Macroeconomic Behavior During Periods of Speculative Pressure or Realignment: Evidence from Pacific Basin Economies

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This paper uses nonparametric tests to provide a description of the "stylized facts" associated with episodes of speculative pressure in foreign exchange markets in Pacific Basin Economies and to see whether these "stylized facts" appear to be broadly consistent with the alternative explanations for such episodes suggested in the theoretical literature.

The empirical results are mixed, but some are nonetheless suggestive. Larger budget deficits and growth in central bank domestic credit appear to be associated with episodes of depreciation rather than episodes of appreciation or periods of tranquility, indicating that unusually expansionary or contractionary policies may contribute to speculative pressures in foreign exchange markets. There also is some evidence that episodes of speculative pressure may arise when economic conditions make it costly for the government to maintain a stable exchange rate.

In recent years, there has been renewed interest in the causes and characteristics of episodes in which speculators put strong upward or downward pressure on a currency. General interest has been motivated by the attack on the exchange rate mechanism of the European Monetary System in September 1992 and more recently by the devaluation and float of the Mexican peso in December 1994. In Asian economies, interest in speculative pressures is largely motivated by their experiences with surges in capital inflows (see Glick and Moreno, 1994).

It is not easy to explain why an exchange rate may be subject to speculative pressure. One view is that macroeconomic policies that are inconsistent with a government's exchange rate target trigger speculative pressures. Another explanation is that the speculators' beliefs affect government policy and, specifically, the willingness of a government to defend a peg, triggering episodes of speculative pressure that may force adjustment in the exchange rate. For example, expectations of inflation may raise domestic interest rates, making it costly for the government to preserve a peg that it otherwise would have maintained, leading to devaluation and higher inflation. Under these conditions, market expectations take on the characteristics of self-fulfilling prophecies.

The underlying source of speculative pressure in foreign exchange markets has important implications for policy. If such pressures reflect the adoption of inconsistent macroeconomic policies, they can be avoided by pursuing policies that are consistent with the exchange rate peg. However, if speculative pressures largely reflect more or less arbitrary changes in expectations, sound macroeconomic management may not suffice to ensure the maintenance of a peg. In response, countries may adopt policies seeking to enhance the credibility of the peg (for example, by adopting a currency board), choose to allow the exchange rate to float, or occasionally adopt capital controls, at the cost of efficiency and the development of their financial sectors.

In spite of the possible usefulness of distinguishing between the causes of realignment, there is little evidence on which type of model is more relevant empirically. The reason is that, with the exception of a study by Eichengreen,

Rose, and Wyplosz (ERW, 1995),[1] most empirical studies of speculative attacks generally assume that pressures to realign reflect macroeconomic policies that are inconsistent with the exchange rate peg.[2]

ERW suggest that comparing the behavior of macroeconomic variables during periods of speculative pressure with their behavior during periods of tranquility may provide insights into the plausibility of alternative explanations of episodes in which there is pressure to realign. They argue that a finding that the behavior of macroeconomic variables is different in the two periods supports the view that episodes of speculative pressure are triggered by inconsistent macroeconomic policies. If no difference is found, then episodes of speculative pressure may be the result of arbitrary shifts in expectations.

Using monthly data for 1967–1992 covering 22 countries (mostly OECD members) and applying nonparametric tests, ERW find that, among the European economies, the behavior of macroeconomic variables during periods of speculative pressure does not differ significantly from the behavior of these same variables during tranquil periods. However, their behavior does differ across periods among the non-European economies in their sample.

This paper applies methods similar to those suggested by ERW to a sample of economies in the Asia-Pacific Basin over the period 1980–1994. The experience of these economies is of interest because it was not considered in ERW's study. Also, in contrast to developing economies in Latin America and Africa, they have by and large adopted stable macroeconomic policies that have resulted in moderate rates of inflation. Nevertheless, these economies have also experienced episodes of speculative pressure in which their currencies tended to depreciate or to appreciate.

The paper has two relatively modest objectives. The first is to provide a description of the "stylized facts" associated with episodes of speculative pressure in foreign exchange markets. The second is to see whether these "stylized facts" appear to be broadly consistent with the alternative explanations for such episodes suggested in the theoretical literature.

The paper is organized as follows. Section I discusses models of speculative pressure in some detail and their implications for macroeconomic behavior during episodes of speculative pressure and tranquility. Section II implements the comparisons of episodes of speculative pressure and tranquility and Section III offers some conclusions.

I. MODELS OF SPECULATIVE PRESSURE

Pre-attack Macroeconomic Policies

To illustrate how macroeconomic policies may lead to speculative attacks, as in Krugman's (1979) model, consider the case of a fictitious country, Latinia. The Latinian currency is the peso, and its exchange rate against the dollar is governed by the relative supply of and demand for pesos. Suppose that the peso exchange rate is pegged by the government. The enforcement of the peg depends on the ability of the government to control the monetary base, which is the sum of central bank domestic credit and net foreign assets. The central bank is prepared to defend the peso peg so long as it has a minimum level of net foreign assets.

Suppose now that the Latinian central bank increases domestic credit to finance government deficits. The resulting incipient increase in the money supply will tend to depreciate the peso. In order to prevent the peso from depreciating, the Latinian government must prevent the money supply from increasing. As reducing the stock of domestic credit is ruled out by deficit financing, Latinian authorities must stand ready to sell any dollars demanded by the market at its target exchange rate. The sale of dollars has a contractionary influence on the Latinian money supply (simultaneously reducing the net foreign assets and the monetary liabilities of the central bank) that fully offsets the increase in domestic credit and preserves the peso peg.

Although (unsterilized) intervention preserves the peso peg in the short run, such a peg may be unsustainable in the long run if domestic credit is used to finance a persistent fiscal deficit. Under these conditions, domestic credit increases in each period, and Latinia's central bank must keep on selling foreign assets to prevent the peso from depreciating. At some point, the central bank will reach its minimum acceptable level of foreign exchange reserves and will be forced to abandon the exchange rate peg. Anticipating this, speculators will attack the peg prior to this point, reducing the central bank's reserves to zero and forcing the abandonment of the peg.

Blanco and Garber (1986) provide an intuitive way of identifying the precise point in time at which the exchange rate peg will collapse. They define the shadow exchange rate as the floating rate that would clear the foreign exchange market given the stock of domestic credit, after all foreign exchange reserves have been sold to the private sector. They show that the exchange rate will be attacked at

1. Another study that does not assume that attacks are caused by pre-attack macroeconomic policies that are inconsistent with a peg is by Drazen and Masson (1994). This study draws on a model developed by Obstfeld (1991, 1994) which is discussed later.

2. Blanco and Garber (1986), Cumby and van Wijnbergen (1989), and Goldberg (1994).

precisely the time (say t^*) when the shadow exchange rate equals the fixed exchange rate.

Before t^*, if foreign exchange reserves were all sold off by the central bank, the money supply would be smaller than at t^* (the date when the floating rate equals the fixed), so that the exchange rate would *appreciate* from the pegged level. As speculators are aware that they would experience capital gains if the peg were abandoned, they will hold on to their pesos, and no attack will occur before t^*. After t^*, the money supply will be greater than at t^*, even if all foreign exchange reserves are sold off. The exchange rate therefore would *depreciate* if the peg were abandoned, exposing holders of pesos to capital losses. To avoid such losses, speculators would attack the peso at t^*, at which point the central bank's foreign exchange reserves would fall to zero and the currency would float. After t^*, the shadow exchange rate equals the actual floating rate.

As there is no uncertainty in Krugman's original model, the exchange rate cannot jump when the peg is abandoned (otherwise agents could experience fully anticipated capital gains and losses, which would not be consistent with rationality). By introducing uncertainty into the process of domestic credit creation, Blanco and Garber obtain two plausible results. First, the spread between domestic and foreign interest rates rises over time, as the probability of a devaluation increases. Second, the timing of a devaluation is no longer fully anticipated (it depends on the size of the shock to domestic credit at a given point in time), so the exchange rate can jump when the peg is abandoned.

Self-Fulfilling Expectations

A number of observers have noted that Krugman's model does not seem to describe the situation of some European countries that experienced attacks on their exchange rates in 1992–1993. In contrast to Krugman's model, European countries at the time were not constrained by the availability of foreign exchange reserves. Speculative attacks, which tended to put downward pressure on the exchange rates of a number of European countries against the deutsche mark, were at times directed at countries whose economic policies were not obviously inconsistent with a deutsche mark peg—such as France. In some of the European countries, the decision to abandon a currency peg appeared to be related to the perceived cost of defending a peg by raising interest rates. Similarly, speculative pressures on some Asian currencies such as the Hong Kong dollar, and the Thai bhat, following Mexico's financial crisis in December 1994, did not appear to reflect the perception that those countries' monetary authorities lacked foreign exchange reserves.

These differences have prompted some authors to consider models in which the beliefs of speculators may affect the government's incentive to defend or abandon a currency peg, leading to self-fulfilling crises. As noted by Obstfeld (1994), a circular dynamic arises because expectations depend on conjectured government responses, which in turn depend on how changes that themselves result from expectations affect the government's desired response. This "implies a potential for crises that need not have occurred, but that do occur because market participants expect them to" (p.3).

To illustrate how self-fulfilling crises and multiple equilibria may arise in a regime with fixed but adjustable parities, consider Obstfeld's (1991, 1994) open-economy extension of Barro and Gordon's (1983) model. In this model, labor market rigidities introduce a role for output fluctuations and stabilization policy in the presence of demand shocks. For example, if the demand shock is deflationary, the real wage set beforehand will be too high, and output will contract. The government can offset the shock by devaluing the exchange rate, at the cost of higher inflation. Precisely how the government will respond to the shock depends on its objective function.

The government is assumed to minimize a quadratic loss function that penalizes deviations from zero inflation and a target level of output. It is also assumed that because of distortions (say, in the labor market) that lead to production that is not fully efficient, the target (log) level of output is positive (compared to the rational equilibrium output level of zero when the demand shock is at its mean value of zero).

If the government cannot pre-commit to a fixed exchange rate, the government reaction function can be derived to show that the government ex post will (i) use the exchange rate partially to offset shocks to output; (ii) attempt a "surprise" depreciation whenever wage inflation risks eroding competitiveness; (iii) attempt to drive output above the "natural" level (of zero) by devaluing to offset the assumed distortion in the economy. Under these conditions, a fixed exchange rate will be optimal only if the penalty for inflation is infinitely large.[3]

As is to be expected in this type of model, the economy is characterized by a systematic inflation bias proportional to the deadweight output loss. This inflation bias reflects the government's attempts to exploit the potential short-run Phillips trade-off created by predetermined nominal wages. While a precommitment to a fixed exchange rate would eliminate the inflation bias, it also would prevent the government from responding to unpredictable output shocks. In choosing whether to maintain a peg or to adjust

3. Appendix 1 provides a derivation of these results.

the exchange rate the government will select the alternative that minimizes its loss.

To describe the nature of the choice facing the government, Obstfeld assumes that the government cannot credibly commit to fix the exchange rate in all circumstances, and that instead it faces a fixed realignment cost, c. The loss function of the government can then be described by:

(1) $l_t = (\theta/2)(e_t - e_{t-1})^2 + (1/2)[\alpha(e_t - w_t) - u_t - y^*]^2 + cZ_t$
($Z = 1$ if $c \neq 0$, $Z = 0$ otherwise).

In equation (1), e_t is the nominal exchange rate, w_t is the wage, u_t is a demand shock and y^* is the target level of output. The first right-hand term reflects the cost of deviations from zero inflation, the second the cost of deviations from the target level of output y^* associated with changes in the real exchange rate $(e_t - w_t)$ or demand shocks, and the third the fixed cost of realignment.

A realignment will then occur whenever the cost of pegging the exchange rate exceeds the cost of keeping the exchange rate fixed, or when the following condition is satisfied:[4]

(2) $$(1/2)\lambda[\alpha\pi_t + u_t + y^*]^2 > c\ .$$

If equation (2) is binding, we obtain two roots which represent the upper and lower bounds for the demand shock ($u_H > u_L$). The government devalues whenever $u > u_H$ and revalues whenever $u > u_L$. Intuitively, when the demand shock is very large, the cost of unemployment is so high that the benefits of a stimulus offset the costs of inflation associated with a devaluation. When the demand shock is small enough, then the benefits of reducing overemployment outweigh the costs of deflation.

The preceding fixed exchange rate mechanism, which allows for realignment for sufficiently large demand shocks, opens the door for successful speculative attacks. The reason is that the threshold points u_H and u_L which determine whether the government will revalue or devalue depend on prior expectations of depreciation π_t. These expectations in turn depend on market perceptions of where the points u_H and u_L lie. A shift in these market perceptions, or in the cost of realignment, can lead to a change in the threshold points and to an exchange rate crisis and devaluation, whereas none might have occurred in the absence of this shift. The shift in perceptions may have nothing to do with the soundness of domestic economic policy or other market fundamentals.

The importance of market perceptions in determining the timing and success of speculative attacks suggests that a reputation for "toughness" may help policymakers deter an attack and preserve a peg. (This appears to be the rationale for proposals such as the adoption of currency boards, which can make it less likely that money will be issued in a manner inconsistent with a peg, and also make it more difficult to adjust a peg.) Drazen and Masson (1994) investigate this question and point out that there is still a trade-off. Speculators may infer that a government resisting a speculative attack is indeed "tough," thus deterring them from future attacks, or they may instead infer that the defense against the first speculative attack was so costly that the government could not possibly resist a future attack. Drazen and Masson's model seems to fit the experience of Sweden. Obstfeld (1994) observes that in September 1992, Swedish authorities successfully resisted an attack on the krona by raising the domestic interbank rate up to 500 percent (annualized). However, they responded to a second attack in November 1992 by floating the currency. The cost of defending the peg, given high unemployment, was simply too high.

Two-Sided Attacks

Most discussions of pressures to realign focus on episodes in which devaluations may occur either because a country has pursued policies that deplete foreign exchange reserves (as in Krugman's model) or because the government cannot resist the temptation to inflate when inflationary expectations make the economy less competitive or output growth is sluggish (as in Obstfeld's model). However, speculative pressures involve revaluations as well as devaluations. In Pacific Basin economies, which are the focus of this paper, episodes of speculation that a currency will appreciate against the U.S. dollar are not uncommon. For example, the methods used in this paper identify 54 episodes of appreciation pressures on the exchange rate compared to 72 episodes of depreciation pressure in the period 1980–1994 (see the last row of Table 1).

As is apparent from the preceding discussion, a model where realignments reflect the government's desire to offset shocks to competitiveness and employment allows for appreciation or depreciation pressures. In such a model, surprise revaluations reduce excess demand by reducing the competitiveness of the export sector. Appreciation pressures can be interpreted as resulting from a real exchange rate that is "misaligned," in the sense that it produces a macroeconomic outcome that is not consistent with the government's ultimate policy objectives.

In contrast to the models with multiple equilibria, the literature based on Krugman's (1979) paper typically focuses on episodes of depreciation. This may reflect the fact

4. See Appendix 1, equations (A4) and (A6).

TABLE 1

SOURCES OF SPECULATIVE PRESSURE

(Percentage of episodes in which the change in variable led to identification of a speculative episode. Episodes are identified using individual country data.)

	ALL SPECULATIVE	DEPRECIATION	APPRECIATION
EXCHANGE RATE	49	51	46
RELATIVE NET FOREIGN ASSET	34	36	31
RELATIVE SHORT TERM RATE	17	13	22
NUMBER OF EPISODES	126	72	54

that it is not easy to explain why exchange rate appreciation might matter in this type of model. Grilli (1986) does examine the implications of appreciation pressures by extending Blanco and Garber's (1986) model to allow for both a lower and an upper limit on reserves at which the exchange rate will be allowed to float.

Grilli does not explicitly discuss why a country would want to limit the level of reserves. It might be argued that policymakers worry about the expansionary impact such foreign exchange reserves may have on the stock of money. However, this cannot be the case in this type of model, because episodes of appreciation pressure necessarily reflect monetary contraction (in spite of foreign exchange accumulation). Another plausible explanation is that policymakers do not want to hold too high a level of foreign reserves because the return on foreign assets is lower than on domestic assets, imposing a quasi-fiscal cost on the government. This type of explanation is not ruled out by this class of models, but neither is it explicitly taken into account.

Another point worth noting is that it is not entirely clear what process would lead to the persistent foreign exchange reserve accumulation described in Grilli's model. The counterpart to Krugman's original scenario of reserve drainage would be a situation where a country experiences budget surpluses that the government uses to increase its deposits with the central bank. The resulting monetary contraction then attracts capital inflows and leads to increases in reserves. One limitation of this type of scenario is that it may not explain most appreciation episodes in Pacific Basin economies. While most of these economies adopt relatively conservative fiscal policies, it does not appear that government budget surpluses systematically drain liquidity in most of the economies in the region (with the exception of Singapore).[5]

II. EMPIRICAL ANALYSIS

In this section we examine some "stylized facts" about speculative episodes. The preceding discussion of alternative models of speculative pressure may provide a broad framework for attempting to interpret the results of this analysis.

Two broad sets of questions are addressed. First, how does foreign exchange market adjustment occur during episodes of speculative pressure? Are most such episodes associated with sudden adjustment in the exchange rate, with sharp changes in net foreign asset growth, or with changes in relative interest rates? Are there differences in adjustment during periods of appreciation and depreciation? These questions may be addressed by evaluating the behavior of indicators of speculative pressure (changes in the nominal exchange rate, relative net foreign asset growth, and changes in interest rate differentials) and seeing how the behavior of these variables differs during periods of speculative pressure and tranquility.

Second, are there significant differences in macroeconomic behavior during periods of speculative pressure and periods of tranquility? Such differences were not found by ERW for a sample of European countries, but were found for a set of non-European economies. Are there also differences in macroeconomic behavior during episodes of appreciation and depreciation? As argued by Eichengreen, Rose, and Wyplosz, if speculative episodes are caused by more or less arbitrary changes in expectations, there may be no differences in the behavior of macroeconomic variables during periods of speculative pressure and tranquility. However, if some differences in the behavior of macroeconomic variables are observed, the nature of these differences may shed light on whether speculative pressures appear to reflect inconsistent macroeconomic policies or policymakers' response to adverse economic conditions.

In particular, the policy environment, which can be represented by comparing monetary and fiscal policy indicators during periods of speculative pressure and tranquility, may shed light on whether expansionary monetary and fiscal policies trigger speculative attacks, as in Krugman (1979). It may be argued that such policies can be the source of speculative pressures if it is found that monetary

5. For a discussion of Singapore's monetary regime, see Moreno (1988). The monetary regimes of Singapore and other economies are discussed in Talib (1993).

and fiscal policy variables differ during periods of speculative pressures and periods of tranquility.[6]

Indicators of internal or external balance may shed light on whether the cost of maintaining a stable exchange rate is too high for the government, leading to shifts in expectations associated with speculative pressures. For example, if output is unusually sluggish, domestic inflation is relatively high, or the current account is unbalanced, the government may find it too costly to defend the exchange rate, as suggested by some models used by Obstfeld (1991, 1994) and Drazen and Masson (1994).[7]

The Data

In order to analyze episodes of speculative pressure, a number of data series were constructed. The percentage change in the bilateral exchange rate against the U.S. dollar, changes in relative net foreign asset growth, and the differential between the first difference of the logs of the domestic and U.S. interest rate, were used as indicators of speculative pressure. The differential between the relative growth (domestic compared to U.S.) in an estimated measure of central bank domestic credit, narrow and broad money were used to indicate the monetary policy environment. The ratio of the budget deficit to government spending (relative to the U.S.) was used to represent the fiscal policy environment. The differential (domestic less U.S.) in inflation and deviations of output growth from the mean rate of growth for each country were used to represent the internal balance, while the ratio of exports to imports was used to represent the external balance.

The data are taken from the IMF *International Financial Statistics.* All the series are monthly, except real output growth and the government budget balance, which are quarterly. Speculative pressure episodes were identified over the period 1980–1994. However, the indicators of the policy environment or the internal and external balance did not always span the full period or in some cases were missing values. For some series data from certain countries are excluded because of lack of availability. The countries covered are Indonesia, Japan, Korea, Malaysia, Philippines, Singapore, and Thailand.[8]

Analyzing Episodes of Speculative Pressure

The models discussed previously assume that the exchange rate is fixed. However, as is apparent in Appendix 3, the countries in our sample have adopted a variety of exchange rate regimes in various time periods, including *de facto* pegs to the U.S. dollar (Thailand up to 1984), basket pegs or managed floats (most of the countries in the 1980s) and relatively free floats with occasional massive intervention (Japan). Nevertheless, a review of these exchange rate regimes suggests that policymakers as a rule seek to dampen large fluctuations in the exchange rate.[9] For this reason, it can be argued that while the exchange rate is not strictly fixed in many cases, episodes of very large exchange rate movements may be interpreted as episodes of speculative pressure that will be viewed with concern by authorities and may trigger a policy response, even in regimes where the exchange rate is supposed to float freely. Also, large changes in net foreign assets of the central bank or in short-term interest rates may be interpreted as reflecting episodes of pressure in foreign currency markets where authorities may have resisted an adjustment in the exchange rate.

The models discussed previously also tend to assume that speculative attacks on the exchange rate always succeed because rational agents correctly anticipate that they will be worse off by delaying an attack. In practice, however, episodes of speculative pressure do not always result in large adjustments in the exchange rate.

In line with this, episodes of speculative pressure in foreign exchange markets were identified by focusing on large adjustments in the exchange rate and on episodes in which there were large changes in net foreign assets or in relative short-term interest differentials. Using data for each country, an arbitrary band was constructed around each indicator of speculative pressure by taking the mean of the indicator plus or minus 1.5σ, where σ is the standard deviation of the indicator. To identify episodes of "speculative pressure," episodes where changes in the exchange rate were outside the 1.5σ band were selected first. From the remaining (nonselected) observations, episodes where changes in relative net foreign assets were outside the 1.5σ

6. It may be noted that in one of the models described by Obstfeld (1994), a weak fiscal position may lead to self-fulfilling attacks on the exchange rate, so it is not entirely possible to rule out this type of explanation when looking at the budget deficit.

7. Although the general approach adopted here is inspired by Eichengreen, Rose and Wyplosz (1995), the interpretation differs from theirs. Eichengreen, Rose and Wyplosz do not explicitly distinguish between policy and internal and external balance indicators, but instead interpret these indicators as broadly representing the behavior of "fundamentals." They argue that if the tests reveal that the distribution of fundamentals differs during periods of speculative pressure and tranquility, then this suggests that episodes of speculative pressure are best explained by models in which a peg becomes unsustainable because of inconsistent macroeconomic policies, as in Krugman's (1979) study.

8. Appendix 2 provides more information on the data.

9. For recent reviews of exchange rate policies in Pacific Basin economies see Glick and Moreno (1995), Glick and Hutchison (1994), and Moreno (1994).

band for that series were selected next. The list of speculative pressure episodes was completed by adding episodes where changes in short-term interest differentials were outside the 1.5σ bands. The remaining observations (inside the band defined for each of the three indicators) were treated as periods of "tranquility." In order to prevent the continuation of a speculative episode from being identified as a new episode, windows were created by dropping five observations around previously identified episodes.[10]

Eichengreen, Rose, and Wyplosz (1995) use similar indicators but adopt a different approach for identifying speculative episodes. They construct a weighted average index of the three indicators, and identify speculative attack episodes by taking those observations that fall outside the 1.5σ band around the index. Their weights are constructed to compensate for the volatility of each variable, in effect rescaling, so that each variable has the same influence in the index.[11] It may be noted that for some Pacific Basin countries, data for interest rates (Indonesia) or net foreign assets (Philippines) are missing over certain periods. If a weighted-average index were used, those periods would have to be treated as missing, or as periods of tranquility. In either case, the weighted-average index would not fully utilize information from the indicators of speculative pressure that are observed during periods when data from one of the series is missing. The selection procedure used in this paper avoids this difficulty and, as a result, identifies a larger set of speculative pressure episodes than would a weighted-average index.

A number of plausible episodes of speculative pressure are identified by the sequential method used in this paper. In the case of Japan, the present method picks up the pressure on the yen to appreciate in September 1985, around the time of the Plaza meetings. However, speculation on the yen in March 1987, after the Louvre meetings, was excluded because it fell within the window that followed a speculative episode in October 1986. Other plausible episodes that have been identified include the 1980 devaluation of the Korean won, the December 1993 speculation on the Malaysian ringgit,[12] the Thai baht devaluation of 1984, the depreciation pressure on the Philippine peso during the political-cum-debt crisis of 1983, and the appreciation pressure in Indonesia in recent years after the country's depreciation pressures in 1983 and 1986.

Eichengreen, Rose, and Wyplosz use their index to test for differences in the statistical properties of macroeconomic variables during periods when the index value is inside the band and when it is outside. In this paper, their approach is taken a step further by also distinguishing between episodes of appreciation and depreciation for those points outside the band. A *depreciation episode* is said to occur if the percentage change in the exchange rate is outside the 1.5σ band for the exchange rate and is greater than zero, or if the exchange rate is inside its band but the change in relative net foreign assets is outside its corresponding band and is negative, or if neither the exchange rate nor the change in relative net foreign assets are outside their respective bands but the change in short-term interest rates is outside the band and positive. *Appreciation episodes* are constructed in a similar manner, but the changes are negative for the exchange rate, positive for net foreign assets and negative for short-term interest rates.

To describe the characteristics of episodes of speculative pressure more fully, we estimated the proportion of times that a change in either the exchange rate, relative net foreign assets or relative short term rates was the criterion used in selecting a speculative pressure episode. The results, reported in Table 1, indicate that unusual behavior in the exchange rate accounted for about 50 percent of the speculative pressure episodes identified (whether we consider all episodes combined, depreciation episodes or appreciation episodes), relative net foreign assets for over 30 percent, and relative short-term interest rates for 13–22

10. More precisely changes in the exchange rate, net foreign assets or short-term interest rates outside the corresponding 1.5σ band were not treated as speculative pressure episodes if they fell within the five-month window following an episode already identified by a large movement in the exchange rate. In addition, episodes identified by relative net foreign asset growth or short-term interest differentials were dropped if the five months that followed included an episode previously identified by the exchange rate. Episodes identified by short-term interest differentials were dropped if the five months that followed included an episode previously identified by the relative net foreign assets. The effect of this procedure is to give first priority to the exchange rate and second priority to net foreign assets when an observation falls within a five-month window. A similar priority is given to these variables in classifying episodes of depreciation and appreciation. Macroeconomic behavior is analyzed in the month or quarter corresponding to the date of the speculative episode.

11. Eichengreen, Rose and Wyplosz's speculative pressure index is defined as

$$(s_t - s_{t-1})/s_{t-1} + \alpha^*(\Delta\log i_t - \Delta\log i^{US}_t) - \beta^*(\Delta NFA_t - \Delta NFA^{US}_t)$$

where s is the nominal exchange rate (domestic over foreign), i is the short-term interest rate, and NFA is net foreign assets of the central bank. The weights α and β are based on conditional volatilities scaled so as to dampen the impact of the more volatile components on the index.

12. However, December 1993 would be classified as a depreciation episode by the method used here, because the exchange rate depreciated and this takes precedence over the large accumulation of foreign exchange reserves. Since the main concern of policymakers at the time was capital inflows, it would seem more reasonable to classify it as an appreciation episode. Such difficulties in interpreting particular episodes are likely to arise in any procedure adopted for classifying episodes.

percent. The fact that half of speculative pressure episodes are identified by unusual movements in relative net foreign assets and relative short-term interest rates (episodes in which the exchange rate itself does not make a large adjustment) suggests that monetary authorities in the Asia-Pacific Basin intervene actively in foreign exchange markets, and succeed in preventing large movements in the exchange rate quite often.

Table 2 seeks to shed further light on the characteristics of speculative pressure episodes by reporting the median values of changes in the exchange rate, relative net foreign assets and relative short-term rates during speculative pressure episodes and periods of tranquility. The differences between the median values for the combined speculative episodes and tranquil periods appear to be relatively small. In contrast, median values for all the variables are much larger (in absolute value) during episodes of depreciation than during periods of tranquility. Adjustments in the exchange rate, net foreign assets and short-term rates also tend to be larger during episodes of depreciation than during episodes of appreciation.

To assess more formally whether periods of speculative pressure differ from periods of tranquility, two nonparametric tests were implemented, both suggested by Eichengreen, Rose, and Wyplosz (1995). The first test is the Kruskal Wallis (KW) test, and the second is the Kolmogorov-Smirnov (KS) test. In both cases, the null hypothesis that the distribution of selected variables during periods of speculative pressure does not differ from the distribution of these same variables during periods of tranquility was tested.

Consider the distribution of relative inflation rates during periods of speculative pressure and of tranquility. The KW statistic can be used to test the null hypothesis that the populations from which the two inflation samples are drawn (speculative pressure and tranquil populations) are identical, against the alternative that one of the populations yields a larger observed value (higher inflation) than the other population. The KW test statistic depends not only on central location but also on the ranks of the observations in the combined sample. It therefore uses more information than does the median test statistic, which relies only on determining whether observations are below or above the median (Conover, 1971).[13]

One limitation of the KW test is that it assumes that any difference in distribution reflects only a difference in central location (if the distribution $F(x) \neq G(x)$, then $F(x) = G(x + c)$, where c is a constant).[14] The test may not detect differences of other types, such as differences in variance. For this reason, the KS test statistic, which computes differences in the empirical distribution function of two samples (speculative pressure versus tranquility) is also used.

The Behavior of Macroeconomic Variables

Table 3 reports the results of the comparison of indicators of the policy environment and of internal and external balance during periods of speculative pressure and tranquility. The qualitative features of differences in the behavior of the various series are presented in Table 4, which reports the median values during episodes of all types of speculative pressure, depreciation, appreciation, and tranquility.

In line with Krugman's (1979) model, we would expect an expansion in monetary aggregates to be associated with episodes of depreciation pressure, and monetary contraction with episodes of appreciation. Also, we would expect budget deficits to be larger during episodes of depreciation pressure than during periods of tranquility. The data in Tables 3 and 4 provide mixed support for this type of story.

The results in Table 3 indicate that the distribution of broad money differs during periods of depreciation pressure and tranquility (significant at 5 percent) and provide mixed evidence of differences in central bank domestic credit during periods of appreciation and tranquility (p value of 8 percent for the KW test). The median values for central bank domestic credit are broadly consistent with the view that depreciation episodes may result from faster money growth and appreciation episodes from monetary contraction. However, these results should be interpreted with caution, as the central bank domestic credit contraction during appreciation episodes may reflect sterilization efforts to offset net foreign asset accumulation. Thus such contraction could be *caused by* appreciation pressures rather than

13. The KW test combines both samples (speculative pressure and tranquil) into a single, ordered sample. Ranks are then assigned to the combined sample values from smallest to largest. The test statistic is the sum of the ranks assigned to the values from one of the populations. If the sum is very small, or very large, the values from that population may be taken to be smaller, or larger, than the values from the other population. The null hypothesis of no difference between the samples is rejected if the ranks associated with one sample are sufficiently large compared to the ranks associated with the other sample. Ranks are preferred in this case because the distribution functions may not be normal, in which case the probability theory underlying the actual data may not be known. The probability theory of statistics based on ranks is simpler and may not depend on the distribution of the actual data. Note that difficulties arise in implementing the KW test if there are too many ties in the rankings. However, this is likely to be a problem only when the test is applied to the exchange rate if there are periods when the exchange rate is fixed.

14. Another limitation is that the KW level of significance is likely to differ from the true level of significance if there are many tied values. However, this is not likely to be the case for the series being analyzed.

TABLE 2

SPECULATIVE PRESSURE AND TRANQUIL PERIODS
MEDIAN VALUES

CHANGES IN:	ALL SPECULATIVE	DEPRECIATION	APPRECIATION	TRANQUIL
Dollar Exchange Rate	0.25	2.01	–0.73	0.09
Net Foreign Assets	0.73	–2.89	4.6	1.37
Short Term Interest Differentials	–0.53	0.34	–1.52	–0.11

TABLE 3

ALL SPECULATIVE PRESSURE AND TRANQUIL PERIODS
TESTS OF SIMILARITY AND DISTRIBUTIONS

	ALL SPECULATIVE		DEPRECIATION		APPRECIATION	
	KW	KS	KW	KS	KW	KS
			Indicators of policy environment			
DOMESTIC CREDIT	0.17	0.76	0.91	0.74	3.17*	1.18
	(0.68)	(0.61)	(0.34)	(0.64)	(0.08)	(0.13)
NARROW MONEY	1.46	0.93	1.33	1.08	0.35	0.67
	(0.23)	(0.36)	(0.25)	(0.19)	(0.56)	(0.76)
BROAD MONEY	2.97*	1.16	5.88**	1.47**	0.01	0.64
	(0.08)	(0.13)	(0.02)	(0.03)	(0.94)	(0.80)
BUDGET DEFICIT	0.44	0.92	2.86*	1.14	0.81	0.77
	(0.50)	(0.36)	(0.10)	(0.15)	(0.37)	(0.59)
			Indicators of internal and external balance			
CPI INFLATION	1.13	1.19	0.99	1.22*	0.29	0.60
	(0.29)	(0.12)	(0.32)	(0.10)	(0.59)	(0.86)
REAL OUTPUT	0.16	0.95	2.03	1.22*	1.09	0.85
	(0.69)	(0.33)	(0.15)	(0.10)	(0.30)	(0.47)
EXPORTS/IMPORTS	0.27	0.97	0.93	1.08	0.09	0.59
	(0.61)	(0.31)	(0.33)	(0.19)	(0.77)	(0.88)

NOTE: The test in each case compares the distribution of the data during periods of tranquility with the distribution of the data during all speculative, depreciation, and appreciation episodes respectively. Test statistics are reported, followed by *p* values in parentheses.
** Reject null at 5%
* Reject null at 10%

be the cause of appreciation pressures as is implicitly assumed in our approach here. Further research is needed to sort out the causality.

It may also be noted that the median values for narrow and broad money do not appear to be consistent with the view that excessive money growth contributes to depreciation episodes. As can be seen in Table 4, money growth rates appear to be larger during periods of tranquility, and broad money growth seems to be greater during periods of appreciation than during periods of depreciation. Given that central bank domestic credit behaves in the opposite fashion, the behavior of broader money growth appears to reflect changes in monetary conditions during episodes of speculative pressure that need to be explored further.

The data provide some evidence that large budget deficits may be associated with speculative pressures. Table 3 indicates that the distribution of budget deficits differs during periods of depreciation pressure and tranquility (p value of 9 percent for the KW test).[15] Budget deficits also appear to be larger during episodes of depreciation (or tranquility) than during episodes of appreciation (Table 4).

Further insights may be gained on the characteristics and possible causes of episodes of speculative pressure by examining indicators of internal and external balance. As noted previously, if output is unusually sluggish, domestic inflation is relatively high, or the current account is unbalanced, the government may find it costly to defend the exchange rate, and this perception of government weakness may trigger speculative pressures. Such results would lend support to explanations that do not attribute speculative pressures to prevailing monetary or fiscal policies (e.g., Obstfeld, 1994 or Drazen and Masson, 1994).

Table 3 provides mixed evidence that the distribution of CPI inflation and output growth differs during periods of depreciation pressure and tranquility (p values of around 10 percent). In addition, the data in Table 4 suggest that inflation is higher and relative output growth is slower (in fact negative) during episodes of depreciation than during episodes of appreciation or tranquility. This is consistent with explanations that suggest that economic conditions (rather than macroeconomic policies) may contribute to episodes of speculative pressure. However, it may be noted that the behavior of the indicator of external balance, the ratio of exports to imports, does not appear to differ during the various periods, and the median values are close.

15. The significant result for the budget deficit should be interpreted with caution because these are quarterly observations and some of the countries had to be dropped due to lack of data. See data Appendix 1.

TABLE 4

ALL SPECULATIVE PRESSURE AND TRANQUIL PERIODS
MEDIAN VALUES
(Monthly percentage changes or percentage ratios)

	ALL SPECULATIVE	DEPRECIATION	APPRECIATION	TRANQUIL
		Indicators of policy environment		
DOMESTIC CREDIT	–0.14	0.06	–0.38	–0.09
NARROW MONEY	–0.01	–0.07	0.21	0.41
BROAD MONEY	0.64	0.43	0.88	0.90
BUDGET DEFICIT	0.57	0.92	0.28	0.67
		Indicators of internal and external balance		
CPI INFLATION	0.04	0.09	0.01	0.02
REAL OUTPUT	–0.04	–0.20	0.21	–0.05
EXPORTS/IMPORTS	0.98	0.99	0.97	1.00

Alternative Assumptions

To see whether the preceding results are sensitive to alternative assumptions, the tests were first rerun excluding Japan from the sample, as it may be argued that its foreign exchange market differs from those of other economies in the region (deeper market with a wider array of domestic instruments, and a freer float). For the sake of brevity, the main findings will be summarized but the actual values will not be listed. With Japan excluded, the behavior of the budget deficit ratio no longer differs between periods of tranquility and of depreciation or appreciation. However, as in the full sample, the behavior of broad money differs during depreciation episodes (with *p* values of 5 percent for the KW test and 9 percent for the KS test), and the evidence that central bank domestic credit differs during episodes of appreciation is now stronger (*p* values of 3 percent and 7 percent for the KW and KS tests, respectively). The median values still convey the impression that during episodes of depreciation budget deficits are larger and that during episodes of appreciation central bank domestic credit is smaller, and broad money growth is greater.

For the indicators of internal and external balance, as for the full sample, there is mixed evidence that the distribution of the CPI differs during episodes of depreciation. However, no significant differences in output behavior are now found. The median values are qualitatively similar to those found previously, as they indicate that inflation tends to be higher and relative output growth contracts during episodes of depreciation in comparison to other periods (appreciation or tranquility).

One potential difficulty with the preceding results is that the crisis episodes and the macroeconomic variables are contemporaneous, making the direction of causality uncertain. For example, while some of the models described earlier might suggest that a rise in domestic inflation may lead to speculative pressures, it is possible that speculative pressures lead to inflationary pressures instead. To see whether this possibility affected the results, the tests were performed by comparing the behavior of monthly variables in the month *before* the date of a speculative episode to their behavior during periods of tranquility (once more including Japan in the data set).[16] Using this data set, the evidence that domestic credit of the central bank differs during episodes of appreciation was once more mixed (significant at 10 percent for the KS test but not the KW). There was also mixed evidence that the relative CPI differed in the month before a depreciation episode (KW test rejects the null at 10 percent), and that broad money growth differs in the month before an appreciation episode (both KW and KS tests significant at 5 percent). The other test results were not significant. As for the median values, those for central bank domestic credit are very similar to those reported in Table 4. CPI inflation is much smaller during episodes of appreciation, and is in fact negative in this case, which is consistent with the previous findings. Broad money growth once again is larger during episodes of appreciation.

III. CONCLUSIONS

This study applied a procedure to identify episodes of speculative pressures in foreign exchange markets for selected economies in the Asia-Pacific Basin and compared the behavior of macroeconomic variables during periods of speculative pressure and periods of tranquility. The empirical results are mixed, but some of the results are nonetheless suggestive. Episodes of depreciation appear to be associated with larger budget deficits and growth in central bank domestic credit than are episodes of appreciation or periods of tranquility, indicating that expansionary policies may contribute to speculative pressures in foreign exchange markets. There is also some evidence that episodes of speculative pressure may arise when economic conditions make it difficult for the government to maintain a stable exchange rate.

Further research using different methods may give additional insights on the sources of speculative pressures in foreign exchange markets and shed further light on the properties of speculative episodes. In addition, alternative statistical techniques may permit estimation of the relative importance of alternative sources of speculative pressure on the exchange rate.

16. The test was not performed for quarterly data because it is likely that the indicators of speculative pressure did not cause differences in budget deficits or relative output growth. For the monthly data, it may be noted that if the observation preceding a speculative episode falls in the six-month window of a previous speculative episode, it is not included in the set.

APPENDIX 1

SUMMARY OF OBSTFELD'S OPEN ECONOMY MODEL OF SPECULATIVE ATTACKS

The model assumes PPP, capital mobility and perfect asset substitution. The log of output in period t depends on the contemporaneous log real exchange rate and a mean zero, serially independent shock that reflects the impact of foreign interests rates, private and government shifts in demand and so on. Before the demand shock is observed, labor markets set wages so as to maintain a constant expected real wage. Consider the government's flow loss for period t, which can be expressed as:

$$(A1) \quad l_t = (\theta/2)(e_t - e_{t-1})^2 + (1/2)[\alpha(e_t - w_t) - u_t - y^*]^2$$

where the first right-hand term reflects the cost of deviations from zero inflation, the second, the cost of deviations from the target level of output y^*. The government chooses the home currency's exchange rate e_t each period to minimize l_t given the nominal wages set at t–1. Minimizing the preceding expression over e_t yields first order conditions that imply the following reaction function

$$(A2) \quad e_t - e_{t-1} = \lambda(u_t/\alpha) + \lambda(w_t - e_{t-1}) + \lambda(y^*/\alpha) .$$

In the term $\lambda = \alpha^2/(\theta + \alpha)^2$, α reflects the responsiveness of output to changes in competitiveness (the real exchange rate) and θ reflects the weight assigned to inflation in the government's loss function.

Workers and firms know the government's reaction function and will set wages to take the government's expected exchange rate adjustment into account. Under these conditions, it can be shown that the equilibrium depreciation rate in the economy is:

$$(A3) \quad e_t - e_{t-1} = \lambda u_t + (\lambda/1 - \lambda)(y^*/\alpha)$$

where all variables are in logs, e_t is the nominal exchange rate in domestic currency units per foreign currency unit, u_t is the demand shock, $y^* > 0$ is the government's target level of output, and λ is a measure of the extent to which the government accommodates shocks. This last expression is higher the greater is the adverse impact of changes in the real exchange rate on output, and smaller the greater is the weight given to inflation in the government's loss function. It may be noted that under a discretionary policy, a fixed exchange rate would result here only if inflation is infinitely costly, in which case the term λ goes to zero.

The Case with Fixed Cost of Realignment

Since the government faces a preset nominal wage w_t when deciding the exchange rate for period t, the predetermined expected rate of price inflation is given by the expected change in the exchange rate. More explicitly,

$$(A4) \quad \pi_t = w_t - e_{t-1} = E_{t-1}(e_t) - e_{t-1} .$$

In (A1) it is assumed that workers negotiate wage changes to match the expected rate of inflation. Now under a fixed exchange rate, $e_t - e_{t-1} = 0$, so the loss according to equation (1) in the text is

$$(A5) \quad l_t^F = (1/2)[\alpha\pi_t + u_t + y^*]^2$$

If the government instead realigns according to the reaction function described earlier, it incurs a fixed cost c, and it can be shown that the loss is:

$$(A6) \quad l_t^R = (1/2)(1 - \lambda)[\alpha\pi_t + u_t + y^*]^2 + c .$$

APPENDIX 2

DATA DESCRIPTION AND SOURCES

The following variables are from the IFS CD-ROM: end of period exchange rate (line ae), short-term interest rate (line 60b, except for Philippines line 60c), foreign assets (line 11), foreign liabilities (line 16c) where possible, reserve money (line 14), narrow money (line 34), quasi-money (line 35), CPI inflation (line 64), exports (line 70), imports (line 71), budget deficit (line 80), and government expenditure (line 82). Japan's government expenditure is from IFS line 91F.C. while the deficit is taken from OECD quarterly National Accounts. The U.S. budget deficit and government expenditure are from Citibase with mnemonics GGFNET and GGFEX, respectively. To represent output, real GDP (typically line 99b.p) was used for all countries except Japan and Taiwan, where real GNP (line 99a.r) is used. United States money is from Citibase (fm1, fm2).

When IFS data were not available, central bank publications were used. Taiwan data are from *Financial Statistics*, Taiwan District, The Republic of China. Quasi-money data for 1980:1–1981:2 are taken from Taiwan's *Supplement to Financial Statistics Monthly.* Part of Indonesia's interest rate, reserve money and money are from *Indonesia's Financial Statistics.* Philippine money data for January 1984 to November 1986 (except the December numbers in this period) were obtained from *Philippines Financial Statistics.* Thailand's 1994 exports and imports are from the Bank of Thailand's *Quarterly Bulletin.* Malaysia's 1994 reserve money series is constructed using data from Bank Negara Malaysia's *Monthly Statistical Bulletin.*

The frequency of all the data is monthly except for output and the budget deficit which are quarterly. Net foreign assets is defined as foreign assets (11) less foreign liabilities. Missing values for foreign liabilities are set to zero if

these are small as a proportion of foreign assets. Because of missing values, Philippines liabilities for August 1983, December 1983 and December 1984 are calculated using changes over the same period 12 months earlier. Also, the Thai interest rate for December 1993 was computed using the 12-month change. A number of macroeconomic series did not span the entire period or contained missing values. Estimates were then performed using the available data for each country. Because of lack of quarterly data, Indonesia, Thailand and Malaysia were excluded in the output comparisons and Taiwan was excluded in the budget deficit comparisons.

Many of the variables are transformed by taking the differential between domestic and United States first differences of natural logarithms or percentage changes. Central bank domestic credit growth is the difference between the percentage growth in reserve money less the change in net foreign assets scaled by reserve money in the last period. Net foreign assets is the first difference of net foreign assets divided by the previous month's reserve money. The nominal dollar exchange rate is expressed as the percentage change over the previous month. Output is the deviation from the mean growth of real GDP or real GNP. The budget deficit is taken as a ratio of government expenditure (to maximize data use, as quarterly output data are often unavailable), and then divided by the corresponding budget ratio for the U.S. Budget ratios, narrow and broad money (the sum of narrow money and quasi-money), exports, and imports are seasonally adjusted using X11.

APPENDIX 3

EXCHANGE RATE REGIMES IN PACIFIC BASIN ECONOMIES

Indonesia. Indonesia has had a managed float in place since January 16, 1978, when the link with the U.S. dollar was discontinued. Bank Indonesia (BI) has set the middle rate of the rupiah in terms of the U.S. dollar, the intervention currency, by taking into account the behavior of a basket of currencies of Indonesia's main trading partners. In September 1989, the foreign exchange system was modified substantially so that the BI-announced exchange rate applies only to certain transactions undertaken at certain times of the day. For all other transactions, banks are free to set their own rates.

Japan. Exchange rates are determined on the basis of underlying demand and supply conditions in the exchange markets. However, the authorities intervene when necessary in order to counter disorderly conditions in the markets. The principal intervention currency is the U.S. dollar.

Korea. From January 1980 to March 1990, the won was linked to a multicurrency basket (consisting of trade-weighted basket and SDR basket), but other factors were also taken into account in setting the exchange rate. The Bank of Korea (BOK) set a daily exchange rate of the won (BOK base rate) in terms of the U.S. dollar, which is the intervention currency. A market average rate (MAR) system introduced on March 2, 1990 sets the won–U.S. dollar rate on the basis of the weighted average of interbank rates for won-U.S. dollar spot transactions of the previous day. During each business day, the Korean won–U.S. dollar exchange rate in the interbank market is allowed to fluctuate within fixed margins (plus or minus 1 percent in 1994) against the MAR of the previous day. The won exchange rate against other currencies is determined by the level at which these currencies trade against the U.S. dollar in the international market. Buying and selling rates offered to customers are set freely by foreign exchange banks.

Malaysia. The value of the ringgit is determined by supply and demand conditions in the foreign exchange market. Bank Negara Malaysia (the central bank) intervenes to maintain orderly market conditions and to avoid excessive fluctuations in the value of the ringgit against a basket of currencies weighted in terms of Malaysia's major trading partners and the currencies of settlement.

Philippines. Up to 1984, authorities intervened when necessary to maintain certain margins around a "guiding rate" that was established daily by the Bankers' Association. Commercial banks were required by the association to observe certain margins for transactions of less than US$100,000. The minimum and maximum spot buying (selling) rates were 0.5 percent (0.75 percent) and 1 percent (1.25 percent), respectively below (above) the guiding rate. For transactions above US$100,000, margins were determined competitively. Since October 1984, the value of the peso has been determined freely in the foreign exchange market. However, the central bank is a major participant in this market and intervenes when necessary to maintain orderly conditions in the exchange market and in light of medium-term policy objectives.

Singapore. The Singapore dollar is permitted to float, and its exchange rate in terms of the U.S. dollar and all other currencies is freely determined in the foreign exchange market. However, the Monetary Authority of Singapore monitors the external value of the Singapore dollar against a trade-weighted basket of currencies. Historically, Singaporean authorities have targeted the exchange rate (through intervention) to achieve a domestic inflation goal. Rates for other currencies are available throughout the working day

and are based on the currencies' exchange rates against the U.S. dollar in international markets. Banks are free to deal in all currencies, with no restrictions on amount, maturity, or type of transaction.

Taiwan. A managed float was adopted in 1979, involving a daily exchange rate ceiling set by the central bank. The ceiling was abandoned in March 1980, and reestablished in September 1982. Until 1989, the spot central rate of the U.S. dollar against the NT dollar was set daily on the basis of the weighted average of interbank transaction rates on the previous business day. Daily adjustment of the spot rate was not to exceed 2.25 percent of the central rate on the previous business day. In April 1989, the limits on daily fluctuations of the interbank rate were rescinded, and a new system of foreign exchange trading was established, based on bid-ask quotations.

Thailand. The Thai baht was *de facto* pegged to the U.S. dollar from 1981 until 1984, when it was devalued. The baht was subsequently pegged to a weighted basket of currencies of Thailand's major trading partners, but the exchange rate can also be influenced by other considerations. The Exchange Equalization Fund announces daily the buying and selling rates of the U.S. dollar for transactions between itself and commercial banks. It also announces daily minimum buying and maximum selling rates that commercial banks must observe when dealing with the public in various currencies. The EEF intervenes to keep the relationship of the baht to the basket of currencies within a margin and to maintain orderly conditions in the exchange market.

SOURCES: IMF. Exchange Arrangements and Exchange Restrictions. Moreno (1994), Working Paper version.

REFERENCES

Barro, Robert J., and David B. Gordon. 1983. "A Positive Theory of Monetary Policy in a Natural Rate Model." *Journal of Political Economy* 91 (August) pp. 589–610.

Blanco, Herminio, and Peter M. Garber. 1986. "Recurrent Devaluation and Speculative Attacks on the Mexican Peso." *Journal of Political Economy* 94 (11) pp. 148–166.

Conover, W. J. 1971. *Practical Non-Parametric Statistics.* New York: John Wiley & Sons, Inc.

Cumby, Robert E., and Sweder van Wijnbergen. 1989. "Financial Policy and Speculative Runs with a Crawling Peg: Argentina 1979–1981." *Journal of International Economics* 27, pp. 111–127.

Drazen, Allan, and Paul R. Masson. 1994. "Credibility of Policy versus Credibility of Policymakers." *The Quarterly Jounal of Economics* IX (3) pp. 735–754.

Eichengreen, Barry, Andrew K. Rose, and Charles Wyplosz. 1995. "Speculative Attacks on Pegged Exchange Rates: An Empirical Exploration with Special Reference to the European Monetary System." Presented at the CEPR (Stanford Univ.)/Federal Reserve Bank of San Francisco conference "Monetary Policy in a Changing Financial Environment," March 3–4, 1995. Federal Reserve Bank of San Francisco Working paper 95–04.

Glick, Reuven, and Michael Hutchison. 1994. "Monetary Policy, Intervention and Exchange Rates in Japan." In Reuven Glick and Michael Hutchison, (eds.) *Exchange Rate Policy and Interdependence: Perspectives from the Pacific Basin.* New York: Cambridge University Press.

_____, and Ramon Moreno. 1995. "Capital Flows and Monetary Policy in East Asia." In Hong Kong Monetary Authority (ed.) *Monetary and Exchange Rate Management with Capital Mobility.*

Goldberg, Linda. 1994. "Predicting Exchange Rate Crises: Mexico Revisited." *Journal of International Economics* 36(3–4), pp. 413–430.

Grilli, Vittorio. 1986. "Buying and Selling Attacks on Fixed Exchange Rate Systems." *Journal of International Economics* (20) pp. 143–156.

Krugman, Paul. 1979. "A Model of Balance of Payments Crises." *Journal of Money, Credit and Banking* 11, pp. 311–325.

Moreno, Ramon. 1988. "Exchange Rates and Monetary Policy in Singapore and Hong Kong." In Hang-Sheng Cheng (ed.) *Monetary Policy in Pacific Basin Countries.* Boston: Kluwer Academic Publishers.

_____. 1994. "Exchange Rate Policy and Insulation from External Shocks: The Cases of Korea and Taiwan." In Reuven Glick and Michael Hutchison (eds.) *Exchange Rate Policy and Interdependence: Perspectives from the Pacific Basin.* New York: Cambridge University Press. (An earlier version with additional appendices was issued by the Center for Pacific Basin Monetary and Economic Studies, Federal Reserve Bank of San Francisco, Working Paper No. PB93–05.)

Obstfeld, Maurice. 1991. "Destabilizing effects of exchange rate escape clauses." NBER Working Paper No. 3603.

_____. 1994. "The Logic of Currency Crises." NBER Working Paper No. 4640.

Talib, Azizah. 1993. *Monetary Policy in the SEACEN Countries: An Update.* Kuala Lumpur: The Southeast Asian Central Banks Research and Training Center.