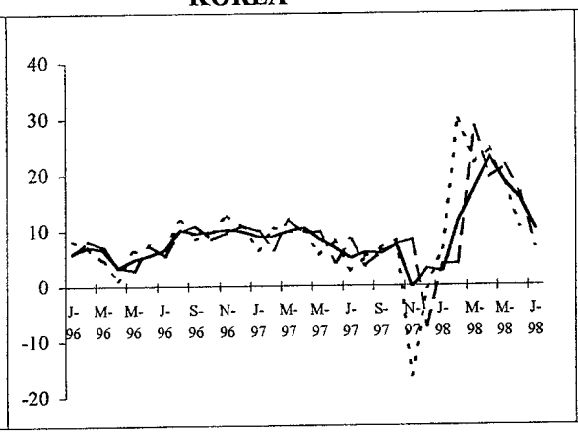
Chart 4. REAL INTEREST RATES *(various measures)*

i - π *qtr. ave:* ___ *i* - $\pi(t)$: __ __ *i* - $\pi(t+1)$:- - - -

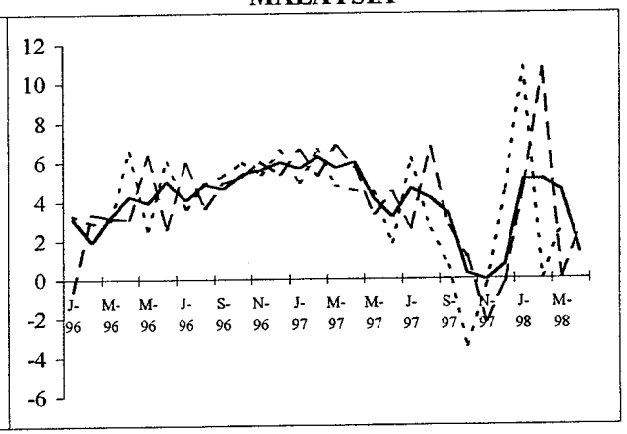
INDONESIA



KOREA

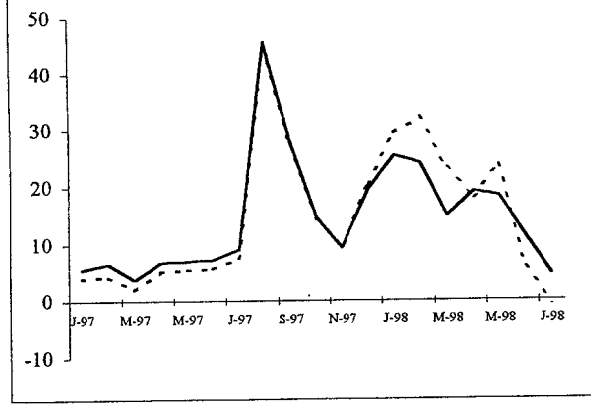


MALAYSIA

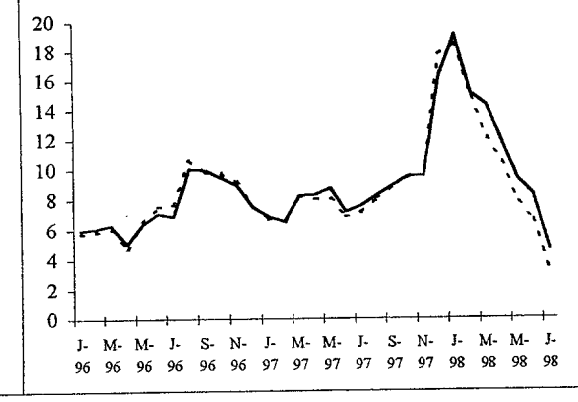


i - π *(past 12 months):* ____ *i* - π *(survey forecast):* - - - -

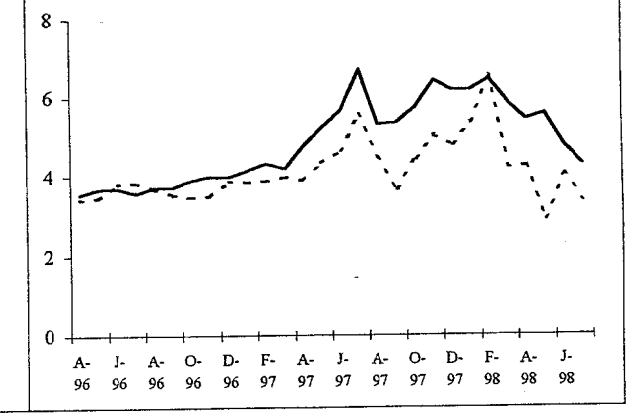
INDONESIA



KOREA



MALAYSIA

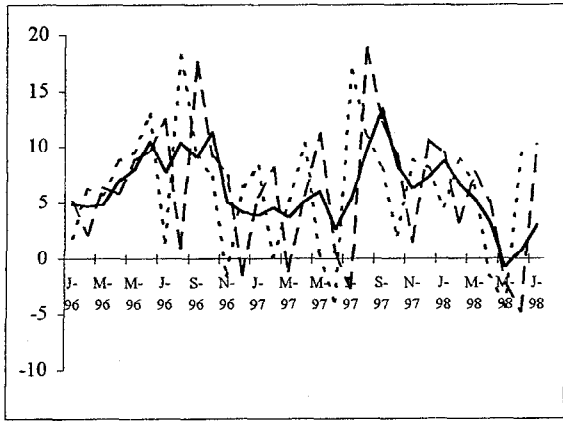


Sources: Data provided by authorities; and IMF staff calculations. Inflation forecast obtained from Asian Consensus Forecast.

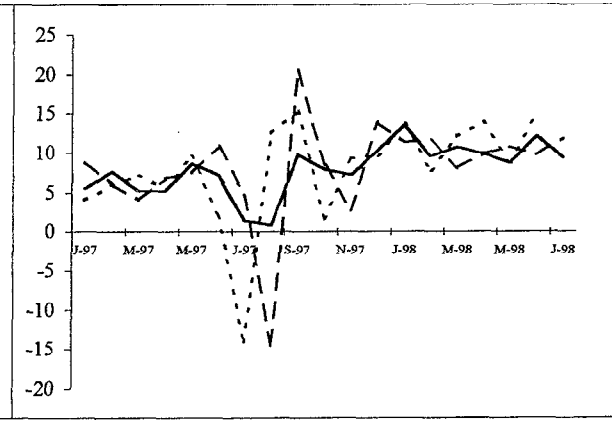
Chart 4. REAL INTEREST RATES *(continued)*

$i - \pi_{qtr.\ ave}$: ___ $i - \pi(t)$: __ __ $i - \pi(t+1)$: - - - -

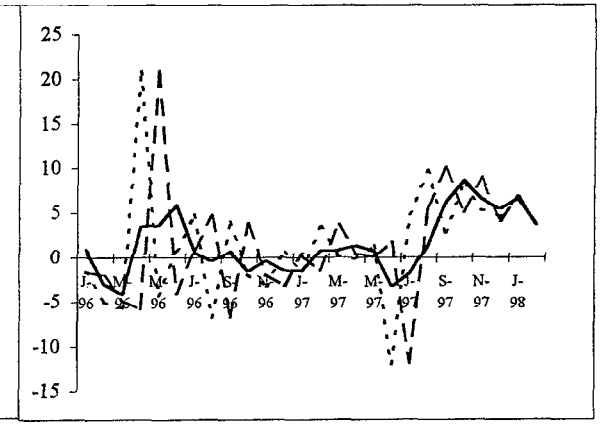
PHILIPPINES



THAILAND

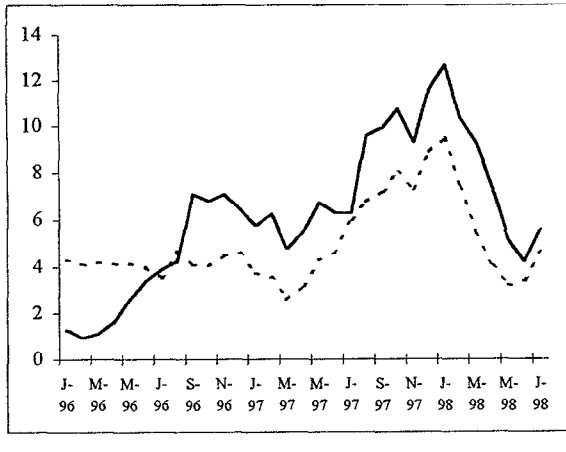


HONG KONG



$i - \pi_{(past\ 12\ months)}$: ____ $i - \pi_{(survey\ forecast)}$: - - - -

PHILIPPINES



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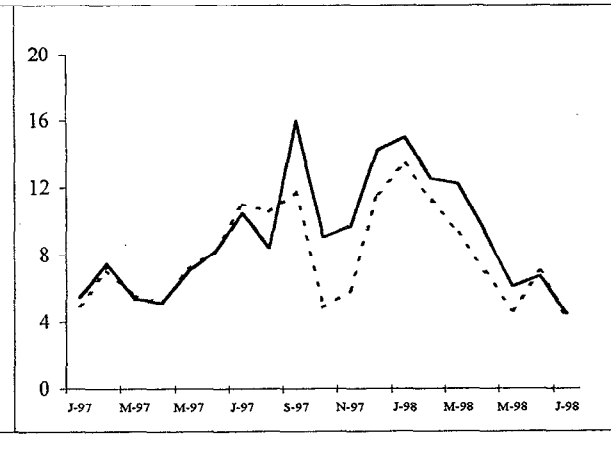
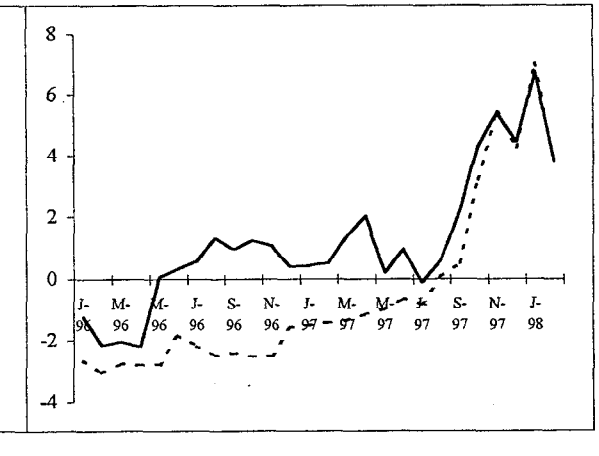
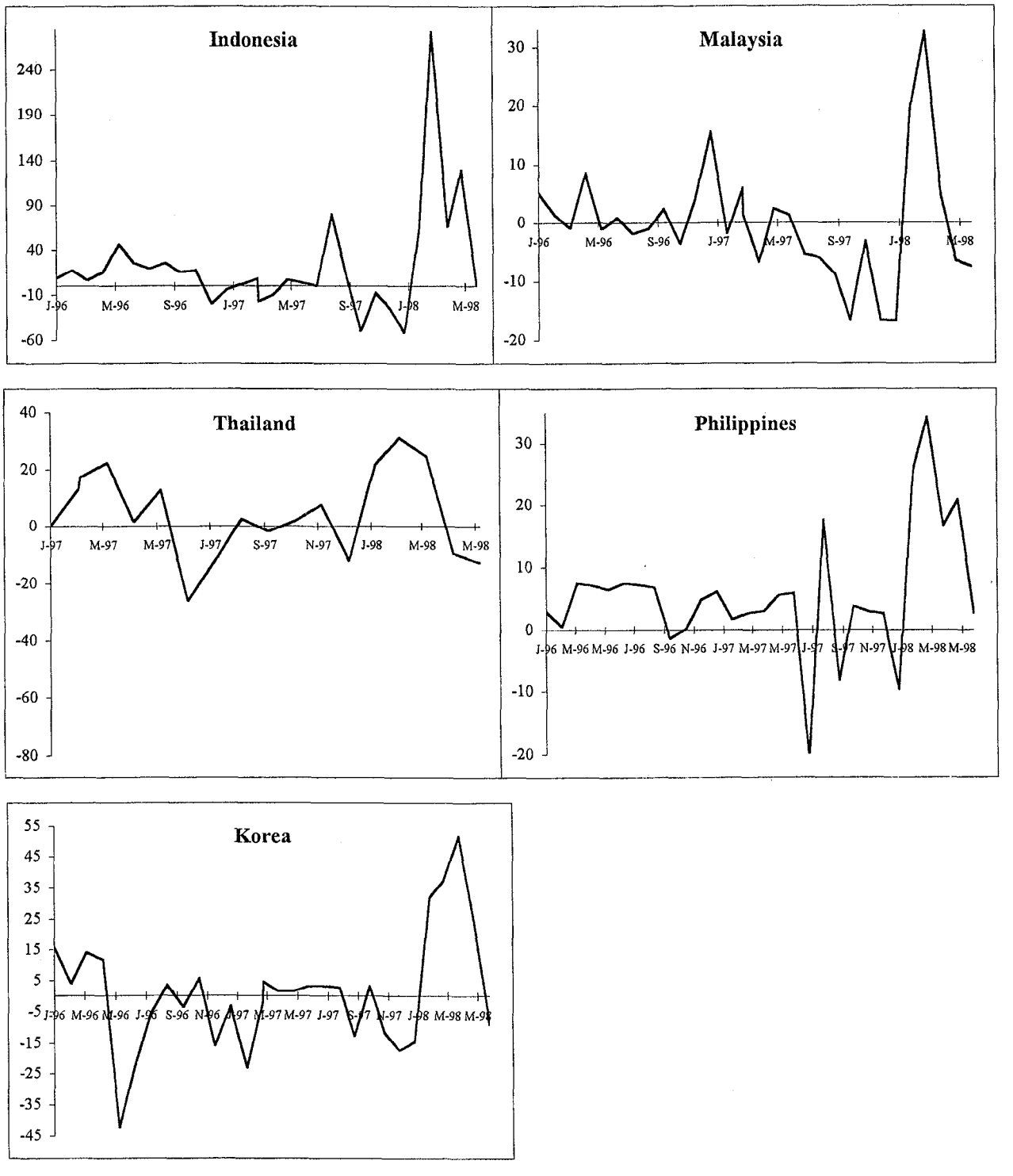


HONG KONG



Sources: Data provided by authorities; and IMF staff calculations. Inflation forecast obtained from Asian Consensus Forecast.

Chart 5. UNCOVERED INTEREST RATE DIFFERENTIAL 1/



Sources: Interest rate data provided by authorities; Currency forecast obtained from Financial Times Currency Forecaster

1/ Interest Rate Differential calculated by subtracting short term US treasury Bill yield and currency depreciation forecast from representative nominal rates. All numbers have been annualized.

rate differentials confirm that there is little evidence of overly tight monetary policies in Asia at the beginning of the crisis through early 1998.

The relationship between real interest rates and real exchange rates for the five countries considered is shown in Chart 6. As explained in the theory section, the traditional approach stresses that one should expect a positive correlation between exogenous interest rate shocks and the exchange rate. We have no independent data on monetary policy shocks but it is still interesting to look at the simple correlations. The evidence is mixed, in the period of the crisis July 1997 to July 1998, a fairly positive correlation exists for Hong Kong (0.55), Indonesia (0.57), Malaysia (0.42), and Philippines (0.13). In contrast, we observe a negative correlation in Korea (-0.46) and Thailand (-0.46).

Chart 7 shows the relationship between real interest and exchange rates in the other crisis episodes. A positive correlation is evident in all the cases. In Mexico (1994), the recovery of the real exchange rate happened when real interest rates were raised in the second quarter of 1995. Likewise, in Mexico (1982) the real exchange rate recovered when interest rates were raised in mid-1982. In Chile (1982), interest rates were raised shortly after the crisis but allowed to fall immediately thereafter. The RER recovered initially but the recovery was not sustained. A notable feature is that the increases in real rates in these cases were much sharper than those seen in most of the Asian crisis countries.

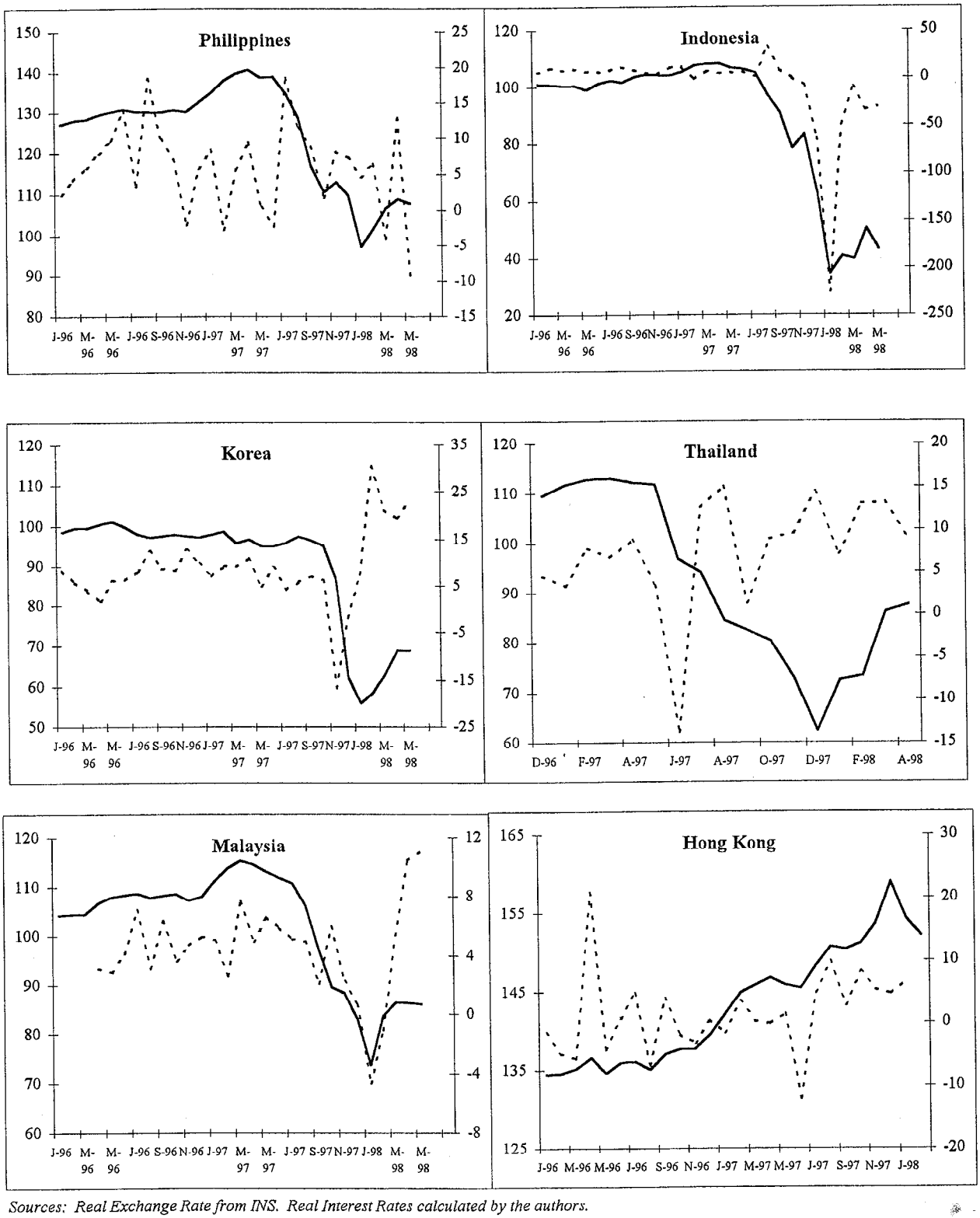
One could analyze econometrically the relationship between real exchange rates and real interest rates by looking at historical data to increase the number of data points available. However, in this paper, we are restricting our attention to the correlation between these variables in crisis episodes. There are two alternative approaches. One is to extend the sample of crisis episodes and run a panel data set regression. This approach is followed in Goldfajn and Gupta (1998). Another approach is to use higher frequency data, i.e., daily data. In this case, we will need to focus our attention on the relationship between nominal exchange rates (national currency per unit of dollar) and nominal interest rates. Chart 8 shows the impulse responses of a vector autoregression of the changes in nominal interest rates on the changes in nominal exchange rates. The results show that the effect of a shock in interest rates on the exchange rate is insignificant in all the five cases (perhaps, the only exception is Philippines). This confirms previous results obtained in Ghosh and Phillips (1998) and Kaminsky and Schmukler (1998).

It is interesting to observe how the correlation of interest rates and exchange rates has evolved over time. Table 3 shows rolling regressions for the five Asian crisis cases plus a panel regression. As expected, when running the panel regression for the whole sample one does not obtain a negative correlation. However, there are periods where there was a negative correlation between the variables. In particular, one obtains a significant negative correlation in the period from the Thailand crisis to October 1997 and from January to April 1998. Looking at particular countries, the strongest negative correlation occurs in Indonesia and Korea in 1997 and Philippines in 1998. The only positive correlation is found for Malaysia in the last four months of 1997.

Chart 6

REAL EFFECTIVE EXCHANGE RATES _____

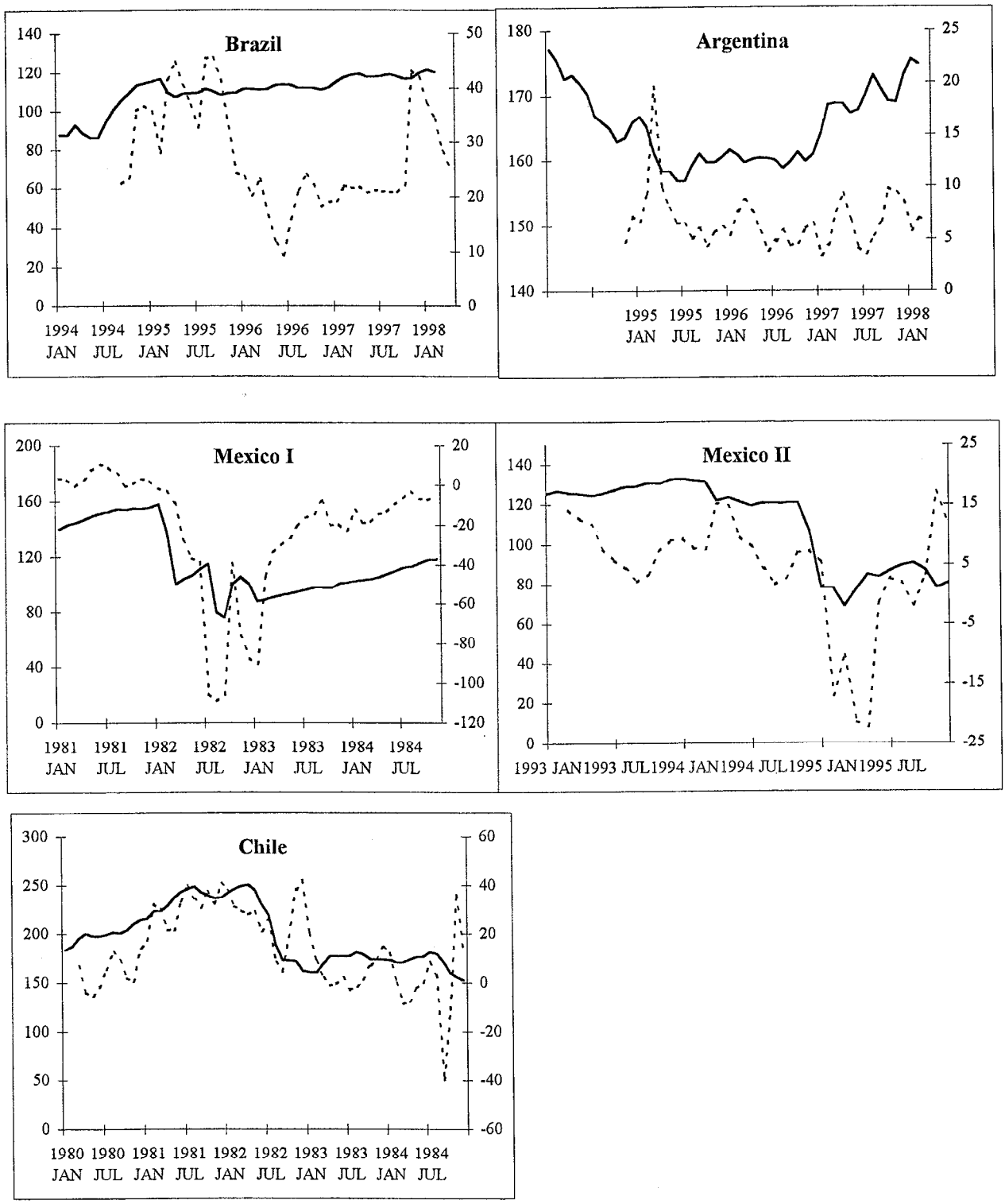
REAL INTEREST RATES 1/ _ _ _ _



Sources: Real Exchange Rate from INS. Real Interest Rates calculated by the authors.

1/ Real Interest Rate is the nominal interest rate minus expected inflation extracted from the next month's inflation.

Chart 7. Latin America
REAL EFFECTIVE EXCHANGE RATES _____
REAL INTEREST RATES 1/ _ _ _ _

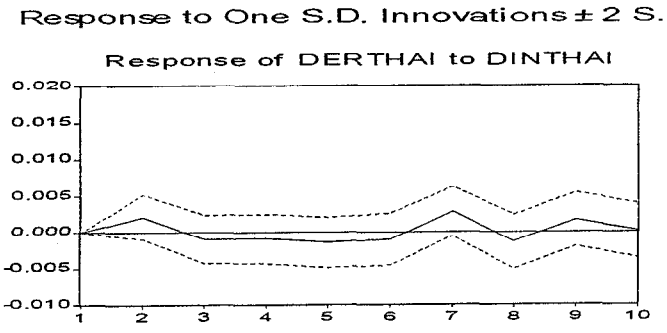


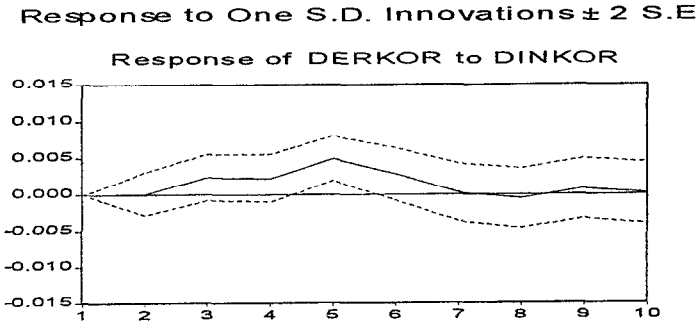
Sources: Real Exchange Rate from INS. Real Interest Rates calculated by the authors.

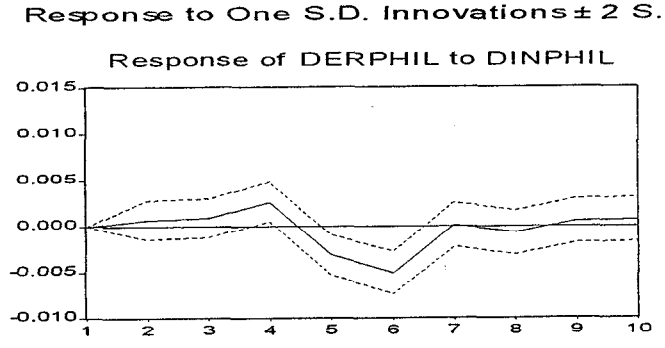
1/ Real Interest Rate is the nominal interest rate minus expected inflation extracted from the next month's inflation.

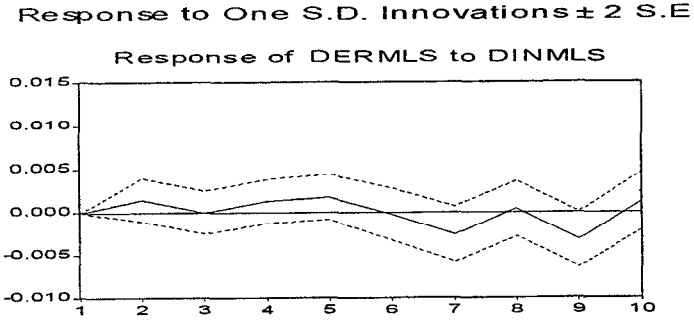
Chart 8. Impulse Response of Exchange Rate Changes due to Innovations in Interest Rate Changes

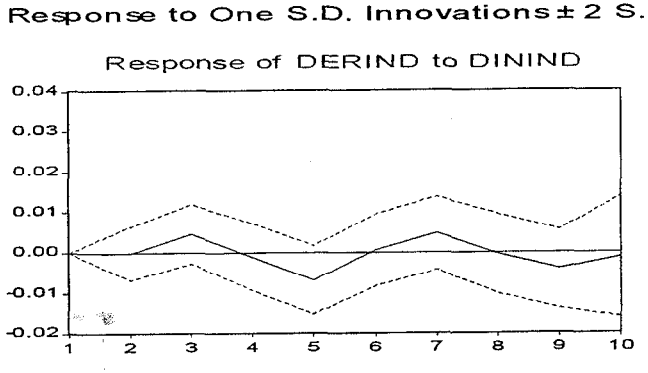
(Country Code: THAI-Thailand, KOR-Korea, MLS-Malaysia, PHIL:Philippines, IND: Indonesia)











Note: VAR estimation, using daily data from 06:01:1997 to 05:18:1998. Contains a constant term and 12 lags of each variable.

Dependent Variable (DER followed by country code): first log difference of exchange rate vis-à-vis US$

Independent Variable (DIN followed by country code): first difference of daily call rate

Source: Data obtained from authorities and IMF staff estimates.

Table 3. Individual and Panel Data Regression of Nominal Exchange Rates on Nominal Interest Rates

Sample:	June, 1997 Sep, 1997	July, 1997 Oct, 1997	Aug, 1997 Nov, 1997	Sep, 1997 Dec, 1997	Oct, 1997 Jan, 1998	Nov, 1997 Feb, 1998	Dec, 1997 Mar, 1998	Jan, 1998 Apr, 1998	Whole Sample
Fixed Effects Panel									
(with 1 lag of independent variable)									
coeff. Est	-0.0003	-0.0002	-0.0001	-0.00006	-0.00002	-0.0001	-0.002	-0.002	-0.00009
t-stat	-2.49**	-1.66*	-1.21	-0.29	-0.11	-0.38	-1.61*	-1.76*	-0.52
Country by Country regression									
(with 1 lag of independent variable)									
Indonesia									
coeff. Est	-0.0006	-0.0005	-0.0006	-0.0003	0.0008	0.0005	0.0003	0.0004	-0.0004
t-stat	-2.95**	-2.27**	-2.04**	-0.258	0.31	0.14	0.63	0.66	-0.71
Malaysia									
coeff. Est	0.0001	0.00008	0.002	0.005	0.001	0.002	0.001	-0.002	0.0001
t-stat	0.28	0.16	1.00	2.21**	0.4	0.37	0.20	-0.33	0.19
Philippines									
coeff. Est	-0.0002	0.00003	0.000006	-0.000004	-0.000007	-0.0003	-0.0007	-0.006	-0.00004
t-stat	-0.41	0.14	0.02	-0.01	-0.02	-0.65	-3.51**	-3.63**	-0.19
Korea									
coeff. Est	0.0002	-0.002	-0.01	-0.003	0.002	-0.001	0.002	0.003	-0.0009
t-stat	0.39	-2.32**	-3.16**	-0.78	-0.45	-0.32	0.55	0.83	-0.38
Thailand									
coeff. Est	0.001	0.001	0.0006	0.001	0.001	-0.001	0.0009	-0.0008	0.0008
t-stat	1.11	1.33	0.54	0.67	0.55	-0.56	0.33	-0.36	0.82

*Note: Results of regressions using daily data. Significance at 10% and 5% level are denoted by * and **.*

In summary, this section has two main results. First, we find little evidence that monetary policy was overly tight in the immediate aftermath of the crises. Second, there is no clear evidence that higher interest rates led to weaker exchange rates. If anything, we find that there are periods where higher interest rates led to stronger exchange rates.

IV. Optimality and Trade-offs in Raising Interest Rates

The previous section discussed the relationship between interest rates and exchange rates and considered the hypothesis that interest rates can stabilize the exchange rate. Even if one accepts this hypothesis, the costs of using monetary policy may be too large to justify high interest rates. This section evaluates the benefits of raising interest rates to defend the currency with the alternative of letting the exchange rate overshoot.

Apart from the traditional output-inflation involved in monetary policy decisions, corporate balance sheet considerations have figured prominently in the debate. The key here is to evaluate the relative exposure of companies to changes in interest rates and exchange rates. On the one hand, increases in interest rates raise the cost of borrowing to highly leveraged companies and, in the banking system, increases in interest rates may significantly reduce profits due to the existence of maturity mismatches. In addition, failures in the nonbank corporate sector may induce failures in the banking system through increases in non-performing loans. On the other hand, in the same manner that increases in interest rates may induce problems in the corporate sector, an overdepreciated currency increases the funding costs of corporations exposed to foreign currency. In particular, in developing countries with fixed exchange rate regimes, banks and companies may have a currency mismatch in their portfolio and may thus be vulnerable to changes in the exchange rate. However, some corporations in the tradable sector have a natural hedge to changes in the exchange rate since part of their receipts is in foreign currency.

The evidence on the relative cost of interest rate versus exchange rate changes on the corporate sector is scarce. For the banking system, the study by Demirguc-Kunt and Detragiache (1997) for 30 developing and industrial countries show that high interest rates substantially increase the probability of a financial crisis while depreciations of currencies have little, if any effect.

Table 4 shows for the Asian crisis cases a few indicators that hint at the relative cost of interest rate versus exchange rate changes. Table 5 shows the same indicators for other currency crises. From the perspective of the traditional trade off (output versus inflation), the low rates of inflation and large declines in output in the five Asian crisis cases suggest that the relative cost of an additional increase in interest rates may have been higher than that of an additional decline in exchange rates. This is particularly true if a comparison with the previous Latin American currency crises is made, where inflation rates tended to be higher and

Table 4. Asia 5 -- Selected Indicators for Policy Trade-off, 1998

	Thailand	Malaysia	Philippines	Indonesia	Korea
Traditional Trade-off (growth versus inflation):					
CPI Inflation Forecast 1/	7.6	7.2	5.3	42.0	8.5
Growth Projection for 1998	-8.0	-4.0	-0.7	-12.0	-5.0
Effective Real Exchange Rate on April, 1998 (June, 97 =100)	66.3	77.2	78.5	47.7	72.6
Balance Sheet Trade-off:					
Corporate Debt/Equity Ratio (in percent)	419	200	63	950	518
Credit ot Private Sector/GDP Ratio, end-1997 (in percent)	145	162	56	61	74
External Debt (as a percent of GDP)	59.6	43.6	62.1	78.0	51.2
of which: short term debt	19.4	10.4	15.7	15.0	14.3
Monetary Policy:					
Nominal Interest Rates on July 1998	16.1	11.0	14.9	79.2	13.0
Real Interest Rates 2/	7.9	3.5	9.1	26.2	7

1/ Expected Inflation for the second half of the year annualized. Staff Estimates.

2/ Real interest rate calculated using the exact formula (1+i)/(1+inf) - 1.

Country Notes:

Malaysia: Nominal interest rate is three month interbank rate. External Debt numbers are end-1997.

Philippines: Nominal interest rate is the three month Treasury Bill. Effective Debt/equity ratio is based on a sample of companies (full data n.a.) and based on net rather than gross debt. Impact on corporate sector based on 1997 data.

Korea: Nominal interest rate is the three month CD rate. External Debt numbers are end-1997. Debt/Equity ratio is based on top 30 Chaebols.

Indonesia: Nominal rate is the one month interbank rate. External debt numbers include $ domestic debt and GDP is calculated as 4 times June quarter GDP at average e/r for June quarter. Debt equity ratio calculated using market value of equity of incorporated co's only (equity is thus understated and D/E overstated). Simple monthly interest rates are converted to represent compounded annualized rates.

Thailand: Nominal interest rate is the one month repurchase rate. External Debt numbers are end-1997.

Table 5. Selected Indicators for Policy Trade-off, Other Currency Cases

	Chile ('82)	Mexico ('82)	Mexico ('94)	Sweden ('92)	UK ('92)
Traditional Trade-off (growth versus inflation):					
CPI Inflation 1/	30.1	208.7	52.0	4.4	1.02
Growth Rate 2/	-2.3	-4.1	-7.5	-1.2	1.0
Effective Real Exchange Rate, (crisis period = 100)	76.7	55.5	75.4	76.3	98.1
Balance Sheet Trade-off:					
Credit to Private Sector/GDP, in the year of devaluation (%)	68.2	7	40	54	127
External Debt (as a percent of GDP)	67.3	52.1	37.3	#na	#na
of which: short term debt	12.3	15.2	7.0	#na	#na
Monetary Policy:					
Nominal Interest Rates on the Month of the Crisis	34.8	34.2	26.4	82.38	8.8
Real Interest Rates 3/	8.1	-24.6	7.3	78.5	5.56

1/ 12 month inflation from the onset of the crisis. The same holds for REER.

2/ Annual GDP growth rate from the quarter of the crisis.

3/ Real interest rate calculated as the nominal interest minus CPI inflation, both defined above.

Country Notes:

Chile: Nominal interest rate is the deposit rate.

Mexico: Nominal interest rate is treasury bill rate.

Sweden: Nominal rate is the overnight call money rate.

UK: Nominal interest rate is the overnight interbank rate.

output declines smaller. The only caveat is if the lags in Asia were to imply a larger passthrough in the future, as suggested in section II.B, and, therefore, a higher inflation.

A different perspective emerges if one considers the relative exposures to exchange rates versus interest rates. Indonesia had the highest external debts and the largest real depreciation within Asia and compared also to other currency crises cases. This suggests a large exposure to exchange rate changes. Korea, with relatively low external debt (compared to both Asian and other crises) and a high debt/equity ratio of domestic corporates, suggests a high exposure to interest rate increases. In Thailand both the high debt to equity ratio and the large ratio of credit to the private sector as a percentage of GDP suggests a large exposure to high interest rates. This assessment, in conjunction with the traditional trade-off (large drop in output and relatively low inflation), suggests that a trend towards lower rates was beneficial. Philippines had a relatively high real rate if one considers that its debt to equity and private credit to GDP ratios are relatively low and the expected decline in output is moderate. In contrast, Malaysia had a relatively low rate considering the low debt to equity ratio (although the credit to the private sector was substantial).

V. Conclusion

This paper evaluated monetary policy and its relationship with the exchange rate in the five Asian crisis countries. The findings were compared to previous currency crises in recent history. The paper argues that there was room to believe that exchange rates had overshot during the crisis and that further declines were not desirable, naturally raising the question of the appropriate policies to reverse this overshooting.

The paper finds that there is no evidence of overly tight monetary policy in the Asian crisis countries in 1997 and early 1998. Negative real rates were encountered for Indonesia, Korea, and Malaysia in early 1998, and for Thailand in the third quarter of 1997. In addition, real interest rates in Indonesia, Malaysia, and Philippines were below their pre-crisis levels. There is also no evidence of large uncovered interest rate differentials in the Asian crisis countries in 1997 and early 1998.

There is also no evidence that high interest rates led to weaker exchange rates. Simple correlations using monthly data provide mixed results and vector autoregression model estimations with daily data imply, if anything, that higher interest rates are associated with stronger exchange rates. There are a couple of issues one should consider regarding this result. First, the Asian crisis generated an increase in the risk premium demanded for holding the crisis countries assets. This increase is associated with both a higher interest rate and a more depreciated exchange rate that would tend to bias the result in favor of finding a perverse effect of interest rates on the exchange rate. However, the perverse effect is not found despite this natural bias. Second, the paper recognizes that the relationship between interest rates and exchange rates is more complex and is affected by other macroeconomic policies and the political support and credibility they enjoy. Absent this credibility, even large increases in interest rates would not be successful in stemming exchange rate depreciations.

Third, in order to test more rigorously this result, one needs to assemble a larger data set, which is only available once a great number of currency crises are considered. This larger exercise is performed in a separate paper (see Goldfajn and Gupta, 1998).

The paper highlights the need to reconcile the traditional interest rate-exchange rate trade-off with a corporate balance sheet approach. The cost associated with high interest rates to stabilize the currency can be overwhelming if the banking sector is fragile. On the other hand, if the corporate sector is heavily exposed to foreign debt, then increasing interest rates may be the appropriate policy. Monetary policy in the aftermath of currency crisis requires close attention to these issues.

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