APPLICATIONS OF REAL EXCHANGE RATE ANALYSIS

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This paper presents an approach for analyzing changes in the real exchange rate. It cites three views of the real exchange rate and outlines the complex forces that cause the rate to change. Using data from the International Monetary Fund's International Financial Statistics, *the analysis then focuses on selected countries, each chosen because its experience reflects the operation of a principal force affecting the exchange rate. A summary of the experience of several countries during the 1970–1983 period illustrates the importance of the real exchange rate in the wake of inflationary episodes, oil crises, massive capital movements, and debt crises during that period. The analysis directs particular attention toward the central role that real exchange rate movements have played in the international debt crisis.*

I. INTRODUCTION

The purpose of this paper is to provide a simple manual for analyzing movements of different countries' real exchange rates. The principal source of data is *International Financial Statistics* (*IFS*), published monthly by the International Monetary Fund (IMF). The monthly *IFS* issues present data on many economic variables for each covered country. These data appear monthly going back about eight or nine months, quarterly going back about a dozen or more quarters, and annually going back about six or seven years. Published annually is a yearbook devoted only to annual data and going back more than two decades. Most information used in examples presented here is from the *1985 IFS Yearbook*.

II. VIEWS OF THE REAL EXCHANGE RATE AND FORCES AFFECTING IT

The concept of the real exchange rate is used widely in countries undergoing severe inflation. Within these countries, the business and financial communities follow the movements of the nominal exchange rate as compared with the general price level—usually the consumer price index (CPI). When the exchange rate lags behind the general price level, the real exchange rate is described as falling. When the exchange rate (E) increases faster than does the CPI ($\bar{p}_d$) or some other domestic price index, the real exchange rate is described as rising.

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This simple concept of the real exchange rate as a deflated nominal exchange rate ($E/\bar{p}_d$) is quite useful under highly inflationary circumstances, when prices are increasing so much faster locally than they are elsewhere in the world that one sometimes can ignore the world inflation. In fact, this index measures the real price of the dollar, or of some other foreign currency unit, but does not adjust for the fact that the dollar itself changes in value, or purchasing power, over time. A more refined index ($E\bar{p}^*/\bar{p}_d$) of the real exchange rate corrects for changes in the purchasing power of the dollar by multiplying by a general index ($\bar{p}^*$) of dollar prices in the world market. In the table 1 data, this index is built up from the wholesale price indexes (*WPIs*) of the United States, Germany, France, Japan, and the United Kingdom by using the weights that since 1981 have been employed in the IMF calculation of the Special Drawing Rights (SDRs). Thus, a given country's real exchange rate measures the price in its own currency of an international basket built up of wholesale price baskets of the five major industrial economies. This price then is deflated by the country's own CPI. In short, the real exchange rate is the *real* price (i.e., it is being deflated by the country's own general price index) of the *real* dollar (i.e., its international purchasing power is held constant over time).

A second way to view the real exchange rate recognizes that in most cases where the real exchange rate must be adjusted, the required adjustment entails changes in the prices of tradable goods relative to those of non-tradables. Under flexible exchange rates, such adjustment ideally occurs by movements of the nominal rate (E), which affects equally the prices of all tradable goods. Under fixed exchange rates, with tradables' prices given in the world market, adjustment occurs through movements of the internal price level ($\bar{p}_d$). In both cases, adjustment occurs through changes in the ratio of tradables prices to non-tradables prices.

A third way to view the real exchange rate examines the forces working on the respective prices of tradable goods and non-tradables. In this view, the nominal exchange rate is the variable bringing about changes in the internal prices of tradables for given levels of their world prices, while the level of wages (W) is the major force causing the internal prices of non-tradables to move relative to those of tradables. Thus, major appreciations (in real terms) of a country's currency likely entail large gains in the real wages of workers, while important depreciations involve substantial reductions of real wages—at least when one measures these in terms of tradable goods. Viewing E/W as a proxy for the real exchange rate, even though E/W is inexact in the literal sense, contributes greatly to how well we understand both the euphoria sometimes following in the wake of a significant real appreciation of a country's currency and the pain and suffering accompanying major real devaluations.

TABLE 1
Range of Variation in Real Exchange Rates, 1960–1983
(maximum rate during period/minimum rate during period)

Range	Industrial Countries	Other Countries: Europe and Middle East		Asia		Africa		Latin America	
A. Range of Variation During 1960–1969									
1.00–1.20	Australia	1.09	Iran	1.04	Singapore	1.03	Kenya	1.09	Mexico 1.10
	United Kingdom	1.14	Greece	1.08	Malaysia	1.05	Morocco	1.16	Costa Rica 1.14
	Belgium	1.16	Syria	1.11	Thailand	1.15	Nigeria	1.17	Dominican Republic 1.17
	Switzerland	1.17					Cote d'Ivoire	1.19	
	Germany	1.18							
1.20–1.25	France	1.22	Portugal	1.30	Pakistan	1.23	Uganda	1.28	Paraguay 1.22
	Sweden	1.24	Egypt	1.30	India	1.25	Congo	1.33	Ecuador 1.25
	Norway	1.25							
	Italy	1.26							
1.35–1.50	The Netherlands	1.37	Spain	1.43	Burma	1.44			Colombia 1.39
	Japan	1.44	Israel	1.48					Venezuela 1.45
									Bolivia 1.49
1.50–1.75			Iceland	1.57					Peru 1.54
									Brazil 1.75
1.75–2.00			Turkey	1.87	The Philippines	1.77	Ghana	1.80	
2.00–2.50					Korea	2.20	Zaire	2.05	
Over 2.50			Yugoslavia	2.60					

TABLE 1 (continued)
Range of Variation in Real Exchange Rates, 1960–1983
(maximum rate during period/minimum rate during period)

Range	Industrial Countries		Other Countries: Europe and Middle East		Asia		Africa		Latin America	
			B. Range of Variation During 1970–1983							
1.00–1.20	Australia	1.19	Greece	1.16	Malaysia	1.10				
					Pakistan	1.19				
					Thailand	1.19				
1.20–1.35	Norway	1.24	Iceland	1.27	Singapore	1.27	Kenya	1.21	Dominican Republic	1.21
	Italy	1.24					Congo	1.28		
	France	1.25								
	Germany	1.25								
1.35–1.50	Sweden	1.37	Portugal	1.37	Korea	1.35	Morocco	1.38	Ecuador	1.37
	United Kingdom	1.37	Israel	1.44	India	1.42	Ethiopia	1.49	Colombia	1.45
	The Netherlands	1.40	Spain	1.46					Mexico	1.47
	Belgium	1.44								
1.50–1.75	Japan	1.65	Syria	1.56	Burma	1.70	Cote d'Ivoire	1.55	Venezuela	1.51
	Switzerland	1.67	Yugoslavia	1.59	Indonesia	1.71			Brazil	1.70
			Turkey	1.63					Peru	1.71
									Uruguay	1.74
1.75–2.00			Iran	1.95			Tanzania	1.95	Paraguay	1.81
			Egypt	1.98						

TABLE 1 (continued)
Range of Variation in Real Exchange Rates, 1960–1983
(maximum rate during period/minimum rate during period)

Range	Industrial Countries		Other Countries: Europe and Middle East		Asia		Africa		Latin America	
			B. Range of Variation During 1970–1983 (continued)							
2.00–2.50					Pakistan	2.11	Nigeria	2.35	Bolivia	2.00
									Costa Rica	2.42
Over 2.50							Zaire	2.90	Argentina	2.68
							Uganda	4.62	Chile	5.90
							Ghana	12.89		

Note: The real exchange rate is the nominal average price of the U.S. dollar during the period divided by the local consumer price index and multiplied by a weighted average of the wholesale price indexes of the United States (0.42), Germany (0.19), France (0.13), Japan (0.13), and the United Kingdom (0.13). The basic data used for this table are annual average exchange rates against the U.S. dollar. Each constituent WPI is multiplied by an index of the U.S. dollar price of the respective currency before the weighted average index is formed. The weights used to form the weighted-average WPI are those used since January 1981 to define the SDR.

All three ways to view the real exchange rate contribute to our understanding of the sources of its movements. Perhaps easiest is considering the reasons why the nominal rate might change in a country pursuing a flexible exchange rate policy in an otherwise stable environment, with the general price level at home and abroad remaining roughly constant:

A. *Forces Affecting the Supply of Foreign Currency*

(1) Improved efficiency in producing export goods

(2) Development of new export goods or opening of new supplies of old ones

(3) Increases in world prices of export goods

(4) Changes in the rate of capital inflow from abroad

B. *Forces Affecting the Demand for Foreign Currency*

(1) Reduction (or increase) in intensity of import restrictions

(2) Increases in income, part of which is spent on tradable goods

(3) Changes in the rate of capital inflow from abroad, part of which usually is spent on tradable goods

(4) Changes in the level of debt service payments

(5) Changes in world prices of particular import goods (a rise in world price can affect demand for foreign currency in either direction depending on whether the country has an elastic or inelastic demand for imports of the good in question)

Because these and other forces act together on a country's real exchange rate—and with an intensity that varies over time—quantitative analysis is quite difficult. In each of the six real cases depicted in figure 1, one particular force seems to predominate. This makes them ideal for expository purposes, but most real-world cases are much more complicated.

III. CASE STUDIES OF THE REAL EXCHANGE RATE

The following case studies have been chosen because each reflects the operation of one of the principal forces listed in section II. The examples are important because they demonstrate the real-world relevance of the concepts involved. They are convenient because they are simple.

Japan has enjoyed a tremendous economic boom, propelled greatly by increasing efficiency in the production of manufactured goods. Because Japan's efficiency in producing non-tradables did not increase so quickly, the price level of non-tradables had to rise relative to that of tradables—that is, the real exchange rate had to fall. One can use other views of the real exchange rate to interpret the same phenomenon. On the wage side, increased efficiency caused wages to rise relative to prices of tradables. In terms of demand and supply of foreign currency, Japan's export growth produced increases in income and in the supply of foreign currency. However, only

FIGURE 1
Real Exchange Rates in Selected Countries

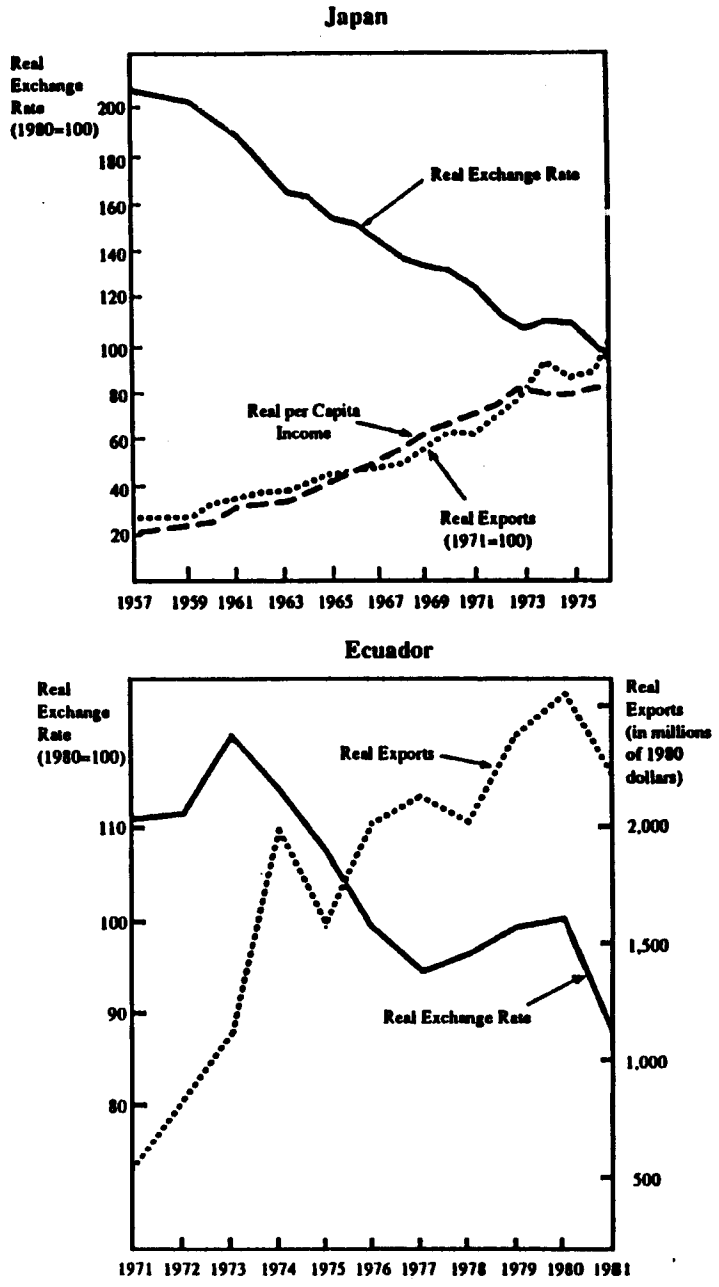
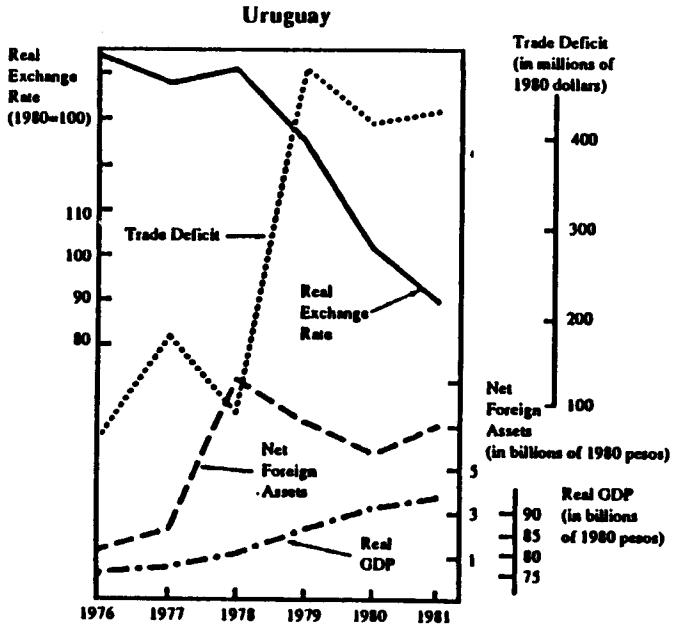


FIGURE 1 (continued)
Real Exchange Rates in Selected Countries



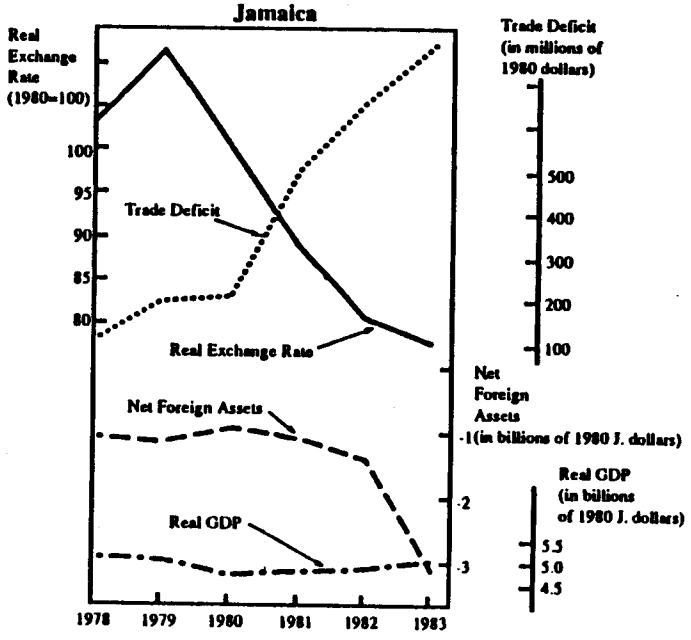
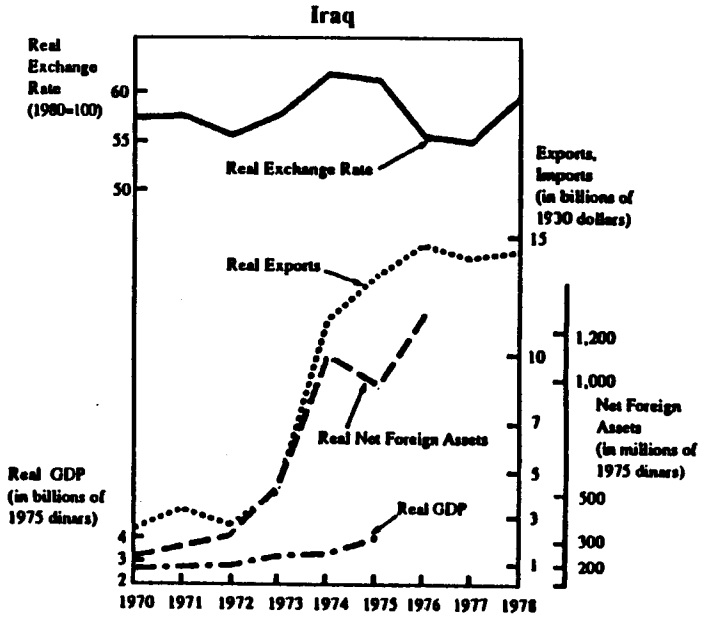
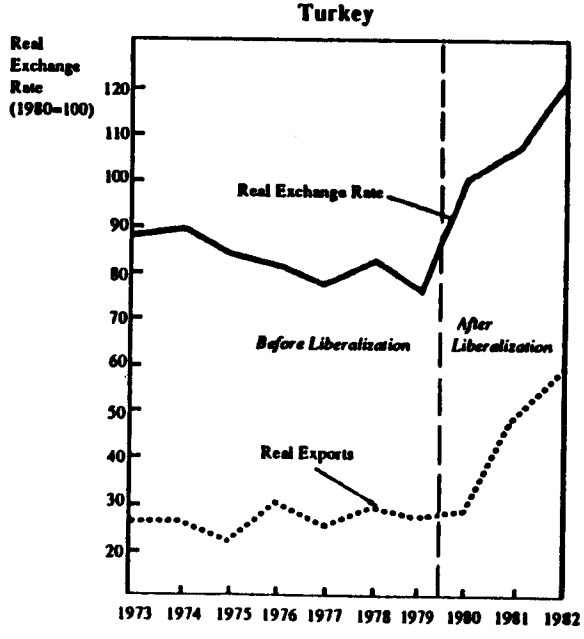


FIGURE 1 (continued)
Real Exchange Rates in Selected Countries





part of such increases was directly reflected in increased demand for foreign exchange. For supply and demand to be in equilibrium, the real price of foreign currency had to fall.

Ecuador is similar to Japan in that it had a great boom in real exports. But in Ecuador's case, the boom was due not to generally improved efficiency in the production of tradables but to the development of oil reserves and to the oil price booms of 1973–1974 and 1979–1980. These events added to the supply of foreign exchange and to the nation's income. The money was spent—for both consumption and investment—partly on tradable goods and partly on non-tradables. Only part of the extra foreign exchange proceeds was spent directly on imports. Because supply of foreign exchange increased more than did demand, a fall in the real exchange rate ensued. Another way to view the Ecuadorean case is to note that the extra income the oil boom generated was spent partly on non-tradables. Because no autonomous increase occurred in the supply of non-tradables, the latter's price had to rise relative to that of tradables. Such a rise, of course, corresponds to a fall in the real exchange rate.

The case of Iraq illustrates the complexity of real exchange rate analysis. Iraq shared with Ecuador the oil boom of the 1970s, but Iraq did not experience a similar decline in its real exchange rate. The reason is twofold. First, at the time of the oil price boom, Iraq was pursuing a policy of quantitative controls—licenses, quotas, prohibitions—on imports. When more foreign exchange resources became available, imports were expanded simply by relaxing controls. This produced an added demand for foreign exchange at the old real exchange rate. No fall in the real exchange rate was necessary to bring about an equilibrium of supply and demand. The second reason for the relative constancy of Iraq's real exchange rate over the period shown in figure 1 was Iraq's vast accumulation of foreign assets in the wake of the oil boom. Imports, which had averaged around 60 percent of exports during the late 1960s, fell to well under half of exports from 1973 onward. This induced a great surge in the country's foreign assets, many of which were held by banks. The great surge of the banking system's net foreign assets starting in 1973 illustrates the process. Simply put, when the proceeds of an export boom are held abroad, they put no downward pressure on the foreign exchange rate.

Turkey exhibits quite different behavior. In the three cases treated so far, the export boom was autonomous. The added supply for foreign exchange drove down the real exchange rate in Japan and Ecuador, while it permitted major increases in imports plus accumulation of foreign exchange at the old real exchange rate in Iraq. By contrast, Turkey's export boom was induced. The moving force was a massive liberalization of pre-existing import restrictions dating from the first quarter of 1980. The liberalization increased the demand for imports. This in turn caused the real exchange rate to rise and so stimulated an increase in the volume of exports. In this case, the view

that the real exchange rate is the price level of tradable goods relative to that of nontradables is one that falters. Internal relative prices fall for goods being freed from restrictions. Through the effect of liberalization in increasing the real exchange rate, this fall is accompanied by a rise in the relative prices of the remaining tradable goods such as the exports depicted in figure 1.

Uruguay illustrates an increased supply of foreign exchange coming from a different source—an increased flow of foreign capital to the country. Such a flow might have no effect on the real exchange rate—for example, if the newly borrowed funds were earmarked for incremental purchases of imported capital goods or other tradables. Typically, however, only part of the borrowing is spent directly on tradables. The rest is sold in the foreign exchange market to finance purchases of non-tradable goods such as construction, locally produced materials, and local services. This creates downward pressure on the real exchange rate. In the case of a flexible exchange rate system, the downward pressure works directly. Under a fixed rate system, the downward pressure works indirectly by inducing monetary expansion and a consequent rise in the level of internal prices relative to the price level of tradables.

The case of Jamaica contrasts with that of Uruguay in a subtle sense. In both cases, the flow of capital to the country increased, and this was represented by the trade deficit. In both cases, the real exchange rate fell. But in Uruguay's case, the capital inflow basically was a voluntary flow. In Jamaica's case, it represented largely official "emergency financing" to cover a growing trade deficit. In Uruguay's case, not only did real GDP sustain a healthy growth over the period shown, but the net foreign assets of the banking system grew also. In Jamaica's case, GDP was stagnating—actually declining in per capita terms—as the economy was supported partly by foreign loans and, toward the end of the period shown, by a dramatic drawing down of the banking system's net foreign assets. Characteristically, Jamaica's experience involved huge fiscal deficits of between 15 and 20 percent of GDP, while Uruguay's deficits were small—less than 2 percent of GDP.

The Jamaican case quite naturally leads to others that shared a similar experience. Consider the cases of Chile (1969–1972), Ghana (1979–1982), Uganda (1973–1978), and Zaire (1974–1978). In each of these cases, a massive fiscal deficit set in motion the machinery of monetary expansion. This produced pressure on the country's international reserves. Each country resorted to a series of import restrictions rather than allowing a sufficient rise in the nominal exchange rate to stem the incipient drain of reserves. These import restrictions in turn permitted the internal price level to rise dramatically relative to the exchange rate. Thus, the great appreciation of the exchange rate increasingly distorted the structure of internal prices and subjected the economy to progressively more serious strains. In each case, the dam finally broke, as a massive devaluation reversed the downward trend of the real exchange rate.

Chile's money supply grew by some 800 percent between 1969 and 1972, as increased advances from the banking system to the government accounted for the full increase. During this same interval, the general price index (GDP deflator) quadrupled while the nominal exchange rate of the dollar barely doubled. During the second quarter of 1972, the process of "correcting" the greatly appreciated real exchange rate began. By the fourth quarter of 1973, this real rate was more than three times its 1972 low and was still rising.

In Ghana, the money supply (M2) multiplied by 2.5 between the end of 1979 and the end of 1982. Again, the increase was fully accounted for by increased banking system advances to the public sector. Consumer prices multiplied by 4 from 1979 to 1982, while the nominal exchange rate of the dollar remained absolutely fixed. A massive devaluation during the fourth quarter of 1983 finally reversed the cumulative real appreciation. During that quarter, the cedi price of the dollar multiplied by more than 10.

In Uganda, the shilling was pegged directly to the SDR and the nominal exchange rate remained unchanged from 1975 through 1980. During the interim, the money supply (M2) multiplied by 4 and the GDP deflator multiplied by 6. In this case, the increment of banking system credit to the government amounted to more than 80 percent of the rise in M2. Corrective devaluation in 1981 caused the shilling value of the SDR to multiply by more than 10.

In Zaire's case, the minimum value of the real exchange rate occurred during the process of successive devaluations following a long period (1968–1975) with the exchange rate fixed at 0.5 Zaires per dollar. By the time the real exchange rate reached its low point in 1978, the Zaire price of the dollar already had risen to 0.836. But since 1974, consumer prices had multiplied by nearly 6, the money supply had quadrupled, and increases in bank loans to the government had accounted for nearly all of the M2 growth. In Zaire's case, the inflation process grew worse over time, as the exchange rate *vis-a-vis* the dollar multiplied by 5 between 1978 and 1981, and by 8 during 1981–1984.

All of the cases just examined reflect situations in which the drastic decline of the real exchange rate was in some sense a byproduct both of a fiscal deficit out of control and of the monetary expansion that such a deficit engendered. In these cases, the real exchange rate movement was not a conscious policy objective, nor was it the natural result of an inflationary fiscal deficit. In these instances, the deterioration of the real exchange rate could have been prevented by a policy of moving the nominal exchange rate upward so as to reflect the full extent of the inflationary forces being generated internally. The governments in question failed to take this route. Inevitably, import restrictions piled up and grossly distorted relative prices.

In a sense, then, one could say that Japan's real exchange rate appreciation was a natural consequence of the process of technical advance that it was experiencing. Ecuador's real exchange rate appreciation was a natural outgrowth of the development of oil exports plus the oil price boom, and Uruguay's was the natural concomitant of an increased inflow of foreign capital. Similarly, Turkey's real exchange rate depreciation was the natural result of its massive liberalization of import restrictions in 1979.

By contrast, the constancy of Iraq's real exchange rate was anomalous in the face of the oil price boom. Iraq was able to prevent the natural result—an appreciation—and maintain a relatively constant real exchange rate because it already had heavy controls on imports. Iraq proceeded to relax these controls while accumulating abroad some of the dollar proceeds of the oil bonanza.

The cases of Chile, Ghana, Uganda, and Zaire also contrast sharply with the others. In these countries, the appreciation of the real exchange rate came not as a natural consequence of ongoing inflation but as a byproduct of the particular way in which these countries handled their inflationary episodes. Of all the cases examined, the volatility of the real exchange rate in these countries can be attributed most readily to errors and misjudgment in policy.

IV. CALCULATION OF REAL EXCHANGE RATES

Practical applications of real exchange rate analysis generally are based on data for the country's nominal exchange rate (E). This always must be deflated by a general price index $\bar{p}_d$ of the country in question. If movements of the world price level $\bar{p}^*$—or the price level of a particular partner country for which the real exchange rate is being calculated—are quantitatively significant, then a time series of the real exchange rate should also embody a correction for these movements.

Thus, the general expression for the real exchange rate is $E\bar{p}^*/\bar{p}_d$. Particular measures will differ, depending on how each component variable is defined. To some degree, these differences are matters of judgment, convenience of use, availability of data, etc. But it also is possible to make genuine mistakes simply in putting together the basic data. This presentation calls attention to these possible mistakes and indicates how to avoid them.

The basic data on exchange rates are given at the beginning of the *IFS* presentation for each country. The first series shows the exchange rate with the SDR. This is followed by measures of the exchange rate *vis-a-vis* the U.S. dollar. Because the composition of the SDR has changed over time and because data on world imports and exports are expressed in U.S. dollars, we concentrate on exchange rates with the dollar.

For most countries, *IFS* presents two series on exchange rates with the dollar. One, labeled *ae*, refers to the local-currency price of the dollar at the end of the period considered. For most purposes, this is less desirable than the second series, labeled *rf*. This gives the *average* price of the dollar, measured in local currency, over the reference period—month, quarter, or year. This is the more appropriate series, but not only because most questions that we want to answer concern the entire periods considered here rather

than just their terminal dates. It also is more appropriate for defining the real exchange rate since the *IFS* price-level data invariably refer to average prices over the period covered. Hence, the variable *rf* is the series of choice to represent the nominal exchange rate E.

A few countries, such as the United Kingdom, typically refer to the exchange rate as the foreign price of local currency—in the United Kingdom's case, the U.S. dollar price of the pound—rather than the local currency price of foreign money. In the few instances in which *IFS* follows this practice in presenting its exchange rate data, the end-of-period rate is labeled *ag* and the average-over-the-period rate is *rh*. Users must be aware of this difference. For these cases, the exchange rate E as used in this paper is $1/rh$.[1]

Regarding the internal general price level ($\bar{p}_d$) used to deflate the nominal exchange rate, the theory of the subject requires that the deflating index include non-tradable goods as well as tradable goods. The best-candidate indexes are the CPI and the GDP (or GNP) deflator. Between these two, the GDP deflator prevails from the standpoint of coverage, while the CPI prevails regarding timeliness of publication and availability on both a monthly and a quarterly basis. These exercises all use the CPI, which indeed is the most widely used deflating index.

Because of recent advances in our understanding of the conceptual basis of real exchange rate analysis, we have departed from the symmetrical treatment of the two price levels involved—the domestic price level $\bar{p}_d$ and the foreign price level $\bar{p}^*$.[2]

A growing consensus exists to the effect that the foreign price level $\bar{p}^*$ should be an index principally including tradable goods prices while the deflating domestic price level $\bar{p}_d$ should be an index including non-tradable goods prices as well. This growing consensus regarding concept is reflected in the increasing practices of using foreign wholesale price indexes to construct $\bar{p}^*$, and of using CPIs or GDP deflators for $\bar{p}_d$.[3]

1. The countries for which *IFS* presents the exchange rate as defined by *rh* (rather than *rf*) are Australia, Bahrain, Botswana, Cyprus, Fiji, the Gambia, Ghana, Iraq, Ireland, Jordan, Kuwait, Lesotho, Malta, New Zealand, Nigeria, Papua New Guinea, Qatar, Sierra Leone, South Africa, Sudan, Switzerland, Western Samoa, and the United Kingdom.

2. The older literature on purchasing power parity used similar indexes in the two countries. This may not be a serious problem when one is concerned was purely monetary disturbances, as that literature was. Modern real exchange rate analysis deals, however, with many different types of real disturbances. For these, one must not miss the essential nature of the adjustment process. This is what would happen if a similar index of tradable goods were used in the two countries. For each imported commodity (X_i), the domestic price P_{id} is connected to the world price P^*_i by the nominal exchange rate E plus any tariffs (or $P_{id} = P^*_i(1 + t_i)E$. For export commodities (X_j), the relation is similar: $P^*_j = P_{jd}(1 + t_j)/E$. Here, the tariff is that of the foreign country importing the good. (Transport costs, where significant, play a role similar to that of tariffs) Because tariffs are changed at relatively rare intervals, an index of the domestic prices of tradables P_{id} and P_{jd} would tend to equal the same index—i.e., an index constructed using the same weights—of the foreign prices P^*_i and P^*_j of the same tradables. Thus, a general index of the real exchange rate Ep^*/P_d always would tend to be equal to unity except where tariffs have changed over time or where transport costs, which also intervene between domestic and foreign prices and which in the preceding description can be viewed as part of t_i, have changed over time. This makes clear the reason why the deflating index P_d in principle should cover non-tradable goods as well as tradable goods.

V. SUMMARY OF REAL EXCHANGE RATE VARIATION: 1960s AND 1970s

The real exchange rate always has been a significant economic concept, but particular attention has been drawn to its importance in the wake of the inflationary episodes, the oil crises, the massive capital movements, and the debt crises of the 1970s and early 1980s. Table 1 summarizes the real exchange rate experience of several countries—part A covers the 1960s decade and part B the 1970–1983 period. The data measure how much each country's real exchange rate has varied. Specifically, the data present the ratios of the highest to lowest annual average real exchange rates observed during the period covered.

Table 1 illustrates how substantially the world economy changed following the 1960s. During that decade, nearly all the listed countries had ranges of exchange rate variation between 1.0 and 1.35. During the subsequent period (part B of the table), most observations show real exchange rate ranges between 1.35 and 1.75.

Table 1 not only shows the large increase in real exchange rate variability, but highlights differences across regions and calls attention to countries with unusually high or low variability. In sum, one could say that the outlier observations during the 1960s represented situations specific to each country, with little true regional tendency. By contrast, the data since 1970 show a more general tendency for the variability of real exchange rates to differ among regions. They are significantly higher in Latin America than they are in other areas considered.

VI. DEBT CRISES AND THE REAL EXCHANGE RATE

This section focuses on a particular phenomenon—the debt crises—in which movements of the real exchange rate play a central role.

A characteristic debt crisis begins with an unusually large inflow of capital. This inflow adds to total spending in the receiving country and propels GDP to high—and possibly unsustainably high—levels. During this period of inordinately high capital inflow, the balance of trade moves strongly to the negative side and the real exchange rate—or the real price of the dollar—falls.

3. Examples of recent literature in which this schema is followed:

Edwards, S., "Are Devaluations Contractionary?" *Review of Economics and Statistics*, forthcoming.

Diaz-Alejandro, C. F., "Comment" in *Economics Adjustment and Exchange Rates in Developing Countries*, S. Edwards and L. Ahamed, eds., University of Chicago Press, Chicago, 1986.

The onset of the crisis is marked by a sharp reduction in the inflow of capital. This requires a corresponding improvement in the balance of trade, brought about partly through a reduction in spending and partly through a rise in the real price of the dollar.

Figure 2 shows how, in four countries, the real exchange rate fell during the period of capital inflow—i.e., declining trade balance—and then rose as the trade balance improved in response to the onset of the debt crisis. Figure 3 shows how, in the same countries, real GDP rose to a peak during the period of large capital inflows and then fell sharply as the countries adjusted to the reduction in this flow, Some movement represents the direct impact of a reduced capital inflow. However, part of the fall in GDP represents belt-tightening monetary and fiscal policies adopted to contain spending so as to improve the balance of trade.

In all four countries, the triple pressure—from reduced spending of capital funds flowing in, from tighter macroeconomic policies, and from a rising real exchange rate—produced an extremely sharp fall in real imports. This also is shown in figure 3. Imports bear the brunt of adjusting the trade balance in the short run since the supply of exports tends to respond to economic stimuli only with a lag.

Exports in various countries responded somewhat differently in the wake of the debt crisis. The situation was complicated by other developments such as agricultural weather cycles and world price movements of the countries' principal export products. Argentina's real exports rose by 10 percent during the first year of adjustment (1981), only to fall back to about their 1980 levels during the following two years. Chile's real exports stayed about constant—despite a substantial real devaluation—due mainly to declining world copper prices. Exports of both Mexico and The Philippines grew, but only moderately, during the years following their debt crises (1982 and 1983, respectively).

One area of major differences among debt crisis countries is the way in which inflation impinged on their adapting to the crisis. Table 2 summarizes the experiences of 11 countries in this regard. Column (3) presents the ratio of the post-crisis real exchange rate to its pre-crisis level. This ratio indicates the maximum percentage of real devaluation achieved. Column (4) presents, for the same comparison period, an index of the rise in consumer prices. Column (5) expresses the column (4) figure as a ratio to the amount of real devaluation shown in column (3). Because a devaluation of the nominal exchange rate implies a corresponding rise in the internal prices of tradable goods, a major real devaluation almost certainly will be accompanied by some rise in a country's internal price index. (Otherwise, a major fall in the price level of non-tradable goods would be required.) Policymakers' challenge is to limit this price rise. One can view column (5) figures as an index of different countries' relative success in meeting this challenge. Venezuela, The Philippines, Uruguay, and Chile were the most successful in this regard.

FIGURE 2
Trade Balances and Real Exchange Rates in Selected Countries

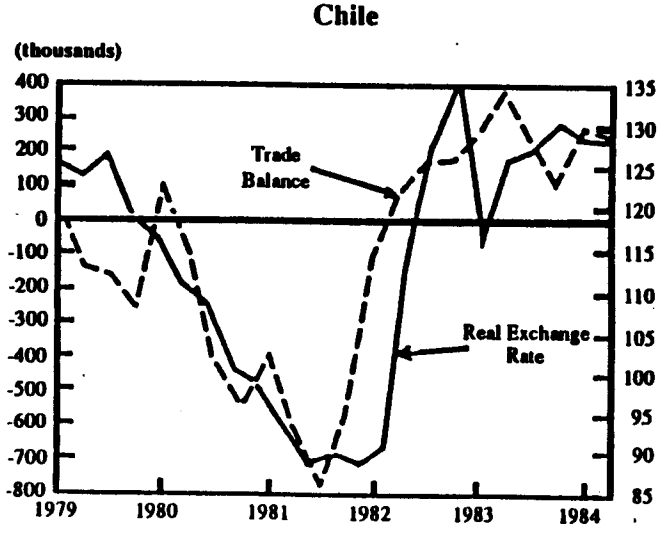
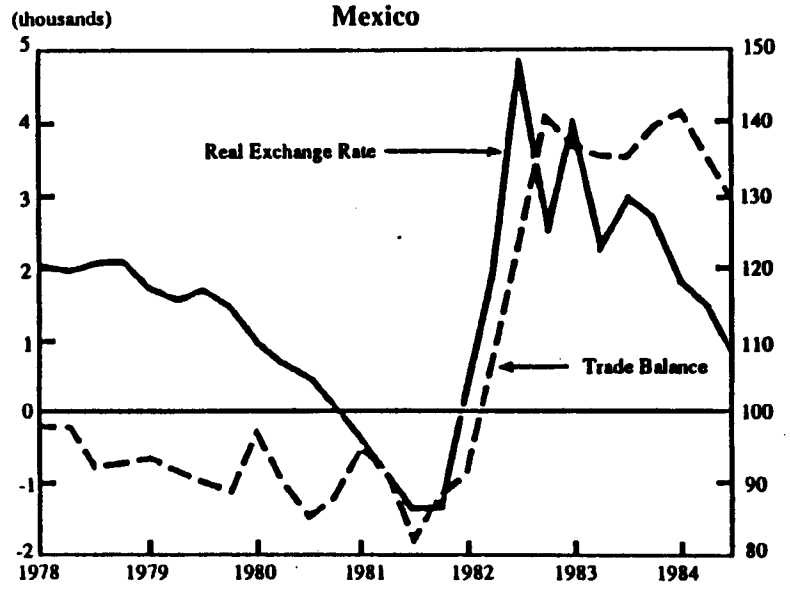


FIGURE 2 (continued)
Trade Balances and Real Exchange Rates in Selected Countries



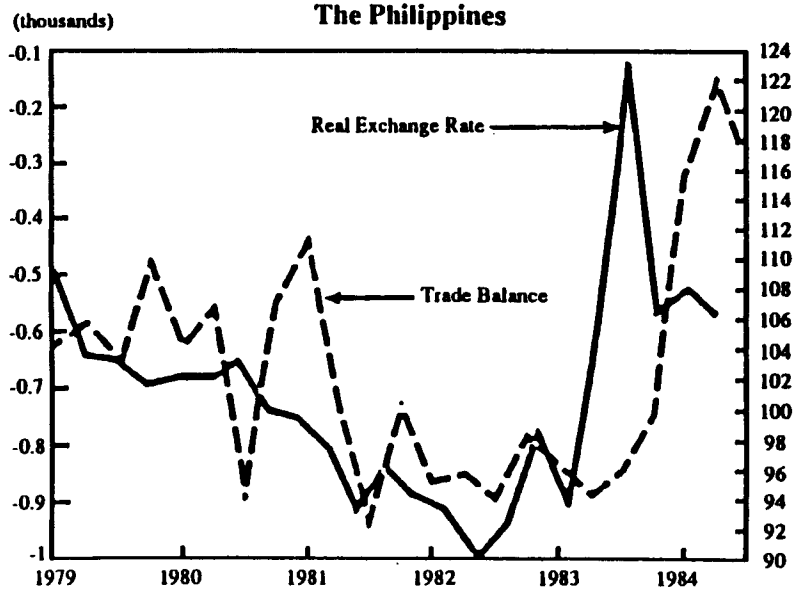


FIGURE 3
Effects of Changes in Capital Inflows on Real GDP and Real Imports

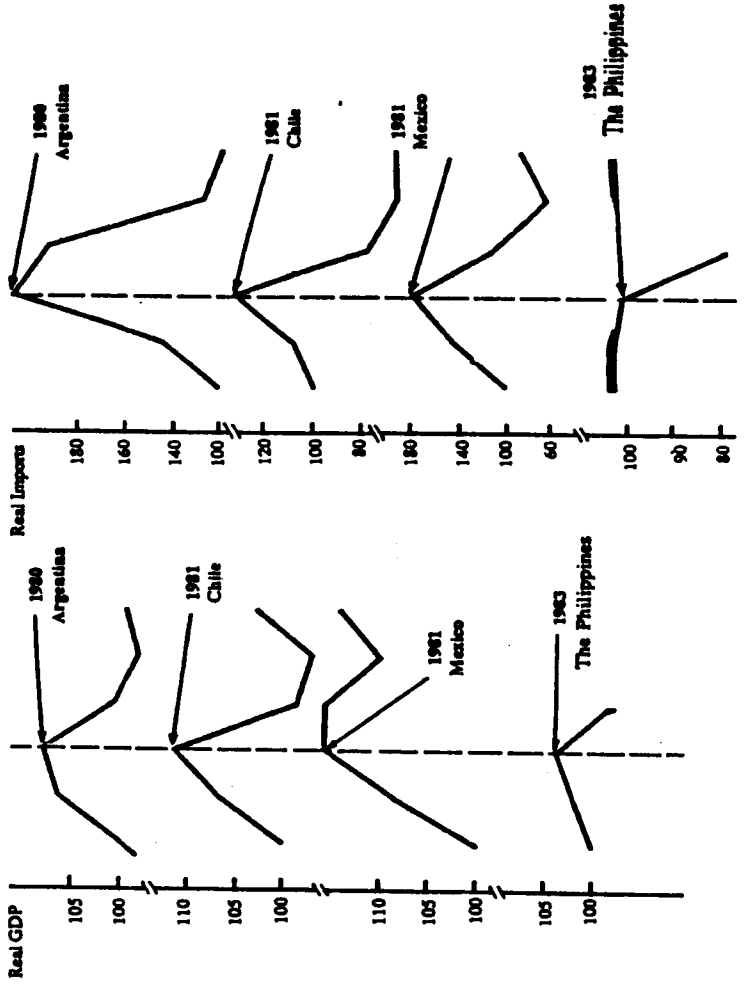


TABLE 2
Real Devaluation and Inflation in Countries Facing Debt Crises, 1980–1984

Country	Time Period Being Compared: Pre-crisis Trough (1)	Time Period Being Compared: Post-crisis Peak (2)	Ratio of Real Exchange Rate (peak/trough) (3)	Ratio of CPI (peak period/trough period) (4)	Inflation Relative to Real Devaluation (4/3) (5)
Argentina	1980 IV	1984 I	2.57	53.34	20.75
Bolivia	1982 III	1984 II	1.59	18.83	11.85
Brazil	1982 III	1984 III	1.48	7.23	4.89
Chile	1982 I	1984 III	1.45	1.61	1.11
Mexico	1981 IV	1983 III	1.50	3.13	2.08
Peru	1982 I	1984 III	1.11	5.86	5.28
The Philippines	1982 III	1983 IV	1.36	1.19	0.87
Portugal	1979 III	1983 III	1.48	2.15	1.45
Turkey	1979 IV	1984 II	1.92	5.65	2.94
Uruguay	1982 III	1984 II	2.00	2.09	1.05
Venezuela	1983 II	1984 II	1.74	1.11	0.64

Source: International Financial Statistics, International Monetary Fund.

Argentina, Bolivia, Peru, and Brazil suffered the strongest surges of inflation, over and above any that one might consider a necessary consequence of their respective real devaluations or international debt crises.

VII. CONCLUDING REMARKS

The real exchange rate always has been an important economic concept. However, during the 1970s and 1980s, international inflation, oil crises, massive capital movements, and debt crises have drawn increased attention to its importance. Because the forces affecting real exchange rate movements vary in intensity over time, quantitative analysis of these forces is quite difficult. However, in each of the countries selected for analysis here, one particular force seems to predominate—making these countries ideal for expository purposes.

TABLE 3
Calculation of Real Exchange Rate of Kenya Shilling Against U.S. Dollar, 1975–1984
(deflating indexes: Kenya consumer price index and U.S. wholesale price index)

Year	Nominal Exchange Rate [IFS, *rf*] (1)	Nominal Exchange Rate Index (1980=100) [1 × 100/7.42] (2)	U.S. Wholesale Price Index (1980=100) [IFS, line 63] (3)	Kenya Consumer Price Index (1980=100) [IFS, line 64] (4)	Real Exchange Rate Index [2 × ¾] (5)
1975	7.343	98.96	65.04	54.4	118.3
1976	8.367	112.76	68.07	60.6	126.7
1977	8.277	111.55	72.24	69.6	115.8
1978	7.729	104.16	77.86	81.4	99.6
1979	7.475	100.74	87.62	87.9	100.4
1980	7.420	100.00	100.00	100.0	100.0
1981	9.048	121.94	109.13	111.8	119.0
1982	10.922	147.20	111.33	134.7	121.7
1983	13.312	179.41	112.73	150.2	134.7
1984	14.414	194.26	115.41	165.4	135.5

Note: All data are from *1985 International Financial Statistics Yearbook*, International Monetary Fund. Columns (1) and (4) are from Kenya pages. Column (3) is from U.S. pages. See Appendix, part I, for details regarding calculations.

APPENDIX

ELEMENTARY CONCEPTS AND MEASUREMENTS

I. Calculation of Real Exchange Rate Using U.S. Wholesale Price Index

Table 3 presents an actual calculation of Kenya's real exchange rate for the period 1975–1984. For simplicity, the calculation is done *vis-a-vis* the U.S. dollar using the U.S. wholesale price index (WPI) in the role of $\bar{p}^*$ so as to express the dollar in real terms. E, the nominal exchange rate, is the nominal price of the nominal dollar. Multiplying it by $\bar{p}^*$ results in $E\bar{p}^*$, the nominal price of the real dollar—defined, in this case, as the U.S. WPI basket. Dividing this by the Kenyan CPI gives us $E\bar{p}^*/\bar{p}d$, Kenya's real exchange rate for U.S. WPI baskets.

This is what is done in table 3. Column (1) gives the nominal exchange rate directly, and column (2) converts this to index form with 1980 = 100. Column (3) presents the U.S. WPI, and column (4) presents the Kenyan CPI. Finally, column (5) calculates $E\bar{p}^*/\bar{p}_d$ to obtain the Kenya real exchange rate index.

II. The Concept of the "SDR–WPI"

For the period 1955–1970, the U.S. WPI is perfectly adequate for use in real exchange rate calculations. Most major currencies maintained fixed exchange rates *vis-a-vis* the dollar during these years, and price fluctuations were relatively moderate.

The institutional situation changed significantly following 1970. The major countries moved in a series of steps toward a flexible exchange rate system, which was in full operation by 1973. Inflation rates, which had been quite moderate up to at least the mid-1960s, began to grow and become more disparate among countries. Moreover, the 1970s oil shocks added a new type of pressure on the world's monetary system.

Because of these and other influences, the U.S. WPI became a less appropriate surrogate for the "world price level of tradable goods" than it had been earlier. In fact, situations arose in which no one country's WPI could be considered representative.

The problem became particularly acute during the late 1970s and early 1980s. During the last half of the 1970s, the U.S. dollar depreciated significantly against other major currencies. From 1981 until early 1985, it experienced a major appreciation. Because of these events, questions arise in interpreting the movements of a country's real exchange rate when only the U.S. WPI is used for $\bar{p}^*$ in the calculation. To what extent can one interpret the movements in question as originating in the economic situation of, say, Kenya? Or, alternatively, to what extent do the measured movements of Kenya's real exchange rate simply reflect the story of the U.S. dollar?

An element of doubt similar to that implicit in these questions is inevitable whenever one deals with an economic concept involving data from different places. Nonetheless, sometimes the issue may be acute and other times it may hardly matter. In developing the concept of the "SDR–WPI," a conscious effort has been made to moderate the influence that any particular country has on the general price-level variable ($\bar{p}^*$) used to define the "real dollar."

The SDR–WPI still is a dollar-price index but does not draw all its data from the United States. To see the nature of the SDI–WPI, one may conceive of each individual country's WPI as being the price in that country's local currency of that country's "wholesale price basket of goods and services." One can imagine going year by year through that country's experience and calculating how much its wholesale price basket would have cost in U.S. dollars. Doing this simply entails multiplying, say, the franc price of the French basket by the number of dollars per franc, the deutsche mark (DM) price of the German basket by the number of dollars per DM, etc. After deriving indexes of the dollar prices of the various countries' wholesale price baskets, one can consider taking an average of them all. That is how the SDR–WPI is calculated.

The index is called the SDR–WPI because it applies the weights used since January 1981 in calculating the value of Special Drawing Rights at the International Monetary Fund. These weights are 42 percent for the U.S. dollar, 19 percent for the West German DM, and 13 percent each for the French franc, the British pound, and the Japanese yen. These weights are used for all years in constructing the SDR–WPI index even though, prior to 1981, different currencies entered into computing the value of the SDR—and with different weights. (Indeed, prior to November 1971, the SDR was defined as exactly one U.S. dollar. Up to 1974, it still was defined exclusively in terms of the dollar, though at differing parities.) Thus, the objective of the SDR–WPI is not to follow the IMF in its changing definitions of special drawing rights. Rather, the objective is to settle on one simple and plausible definitive weighting pattern by which one can combine different countries' WPI baskets into a global index of a dollar price level relevant for world trade.

Table 4 gives a representative calculation of the SDR–WPI for 1970, 1974, and 1984. Row (a) of each year gives the country's own WPI. Row (b) gives its nominal exchange rate *vis-a-vis* the U.S. dollar. Because the initial data are indexes and the objective is to end up with an index, the nominal exchange rates are converted to indexes in row (c). This is done by dividing each country's nominal exchange rate for the particular year by the corresponding 1980 figure, and then multiplying by 100. For example, Germany's nominal exchange rate for 1970 is 3.660 DMs, and that for 1980 is 1.818 DMs. Therefore, the nominal exchange rate index for 1970 is (100)(3.660)/1.818, or 201.3, and the index of the U.S. dollar price of the German WPI basket is (100)(60.79)/201.3, or 30.20. This, along with similar figures calculated for the other currencies, enters into the weighted average constituting the SDR–WPI.

One should bear clearly in mind that the SDR–WPI is an index of *U.S. dollar prices*. That is because the bulk of statistics on international trade—exports, imports, capital flows, balances of trade and payments, and the like—typically are denominated in U.S. dollars. The index of dollar prices is what one needs to express such figures in real terms. And, of course, the exchange rate most widely used and cited in most countries is that with the U.S. dollar. Thus, an index of U.S. dollar prices is what one needs to convert that exchange rate to real terms.

III. Comparison of the SDR–WPI with the U.S. WPI

Table 5 compares the SDR–WPI with the U.S. WPI. The two indexes clearly were very close to each other during the 1950s and 1960s. In fact, during the entire span from 1955 to 1969, the ratio of the two indexes stayed between 0.837 and 0.878—a range of variation of less than 5 percent over a 15-year period. By contrast, the ratio of the two indexes varied between 1.0 and 0.823 from 1980 to 1984—a range of variation in which the maximum exceeded the minimum by more than 20 percent.

TABLE 4
Calculation of SDR–WPI, 1970–1984

	Germany	United Kingdom	France	Japan	United States
1970:					
(*a*) Country's Own WPI (1980=100)[a]	60.79	28.02	45.95	48.4	41.05
(*b*) Nominal Exchange Rate (*rf*)[b]	3.660	0.4167	5.554	360.0	0
(*c*) Nominal Exchange Rate Index (1980=100)	201.3	96.9	131.4	158.8	0
(*d*) WPI in U.S. dollars (100 × *a*/*c*)	30.2	28.92	34.97	30.48	41.05
(*e*) SDR–WPI[c]=35.25=(0.19)(30.20)+(0.13)(28.92)+(0.13)(34.97)+(0.13)(30.48)+(0.42)(41.05)					
1974:					
(*a*) Country's Own WPI (1980=100)[a]	78.67	42.60	72.71	73.7	59.54
(*b*) Nominal Exchange Rate (*rf*)[b]	2.588	0.4275	4.814	292.1	0
(*c*) Nominal Exchange Rate Index (1980=100)	142.4	99.4	113.92	128.8	0
(*d*) WPI in U.S. dollars (100 × *a*/*c*)	55.25	42.86	63.83	57.22	59.54
(*e*) SDR–WPI[c]=56.81=(0.19)(55.25)+(0.13)(42.86)+(0.13)(63.83)+(0.13)(57.22)+(0.42)(59.54)					
1984:					
(*a*) Country's Own WPI (1980=100)[a]	119.17	132.08	155.07	100.7	115.41
(*b*) Nominal Exchange Rate (*rf*)[b]	2.846	0.7483	8.739	237.5	0
(*c*) Nominal Exchange Rate Index (1980=100)	156.5	174.09	206.8	104.8	0
(*d*) WPI in U.S. dollars (100 × *a*/*c*)	76.15	75.87	74.99	96.09	115.41
(*e*) SDR–WPI[c]=95.04=(0.19)(76.15)+(0.13)(75.87)+(0.13)(74.99)+(0.13)(96.09)+(0.42)(115.41)					

[a]From *IFS*, country pages, line 63 for the particular country.

[b]From *IFS*, country pages, line *rf* for the particular country.

[c]A weighted average of the corresponding figures from row (*d*). The weights are 0.19, 0.13, 0.13, 0.13, and 0.42 for the five countries in the order listed.

Note: See Appendix, part II, for details regarding SDR–WPI concept and calculations.

TABLE 5
Comparison of U.S. WPI and SDR–WPI, 1955–1985

Year	Wholesale Price Index U.S. WPI[a]	Wholesale Price Index SDR–WPI[b]	Year	Wholesale Price Index U.S. WPI[a]	Wholesale Price Index SDR–WPI[b]
		A. Annual Data			
1955	32.67	28.58	1971	42.42	36.95
1956	33.72	29.56	1972	44.29	40.17
1957	34.70	30.29	1973	50.11	47.76
1958	35.19	29.83	1974	59.54	56.84
1959	35.26	29.50	1975	65.04	61.70
1960	35.30	29.80	1976	68.07	62.42
1961	35.19	30.22	1977	72.24	68.04
1962	35.26	30.37	1978	77.86	77.63
1963	35.15	30.55	1979	87.62	87.97
1964	35.23	30.92	1980	100.00	100.00
1965	35.93	31.52	1981	109.13	99.42
1966	37.12	32.41	1982	111.33	97.07
1967	37.20	32.42	1983	112.73	95.96
1968	38.13	32.37	1984	115.41	95.04
1969	39.61	33.59	1985	114.90	94.58
1970	41.05	35.23			

Year/Quarter	U.S. WPI	SDR–WPI	Year/Quarter	U.S. WPI	SDR–WPI
		B. Quarterly Data			
1957 I	34.5	30.3288	1961 I	35.4	30.0954
1957 II	34.6	30.3770	1961 II	35.1	30.2097
1957 III	34.9	30.4846	1961 III	35.1	30.3126
1957 IV	34.9	30.0884	1961 IV	35.1	30.3119
1958 I	35.2	29.9619	1962 I	35.3	30.4043
1958 II	35.2	29.8489	1962 II	35.1	30.3123
1958 III	35.2	29.7822	1962 III	35.3	30.3996
1958 IV	35.2	29.7590	1962 IV	35.3	30.433
1959 I	35.3	29.4254	1963 I	35.1	30.4690
1959 II	35.4	29.5378	1963 II	35.1	30.5183
1959 III	35.3	29.5508	1963 III	35.2	30.6100
1959 IV	35.1	29.5903	1963 IV	35.2	30.7055
1960 I	35.3	29.7427	1964 I	35.3	30.8464
1960 II	35.3	29.7940	1964 II	35.1	30.8269
1960 III	35.2	29.7619	1964 III	35.2	30.9479
1960 IV	35.3	29.8731	1964 IV	35.3	31.1035

[a]From *1985 International Financial Statistics Yearbook*, U.S. pages, line 63.

[b]Calculated from *IFS* data tape following methodology presented in *1985 International Financial Statistics Yearbook*, table 4.2

Note: See Appendix, part III.

TABLE 5 (continued)
Comparison of U.S. WPI and SDR–WPI, 1955–1985

Year/Quarter	U.S. WPI	SDR–WPI	Year/Quarter	U.S. WPI	SDR–WPI
1965 I	35.5	31.2708	1975 I	63.7	62.0170
1965 II	35.8	31.5126	1975 II	64.4	62.6020
1965 III	36.1	31.6436	1975 III	65.7	61.2170
1965 IV	36.3	31.8301	1975 IV	66.4	61.0950
1966 I	36.9	32.2311	1976 I	66.8	61.7870
1966 II	37.0	32.4144	1976 II	67.7	62.2430
1966 III	37.4	32.5518	1976 III	68.6	63.3310
1966 IV	37.2	32.4557	1976 IV	69.2	64.0070
1967 I	37.2	32.4910	1977 I	70.7	65.7890
1967 II	37.1	32.3424	1977 II	72.4	67.5400
1967 III	37.2	32.4433	1977 III	72.5	68.4690
1967 IV	37.3	32.3992	1977 IV	73.4	70.5090
1968 I	37.8	32.2074	1978 I	75.1	73.5070
1968 II	38.1	32.2440	1978 II	77.4	75.5350
1968 III	38.2	32.3662	1978 III	78.6	79.1770
1968 IV	38.4	32.6413	1978 IV	80.4	82.0130
1969 I	39.0	33.1234	1979 I	83.3	84.1930
1969 II	39.5	33.5324	1979 II	86.2	85.7400
1969 III	39.8	33.5546	1979 III	88.9	90.1630
1969 IV	40.2	34.2053	1979 IV	92.1	92.1590
1970 I	40.8	35.0032	1980 I	96.3	96.3100
1970 II	41.0	35.2287	1980 II	98.3	98.7800
1970 III	41.2	35.3366	1980 III	101.5	102.5520
1970 IV	41.3	35.4698	1980 IV	103.9	102.6790
1971 I	41.9	36.0010	1981 I	107.0	101.9970
1971 II	42.4	36.5600	1981 II	109.4	99.4780
1971 III	42.7	37.2150	1981 III	110.1	96.8800
1971 IV	42.7	37.9140	1981 IV	110.0	99.8260
1972 I	43.5	39.5270	1982 I	111.0	99.0520
1972 II	44.0	40.1100	1982 II	111.1	98.0200
1972 III	44.6	40.3720	1982 III	111.6	96.0090
1972 IV	45.1	40.8350	1982 IV	111.7	95.4690
1973 I	47.3	43.6550	1983 I	111.8	96.3980
1973 II	49.6	47.0510	1983 II	112.1	96.2800
1973 III	51.6	50.3810	1983 III	113.2	95.1840
1973 IV	52.0	50.5010	1983 IV	113.8	95.6380
1974 I	55.5	52.7930	1984 I	115.0	96.4270
1974 II	57.5	56.6820	1984 II	115.8	97.1180
1974 III	61.5	58.0960	1984 III	115.5	94.1500