Measuring the international value of the U.S. dollar

Since early 1973, after more than a quarter-century of relative stability that prevailed under the postwar Bretton Woods international monetary system, the value of the U.S. dollar in terms of foreign currencies has been changing daily. It has been fluctuating in response to the supply and demand conditions in the foreign exchange markets within the framework of a system of floating exchange rates of major currencies. In this environment measuring the "international value" of the dollar has become a somewhat confusing task. Financial pages of newspapers have been periodically headlining a "precipitous drop" in the value of the dollar on certain foreign exchange markets, while at the same time reporting its "strengthening" in others. These events have invariably left interested but "uninitiated" laymen confused as to the "real" international value of the currency. In an effort to contribute to a better understanding of these issues, and in response to many inquiries that the Federal Reserve Bank of Chicago has received on this topic, the following article presents a survey of various measures of the international value of the dollar.

Single currency value measurement

The most common measure of the international value of a particular currency is its exchange rate in terms of other currencies. The exchange rates are usually expressed either in terms of a number of units of a foreign currency required to buy one unit of a particular currency or in terms of number of units of a particular currency necessary to buy one unit of a foreign currency. For example, the exchange rates of the dollar in the New York market at noon on February 15, 1977 were as follows:

Currency	U.S. cents per unit	Number of units per U.S. dollar
British pound	170.55	.5863
Canadian dollar	97.65	1.024
German mark	41.60	2.402
Franch franc	20.11	4.972
Japanese yen	.3522	283.93

The foreign exchange quotes (or the "spot rates" as they are sometimes called) are important for traders, investors, and anybody who wishes to purchase a particular currency to make payments abroad. They reflect the "state of the market" at any one point in time. However, because of the differences in scale in the absolute values of currencies, direct comparison of the patterns of movements in the exchange rates of two or more currencies over time is difficult. To facilitate such a comparison, the changes in the value of the currencies are sometimes measured in relative terms by means of indexes: The exchange value of a particular currency in terms of another currency at a particular point in time is taken as a base (i.e., equal to 100), and the exchange rates at subsequent points in time are expressed as percentages of that value. For example, if the exchange rate of the German mark in terms of the U.S. dollar was .2732 dollars per mark in the base period, April 30, 1971, and .4160 on February 15, 1977,

then the value of the mark in terms of the dollar at those two points in time would be expressed as 100 and 152.3, respectively. A graphic tracing of such computations for several currencies is shown in Chart 1.[1]

Any "base period" can, of course, be chosen in computing an index, depending on the intent of the measurement. Regular sources usually choose as a base one of the following several dates that represent "milestones" in the evolution of the international monetary system:

> May 31, 1970, to designate a point in time just prior to the first major change in the postwar international monetary system—the "floating" of the Canadian dollar in June 1970.

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[1]The charts, together with the data entering the computation of the indexes, are published in a monthly report, "Measures of Exchange Rate Change in the U.S. Dollar," compiled by the U.S. Department of Commerce, Bureau of International Economic Policy and Research. Indexes of dollar prices of several major currencies are published periodically on the back pages of the International Letter.

Chart 1. Simple indexes of the value of several foreign currencies in terms of the U.S. dollar

April 1971=100
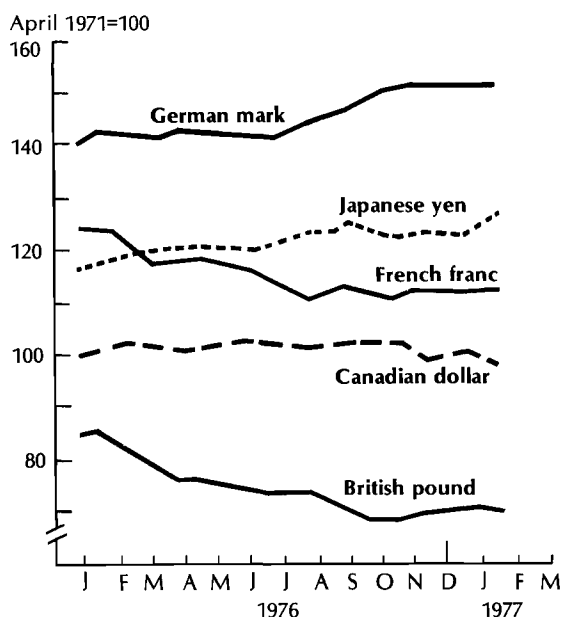
SOURCE: U.S. Department of Commerce.

April 30, 1971, a date just prior to the onset of massive foreign exchange markets pressures that, in early May of that year, forced readjustments in the exchange values of a number of major currencies and ultimately culminated with the abandonment of the gold exchange international monetary standard in August of that year (see International Letter, Nos. 13 and 27).

December 1971, to mark the reestablishment of "fixed" exchange rates of major currencies at new values (including the devaluation of the U.S. dollar by 7.89 percent in terms of gold and of varying percentages in terms of major currencies; see International Letter, No. 45) agreed upon at an international monetary conference held at the Smithsonian Institution in Washington.

February 15, 1973, as a point in time immediately following another formal realignment of the exchange value of major currencies on February 12 (including a 10 percent devaluation of the U.S. dollar; see International Letter, No. 105) and immediately preceding the adoption of a floating exchange rate system by major countries on March 19, 1973.

The exchange values of the dollar in terms of individual foreign currencies, expressed either in absolute or in relative terms, often move in opposite directions due to independent and often conflicting influences on the individual exchange rates. For example, as Chart 1 shows, while over the past year the value of the dollar has been declining in terms of the German mark and Japanese yen, it has been rising in terms of the French franc, the Canadian dollar, and the British pound. Such divergent movements make it impossible to form an objective judgment on the direction of the changes in the "overall" international value of any one currency.

Composite indexes of value

Various methods have been used to overcome the difficulties in arriving at an overall measure of value, arising from the divergent movements in the value of a single currency in terms of other currencies. One such method has been the construction of indexes based on *simple averages of values* of a single currency in terms of several other currencies over time. For example, between mid-April

1971 and mid-February 1977 the value of the U.S. dollar declined 34.3 percent in terms of the German mark and 21.1 percent in terms of the Japanese yen, and increased 150 percent in terms of the Brazilian cruzeiro; a simple average composite index based on the changes in the value of the dollar in terms of these three currencies would show an increase of 31.5 percent in the dollar's value.

Simple average composite indexes provide a better indication of overall changes in the international value of a currency than indexes based on individual currencies. However, they, too, suffer from a serious shortcoming. These indexes fail to differentiate between the relative importance of individual currencies entering the index and thus present (as in the example above) a somewhat distorted measure of an overall change in the value of a currency.

To eliminate the problem, several *weighted average indexes* have been developed. In constructing such indexes, each currency entering the index is assigned a different weight depending on its relative importance. The nature of the weights usually varies depending on the intended use of the index. For example, if the intended purpose is to measure the changes in the competitiveness of the country's goods on the world markets, the changes in the value of that country's currency in terms of the currencies of its trading partners over time are weighted by the historic relative shares of that country's exports to these countries. To use

Chart 2. Export-weighted indexes of the value of the U.S. dollar in terms of foreign currencies

April 1971=100

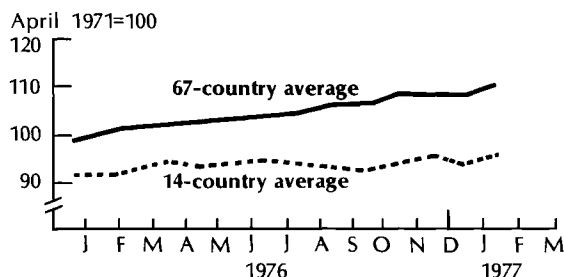SOURCE: U.S. Department of Commerce.

the above example, where the value of the dollar was measured by a simple average index, in computing an export-weighted average, the 34.3 percent decline in the value of the dollar in terms of the German mark would be weighted by the relative share of U.S. exports going to Germany (5.2 percent in 1975), the 21.1 percent decline in terms of the Japanese yen by 9.6 percent, and the 150 percent increase in terms of the Brazilian cruzeiro by 3.1 percent. The resulting index would show a 4.7 percent increase in the value of the dollar between mid-April 1971 and mid-February 1977, rather than the 31.5 percent increase indicated by the simple unweighted average index.

Two such export-weighted indexes, one based on relative shares of U.S. exports of manufactured products to 14 major industrial countries and the other based on a broader sample of 67 countries, are shown in Chart 2.

The impact of changes in the value of the country's currency on the overall cost of that country's imports is usually measured in terms of an index that uses relative import shares as weights. These relative weights are applied to the percentage changes in the value of foreign currencies in terms of the domestic currency.[2] Two indexes of these average weighted values of several foreign currencies in terms of the U.S. dollar are shown in Chart 3.

Several indexes that take into consideration the impact of the changes in the currency values on the country's overall trade flows have also been computed. To the extent that

[2]The magnitude of the percentage change in the value of each currency in terms of domestic currency is, of course, different from the percentage change in the value of domestic currency in terms of a foreign currency. In the example cited in the text, as the value of the dollar in terms of the mark declined 34.3 percent between April 1971 and February 1977, the value of the mark in terms of the dollar rose 26.8 percent in the same period. Changes in values of a currency in terms of foreign currencies are typically used for export-weighted indexes because such changes better reflect the changes in the prices of a country's goods to foreign purchasers due to exchange rate changes. Changes in the values of foreign currencies in terms of domestic currencies are typically used for import-weighted indexes because they reflect the changes in the prices of foreign goods to domestic consumers.

Chart 3. Import-weighted indexes of the value of foreign currencies in terms of the U.S. dollar

April 1971=100
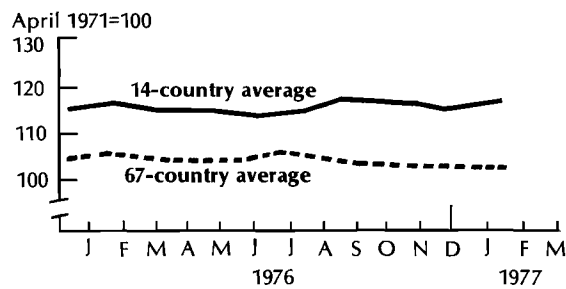
SOURCE: U.S. Department of Commerce.

the concept of the "overall international value" of a currency is of interest as a measure of the overall international standing of a currency (including the changes in the currency's purchasing power abroad and in the competitiveness of the country's goods on the international markets), such indexes represent probably the closest approximation of that concept.

The **Reuters Currency Index** is computed and published daily by the London-based international news service. In constructing the index, changes in the value of nine foreign currencies[3] in terms of the U.S. dollar from the December 1971 base are weighted by the sum of exports and imports to and from the United States in 1970-71, expressed as a fraction of total U.S. trade in that period. Exchange rates as quoted each day at noon in London are used for all currencies except the Japanese yen, in which case Tokyo's market closing rates are used.

The **Morgan Guaranty Index**, computed and published by the Morgan Guaranty Company in New York, weighs changes in the value of the U.S. dollar in terms of each of 15 foreign currencies[4] from May 1970,

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[3]The currencies of Japan, the United Kingdom, Germany, France, Italy, Belgium, the Netherlands, Switzerland, and Sweden.

[4]The currencies of countries shown in footnote 3 plus Canada, Spain, Austria, Denmark, Norway, and Australia. The currencies of the same countries less Spain are used for the computation of the U.S. Department of Commerce 14-country indexes discussed above.

December 1971, and February 1973 bases by the relative share of U.S. exports to and imports from these countries. Exchange rates as quoted in New York at noon and trade figures for the 1974-75 period are used in the computation. A geometric average of the export-weighted and import-weighted values is then computed to produce the index of the value of the dollar.[5] Similar computations are made for each of the currencies against the remaining currencies, weighted by respective trade flows in computing the value index for each of the currencies.

Multilateral trade-weighted indexes

To meet the needs of professional analysts of international trade developments, several indexes have been developed that take into consideration secondary and tertiary impacts of currency value changes on the trade flows of a country. The theoretical underpinning of such indexes is the proposition that changes in the value of a country's currency vis-a-vis other currencies affect not only the bilateral trade of that country vis-a-vis these countries, but the entire matrix of trade flows between all countries. For example, when the Japanese yen and German mark appreciate in value relative to the U.S. dollar, the volume of U.S. imports from Japan and Germany will tend to decrease (as a result of consumer response to the now higher prices of these countries' goods in terms of the dollar), and the U.S. exports to these countries will tend to rise (as a result of the now lower prices of U.S. goods in terms of these currencies). These propositions are implicitly taken into consideration in construction of the bilateral trade-weighted indexes previously discussed. The multilateral trade-weighted indexes consider an additional proposition, namely, that the rest of the world's trading countries will find German and Japanese goods relatively more expensive than U.S. goods, and that as a result, they will tend to shift their purchases to U.S. goods.

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[5]The Morgan Guaranty Index is widely used and is reported daily in the financial pages of a number of newspapers, including *The Wall Street Journal*.

Changes in the international value of the U.S. dollar
(as of February 15, 1977)

	As measured by:								
	U.S. Department of Commerce								
Percentage change in value since:	Index based on U.S. imports from 14 countries*	Index based on U.S. imports from 67 countries*	Index based on U.S. exports to 14 countries	Index based on U.S. exports to 67 countries	Reuter's Index	Morgan Guaranty Index	FRB Index	CIA Index	IMF Index
	(percent)					(percent)			
May 1970	n.a.	n.a.	n.a.	n.a.	n.a.	-10.8	- 9.5	n.a.	-11.9**
April 1971	+17.0	+ 2.7	-4.4	+10.6	n.a.	n.a.	n.a.	n.a.	n.a.
December 1971	+ 6.6	- 2.8	+ .4	+11.7	-7.1	- 1.2	n.a.	n.a.	n.a.
February 1973	- 3.3	- 7.9	+ 6.9	+16.7	n.a.	+ 4.8	n.a.	+6.03	n.a.

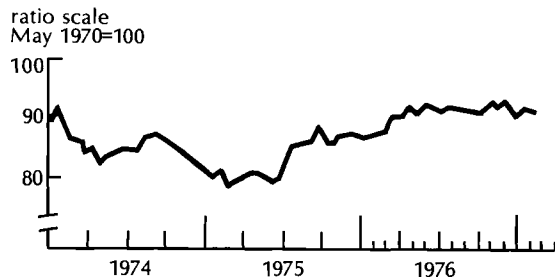*Based on value of foreign currencies in terms of the U.S. dollar.
**Average of the daily changes in the month of February.

One such index is constructed by the **Office of Economic Research of the U.S. Central Intelligence Agency**. In computing this index, the changes in the value of the dollar against each of the 16 major foreign currencies are weighted by the sum of each country's exports to and imports from the other 15 countries, divided by the total trade of the 16 countries. Another, still further refined index is constructed by the **International Monetary Fund**. The index combines the exchange rate changes from the May 1970 base in each of the Fund's 128 member countries' currencies relative to 20 major world currencies with weights derived from the Fund's econometric Multilateral Exchange Rate Model. The weights take into consideration the sensitivity

Chart 4. Trade-weighted index of the average value of the U.S. dollar in terms of 10 major currencies

ratio scale
May 1970=100

SOURCE: Board of Governors of the Federal Reserve System.

of the response of each country's trade flows to price changes (i.e., the price elasticities), as well as the feedback effects of exchange rate changes on the domestic costs and price changes.

The **Federal Reserve Index of Currency Values** is computed by the Board of Governors of the Federal Reserve. In this index changes in the value of the U.S. dollar since May 1970 in terms of the currencies of 10 countries[6] are weighted by the ratio of each foreign country's worldwide exports plus imports to the worldwide exports plus imports of all the sample countries for the year 1972. Exchange rates used for the computation are the noon buying rates in the foreign exchange market in New York. Indexes are constructed for each currency, and a composite weighted average index of all these currencies is constructed for the dollar (see Chart 4).[7]

Conclusion

In a fundamental sense, a currency derives its "value" from the multiplicity of goods and services it buys. Thus, the term

[6]The currencies of countries shown in footnote 3 plus Canada.

[7]This chart together with charts showing composite weighted-average indexes for several foreign currencies are periodically shown on the back of the International Letter.

"value of a currency"—whether it is used in a domestic or an international context—is an abstract concept, and the results of an effort to translate it into a simple, precise figure, or a series of figures that purport to measure changes in the currency's value over time, must be interpreted with great care. The nature of the elements entering into the construction of an index, the process by which they are combined, and the selection of the "base period" from which the changes are measured all influence the results. As the table shows, the various indexes discussed in this article produce widely divergent and seemingly contradictory indications of the movement of the exchange value of the U.S. dollar over time. Which of these is accepted as "the best measure" of the direction of the movement ultimately depends on the end-purpose of the measurement. For, it is that end-purpose that determines the appropriateness of any one procedure in constructing the measure—and its results.

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