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Exchange Rate Policies of Asian Countries 1973-78

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I. Introduction

This paper considers the experience of eight Asian countries (India, Indonesia, Korea, Malaysia, the Philippines, Taiwan, Singapore, and Thailand) 1/ with various exchange rate policies, during the six-year period following the generalized floating of the major currencies in 1973. During the last decade considerable theoretical and empirical research has been done in the area of price and exchange rate stability and the effectiveness of macroeconomic policy under a floating system. 2/ Most of this research, however, has been in the context of the industrial countries and relatively little has been done to adapt it to the case of developing countries. 3/ The purpose of this paper is to analyze the impact of the exchange rate and monetary policies of various Asian countries on their domestic inflation rates and balance of payments positions. As a first step, the actual experience of these countries as regards the movements of their domestic prices, foreign prices and exchange rates are examined. Next, the causal relationships determining domestic inflation and the balance of payments are specified and subjected to empirical verification. Domestic inflation is specified as a function of domestic

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1/ Throughout this paper the term "the Asian countries" refers to the specific group of eight countries mentioned above. These countries were chosen based on the criterion of availability of reasonably reliable statistics over the last decade.

2/ For an excellent survey of this literature see Goldstein (1980).

3/ For some of the work in this area see Crockett and Nsouli (1977), Branson and Katseli-Papaefstratiou (1978), Lipschitz (1978), Johnson (1976), Mussa (1978) and papers by Black, Williamson and McKinnon in Leipziger (1976).

monetary expansion and the imported inflation, while the balance of payments is specified as a function of the rate of credit expansion and the relative price of traded and nontraded goods.

The outline of the paper is as follows: Section I describes the various exchange rate regimes adopted by the Asian countries; Section II examines the secular movements and short-term variability of prices and exchange rates, using interperiod as well as intercountry comparisons; Section III analyzes the determinants of domestic inflation and the balance of payments; and finally, Section IV provides some conclusions regarding the factors affecting appropriate exchange rate regimes for the Asian countries.

II. Exchange Rate Regimes of Asian Countries

Prior to the breakdown of the Bretton Woods system in August 1971, most Asian countries pegged their exchange rates to their intervention currencies with prescribed margins: Indonesia, Taiwan, and Thailand were pegged to the U.S. dollar; India, Malaysia and Singapore were pegged to the pound sterling; and only Korea and the Philippines were floating. During the short interlude when the major currencies were floating and the subsequent re-establishment of par values according to the Smithsonian Agreement of December 1971, all the Asian countries adopted a wait-and-see attitude and continued to maintain their previous exchange rate regimes--although Malaysia and Singapore switched their intervention currency from the pound sterling to the U.S. dollar.

By 1973, it became evident that the par value system could not be maintained for the major currencies. Consequently, it became clear that the exchange rates of the Asian countries would be subject to fluctuations even if they continued to be pegged to a major currency. A number of countries (India, Indonesia, Taiwan, and Thailand) continued to peg to their intervention currency, while Malaysia and Singapore effectively joined the floaters.

During the next five years, a number of other countries (India, Indonesia, and Thailand) linked their currencies to an undisclosed basket. This procedure presents a problem in terms of classification because it is often unclear whether a change in the value of a currency is precipitated by a change in the value of other currencies or by an ad hoc adjustment of the weights used in constructing the basket. 1/ In any event, as long as the authorities do not disclose the precise composition of the basket to which their currency is pegged, they are not publicly committed to maintaining a specifically announced peg.

1/ Some efforts have been made to "second-guess" the weights of some baskets by estimating the actual behavior of the exchange rate as a function of various compositions of major currencies; see Sundararajan (1978).

Consequently, pegging to an undisclosed basket can be classified as managed float except for those cases when the movement of the currency is observed to be closely linked to the movements of a single currency.

A description of the exchange rate regimes of the Asian countries since the generalized floating of major currencies is provided in Table 1. It should be emphasized that this description is based on "revealed" as opposed to "officially announced" policies. All those countries which have pegged to an undisclosed basket are put under the category of managed float, except those cases when the fluctuations of the exchange rate, in terms of the U.S. dollar, have remained within a margin of 2.25 per cent; those cases have been put under the category of pegging to the dollar.

Table 1. Exchange Rate Regimes of Various Asian Countries, 1971-79

	Exchange Rate Regime	Inflation Rate 1/ (in percent)
Indonesia	U.S. dollar peg 1971-78	17.1
Korea	Managed float 1971-73; U.S. dollar peg 1974-78	16.1
Philippines	Managed float 1971-74; U.S. dollar peg 1975-78	10.5
Taiwan	U.S. dollar peg 1971-78	9.8
Thailand	U.S. dollar peg 1971-78	8.2
Malaysia	Sterling peg 1971-72; managed float 1973-78	5.8
India	Sterling peg 1971-74; managed float 1975-78	5.3
Singapore	Sterling peg 1971-72; managed float 1973-78	4.5

1/ Average annual inflation rate (CPI) during the period 1973-78.

A comparison of the exchange rate regimes and average inflation rates for various countries reveals an interesting pattern. Countries with higher rates of inflation have pegged their currency to the U.S. dollar and those with lower inflation rates have adopted a managed float. Consequently, the effective exchange rates 1/ of those countries with higher rates of inflation have depreciated along with the U.S. dollar. As will be discussed later, however, this effective depreciation has not been enough to offset the domestic and foreign inflation differentials for high inflation countries.

II. Secular Movements and Short-term Variability of Prices and Exchange Rates

In this section, the secular movements and short-term variability of domestic prices, foreign prices, and exchange rates of Asian countries are analyzed for the two periods 1968-72 and 1973-78; the first period corresponds to a fixed exchange rate regime for the major currencies, and the second to a flexible regime.

Exchange rate variability in the industrial countries has often been viewed as a major source of instability in the capital markets. In this context, a great deal of emphasis has been placed on the formation of expectations about the future spot exchange rates and on the interest rate parity relationship. In the Asian countries, however, private capital movements are less responsive to exchange rate variability and interest rate differentials than to such factors as political stability. Because of the fragmentation of financial markets, relatively few people have access to foreign capital markets. 2/ Consequently, the size of private capital flows is relatively small and capital movements are dominated by official transactions. In this setting, the major impact of the exchange rate on the economy is through its effect on relative prices and thereby on resource allocation.

In order to analyze the impact of the exchange rate on resource allocation, the economy can be viewed as being composed of three sectors; namely, the import-competing, export, and nontraded sectors. Because the Asian countries are price-takers for most of their import and export commodities, 3/ the relative price of their imports and exports is not affected by the exchange rate and, consequently, import-competing and export industries can be combined into a single sector, which will be referred to as the traded sector. The price of traded goods is then determined by their price on world markets converted into home currency at the exogenously given exchange rate. The exchange rate, therefore, directly affects the relative prices of traded and nontraded goods.

1/ The value of the currency in terms of a trade-weighted basket of major currencies of major trading partners.

2/ With the exception of Singapore, which has a well-developed financial market.

3/ Generally, the Asian countries account for only a small portion of world trade in their import and export commodities.

No data are available for the prices of nontraded goods in the Asian countries; but, assuming stable weights in the domestic price index, the ratio of nontraded to traded prices is proportional to the ratio of domestic to traded prices. The domestic price level, pd, can be expressed as a weighted average of the price of nontraded goods, pn, and the price of traded goods pt. Denoting the weight of nontraded goods in the price index by q, and expressing all variables in logarithmic form, we can write:

$$pd = q.pn + (1-q)\ pt \qquad (1)$$

Defining the real exchange rate, re, as the ratio of domestic to traded goods prices (in logarithms), we can write:

$$re = pd - pt = q.\ (pn - pt) \qquad (2)$$

It can be seen from equation (2) that the real exchange rate index directly measures the relative prices of nontraded to traded goods.

The domestic price level is measured by the consumer price index which is available for all countries on a monthly basis. In principle, the traded goods price could be constructed as a weighted average of export and import prices. For several of the Asian countries, reliable export and import price indices are not available. Because the imports of these countries are quite diversified, the export prices of the industrial countries provide a reasonable indicator for the import prices of the Asian countries. 1/ The exports of the Asian countries, however, are generally concentrated in primary products, and the import prices of the industrial countries (which are based mainly on manufacturing goods) do not provide a good measure of the export prices of the Asian countries. 2/ Consequently, the traded goods price index has been measured by the import price index calculated as the weighted average of the export prices in each of the (i) countries with which the home country trades, pf(i), converted into the home currency by the bilateral exchange rate e(i), 3/ with w(i) denoting the weight of country (i) exports in the home country's total imports.

$$pt = \sum_{i=1}^{N} w(i).\ (pf(i) - e(i)) \qquad (3)$$

1/ The major portion of the Asian countries' imports originate from the industrial countries. It should be noted that the effect of the oil price increases has been captured indirectly through their effect on the export prices of the industrial countries.

2/ Insofar as the domestic consumption of exportables is generally small in most Asian countries, the exclusion of export prices from the definition of traded goods prices does not affect the results appreciably.

3/ Expressed as the value of the trading country's currency per unit of the trading country's currency (an increase denotes appreciation).

Defining the foreign price index, pf, as a weighted average of trading countries export prices and the effective exchange rate, e, as a weighted average of the bilateral exchange rates, we can write the following identities:

$$pf = \sum_{i=1}^{N} w(i).\ pf\ (i) \qquad (4)$$

$$e = \sum_{i=1}^{N} w(i).\ e\ (i) \qquad (5)$$

Substituting (4) and(5) into equation (2) results in the following identity for the real exchange rate, re, defined as the ratio of domestic to import prices. 1/

$$re = pd - pf + e \qquad (6)$$

The above indices were calculated for the eight Asian countries on a monthly basis for the period 1968-78 (Chart 1). In order to separate the secular movements of price and exchange rate indices from their short-term variations, the various indices were regressed against time and the calculated standard error of the estimated equation was used as a measure of the variability. 2/ This index of variability measures the average deviations of each variable from its trend value. For the case of a normal distribution of these deviations, the standard error of the equation provides an unbiased estimate of the standard error of the distribution. 3/

1/ Insofar as only domestic and import prices are included in the definition of the real exchange rate index, the movements of this index measure the change in competitiveness of the nontraded sector relative to the import-substituting sector, and not relative to the export sector.

2/ Various measures of variability can be defined, but the choice should not alter the results appreciably because most of these indices are highly correlated with each other; see Bigman (1978).

3/ The normality of the distributions were tested by Tiwari by calculating the higher order moments, "skewness" and "kurtosis", of the various samples used in this paper; of the 96 tests performed, 90 tests satisfied the normality conditions. A detailed analysis of these tests will be shortly available in a paper by Tiwari. It is interesting to note that Tiwari's results run counter to those obtained by Westerfield (1977).

The estimated trend and the index of variability for domestic prices, foreign prices, effective exchange rates and the real exchange rate are given in Table 2, for the two periods corresponding to the pegged regime (1968-72) and to the flexible regime (1973-78). 1/ Based on this information, two types of comparisons are possible. First, interperiod comparisons can be made in order to discern any significant changes in the pattern of variations in prices and exchange rates under the two regimes. Second, intercountry comparisons can be made in order to reveal any general patterns in the exchange rate policies of the Asian countries.

An examination of price movements in the two periods reveals that, for each country, both the level and variability of domestic inflation were higher during the second period, 2/ providing apparent support for the conjecture that higher rates of inflation are associated with higher variability of inflation. This association, however, does not strictly hold across countries, in the sense that the variability of inflation is not necessarily higher for higher inflation countries. It is also interesting to note that there is no apparent relationship, interperiod or intercountry, between inflation rates and growth rates.

The foreign rates of inflation relevant to each of the Asian countries were very close to each other because the bulk of these countries' trade was with the same industrial countries. The average foreign inflation was around 3 per cent in the first period and about 7 per cent in the second period. The fact that both domestic and foreign inflation rates for all countries were higher during the second period relative to the first is consistent with the argument that imported inflation contributed to domestic inflation in the Asian countries. However, the diversity of inflation rates among the Asian countries indicates that there were other significant factors contributing to inflationary pressures.

The effective exchange rate of each of the Asian countries depreciated over both periods. 3/ An interesting phenomenon is that in all cases the depreciation was higher during the first period; although exchange rates were adjusted less frequently during the first period, the adjustments themselves were larger. This result is somewhat paradoxical, particularly for the higher inflation countries, in that during the first period, when inflation rates were lower, effective exchange rates were less stable; during the second period, the effective exchange rates of high inflation countries depreciated secularly with the general depreciation of the U.S. dollar. This effective depreciation, however, was relatively small because high inflation countries were reluctant to devalue vis-a-vis the dollar. The variability of effective exchange rates was in general higher during the second period.

1/ The period corresponding to the flexible regime is assumed to have started in 1973, excluding the short interlude of floating by a few major currencies between August and December of 1971.

2/ The inflation rate in the Philippines was the same in both periods.

3/ Only Singapore appreciated slightly.

Table 2. Trend 1/ and Variability of Output, Prices, and Exchange Rates

(In percentage)

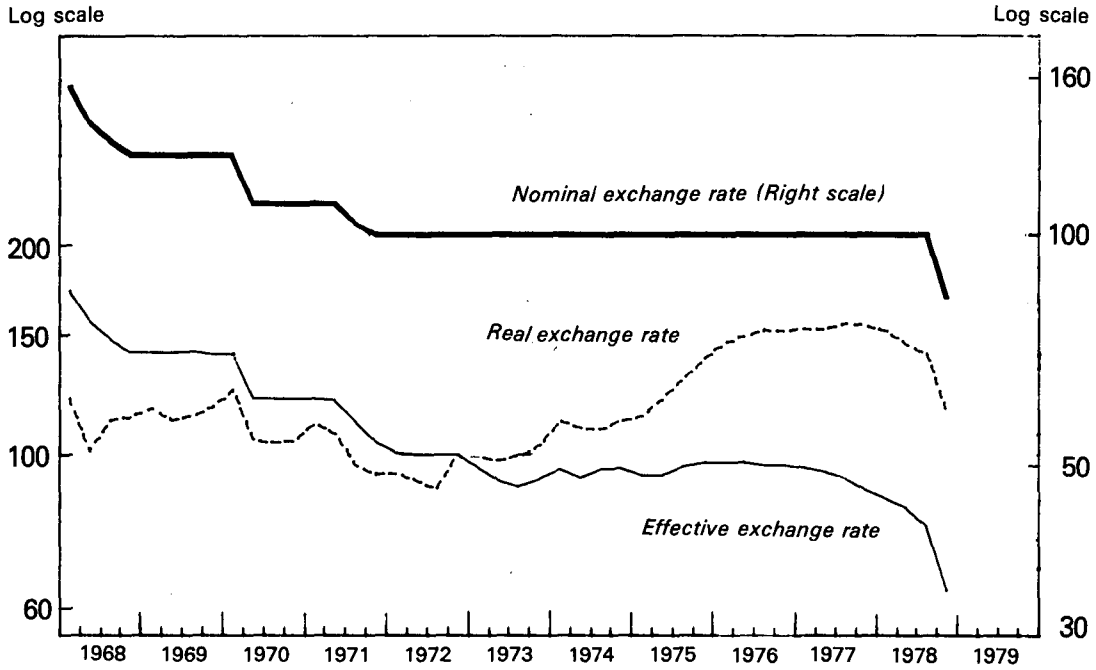
	Output 2/	Domestic Prices		Foreign Prices		Effective Exchange Rate		Real Exchange Rate	
	Trend	Trend	Vari-ability	Trend	Vari-ability	Trend	Vari-ability	Trend	Vari-ability
Indonesia									
1968-72	8.3	8.9	5.7	3.1	1.4	-10.7	4.1	-4.9	6.8
1973-78	7.7	17.1	7.9	6.7	8.0	-2.8	8.8	7.6	10.5
Korea									
1968-72	10.0	11.5	1.8	2.9	1.8	-11.1	5.3	-2.4	4.3
1973-78	11.1	16.1	5.0	6.6	8.6	-6.2	5.0	3.3	6.7
Philippines									
1968-72	4.1	10.5	3.5	3.2	1.4	-17.4	10.6	-10.1	10.5
1973-78	6.6	10.5	7.2	7.2	7.8	-3.6	3.4	-0.3	3.2
Taiwan									
1968-72	10.3	3.5	2.4	3.1	1.7	-2.0	2.4	-1.6	3.0
1973-78	8.1	9.8	10.2	6.5	8.4	-1.6	4.8	1.7	5.9
Thailand									
1968-72	7.1	1.6	1.6	3.4	1.5	-2.7	2.4	-4.4	1.5
1973-78	7.9	8.2	4.7	6.8	7.9	-1.8	6.3	-0.4	3.5
Malaysia									
1968-72	6.2	1.6	1.2	3.4	1.2	-0.1	0.8	-1.9	1.9
1973-78	7.8	5.8	3.9	7.8	7.1	--	3.6	-2.2	2.8
India									
1968-72	3.6	3.9	2.3	3.8	1.1	-2.2	2.5	-2.1	1.9
1973-78	3.4	5.3	8.5	9.1	6.3	-1.9	2.2	-5.7	5.3
Singapore									
1968-72	13.4	1.2	1.5	2.0	2.2	0.3	0.7	-0.6	3.4
1973-78	7.7	4.5	6.3	7.9	7.1	--	2.6	-3.4	3.9

1/ Annual rates of change.
2/ A measure of variability is not provided for output because these series are available only on annual basis.

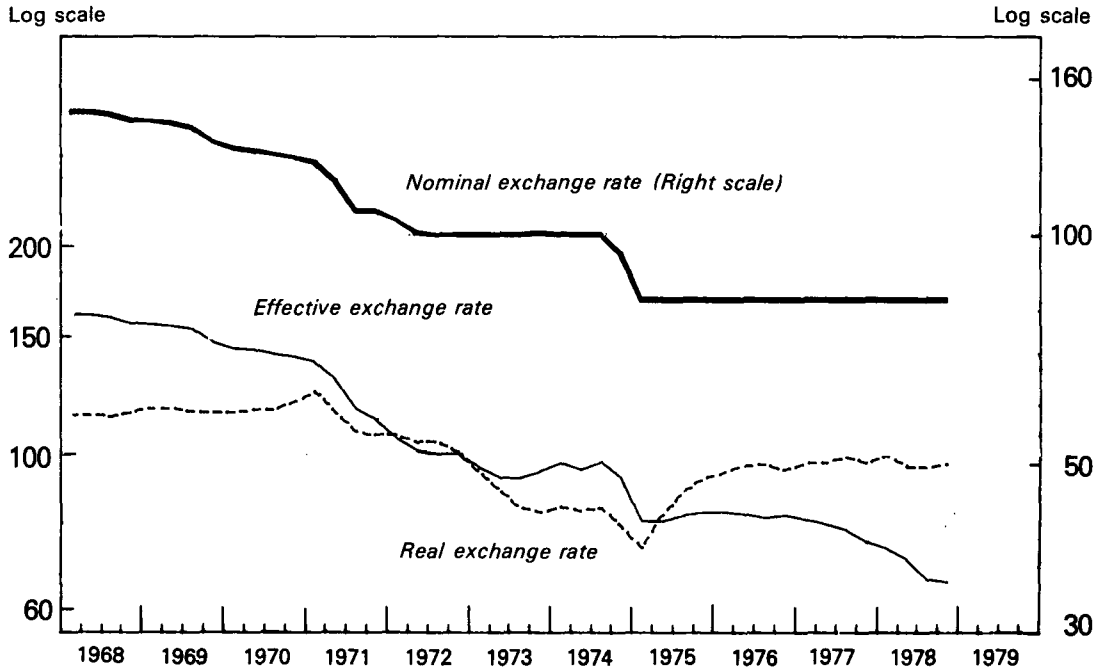
CHART 1

MOVEMENTS OF NOMINAL, EFFECTIVE AND REAL EXCHANGE RATES

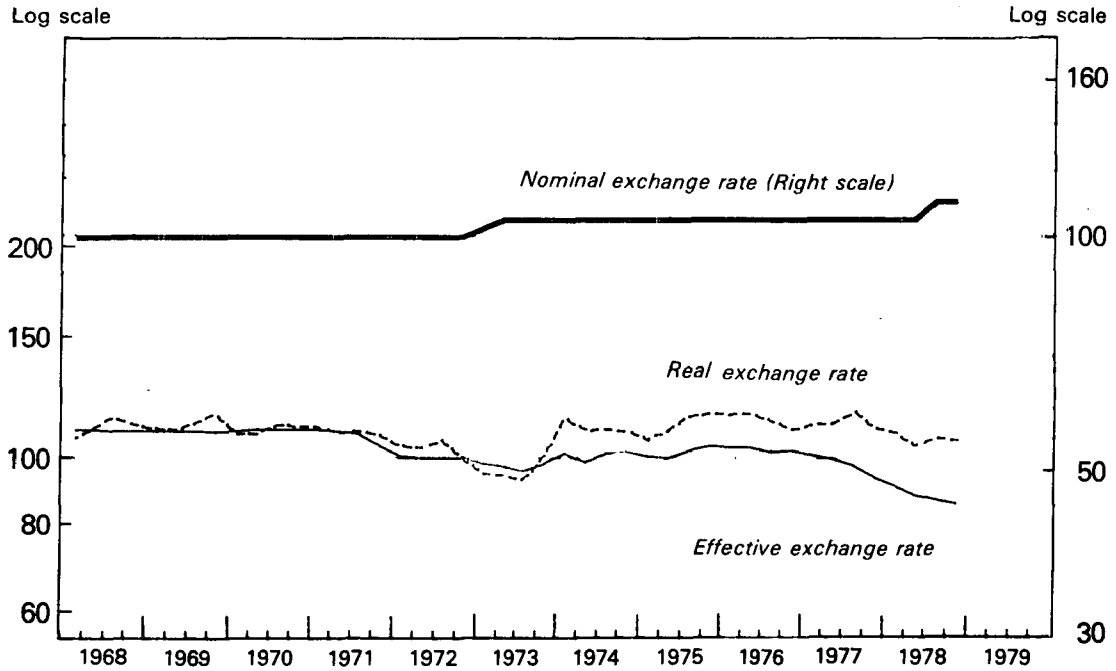
INDONESIA



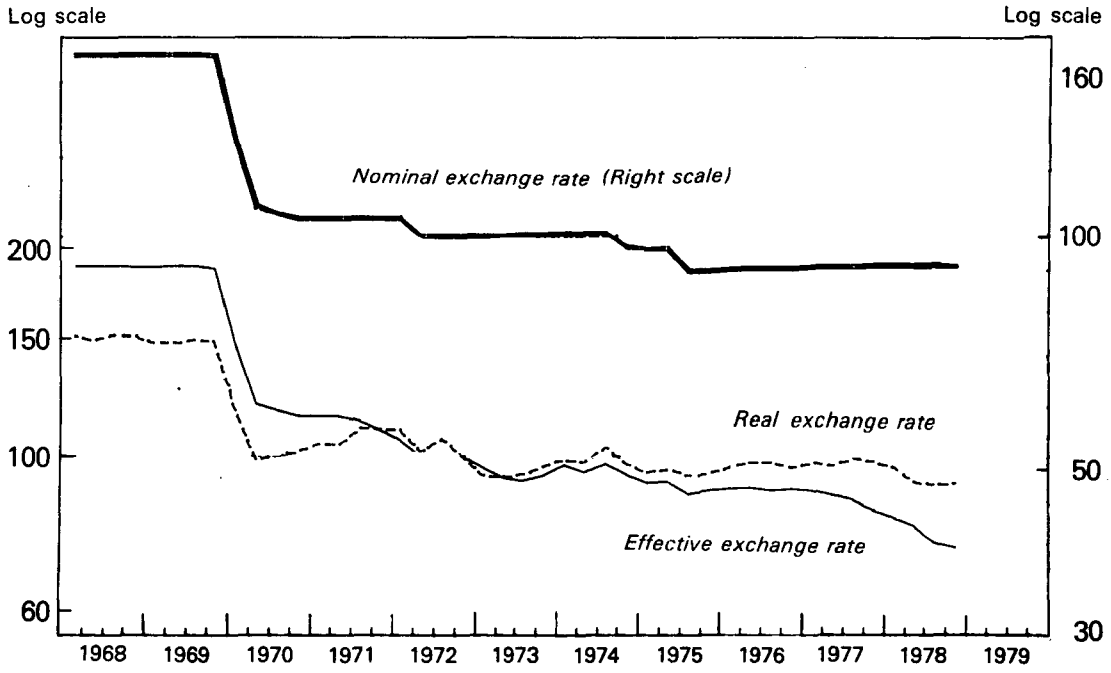
KOREA



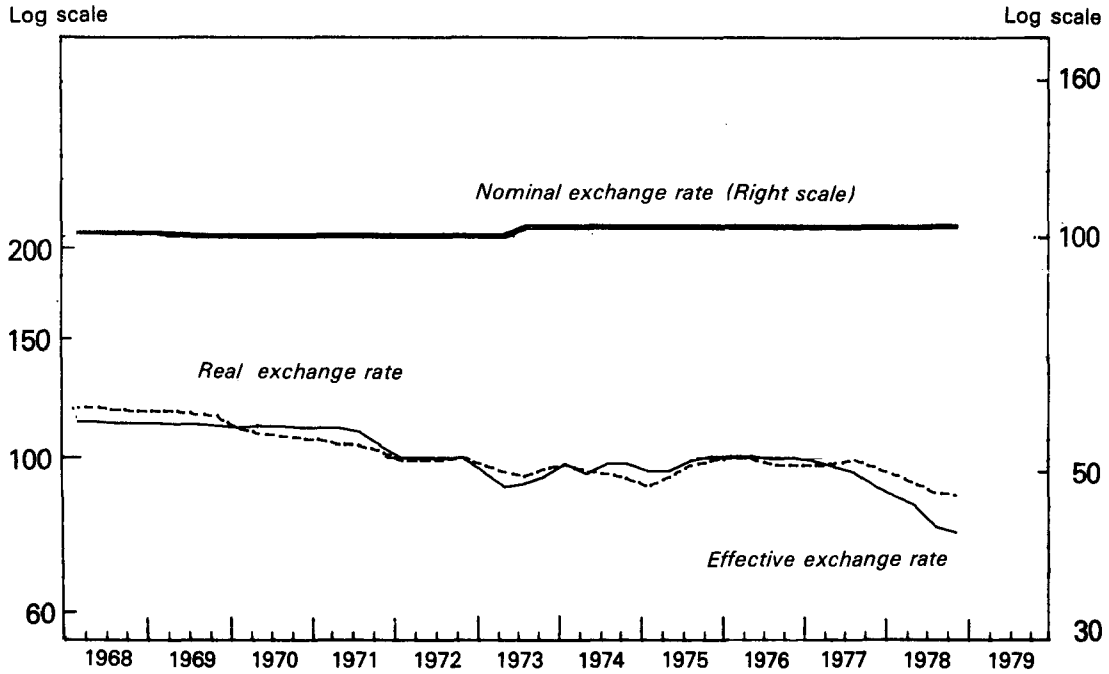
TAIWAN



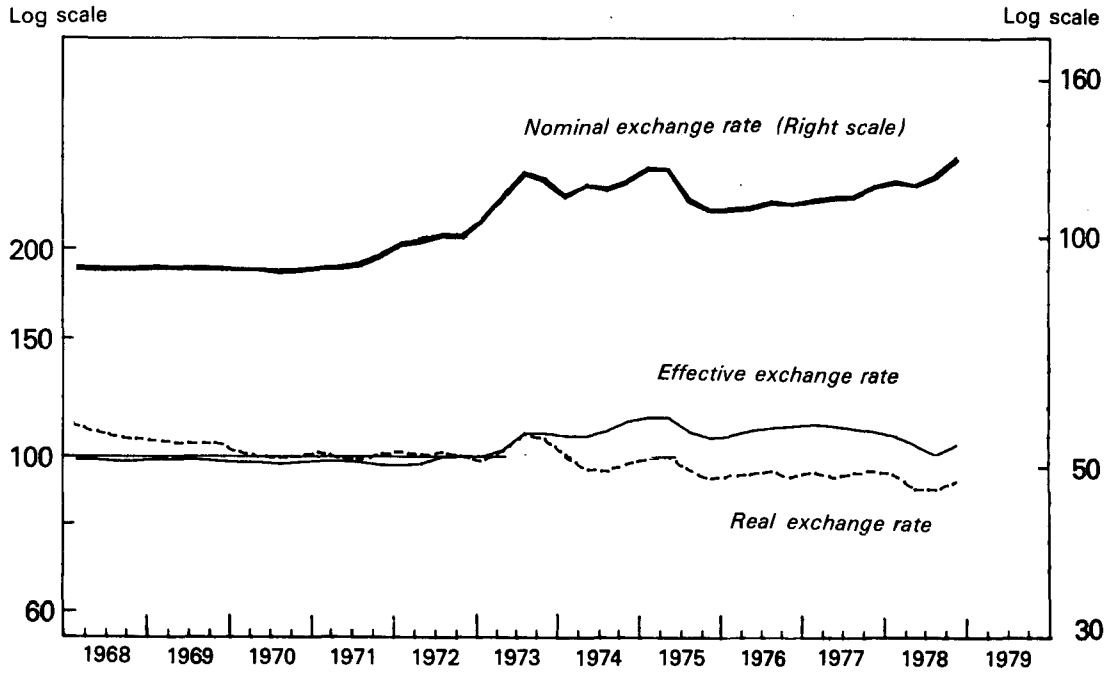
PHILIPPINES



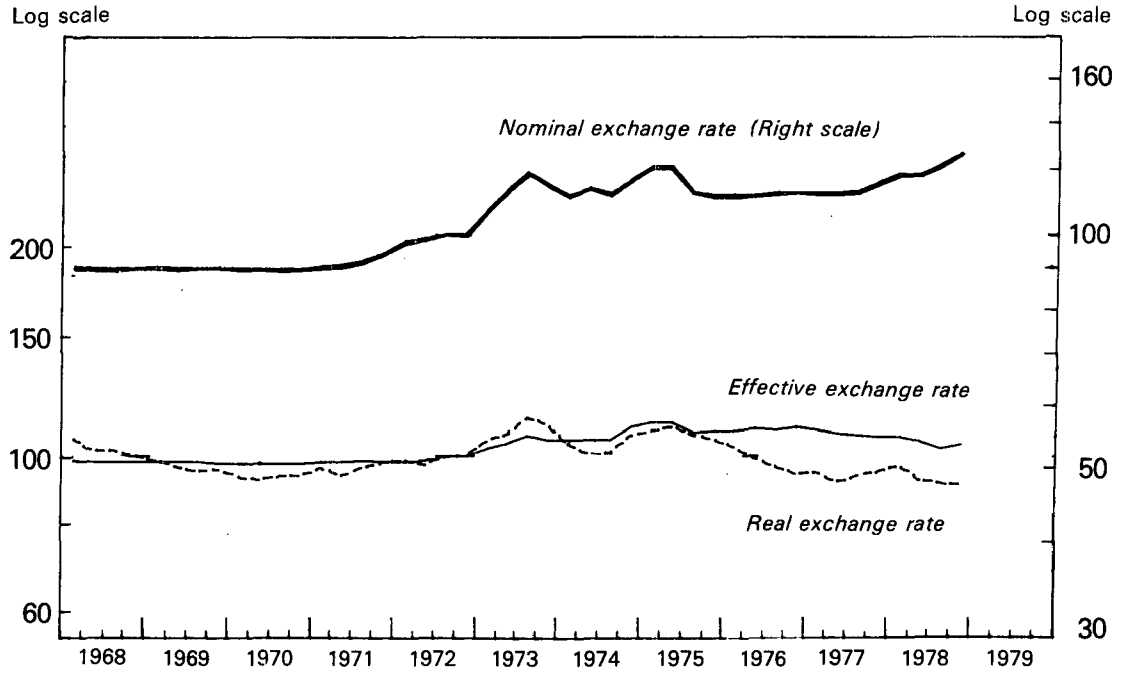
THAILAND



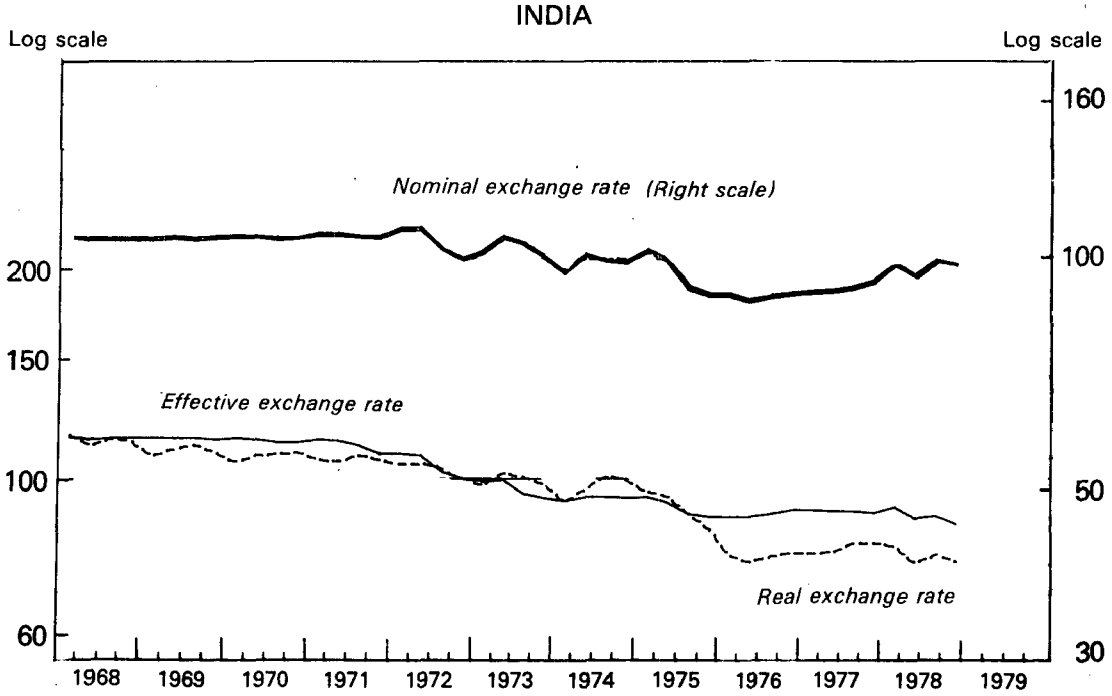
MALAYSIA



SINGAPORE



INDIA



The changes in the real exchange rate (ratio of domestic to import prices) reflect the net effect of the changes in domestic prices, foreign prices and effective exchange rates. During the first period, real exchange rates depreciated in all cases as the higher inflation countries devalued by more than the differential between their domestic and foreign inflation, and low inflation countries maintained a stable exchange rate. During the second period, the changes in real exchange rates were dominated by relative price movements. Consequently, the real exchange rates of high-inflation countries (Indonesia, Korea) appreciated, those of medium-inflation countries (the Philippines, Taiwan, Thailand) remained relatively stable, and those of low inflation countries (India, Malaysia, Singapore) depreciated.

III. Determinants of Domestic Inflation and the Balance of Payments

So far the analysis has been confined to an examination of actual movements in prices and exchange rates. In this section, the determinants of domestic inflation and the balance of payments are identified and the causal relationships are specified according to a distributed-lag formulation. The validity of these causal relationships is then examined by applying the direct test of "causality" suggested by Pierce and Haugh (1977).

Three types of factors can be identified as causing domestic inflation in open economies, namely, structural, external, and monetary. The structural factors, such as wage and price rigidities, which are often a source of inflationary pressure in the industrial countries, are relatively unimportant in the Asian countries; because of the existence of surplus labor in the Asian countries, the size and power of organized labor tends to be limited. 1/ Thus, for all practical purposes, external and monetary factors are the main determinants of domestic inflation in these countries.

Domestic inflation is affected by imported inflation, directly through the price of traded goods, and indirectly through the prices of nontraded goods. The latter effect operates with a lag because as traded prices increase, supply tends to shift from nontraded to traded goods, while demand shifts from traded to nontraded goods; the consequent excess demand for nontraded goods causes their price to increase.

Taking account also of the influence of the domestic monetary expansion on inflation, the rate of change of domestic prices, Dpd, can be specified as a function of the rate of change of traded goods prices, Dpt, and the rate of change of money supply, Dm. Using a distributed lag formulation, this specification can be stated as follows:

1/ A possible exception is India; for contrasting views on the conditions of the labor market in India see Harberger (1972) and Sen (1975).

$$Dpd(T) = \sum^{k} a(i)\ Dpt\ (T-i) + b(i)\ Dm\ (T-i) \qquad (7)$$

In addition to increasing expenditure on nontraded goods, an excess supply of money increases expenditure on traded goods and results in a deterioration of the balance of payments. This relationship is the focus of the "monetary approach to balance of payments" 1/ which views the balance of payments as the main endogenous channel through which the excess supply of money is eliminated in an open economy. In some of the earlier papers in this area, domestic prices were regarded as exogenously determined under the "small country" assumption, and monetary factors only affected the balance of payments. However, with the inclusion of nontraded goods into the analysis, part of the excess supply of money is reflected in changes in domestic prices, thereby changing the real exchange rate. The changes in the real exchange rate, in turn, affect the excess demand for traded goods and consequently the balance of payments position. The balance of payments, B, can then be specified as a function of changes in money supply, Dm, and changes in the real exchange rate, Dre, according to the following distributed lag formulation.

$$B(T) = \sum_{i=1}^{k} c(i)\ Dm(T-i) + d(i).\ Dre(T-i) \qquad (8)$$

In order to examine the validity of equations (7) and (8), 2/ a "causality test" was devised, based on an extension of the direct method suggested first by Pierce and Haugh (1977). 3/ The suggested procedure for testing whether the variable Y "caused" the variable X, is to regress X on the past values of itself and on past values of Y. The past values of X are included to ensure that Y contributes significantly to the variations of X which are not explained by its own past behavior. 4/ The possibility that Y caused X can then be examined by testing whether coefficients of past Ys are nonzero. This test can then be extended to the case of three variables, by regressing X on past values of itself, Y, and the third

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1/ For some of the recent work in this area see Frenkel and Johnson (1976) and IMF publication "The Monetary Approach to the Balance of Payments" (1977).

2/ For an econometric model of domestic inflation and the balance of payments based on similar specifications, see Aghevli and Rodriguez (1979).

3/ Pierce and Haugh note that this test is implicitly contained in Granger's paper (1969), but not discussed. The test used here is an extension of the "direct" method suggested by Pierce and Haugh (p. 288) to the case of three variables.

4/ This procedure is analogous to the use of "filters" in other tests of causality. For a full discussion see Pierce and Haugh.

variable, Z. The possibility that one or both of the variables Y and Z caused X can be examined by testing the hypothesis that coefficients of past Ys and/or Zs are nonzero.

To test that a group of N variables have nonzero coefficients in a regression, a log-likelihood ratio test can be formulated by taking the difference between the log-likelihood function of the regression when all the variables are included, and the log-likelihood function when the group of N variables are excluded; twice the value of this difference is distributed as a chi-square with N degrees of freedom. 1/

Domestic inflation was subjected to the causality test by regressing domestic inflation on the past values of itself, imported inflation and monetary expansion. 2/ The regressions were run on monthly series over the period 1968-78, when 24 lags of each variable were included. 3/ The chi-square values for testing the hypothesis that the past values of imported inflation and/or monetary expansion have nonzero coefficients are all significant at 0.025 level (Table 3). These results indicate that domestic inflation in each country was caused both by imported inflation and by monetary expansion. 4/

The causality test was also performed on the balance of payments, by regressing the balance of payments on the past values of itself, changes in domestic credit, and changes in the real exchange rate. 5/ It should be noted that for this test the changes in domestic credit, instead of money, were used because the past changes in money are identically equal to the past changes in domestic credit and the past values of the balance of payments (which are already included in the regression). In almost all cases, the chi-squares are significant at 0.025 confidence level indicating that the balance of payments outcome was caused by credit expansion and the changes in the real exchange rate 6/ (Table 4).

1/ See Wilks (1962), p. 419.

2/ All series were expressed in logarithmic first differences to ensure that they were "stationary" and did not exhibit a trend. The regression was on a monthly series over the period 1968-78.

3/ Relatively large numbers of lags were included to ensure that no serial correlation in the series was present; the absence of serial correlation was established by the examination of the residuals of the regressions.

4/ It should be noted while this test establishes a causality link from money to prices, it does not exclude the possibility of a reverse causality running from prices to money. For a model based on this reverse causality see Aghevli and Khan (1978).

5/ For this test, changes in the level of the variables, instead of changes in the logarithms of the variables were used. This was necessary because the level of net foreign assets was negative in some cases.

6/ In only one case the coefficients of post changes in the real exchange rate are insignificant at 0.025 level.

Table 3. Causality Tests for Domestic Inflation

	Chi-square values for testing that coefficients of the following variables were nonzero:		
	imported inflation and monetary expansion 1/	imported inflation 2/	monetary expansion 2/
Indonesia	128	60	71
Korea	109	39	93
Philippines	85	48	46
Taiwan	152	98	104
Thailand	110	56	66
Malaysia	105	57	66
India	122	78	54
Singapore	146	61	121

1/ Chi-square with 48 degrees of freedom-values larger than 71 are significant at 0.025 level.
2/ Chi-square with 24 degrees of freedom-values larger than 36 are significant at 0.025 level.

Table 4. Causality Tests for the Balance of Payments

	Chi-square values for testing that coefficients of the changes in following variables were nonzero:		
	domestic credit and real exchange rate 1/	real exchange rate 2/	domestic credit 2/
Indonesia	141	69	94
Korea	186	66	145
Philippines	114	24	105
Taiwan	107	36	73
Thailand	110	54	79
Malaysia	129	62	100
India	135	86	81
Singapore	192	104	169

1/ Chi-square with 48 degrees of freedom-values larger than 71 are significant at 0.025 level.
2/ Chi-square with 24 degrees of freedom-values larger than 36 are significant at 0.025 level.

While the above causality tests indicate which explanatory variables caused domestic inflation and the balance of payments outcome, they do not provide a measure of the separate contributions of each explanatory variable. Such a measure is provided by determining the marginal increase in the coefficient of determination, R^2, when an additional explanatory variable is included (given that all the other variables are used). 1/ The contributions of the rate of monetary expansion and imported inflation to domestic inflation were measured by the marginal increase in R^2 when the past values of these variables were included separately (Table 5). 2/ The results indicate that in all cases, except India, the rate of monetary

1/ See Theil (pp. 167-71).
2/ The results are affected by the order in which the variables are included. The variables were included in the order which maximized the incremental increase in R^2.

expansion contributed more than the imported inflation to domestic inflation. 1/ Similarly, the contributions of the changes in domestic credit and in the real exchange rate to the balance of payments were measured (Table 6). The results indicate that in all cases except India, the changes in domestic credit were the primary factor contributing to the balance of payments.

Table 5. Relative Contributions of the Rate of Monetary Expansion and Foreign Inflation to Domestic Inflation

(In percentage)

	Monetary Expansion	Foreign Inflation	Other Factors
Indonesia	54	23	23
Korea	48	16	36
Phillipines	29	26	45
Taiwan	40	36	24
Thailand	40	25	35
Malaysia	37	26	37
India	21	47	32
Singapore	62	19	19

IV. Conclusions

In this section the exchange rate policies of the Asian countries from 1973 to 1978, the six years following the floating of the major currencies, are discussed in terms of their impact on domestic inflation and on the balance of payments. However, since both inflation and the payments position are also affected by monetary policy, exchange rate policy needs to be considered in conjunction with the monetary developments. Insofar as each of the Asian countries experienced a similar rate of foreign inflation and a relatively small movement in effective exchange rate, the diversity of their inflation rates 2/ could be

1/ In the case of India, a relatively high rate of foreign inflation (9 per cent) and a depreciation of the effective exchange rate (2 per cent) resulted in an imported inflation (11 per cent) substantially higher than the domestic inflation (4 per cent).

2/ Domestic inflation of the Asian countries ranged widely from an average annual rate of 4 per cent in Singapore to 17 per cent in Indonesia.

Table 6. Relative Contributions of the Changes in Domestic Credit and the Real Exchange Rate to the Balance of Payments

(In percentage)

	Domestic Credit	Real Exchange Rate	Other Factors
Indonesia	56	24	20
Korea	68	15	17
Philippines	57	9 1/	34
Taiwan	49	15	36
Thailand	41	24	35
Malaysia	47	24	29
India	35	37	28
Singapore	63	24	13

1/ Not significant.

attributed largely to the differences in their monetary policy; in fact, an ordinal ranking of countries according to their rates of monetary expansion matches that accordding to their rates of domestic inflation (Table 7). In the case of low inflation countries, imported inflation was a significant factor contributing to domestic price movements. In the case of higher inflation countries, rapid rates of domestic monetary expansion were the major contributing factor.

The exchange rate policies of the Asian countries resulted in movements in their effective exchange rates which partially offset the differentials between domestic and foreign inflation rates. Those countries with inflation rates higher than their trading partners (Indonesia, Korea, Philippines, Taiwan, Thailand) effectively pegged their currencies to the U.S. dollar, allowing them to depreciate along with the dollar. Countries with inflation rates lower than their trading partners (India, Malaysia, Singapore), floated their currencies, allowing them to appreciate against the dollar. 1/ In general, however, the movements of effective exchange rates in the various countries were relatively small, reflecting the reluctance of the countries to undertake large adjustments, even when domestic inflation rates were substantially different from foreign inflation

1/ In the case of India, the appreciation of the currency against the U.S. dollar was quite small, resulting in a depreciation in effective exchange rate terms.

rates. This reluctance could partly be attributed to the political implications of an exchange rate adjustment, particularly when domestic inflation was high and fears existed that a devaluation would exacerbate inflationary pressures. Also, because of the uncertainties associated with fluctuations in bilateral exchange rates between the major currencies, a number of countries adopted a wait-and-see attitude. Moreover, the depreciation of the U.S. dollar partially masked the need for further adjustment of those currencies which were pegged to the dollar.

The relatively small adjustments of the effective exchange rates resulted in a striking pattern: an ordinal ranking of the Asian countries according to the differential between their domestic and foreign inflation identically matches their ranking according to the amount of appreciation of their real exchange rates (Table 7, Chart 2). The reluctance of the authorities to undertake large adjustments in the exchange rate tended to lead to an overvaluation of the currency in high inflation countries and to an undervaluation in low inflation countries. 1/ The amount of the overvaluation or undervaluation is positively affected by the differentials between the rates of inflation at home and abroad, and by the length of the lag with which the exchange rate is adjusted (for a mathematical formulation of this pattern see the Appendix). The relative strength of the various countries were generally consistent with the movements of their real exchange rates during the sample period. This can be seen by comparing the reserve-import ratios of various countries, as a measure of their cumulated payments positions. An ordinal ranking of countries according to their reserve-import ratios closely parallels their ranking according to the appreciation of their real exchange rates (Table 7).

On the basis of the observed regularities between domestic inflation rates and the movements of the real exchange rates, some generalizations about the exchange rate and monetary policies of the eight Asian countries can be made. The medium inflation countries (the Philippines, Taiwan, and Thailand), with inflation rates somewhat larger than those of their trading partners, maintained relative stablility in their real exchange rates, by pegging their currencies to the dollar. Although the stability of the real exchange rate could also be maintained by a managed float, it can be argued that pegging to the dollar was more suitable. The market for the currencies of these countries is thin and the institutional framework--including trading mechanisms, forward markets and the like--is rather undeveloped. The volatility of the foreign exchange market under a managed float could thus have been quite high. Pegging to the dollar provided a strong element of stability to the system by allowing the holders of

1/ It should be noted that the movements of real exchange rates do not necessarily imply an overvaluation or undervaluation of the currency because the equilibrium relative prices of the traded and nontraded goods could change due to structural factors affecting supply and demand conditions for these goods.

of domestic currency to gain access to the services provided to the dollar by the world markets at low cost and with limited risk. 1/ So long as forward cover was available, this access spared traders the risk of fluctuations in foreign exchange.

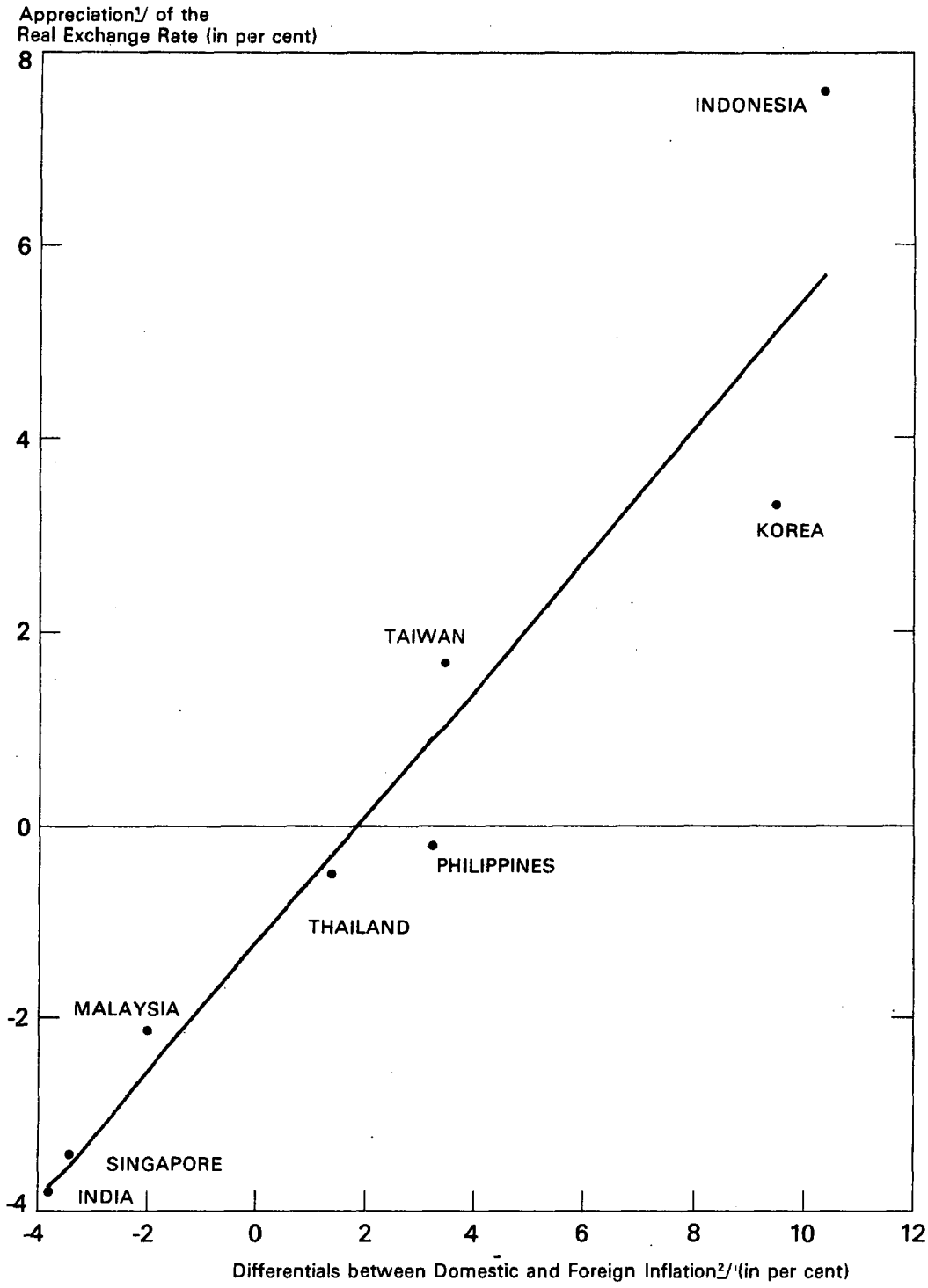
Table 7. Money, Domestic and Foreign Prices, Real Exchange Rates and External Reserves, 1973-78

	Monetary Expansion 1/	Domestic Inflation 1/	Foreign Inflation	Inflation Differentials	Real Exchange Rate	Reserves in Months Imports 2/
Indonesia	28	17.1	6.7	10.4	7.6	3.8
Korea	27	16.1	6.6	9.5	3.3	4.1
Taiwan	25	9.8	6.2	3.4	1.7	4.8
Philippines	21	10.4	7.2	3.2	-0.2	4.5
Thailand	18	8.2	6.8	1.4	-0.5	4.5
Malaysia	17	5.8	7.8	-2.0	-2.2	6.5
Singapore	12	4.5	7.9	-3.4	-3.4	6.9
India	15	5.3	9.1	-3.8	-5.7	10.1

1/ Annual rate of change (in percentage).
2/ Annual rate of appreciation (in percentage); negative values denote depreciation.

1/ Alternatively, the currency could be pegged to a basket of major currencies. The advantage of pegging to a basket is that it would reduce the risk associated with the fluctuations of major currencies. However, insofar as forward cover is often not available for the currencies of the developing countries, the cost of forward cover for the traders would be higher when the currency is pegged to a basket of currencies, as opposed to a single currency. For the advantages of pegging to the dollar, in the case of developing countries, see Mussa (1978); see also Lewis (1972) and Branson and Katseli-Papaefstratiou (1978).

CHART 2



1/ Negative values denote depreciation.
2/ Domestic Inflation minus Foreign Inflation.

In the case of the high inflation countries (Indonesia and Korea), expansionary monetary policies, combined with an exchange rate policy of pegging to the dollar, resulted in a marked appreciation of the real exchange rate. To avoid this, monetary and exchange rate policies needed to be coordinated more closely. In the absence of less expansionary monetary policies, a more flexible exchange rate policy could have been adopted by implementing either a crawling peg regime or a managed float. However, under a managed float it is often difficult to distinguish between short-run random disturbances in the foreign exchange markets and the long-run underlying economic developments relevant to the adjustment of the exchange rate. Moreover, the operational demands of a managed float could strain the policy making process, particularly in light of the inadequacy of the institutional framework and the shortage of skilled operators for the foreign exchange market. With a crawling peg, the exchange rate can be adjusted periodically and systematically on the basis of differential monetary policies and inflation rates, making the daily management of the exchange rate simpler.

In the case of the low inflation countries (India, Malaysia, Singapore), the real exchange rates depreciated significantly from 1973 to 1978. Conservative monetary policies in each of these countries resulted in domestic inflation rates below those of the trading partners; under the managed float regimes, the effective exchange rates of Malaysia and Singapore remained stable while that of India depreciated, reinforcing the divergence between its domestic and foreign prices. As in the case of high inflation countries, it can be argued that in these cases as well, monetary and exchange rate policies could have been coordinated more closely to limit the depreciation of the real exchange rate. It is difficult to argue that these countries should have adopted more expansionary monetary policies, thereby accepting the higher inflation rates abroad. Consequently, more exchange rate flexibility would have to be provided to stabilize the movements of the real exchange rates. Given the institutional framework, which was similar to that in the high inflation countries, 1/ a crawling peg might well have been more appropriate than a managed float for the low inflation countries as well.

1/ The only possible exception is Singapore which has a relatively well developed financial structure. However, even for the developing countries with relatively well developed financial markets, crawling may prove to be more efficient than the managed float, as evidenced by the experience of Israel; see Bruno (1977).

Reaction Function for Exchange Rate Adjustment

This Appendix develops a simple reaction function for exchange rate adjustment. The model is intended as an heuristic device to explain the general movements of effective and real exchange rates in the Asian countries. The basic premise of the model is that the countries adjust their exchange rate to the equilibrium level with a long lag. Consequently, the real exchange rate of high inflation countries tends to be overvalued and, symmetrically, the real exchange rate of the low inflation countries tends to be undervalued.

Using the identities derived in Section II, the real exchange rate, re, can be specified according to the following identity, where pd denotes the domestic price level, pf the foreign price level and e the effective exchange rate. 1/

$$re = pd - pf + e \qquad (1)$$

Assuming that domestic inflation Dpd differs from the foreign inflation, Dpf, and denoting this inflation differential by g, we can write the following expression:

$$Dpd - Dpf = g \qquad (2)$$

Where g is greater or less than zero depending on whether the domestic inflation is higher or lower than foreign inflation.

Assuming that the effective exchange rate is slowly adjusted to bring the real exchange rate to its equilibrium level, re, the following partial adjustment mechanism can be written:

$$De = s\,(re - re) \qquad (3)$$

Where s denotes the speed of adjustment. Taking the first derivative of equation (1) and substituting from (2) and (3) results in:

$$Dre = g + s(\overline{re} - re) \qquad (4)$$

The solution to the above first-order differential equation is given by the following expression:

$$re = \overline{re} + (g/s) - (g/s)\exp(-st) \qquad (5)$$

Clearly, as time progresses, the last term in expression (5) approaches zero and the amount of "overvaluation" or "undervaluation" (depending on whether the domestic inflation is higher or lower than foreign inflation) is given by (g/s). This relationship indicates that the "overvaluation" or "undervaluation" of the real exchange rate is positively affected by the

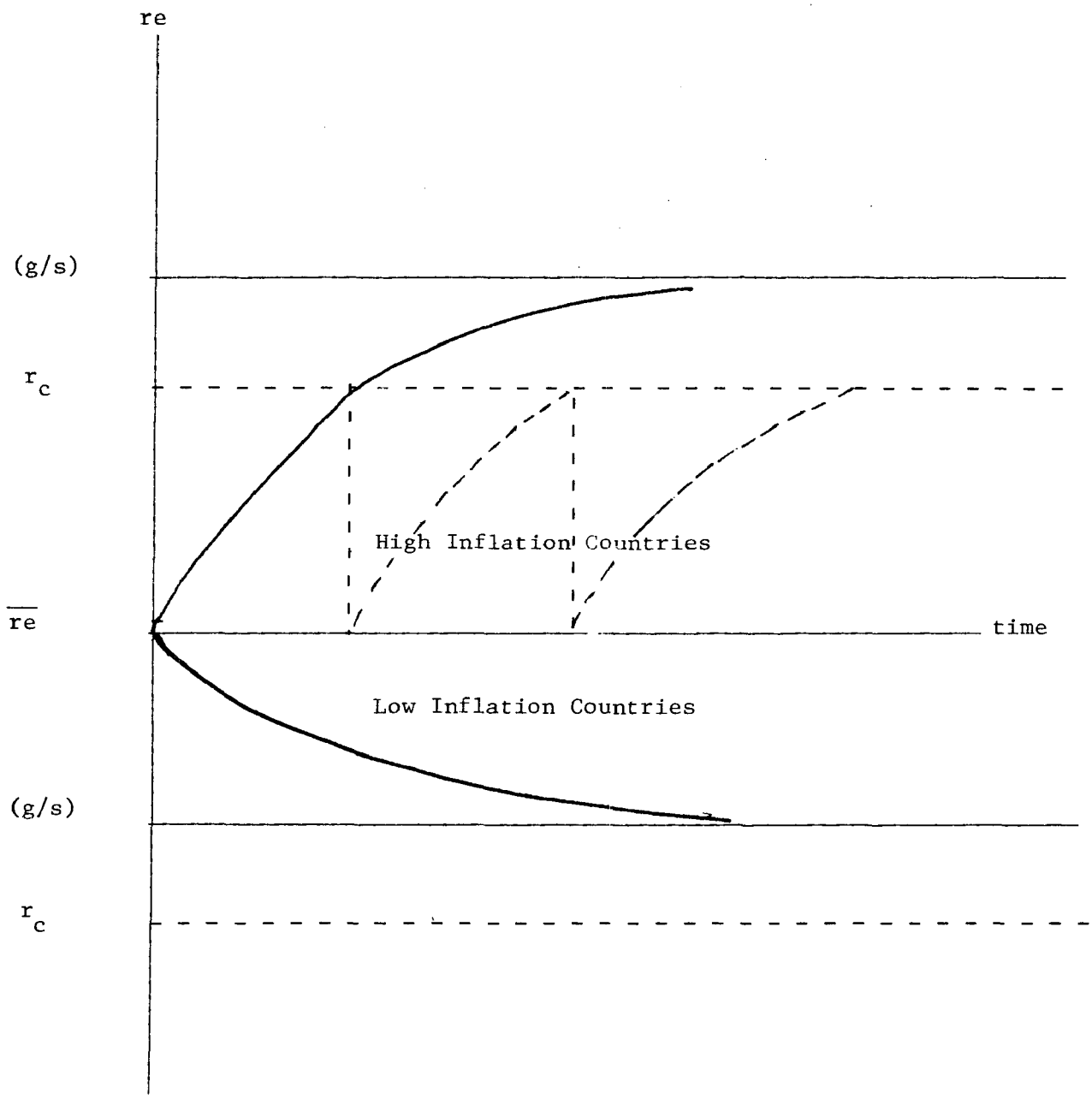
1/ All variables are expressed in logarithmic form.

inflation differentials at home and abroad, g, and negatively by the speed of adjustment of the effective exchange rate, s (see Chart 3).

It should be noted that there are two inherent asymmetries between high inflation and low inflation countries. First, the inflation differential for high inflation countries could be quite large, while the inflation differential for low inflation countries is not likely to exceed the foreign rate of inflation, because negative rates of inflation are seldom observed. Consequently, the overvaluation of the currency in high inflation countries is likely to be larger than the undervaluation in the low inflation countries. Second, the depletion of reserves in the high inflation countries is likely to force a large adjustment in the exchange rate once the external reserves fall below a critical level, while the accumulation of reserves in the low inflation countries is not likely to induce a large adjustment in the rate. Consequently, the high inflation countries are more likely to experience abrupt changes in their exchange rates (Chart 1). This phenomenon is depicted by the dashed lines in Chart 3, where re denotes the amount of overvaluation (undervaluation) of the real exchange rate which is consistent with a minimum (maximum) acceptable level of reserves.

Chart 3

Real Exchange Rate Adjustments in High Inflation and and Low Inflation Countries



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