**Federal Reserve Bank of Cleveland**

# A Hitchhiker's Guide to Understanding Exchange Rates

### by Owen F. Humpage

Each day, more than $1.2 trillion worth of foreign exchange changes hands around the globe, an amount that far exceeds the daily value of world trade. Approximately 83 percent of these transactions involve U.S. dollars, but not all involve U.S. citizens.[1]

Relatively small changes in the prices at which these trades occur—exchange rates—can have immediate and profound effects on economic events, ranging from family vacations to corporate profits. Large changes can shake governments, as recently demonstrated in Southeast Asia. Yet, despite the importance of exchange rates, most people find their behavior unfathomable.

Economists often view the *nominal* exchange rate (the foreign currency price of a dollar typically quoted in *The Wall Street Journal*) as the product of the real exchange rate and a component reflecting the difference between domestic and foreign inflation. Unlike their nominal counterparts, real exchange rates are not directly observable, but economists estimate them because of their influence on international competitiveness (see figure 1). This dichotomy between a real exchange rate and an inflation differential has proved useful for understanding the complex connections between economic fundamentals and nominal exchange rates, and especially for appreciating the role of monetary policy in determining exchange rates.

This *Economic Commentary* offers a nontechnical guide for those seeking a quick tour of exchange rates. The first part considers the role of inflation and monetary policy in determining

exchange-rate movements. The next section utilizes balance-of-payments concepts to illustrate the economic role of the real exchange rate. The final, but perhaps most important, part of the narrative introduces the crucial role of expectations.

### ■ Inflation Differentials

An exchange rate is the relative price of one nation's money versus another's. Currently, for example, 1.82 German marks exchange for one U.S. dollar. If the Federal Reserve creates excessive amounts of dollars (that is, more than people currently wish to hold) at a faster pace than the Bundesbank issues excessive amounts of marks, the value of the dollar will fall relative to the mark, say to 1.75.

Ignoring the difficulties associated with expectations and perceptions of monetary policy, the dynamics underlying the dollar's depreciation might proceed as follows: Faster money growth creates inflationary pressures in the United States, causing people to shift their purchases away from U.S. goods toward the now relatively less expensive German goods. To acquire German goods, however, people must first convert their dollars to marks. The increased demand for marks (and the greater supply of dollars) will bid up the value of the mark relative to the dollar in the foreign exchange market; that is, the dollar will depreciate against the mark. Holding others things constant, this dollar depreciation will continue as long as the U.S. inflation rate exceeds the German inflation rate, and will tend to match the inflation differential between the two countries. If, for example, Germany's inflation rate is

**To understand the behavior of exchange rates, it is often useful to view them as consisting of two parts—a real exchange rate and a component reflecting domestic and foreign inflation differentials. Most important, however, is an appreciation of the crucial role that expectations play.**

2 percent per year and the U.S. inflation rate is 3 percent per year, the dollar will depreciate 1 percent per year against the mark, other things being equal.

The explanation above contains two important implications for monetary policy: First, because monetary policy ultimately determines only the domestic inflation rate, a central bank that wants to engineer a depreciation of its currency must create more money than its trading partners and thereby generate a higher inflation rate. Second, because any resulting exchange-rate depreciation will ultimately offset the inflation differential, a monetary-induced depreciation cannot secure a competitive trade advantage. The real exchange rate, which I discuss below, will remain unaffected in the long term. Any trading gains from engineering a dollar depreciation are purely transitory, lasting only until prices fully adjust.

Economists refer to the relationship linking exchange-rate movements and inflation rates across countries as relative purchasing power parity (PPP). Recent estimates suggest that once disturbed, PPP takes an average of eight years to become reestablished.[2]

One interpretation of this finding is that goods prices adjust slowly to monetary shocks, implying that monetary policy may be able to affect the real exchange rate in the interim. A second interpretation is that nonmonetary events, such as productivity shocks or changes in preferences for domestic versus foreign goods, are important determinants of exchange-rate movements. The latter perspective draws attention to the determination of real exchange rates.[3]

### ■ Real Exchange Rates and the Balance of Payments

By assuming that world inflation rates and expectations are constant, we can focus on the real component of the nominal exchange rate. This will change in response to any economic event that affects the real (inflation-constant) demand for, or supply of, traded goods and international investments. To understand the connection, however, one must first understand balance-of-payments accounting.

The balance of payments records all transactions between residents of the United States and residents of the rest of the world.[4] Anything that creates a debit item in the U.S. balance of payments creates a supply of dollars (and a demand for foreign currency). When we import a German car or invest in German stocks—both debits in balance-of-payments accounting—we must first acquire marks in the foreign exchange market. Likewise, anything that creates a credit item in the U.S. balance of payments, such as the sale of domestic wheat or U.S. Treasury bonds, generates a demand for dollars (and a supply of foreign currency).

A country that incurs a current account deficit—like the United States—is consuming more of the world's output than it is producing. Its imports are a debit item in its current account, creating a supply of its own currency. Such a country must pay for its extra current consumption (that is, its surfeit of imports) by giving foreigners financial claims on its future output (stocks, bonds, bank deposits, and so on). The resulting foreign capital inflows are credit items in the balance of payments and represent a demand for dollars. As table 1 indicates, current account and capital account balances must offset each other exactly (assuming that everything is measured correctly). In sum, then, neither an excess supply nor an excess demand for dollars exists.

## FIGURE 1  MARK/DOLLAR EXCHANGE RATES
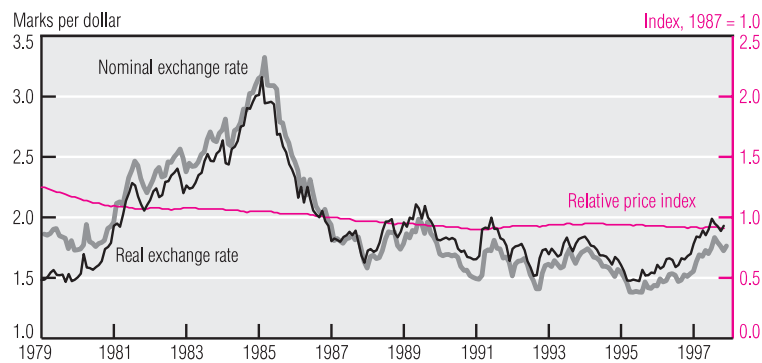


SOURCES: DRI/McGraw–Hill; and author's calculations.

## TABLE 1  U.S. BALANCE OF PAYMENTS
(Billions of dollars)

|  | 1995 | 1996 | 1997[a] |
|---|---|---|---|
| Current account balance | −129 | −148 | −160 |
|    Trade in goods and services | −102 | −111 | −113 |
|    Investment income | 7 | 3 | −11 |
|    Unilateral transfers | −34 | −40 | −36 |
|  |  |  |  |
| Capital account balance | 129 | 148 | 160 |
|    Official capital flows | 101 | 129 | 66 |
|    Private capital flows | 43 | 66 | 166 |
|    Statistical discrepancy | −15 | −47 | −72 |

a. Based on three quarters of data expressed at an annual rate.
SOURCE: U.S. Department of Commerce, Bureau of Economic Analysis.

The capital account does not passively respond to the current account, as the previous paragraph implies. Myriad individuals make separate decisions about importing, exporting, and investing abroad, and each of these decisions affects the balance of payments independently. If at any time the collective intentions are not consistent with equilibrium in the accounts, attempts to enact these plans will cause the real exchange rate to change. The exchange-rate adjustment in turn forces people to reevaluate their plans in such a way as to pull the current and capital accounts into balance. (Other economic variables, like real interest rates, might also shift and contribute to the process.)
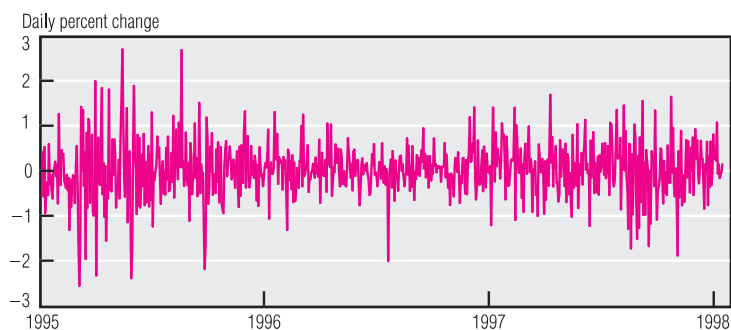
Contrary to popular belief, the mere existence of a current account surplus or deficit implies nothing about how dollar exchange rates will behave. A country may incur a current account deficit through various routes, each with different implications for its exchange rates. If, for example, domestic demand for foreign goods initially increases, imports will expand, the current account deficit will grow, and the dollar will depreciate. The dollar depreciation will encourage a counterbalancing inflow of foreign capi-

tal by making U.S. financial securities more attractive to foreigners. This—the standard view—holds that the dollar depreciates when the U.S. trade deficit widens. Alternatively, suppose that an improved domestic investment climate draws an inflow of foreign capital. The dollar will appreciate, making domestic goods expensive relative to foreign goods and striking a balance between increased capital inflows and the larger trade deficit. This second case connects a dollar appreciation to a U.S. trade deficit.

All economic events that affect the real demand for, or supply of, traded goods and financial investments can potentially determine the level of real exchange rates. While almost any economic variable would seem a possible candidate, real interest-rate differentials, productivity differentials, trade restraints, tax rates, and relative preferences for domestic versus foreign goods seem key.

I have discussed nominal exchange rates as the product of a real component and an inflation differential, identifying or alluding to fundamental economic variables that most economists regard as important to the determination of exchange rates. Nevertheless, empirical

**FIGURE 2  DAILY MARK/DOLLAR EXCHANGE RATES, 1995–97**



SOURCE:  Federal Reserve Bank of New York.

models have typically failed to explain past exchange-rate movements or to predict future exchange-rate paths in terms of combinations of these fundamentals. Although exchange rates bear some long-term correspondence to fundamentals, the relationship is not close in the short or medium term. Instead, research suggests that the best guess of tomorrow's (or next week's or next month's) exchange rate is today's (or this week's or this month's) exchange rate, and even this projection is not very good. This peculiarity has never been fully explained, but expectations seem to play a crucial role.

■ **Expectations**

Economists typically view exchange rates as very similar to asset prices. The current price of an asset reflects the present discounted value of the income stream that investors expect it to generate over its lifetime. Similarly, an exchange rate reflects the present discounted value of all relevant fundamentals, including current fundamentals and their expected future values. Foreign exchange traders face strong incentives to acquire every piece of information about current and anticipated economic developments that could possibly influence exchange rates. If these dealers are successful, their current quotations will incorporate all available, relevant data, and only new information that causes revisions in traders' expectations will influence exchange rates. This implies, for example, that previously anticipated changes in monetary policies or other fundamentals will not affect current exchange rates; only unanticipated changes will.

One might expect profit-seeking exchange dealers to formulate their expectations, and therefore their exchange quotations, without making systematic errors. To the extent that they can do so, revisions to their quotes will be fairly random and will impart a zigzag pattern to exchange-rate movements. Over time, a net change in one direction or the other may emerge as exchange rates adjust to persistent shifts in underlying fundamentals. On a day-to-day basis, the exchange rate will bounce—in a seemingly random manner—around any such path.

Figure 2 illustrates such a pattern for daily movements in the mark/dollar exchange rate. Over the period displayed (January 1, 1995 to December 31, 1997), the average daily change in the exchange rate was 0.02 percent,

suggesting a slight trend toward dollar appreciation. Daily movements about this average seem fairly random, with appreciations or depreciations of almost 1 percent being quite common. The largest single-day appreciation was 2.7 percent, and the largest single-day depreciation was 2.5 percent.

The foregoing discussion is based on the implicit assumption that expectations are fairly uniform and remain firmly anchored to a set of generally recognized fundamentals. The seemingly random pattern of figure 2, together with the small size of day-to-day changes, appears consistent with that view. Nevertheless, other evidence conflicts with it. The aforementioned poor performance of exchange-rate models, for example, undermines the validity of this assumption. Particularly damaging is the fact that since the inception of floating exchange rates, both nominal and real exchange rates have increased substantially, but the volatility of their underlying fundamentals has changed little.[5]

Although exchange traders are highly effective users of information, they probably are not perfectly efficient. Indeed, why would trade occur, especially in such large volumes, if all traders had identical information at all times? For one thing, information about economic fundamentals (both its acquisition and its interpretation) is costly, which may explain why many foreign exchange traders generate profits from technical trading rules—essentially rules of thumb—instead of from models based on economic fundamentals. Many of these rules project past trends into the future. One, for example, requires that a trader buy when the exchange rate rises by some fixed percentage above its past trough, and sell when it falls some fixed amount below its past peak.

Such trading rules could increase short-term volatility. As time passes and as information becomes freely accessible, traders may increasingly respond to fundamentals; initially, however, traders may not be linked to fundamentals in a fixed or even consistent way.[6] Figure 2 demonstrates striking periods of high and low exchange-rate volatility. The standard deviation of exchange-rate changes in 1995, for example, is almost twice as large as in 1996, suggesting more market uncertainty about exchange rates in the former period.

## Conclusion

Over the 25 years since dollar exchange rates began to float, economists have learned to garnish their exchange-rate predictions with humility. Most probably feel secure in betting that a country with a relatively high inflation rate will eventually see its currency depreciate in foreign exchange markets. Few, however, would venture a guess about the time path of the adjustment, or gamble with equal confidence on the long-run exchange-rate implications of most other economic variables, or even speculate about the short run. Nevertheless, international trade and capital flows continue to grow, despite the periodic trepidation about movements in dollar exchange rates.

## Footnotes

**1.** See Bank for International Settlements, *Central Bank Survey of Foreign Exchange and Derivatives Market Activity.* Basle: BIS, May 1996; and International Monetary Fund, *Direction of Trade Statistics Yearbook, 1997.* Washington, D.C.: IMF, 1997, p. 2.

**2.** See Kenneth A. Froot and Kenneth Rogoff, "Perspectives on PPP and Long-Run Real Exchange Rates," in Gene M. Grossman and Kenneth Rogoff, eds., *Handbook of International Economics,* vol. 3, part 2. Amsterdam: North-Holland, 1995, pp. 1647–88.

**3.** The price indexes used to calculate PPP usually include traded and nontraded goods. Deviations between the prices of these goods within a single country can affect calculated values of the real exchange rate.

**4.** The balance of payments, as presented in table 1, records international transactions on a nominal basis. I assume throughout this section that all transactions are measured on a real (constant-price) basis.

**5.** See Jeffrey A. Frankel and Andrew K. Rose, "Empirical Research on Nominal Exchange Rates," in Gene M. Grossman and Kenneth Rogoff, eds., *Handbook of International Economics,* vol. 3, part 2. Amsterdam: North-Holland, 1995, pp. 1689–729.

**6.** See Gregory P. Hopper, "What Determines the Exchange Rate: Economic Factors or Market Sentiment?" Federal Reserve Bank of Philadelphia, *Business Review* (September/October 1997), pp. 17–29.

*Owen F. Humpage is an economic advisor at the Federal Reserve Bank of Cleveland.*

*The views stated herein are those of the author and not necessarily those of the Federal Reserve Bank of Cleveland or of the Board of Governors of the Federal Reserve System.*