1
Gauging the Evidence on Recent Movements in the Value of the Dollar

Richard M. Levich

This symposium is being called at a time when there is great concern about the floating exchange rate system in general and the foreign exchange value of the dollar in particular. Since the early 1970s, with the Smithsonian Agreement in late 1971 and the move to generalized floating in early 1973, news about exchange rate developments and events that might affect the path of exchange rates have become a staple in the diet of national policymakers and business executives. But over the last several years, the dollar has embarked on an unprecedented course. The dollar's rise through 1985:Q1 has been called "phenomenal," "dazzling," even "astronomical."[1] In its current *Annual* Report, the Bank for International Settlements (1985, p. 143) characterized the late-February 1985 period as one of "dollar euphoria."

Events of the last several years have led researchers to reexamine some basic questions:

1. At an "objective" level, what has been the record of exchange rate movements-that is, the behavior of nominal and real, bilateral, and multilateral rates, and their volatility--over the recent years?

2. At a more subjective level, what is meant by a "strong dollar" and in what ways might one measure a currency's performance? Has the market tended to produce exchange rates that conform well to this measure of an "equilibrium" exchange rate (i.e., "public" market efficiency)?

3. If we find episodes of currency misalignment, can we attribute them to causes such as misguided intervention, market inefficiency (of private mar-

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T. Q. Hung (1985) of Merrill Lynch Capital Markets noted that "The phenomenal appreciation of the U.S. dollar in the past five years has revealed the deficiency of some of the traditional explanations of the dollar's exchange value." Jeffrey Frankel (1985) titled his recent article "The Dazzling Dollar." *The New York Times* (May 16, 1985) refers to an amendment introduced by Senators Bill Bradley of New Jersey and Alan Dixon of Illinois calling for "moderate intervention" to bring the dollar down from its "astronomical" highs.

ket participants), or poor coordination of national macroeconomic policies?

The paper to follow is organized along the lines of the above three questions. We first review the experience of nominal bilateral and real effective exchange rates since the early 1970s as well as evidence on exchange rate volatility. The next section begins with an overview of recent asset models of exchange rate behavior and exchange market equilibrium and some estimates of exchange rate misalignment are presented. The penultimate section considers the evidence on the causes of currency misalignments. Here we adopt Williamson's (1983) taxonomy and analyze the case for misguided official intervention, private market inefficiency, or poor coordination of macroeconomic policies in explaining currency misalignments. The final section contains a summary of the major arguments.

A number of excellent analyses of exchange rates have appeared recently and the dollar's strength has been so pronounced and prolonged that the mass media regularly editorializes on its magnitude, causes, and cures.[2] Consequently, we will break little new ground here, attempting instead to synthesize the evidence and assess where matters stand.

While it may have been easily anticipated, the statistical evidence is mixed and its interpretation ambiguous. As a consequence, we cannot reach closure on the key issues for policy. However, we can conclude, first, that the modern asset view of exchange rates offers an exceedingly complex and rich framework for analysis. So much so, that the distinction between disequilibrium rates, reflecting private market or public policy failures, and equilibrium rates, reflecting a peculiar albeit efficient adjustment path, becomes exceedingly difficult to draw. Second, several major building blocks-purchasing power parity (PPP), unbiased forward expectations, and stabilizing private speculation—must return center stage for reevaluation. The recent experience and empirical evidence have undermined all of these relationships and reawakened proposals for a managed flexible exchange rate system with target zones or other forms of exchange rate surveillance. Despite the unsettling evidence, or perhaps because of it, we must also conclude that the case for official intervention or closer central bank surveillance is not substantiated either. While the theory of speculative bubbles and bandwagons suggests that exchange rate changes may themselves be the cause of future exchange rate changes, the empirical evidence is not conclusive. Controlling exchange rate changes directly may amount to treating symptoms rather than causes, which is always a dangerous approach to health care.

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[2] See the analyses by Feldstein (1983), Frankel (1985), Islam (1984), Shafer and Loopesko (1983), and Williamson (1983, 1985).

The objective behavior of exchange rates

The argument for flexible but stable exchange rates rests firmly on the assumption that national economic policies would be stable, predictable, and coordinated and that exogenous disturbances would be few or at least moderate in size. Proponents of pegged or managed exchange rates have argued that the above conditions are not sufficient—a shortage of stabilizing speculative capital, an excess of destabilizing speculative capital, or certain features of the adjustment process itself (e.g., sticky prices) might cause actual exchange rates to be relatively volatile, even if "economic fundamentals" were fairly calm. All parties in the debate on the international monetary system seek stable and predictable exchange rates, in order to promote the gains from trade and capital flows. But for one reason or another, stability and predictability have been elusive.

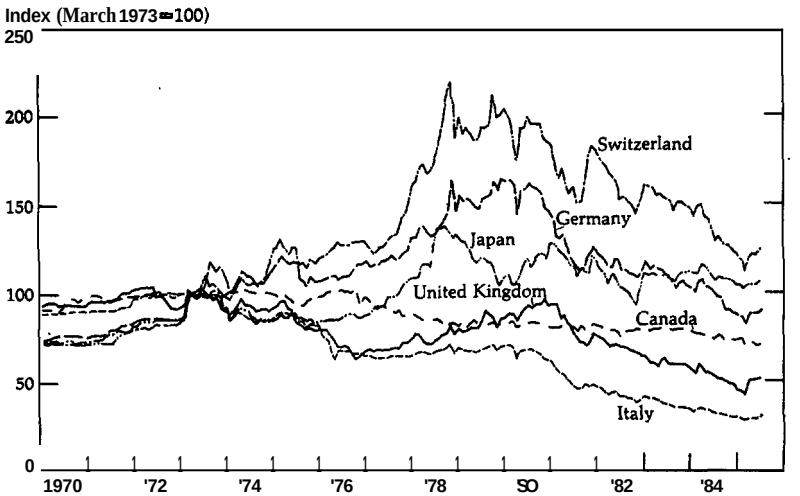
Prior to the 1970s, most exchange rates were pegged to the U.S. dollar, their values held within one percent of the parity rate through official intervention. In response to a fundamental disequilibrium, the central bank would make a discrete, step adjustment in the parity and then resume its official support. Since March 1973, the values of the currencies of the major industrial countries have been determined primarily by free-market forces in a floating exchange rates system. (The Canadian dollar was allowed to float in June 1970 and the British pound in June 1972.) From time to time, central bankers have intervened ostensibly to smooth "disorderly" market conditions, making the term managed floating more appropriate. In fact, most countries (roughly two-thirds of the 148 International Monetary Fund member countries) have chosen to fix their currencies formally to something (e.g., a single currency or a basket) in order to promote stability.

Nominal exchange rates

Chart 1 presents indexes of selected nominal, bilateral exchange rates in U.S. dollars per foreign unit. The graph clearly shows the divergent paths that these bilateral rates have taken after having once been pegged for long periods of time. From 1973 through mid-1975, several currencies (the DM and Swiss franc in particular) demonstrated a strong cyclical pattern, rising by 20-30 percent and then falling back on three separate occasions. This behavior led observers to propose that exchange rates may overshoot their equilibrium values. From mid-1975 through the end of 1976, exchange rate movements for the DM, Swiss franc, Japanese yen, and Canadian dollar were relatively flat, leading some observers to feel that the learning period had been passed and the era of flexible but stable rates had arrived. The U.S. dollar slide erupted again in 1977 to be capped for the DM (at $0.5780) and the Swiss franc (at $0.6787) by the major U.S. intervention announced on

CHART 1

Nominal Bilateral Exchange Rates
$/Local Currency



Data Source: International Financial Statistics

November 1, 1978. The Japanese yen continued to appreciate until late 1979. After March 1973, the British pound depreciated sharply until late-1976 (reaching a then historic low of $1.59 in the week ending October 29, 1976). The pound subsequently appreciated roughly 50 percent over the next four years ending late-1980.

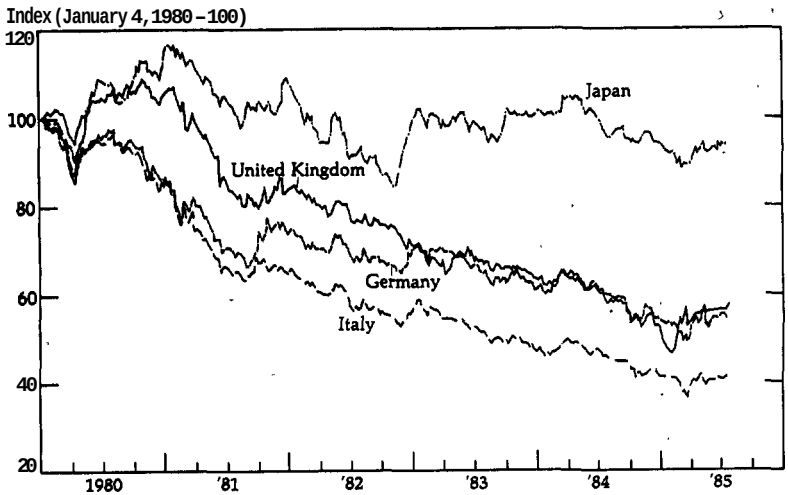
Since 1980 and until very recently, the story has been all U.S. dollar appreciation as shown in Chart 2. The slide of all currencies against the dollar has been almost uninterrupted. The cumulative decline for the British pound and DM reached 50 percent on March 8, 1985.[3] The Japanese yen has been an important exception, its nominal value trading within a 10 percent range of its January 1980 value for most of the last five years. While the dollar's rise has been dramatic, the nominal movements are roughly the same as for the DM, Swiss franc, and yen during the 20-month period ending November 1, 1978.

The strength of the dollar certainly has been remarkable, but all the more given the U.S. balance of payments position. In its *Annual Report,* the Bank

[3] Note that these rates are in $/foreign currency. For example, the DM declined from $0.5840 (i.e., 1.7122 DM/$) on January 4, 1980 to $0.2929 (i.e., 3.4144 DM/$) on March 8, 1985—a 50 percent decline in $/DM terms and a 100 percent increase in DM/$ terms.

CHART 2

Nominal Bilateral Exchange Rates
$/Local Currency



Data Source: Harris Bank Weekly Review
Weekly Data: 1/4/80 — 6/28/85

for International Settlements (1985, p. 147) commented, "There is no parallel for this phenomenon of an ever strengthening currency based on ever increasing capital inflows with the current account steadily deteriorating." The contrast with the strength of the DM and the yen in the 1970s and their current account positions is striking.

Real effective exchange rates

While a nominal bilateral exchange rate is the most common measure of currency value, it may provide misleading signals when price levels and inflation rates differ across countries. ***A real*** exchange rate expresses the value of a currency in terms of real purchasing power. Very often, the real exchange rate is quoted as an index relative to a PPP exchange rate, so that

$$S_{real,t+n} = S_{t+n} / S_{PPP,t+n}$$

where

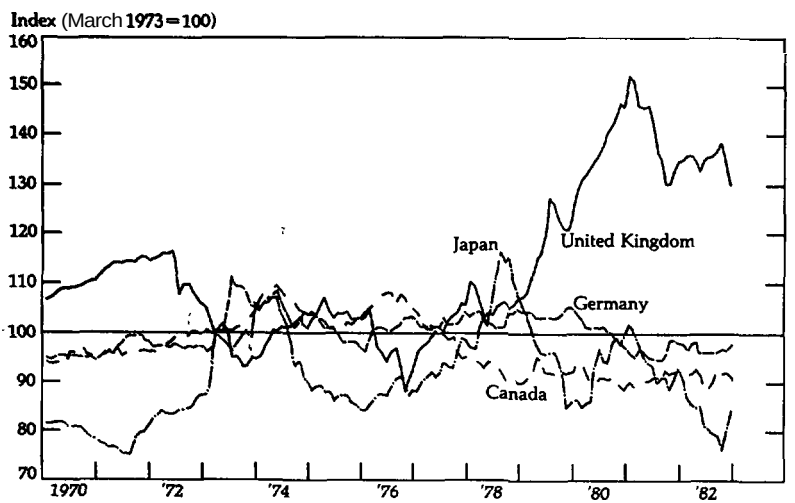
$$S_{PPP,t+n} = S_t (P_{\$,t+n}/P_{F,t+n}) / (P_{\$,t}/P_{F,t}),$$

and S is a nominal exchange rate in dollars ($) per foreign currency (F). This formulation assumes that ***relative*** PPP holds and that period ***t*** is an equilibrium base period. Values of S_{real} greater (less) than unity indicate real depreciation (appreciation) of domestic currency, i.e., more (less) U.S goods are required to purchase one unit of the foreign market basket. Values of S_{real} equal to unity indicate that the real exchange rate and relative purchasing power parity were maintained (i.e., that the nominal exchange rate change was exactly offset by the differential change in U.S. and foreign price indices). Consequently, the real exchange rate is a useful device for measuring the competitiveness of domestic goods in international markets, for predicting future changes in trade patterns, and for evaluating long-term real investment projects.

The ***real effective exchange rate*** is a multilateral rate that attempts to measure the overall competitiveness of home country goods in international markets. Several institutions (International Monetary Fund, Federal Reserve Board, Morgan Guaranty Trust, and others) regularly calculate these rates, however, each institution uses its own weighting scheme and its own base period. These differences become important if real exchange rate movements are taken as a measure of misalignment, as we will discuss further in the next section. While a summary statistic such as the real effective

CHART 3

Real Effective Exchange Rates



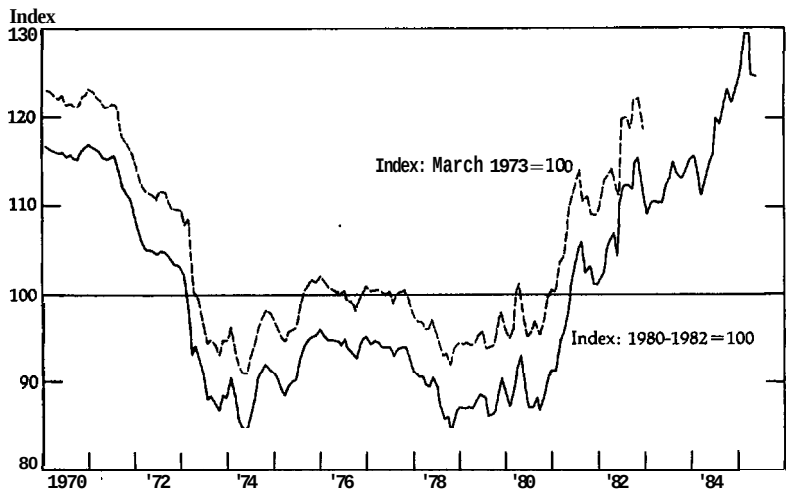
Data Source: Morgan Guaranty Trust

exchange rate should be interpreted with caution, it ought to provide a rough measure of the change in international competitiveness.

A sample of real effective exchange rates is displayed in Chart 3. (The data here are in foreign currency per dollar, so values greater than 100 indicate real appreciation.) The data clearly indicate that during the first seven years of generalized floating, real effective exchange rates were considerably less volatile than nominal rates. In part, this is because a multilateral exchange rate, by its nature, conceals the price behavior of individual bilateral markets. But it also reflects the fact that exchange rate changes were to some extent a response to relative inflation rates, i.e., there was some tendency for PPP to hold over this period. Britain is an exception, where we observed the nominal $/pound rate increasing steadily through 1980, not offset by lower British inflation.

CHART 4

Real Effective Exchange Rate
U.S. Dollar



Data Source: Morgan Guaranty Trust

Over the 1973-1979 period, the band of real exchange rate fluctuations may seem relatively narrow.[4] For example, the real effective rate for Germany varied between 97 and 111, and between 85 and 116 for Japan. Chart 4

[4] Cooper (1984, p. 18) noted that "Contrary to widespread opinion the figures suggest that there have not been wild gyrations in these rates."

shows that the real effective rates for the U.S. (March 1973 = 100) varied between 91 and 103 in the same period. To keep the magnitude of these movements in perspective, it is worth noting that a 20 percent real exchange rate change may be fatal to an exporter who operates on a 20 percent profit margin or whose cost advantage over a producer in another country is 20 percent. In highly competitive industries, small real rate changes may matter significantly.

The behavior of real effective exchange rates for the U.S. dollar since 1980 is clear from Chart 4. The real appreciation of the U.S. dollar amounted to 47.5 percent from a low of 88 in 1980 until peaking at 129.8 (on the new index of 1980-82 = 100) in February and March 1985.[5] We will return to Chart 4 in the next section to discuss the two U.S. indices.

Exchange rate volatility

Along with concern over the level of nominal and real exchange rates, interest in the extent of exchange rate volatility has grown as well. The primary concern is whether exchange rate volatility is "excessive" and deviations from PPP "prolonged." For some observers, this concern reflects a problem in positive economics (i.e., are exchange rates too volatile to be consistent with a credible model of exchange rate determination) rather than a normative issue (i.e., are exchange rates too volatile to allow countries to reach their targets for internal and external balance). Measures of "excessive" volatility require some benchmark of "equilibrium" volatility given economic fundamentals, including institutional market arrangements. We will return to this theme after a look at volatility statistics.

The data which follow measure the total or unconditional volatility of exchange rates. This may confuse expected drift with volatility. Under the assumption that the forward rate reflects the market's expectation of the future spot rate, forward forecast errors measure the conditional or unanticipated exchange rate movements. These results are presented in a later section.

A recent study by Bergstrand (1983) measures exchange rate volatility over the January 1977-May 1983 period for six major currencies and compares these results to the volatility in other financial markets and commodity markets. Bergstrand's results on this broad sample reconfirm earlier calculations by Frenkel and Mussa (1980) and Levich (1981)—exchange rates, although more volatile than aggregate price indices, are "the least volatile of

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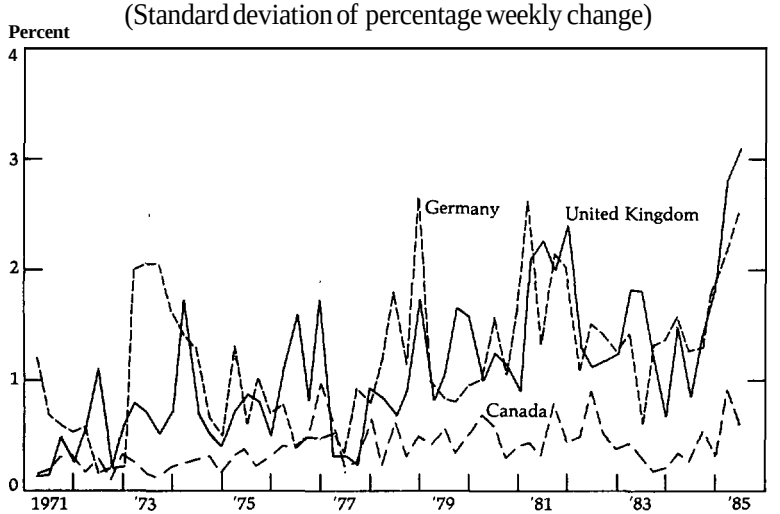
[5] It is not clear how to interpret the high real effective exchange rates for the dollar prior to 1973. They may represent the alleged advantage enjoyed by the U.S. during the Bretton Woods period.

a representative sample of financial and real asset prices."[6] Furthermore, Bergstrand argues that exchange rate volatility increased (along with volatility in other asset prices) after the October 1979 switch to money supply targeting, but this volatility declined during his last September 1982-May 1983 subperiod.

Updated measures of spot exchange rate volatility appear in Chart 5.[7] These results confirm a surge in exchange rate volatility in 1978:Q4 and again in 1980 and 1981 after the changeover in monetary targeting. However, our results indicate that in 1985:Q2 volatility has again jumped, meeting or exceeding the levels of the past ten years.[8] Other data reported by the Bank for International Settlements (1985, p. 146) confirm these results.

CHART 5
Spot Exchange Rate Volatility
(Standard deviation of percentage weekly change)



Data Source. Harris Bank Weekly Review
Quarterly data: 1971:Q1 — 1985:Q2

The subjective behavior of the dollar

The major question facing policymakers is whether the exchange rate behavior described in the preceding section approximates a set of justifiable,

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[6] Bergstrand (1983, p. 14).

[7] The technique of computing the standard deviation of percentage exchange rate changes over a period is suggested by Lanyi and Suss (1982), who also report on an extensive study of bilateral and multilateral exchange rate variability.

[8] The results for the three countries in Chart 5 are representative of the other countries (Belgium, France, Italy, Netherlands, Switzerland, and Japan) we examined.

"equilibrium" exchange rates arrived at through an efficient markets process, or whether, in fact, we *are* passing through a period of exchange rate "misalignment" that demands action of some sort. Notions of "equilibrium rates" or "excessive volatility" require a benchmark, and consequently they *are* both tests of the benchmark and the market's ability to set prices to conform to the benchmark. If the benchmark is hard to identify, we are in deep trouble. We continue with a brief look at theories of exchange rate determination and then go on to consider alternative standards for assessing the relative "strength," "overvaluation," or "misalignment" of the dollar.

Exchange rate determination[9]

It is now widely agreed that the price of foreign exchange is determined largely by asset market considerations. This view, which relies heavily on a stock equilibrium concept, stands in sharp contrast to flow equilibrium models of the balance of payments. In a flow approach, the demand (and supply) for foreign exchange was modeled as a derived demand, derived from the ultimate demand for goods and services in international trade. In the post-World War II period, with limited capital mobility, a small pool of liquid funds, and no Euromarkets, this was probably a reasonable first-approximation. A stock approach stresses that the supply of financial assets denominated in U.S. dollars (or DM or Japanese yen) must be willingly held at any moment in the trading day, and it is the intersection of demand and supply in this context that largely determines the exchange rate. In principle, a general equilibrium would require both flow and stock equilibrium, but in a world with high capital mobility and large pools of liquid capital, it is clear that asset market considerations must play a major role.[10]

One implication of the view that foreign exchange is a financial asset is that the current spot rate reflects the expected values of future exogenous variables, discounted back to the present. This is, of course, analogous to the notion that a security's price reflects the present value of expected future cash flows. At this point, we wish to argue that while this analogy is useful, the pricing of foreign exchange ought to be considerably more complex than the popular capital asset pricing models (CAPM) of the 1960s and 1970s.

The CAPM framework assumes that asset returns are stochastic and investors *are* risk averse utility maximizers. It makes two further critical assumptions: (1) assets *are* in fixed supply, and (2) there *are* many securities in the world and the relative supply of each is small. Given these two simplifying assumptions, investor demand for return and risk (measured relative

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[9] For a more complete review of exchange rate determination models, see Levich (1984).
[10] See Kouri (1976) and Dornbusch and Fischer (1980) for models that incorporate both stock and flow equilibrium characteristics.

to a market index), scaled by the fixed supply of assets, is sufficient to determine asset prices. The first assumption implies that trivial supply shocks, such as a stock split, have a direct effect on share prices. But stochastic supply shocks (e.g., exercise of warrants, executive stock options, exchange of convertible bonds, corporate "buy-back" programs) lead to more complicated and ambiguous effects on the general equilibrium share price. The second assumption suggests that dramatic shocks affecting any individual security do not spill over into other securities to require extensive portfolio rebalancing. A foreign exchange rate pricing model cannot make either of these assumptions and still hope to provide a realistic explanation of exchange rate behavior. First, supplies of foreign currency and of government debt denominated in foreign currency are definitely not fixed, and their growth rates are not easily predicted. In addition, one component of supply, official intervention, may be a reaction to the private demand function. Second, private demands for foreign currency and foreign currency denominated assets will depend on the expected rate of return on these assets and on how well the currency contributes to private utility by providing services as a medium of exchange and store of value at low risk. These factors presumably depend on the supply process so that monetary discipline (i.e., slow and predictable monetary growth) and fiscal discipline (i.e., budget balance) will have a positive impact on currency demand. This strongly suggests that an asset pricing framework for foreign exchange ought to account for the simultaneous determination of supply and demand and the stochastic nature of supply.

Furthermore, the CAPM assumption of many securities and little need for portfolio re-balancing in response to security specific shocks cannot be transplanted easily in the foreign exchange market. World financial wealth is concentrated in a handful of currencies, current account imbalances redistribute sizable pools of wealth, and shifting spending patterns may cause global currency mangers to realign their transaction balances. The attempt of many actors to execute these transactions at once, in response to changing exchange rate or interest rate expectations, could easily produce substantial exchange rate swings.

The above discussion suggests that a complex version of capital market theory combined with macroeconomics is required to achieve a close approximation to the real world setting of exchange rate determination. Unfortunately, capital market theory places major emphasis on expectations, which are unobservable and difficult to approximate empirically. This suggests that it may be extremely difficult to document exchange rate behavior, especially short-run behavior, and determine whether or not prices seem to be evolving rationally in response to an equilibrium model.

The current literature brings into sharp focus the question of what one means by "the fundamentals" in a model of exchange rate determination.

Models that assume that consumer prices adjust slowly (relative to the speed of adjustment in asset markets), or that desired asset accumulation proceeds slowly through the current account, will produce exchange rate "overshooting" (i.e., a short-run change in the exchange rate that exceeds the required long-run equilibrium change) in response to an unanticipated disturbance." But surely, the speed of consumer price change and asset accumulation are fundamental factors in the economy. Moreover, the ***realization*** of a change in fundamentals is not a necessary condition—the expectation of a future disturbance is sufficient to move exchange rates immediately. If these expectations are not realized, one is strained to conclude that speculators, setting price ex ante, performed irrationally (unless these expectations are repeatedly not realized).[12] Thus, the asset market environment is capable of rationalizing an extremely wide range of exchange rate behavior.

In sum, the asset view of exchange rates posits that the current set of exchange rates (spot and forward) reflects everything that is known (about economic structure and fundamentals) or expected to happen. As a corollary, the exchange rates deviate from their expected drift pattern only in response to news. And as another corollary, we would expect exchange rates (on average) to move very little (about their drift), but not be surprised if exchange rates moved a great deal.

Standards for comparison

In his recent monograph on the exchange rate system, Williamson (1983) defines three concepts of equilibrium:

> ***Market equilibrium.*** The exchange ***rate*** that clears private supply and demand without official intervention.
>
> ***Fundamental equilibrium.*** A real exchange rate that could be expected to produce a current account balance offsetting the underlying capital account over the business cycle (i.e., external balance) while maintaining internal balance and without imposing controls on trade or pay-

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[11] These results were developed in Dornbusch (1976), Branson (1977), and surveyed in Levich (1981). In an interesting historical analysis, Bernholz (1982) argues that this style of overshooting was observed in all periods of floating exchange rates over the last two centuries. Further, this pattern and its explanation were known to economists of the day.

[12] If speculators push up the price of orange juice futures several weeks prior to a freeze in northern Florida, we would be unlikely to conclude that "speculators cause weather," rather, that speculators took expectations into account for pricing. Speculators should be held blameless if their expectations are not met. The possibility of a "speculative bubble," especially one that is rational, i.e., based on the likelihood that other investors will appear to buy an overvalued asset, raises further problems regarding the meaning of "market fundamentals."

ments. The fundamental equilibrium rate may change in response to real changes in the economy.

Current equilibrium. A nominal exchange rate that reflects all information including temporary factors such as a divergence between current and desired asset positions, real interest rate changes resulting from a change in monetary/fiscal policy mix, and so forth. Exchange rate overshooting, described earlier, is an example of a current equilibrium that rationally diverges from its long-term fundamental equilibrium value because of temporary factors.

An important issue, which we leave until later, is whether a divergence between the fundamental equilibrium exchange rate (FEER) and a current equilibrium ought to be labeled as a "misalignment." The above definitions make clear that the assessment of an exchange market equilibrium or its absence, i.e., a misalignment or disequilibrium, involves a subjective evaluation relative to a benchmark. We move on to consider alternative candidates for the FEER.

Recent studies on exchange rate misalignment have focused on two empirical approaches: PPP and Current Account balance. As everyone should be aware, PPP calculations are haunted by numerous difficulties. Among these are the selection of an equilibrium base period, the selection of appropriate price indices, accounting for differences in consumption patterns and non-traded goods, specifying whether PPP applies to current prices or expected future prices, gauging a reasonable speed of adjustment between actual exchange rates and their PPP levels, and, of course, accounting for the possibility that PPP may be violated if there are real disturbances that require real exchange rate changes.

Chart 4 illustrates one of these problems. In 1983, Morgan Guaranty Trust (1983a, 1983b) came to believe that a strong dollar did not necessarily imply overvaluation or misalignment. Their reasons included confidence in U.S. monetary policy, progress toward energy price decontrol, changes in U.S. bilateral trade patterns, and serious overstatement of the U.S. current account deficit. They concluded that the earlier period no longer provided "a relevant yardstick for gauging the degree of dollar overvaluation. . . ."[13] As a result, Morgan Guaranty Trust selected 1980-82 as a new base period, reducing the index value at the time from 120 to 112. The report argued that this index implied a 12 percent loss of competitiveness in the U.S. manufacturing sector. It was not, however, "a measure of the dollar's overvaluation from the standpoint of the U.S. economy in its entirety."[14] This final state-

[13] Morgan Guaranty Trust (1983a, p. 11).
[14] Morgan Guaranty Trust (1983a, p. 11).

ment seems to suggest that there are strong reasons to abandon PPP as a guide for measuring misalignment.[15]

None of this should suggest that the current account balance approach is either objective or error-free. Among the difficulties in determining the equilibrium current account, we mention (a) estimating current and desired levels of domestic savings and investment over the appropriate cycle, (b) measuring the impact of government borrowing on domestic credit market conditions, (c) judging the appropriate use of foreign borrowing toward investment or consumption, (d) accounting for productivity changes, (e) coordinating the external balances of various open economies, and (f) doing all of the above with an imprecise statistical base.

While the notion of a country balancing its inflow and outflow of savings has strong intuitive appeal, it is supported neither by economic theory nor historical evidence. Opportunities and preferences for domestic savings and investment, taking tax incentives into account, may require an economy to be a net foreign borrower (or lender) over a long period. The cumulative current account (i.e., the net international investment position) may be nonzero, even though the expected current account at any distant point should approach zero, to keep the international investment position from exploding to infinity. But in a world characterized by growth and inflation, it is difficult to say whether any nominal cumulative current account is unsustainable.[16]

The perpetual current account surpluses in the United Kingdom (1870-1911) and in the United States (1946-70, except for three years) are useful episodes to keep in mind. These persistent "imbalances" would probably not be taken as evidence of serious macroeconomic disequilibrium. In a similar vein, Feldstein (1985) has argued that the persisting Japanese current account surplus has clear structural origins in taxation and savings behavior, rather than the result of exchange rate misalignment or trade practices. Cooper (1985) approaches the U.S. current account from the rest-of-the-world perspective. If non-American GNP is roughly $10 trillion, a 10 percent savings rate corresponds to $1 trillion, of which 10 percent (matching the roughly $100 U.S. capital inflow) might willingly be placed in the U.S. The breadth, depth, and liquidity of dollar-asset markets, both in the U.S. and offshore, lends credence to the view that foreign investors might willingly pay a premium for dollar assets compared with otherwise similar non-

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[15] Also, on this point, Maciejewski (1983, p. 493) notes that real exchange rate measures must be combined with a forward-looking analysis of the balance of payments. "In no case should the results obtained by any of the...indices be elevated into firm norms and used as the only indicators of currency overvaluation or undervaluation." See, also, Williamson (1983, p. 14) on this point.

[16] See the paper by Krugman for this Symposium.

dollar assets.

Overlaying these analytical issues is the problem of data itself. Morgan Guaranty Trust (1983a), Cooper (1985), and others have pointed out that the "Errors and Omissions" category of the U.S. Balance of Payments has become exceptionally large—$30 billion in 1982 and 1984. For the world, the total is close to $70 billion, and the likelihood is that most of these flows are headed toward U.S. dollar financial assets.

Estimates of misalignment

The preceding was intended to persuade the reader that estimates of currency misalignment ought to be handled with caution. Estimates of the FEER could easily be in error by 10 percent or more. Overshooting in response to current unanticipated shocks or future expected shocks could lead to a current equilibrium that diverges further from the FEER.

As of May 1985, the real effective U.S. dollar exchange rate stood at 125 (Chart 4).[17] So by this indicator, the dollar would need to decline by roughly 20 percent against all currencies to restore a competitive equilibrium in the U.S. manufacturing sector. However, as we argued earlier, this need not be evidence of a current misalignment from the standpoint of the entire economy.

Another approach is to consider the current long-term real interest differential (r-r*) as a forecast of the expected real exchange over some interval, and therefore an indicator of the current real exchange rate misalignment. Frankel (1985) estimates a ten-year real interest differential (U.S.-weighted foreign average) of 2.9 percent per annum. Compounded continuously over ten years, a 25 percent decline in the real effective dollar equalizes real returns on the dollar in comparison to the currency basket. There are several problems to consider. First, a longer time span would indicate that the real effective dollar is expected to depreciate further, seemingly without limit.[18] Second, ex ante real interest differentials cannot be observed directly, so they are subject to estimation error. Third, in the presence of a risk premium on the U.S. dollar, the interest rate differential overstates the market's expected rate of dollar depreciation, or equivalently, the extent of its current overvaluation or misalignment.

The final approach to measuring dollar misalignment seeks to estimate the set of exchange rates that would induce a set of current account balances

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[17] The Morgan Guaranty Trust index, as of late 1984, produced values that were as much as 12 percent below other indices. See Williamson (1985, p. 100), Figure A1 for a comparison of eight real effective exchange rates.

[18] See the paper by Krugman for a discussion of how asset accumulation constraints may affect the exchange rate path.

necessary to offset underlying capital flows. Williamson (1983, 1985) applies this approach, setting the desired U.S. current account balance (1976-77) at zero and adjusting for relevant macroeconomic changes after the base year. Williamson admits that the required assumptions are heroic and that barring major changes in the assumptions, the exchange rate estimates should have an error of as much as 10 percent. The estimates in Williamson (1985) indicate that in 1984:Q4, the dollar was about 40 percent above its fundamental equilibrium levels.

Sources of misalignment

The taxonomy introduced in the last section provides a useful guide to discuss exchange rate misalignments. An exchange rate misalignment, i.e., a deviation between the actual current spot rate and its FEER value, may develop through three channels:

(a) Actual spot rate ≠ market equilibrium rate.
(b) Market equilibrium rate ≠ current equilibrium rate.
(c) Current equilibrium rate ≠ fundamental equilibrium rate.

The first channel suggests the case in which private supply and demand are not permitted to produce a market clearing rate because of official intervention. Although official intervention is intended to stabilize exchange rates, some would argue that the actual effect has been destabilizing. A study by Taylor (1981) observes that central banks realized substantial intervention losses in the 1970s and, therefore, their overall effect must have been destabilizing. A later study by Jacobson (1983) argues that measures of profitability are sensitive to the sample period, the level of net intervention and the inclusion of interest opportunity costs. The results tor U.S. intervention are more positive after accounting for these factors. Another study by Mayer and Taguchi (1983) points out that the common concordance between unprofitable (profitable) and destabilizing (stabilizing) speculation is incorrect when the exchange rate has a sustained drift factor. Their own analysis shows that central banks tend to lean against the wind and that they succeed on about 80 percent of their interventions in reducing the volatility of exchange rates about a long-run average.[19]

In theory, official intervention could be destabilizing if private agents discover the intervention rule and attempt to take on profitable positions in advance. This is, of course, a specific example of the general result that sta-

[19] Mayer and Taguchi's study (1983, p. 29) includes Germany, Japan, and the U.K. over the period January 1974-June 1982. To the contrary, in the foreign exchange options market, where volatility is priced directly, recent casual evidence suggests that government intervention is linked with increases in implied volatility and option prices.

bilization policy may be futile in a world with agents who formulate rational expectations. Another theoretical consideration is whether sterilized intervention (i.e., one that leaves the domestic money supply unaffected) can have a significant effect on the exchange rate. A sterilized intervention to depress the dollar would, in essence, increase the outstanding supply of U.S. dollar bonds relative to DM bonds. If investors consider these bonds to be perfect substitutes, then sterilized intervention has no impact on the exchange rate. Perfect substitutability between foreign and domestic currency assets is equivalent to there being no foreign exchange risk premium. The empirical evidence on exchange risk premia is considered below.

The third channel allows that temporary factors (stemming from uncoordinated macroeconomic policies, unanticipated policy developments, or other unanticipated exogenous events) may cause a current equilibrium to deviate from the long-term fundamental equilibrium exchange rate. Certainly over the last decade, the world economy has been hit by several severe real disturbances, major shifts in macroeconomic policy stance, and a lack of policy synchronization across countries. Given the asset pricing framework we described earlier, it is well established that current exchange rates could justifiably deviate from their long-run equilibria. The empirical question is whether markets have pushed current exchange rates "too far."

This brings us to the second channel for introducing an exchange rate misalignment. Market inefficiency may cause the market equilibrium rate to deviate from the current equilibrium rate. The literature on foreign exchange market efficiency has exploded over the last ten years.[20] In an efficient market, prices reflect everything that is known or expected to happen. By implication, the market's expectational errors would average to zero and show no serial correlation. As a corollary, agents acting with the same information set as the market should not be able to earn unusual or risk-adjusted profits.

Empirical evidence on efficiency

Empirical studies have almost always shown that when uncertainty is absent (assuming away default risk) arbitrage profit opportunities are consistently less than transaction costs. The possible exceptions are the apparent covered interest arbitrage profit opportunities in long-dated forward contracts, and violation of put-call-forward parity in the foreign exchange options market, which may reflect either thin-market conditions or other institutional factors.

When uncertainty is present, such as in spot or forward speculation, the researcher must posit both a risk measure and an equilibrium price for risk-

[20] See Levich (1984) for a recent survey.

bearing to determine whether any speculative returns are unusual on a risk-adjusted basis. A consensus is still waiting to be formed on these issues, so empirical studies that uncover profit opportunities are subject to several interpretations.

As far as spot speculation is concerned, the filter-rule studies by Dooley and Shafer (1976, 1983) are modem classics. In these studies, speculative positions are taken when the nominal value of a currency advances a small amount (say, one percent or three percent) above a recent low, or if it declines from a recent high. The null hypothesis in a filter-rule is essentially Fisherian—the interest rate differential should offset the anticipated exchange rate change so that expected returns equalize across currencies. But, after adjusting for transaction costs and the interest expense of establishing spot positions, Dooley and Shafer report that substantial profits remain and persist over the eight-year sample period.

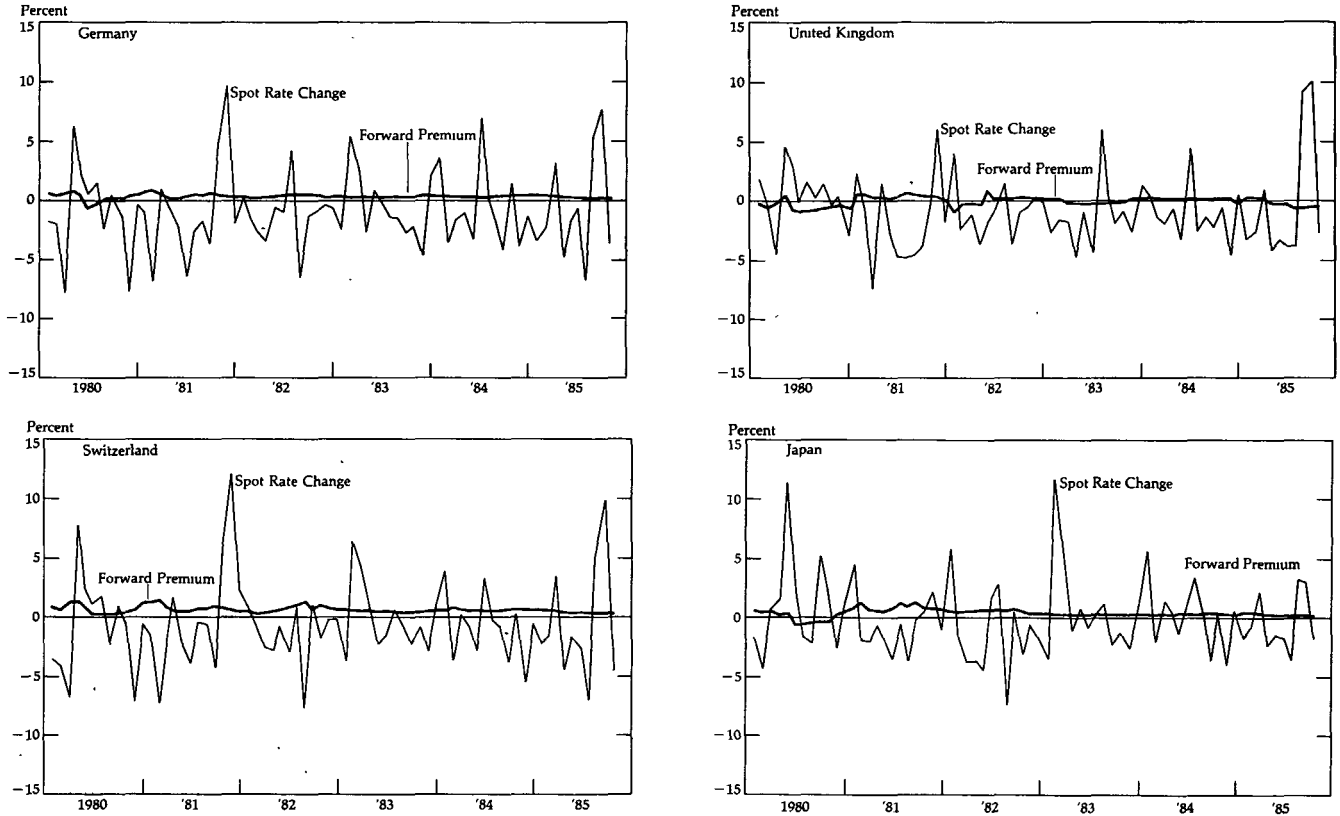
There are several interpretations. On the one hand, profitability of trend-watching may suggest that bandwagons and speculative bubbles characterize spot market dynamics. Speculators may be overly excitable, pushing rates higher only because they expect other buyers to come along. A shortage of stabilizing speculators permits these bandwagons. On the other hand, the evidence could also reflect the fact the spot speculation involves considerable risk as speculators attempt to time currency positions. The filter-rule profits may represent the market's compensation for carrying these risks.

The notion of a risk premium has been investigated directly in the context of forward speculation and forward market efficiency. Studies of forward market efficiency have tested the null hypothesis of "simple efficiency" (today's n-period forward rate, $F(t,n)$, equals the expected future spot rate, $ES(t+n)$) versus the alternative "general efficiency" hypothesis ($F(t,n) = ES(t+n) + RP(t)$, the foreign exchange risk premium at time t). Mussa (1979) summarized the stylized empirical facts as of 1979: "The forward rate is an unbiased predictor of the corresponding future spot rate, [it] is close to the best available predictor...but [it] is probably not a very good predictor. . . ." Recent empirical studies now claim that the current spot rate (i.e., a random walk, no drift model) is a better forecaster of short-term exchange rates, and the forward rate is a biased forecaster of the future spot rate. If the forward rate bias is the result of a risk premium, then foreign and domestic assets are not perfect substitutes in investor portfolios. In this case sterilized intervention can affect the exchange rate.

A set of data on forward premia and future spot exchange changes, for one-month and three-month intervals, are displayed in Charts 6 and 7. The tranquil nature of the percentage forward premium series versus the volatile nature of short-run exchange rate changes is clear from both charts. The charts also establish that the DM, Swiss franc, and Japanese yen consis-

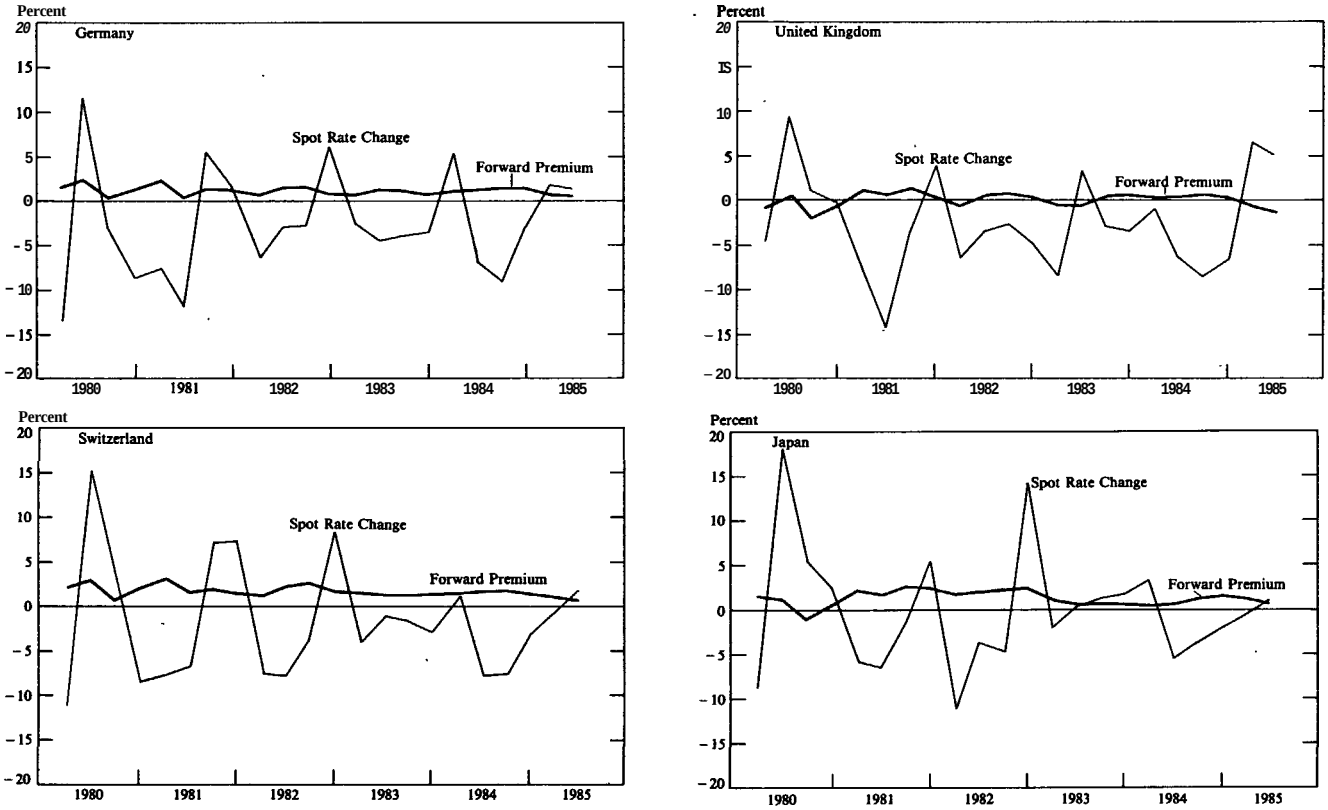
CHART 6

Percentage Forward Premium and Percentage Future Spot Rate Change: Monthly Data



Data Source: Harris Bank Weekly Review

CHART 7
Percentage Forward Premium and Percentage Future Spot Rate Change: Monthly Data



Data Source: Harris Bank Weekly Review

tently traded at forward premia over the last five years, while the exchange rates actually depreciated in the vast majority of periods.

Summary statistics on these data are presented in Tables 1 and 2. The analysis confirms that over this 5-1/2 year period the mean forward premium was positive while the mean exchange rate change was negative. This resulted in significant forward rate prediction errors for the DM, British pound, and Swiss franc. Estimates of the one-month forward bias ranged between -0.6 percent for the yen and -1.4 percent for the Swiss franc. For quarterly data, the bias is roughly three times as great, suggesting a constant

TABLE 1

Summary Statistics of Forward Rates as Predictors
Non-overlapping Monthly Observations,
January 1980-June 1985, N = 70

Currency	Variable	Mean	T-Value	RMSE	RHO/RATIO /AUTO
DM	Forward Premium	0.398	17.445	—	-0.105
	Spot Change	-0.775	-1.826		346.040
	Forward Error	-1.309	-3.050*	3.797	-0.037
British Pound	Forward Premium	0.003	0.088	—	-0.267*
	Spot Change	-0.763	-1.990	—	127.670
	Forward Error	-0.875	-2.253*	3.344	0.128
Swiss Franc	Forward Premium	0.610	21.294	—	-0.167
	Spot Change	-0.643	-1.427	—	246.620
	Forward Error	-1.402	-3.086*	4.027	0.062
Japanese Yen	Forward Premium	0.420	10.744	—	-0.178
	Spot Change	-0.033	-0.084	—	100.800
	Forward Error	-0.558	-1.431*	3.286	0.118

Notes: RHO: Correlation of percentage forward premium and percentage spot rate change

RMSE: Root mean squared error of percentage forward premium forecast of future spot rate change

AUTO: Autocorrelation of forward rate errors

RATIO: Variance of percentage spot changes relative to variance of percentage forward premia

* Significant at the 5 percent level

Data are from Harris Bank Weekly Review

TABLE 2

Summary Statistics of Forward Rates as Predictors Non-overlapping Quarterly Observations, January 1980-June 1985, N = 22

Currency	Variable	Mean	T-Value	RMSE	RHO/RATIO /AUTO
DM	Forward Premium	1.211	10.966	—	0.122
	Spot Change	-2.392	-1.821	—	141.420
	Forward Error	-4.076	2.966*	7.502	-0.105
British Pound	Forward Premium	0.100	0.709	—	-0.392
	Spot Change	-2.259	-1.871	—	72.910
	Forward Error	-2.755	-2.076*	6.675	0.284
Swiss Franc	Forward Premium	1.794	13.427	—	0.018
	Spot Change	-1.930	-1.294	—	124.500
	Forward Error	-4.290	-2.746*	8.347	-0.122
Japanese Yen	Forward Premium	1.295	7.546	—	-0.357
	Spot Change	-0.018	-0.013	—	70.830
	Forward Error	-1.754	-1.194	6.958	-0.016

Note: See Table 1

bias per unit of time. The negative sign indicates that the forward premium (with the forward rate expressed as $/foreign currency) has consistently overstated the realized dollar depreciation. If this risk premium for holding dollar assets persists, then the interest differentials suggested earlier overstate the expected dollar depreciation. Another measure of forecasting accuracy, the RMSE, averages 3.6 percent for monthly data and 7.4 percent for quarterly data. The autocorrelation tests indicate that the forecast errors, while generally non-zero, are essentially white noise.

To understand these prediction errors better, Thiel's U procedure allows us to decompose the mean squared error into the proportions due to bias, unequal variance, and imperfect correlation between the predictor and the actual exchange rate. These results are presented in Table 3. Not surprisingly, they show that most of the errors result from the fact that spot rate variance far exceeds forward premium variance (factor U2). However, sample bias explains onequarter of the three-month prediction errors for the DM and Swiss franc.[21]

[21] These results are similar to those reported by Agmon and Amihud (1981) for the 1974-1978 period. Their estimates of U1 were generally less than 5 percent and U2 more in the neighborhood of 55 to 80 percent.

TABLE 3

Forward Rate Prediction of Future Spot Rates—Proportions Due to Bias (U1), Unequal Variance (U2), and Imperfect Covariance of Forward Rates (U3)

Horizon	Currency	U1	U2	U3	Total
I-Month	DM	9.7	79.7	10.6	100.0
	British Pound	5.1	74.7	20.2	100.0
	French Franc	9.7	77.2	13.1	100.0
	Japanese Yen	1.8	76.2	22.1	100.0
3-Month	DM	25.7	63.1	11.1	100.0
	British Pound	13.6	61.0	25.5	100.0
	French Franc	22.0	64.3	13.7	100.0
	Japanese Yen	3.3	68.2	28.5	100.0

Several studies also rejecting the forward unbiasedness hypothesis have recently appeared in the literature.[22] However, the link between a forward bias and an exchange risk premium remains in dispute. Applying the name "risk premium" to the forward ratelfuture spot rate deviation may amount to unwarranted labeling of the residual; further analysis is needed.

Fama (1984) and Hodrick and Snvastava (1986) use an econometric decomposition $[F(t,n) - S(t) = F(t,n) - ES(t+n) + ES(t+n) - S(t)]$ to show that while variance in the forward premium is small, it can be broken into two pieces which vary inversely. The studies conclude that volatility in the risk premium far exceeds volatility in the expected exctiange rate change component. Dooley and Isard (1983) estimate risk premia using a structural model and arrive at moderate estimates, about 2.5 percent per year in the $1 DM rate. However, the risk premium explains only a small fraction of forward rate prediction errors. Frankel (1985) adopts a mean-variance optimization framework to estimate the exchange risk premium. His conclusion is that risk premia are negligible, perhaps only two to three basis points per year. The implication would be that persistent forward rate prediction errors are a sign of inefficiency.

Conclusions

The objective of this paper was to gather and report "facts" regarding

[22] See Fama (1984), Hsieh (1984), and Hodrick and Srivastava (1986), as well as other references in Levich (1984).

exchange rate behavior over the floating rate period. One conclusion is that there are relatively few facts. Nominal bilateral exchange rates (their level, changes, and volatility) and forward premiums (their behavior and prediction power) are straight-forward measures that were reviewed in detail. But other important variables (e.g., a real effective exchange rate, an ex ante real interest rate, or an exchange risk premium) are theoretical constructs that require us to impose an equilibrium base period, a weighting scheme to aggregate across countries, or an estimate of (unobserved) expectations. The really interesting questions—whether the dollar has been too strong or too volatile and whether forward markets are efficient--depend heavily on the benchmark model and other judgments regarding parameter values. Our discussion of exchange rate theory and empirical evidence intended to show that because of these judgment issues, assessments of the floating rate experience are likely to differ.

To be certain, the experience of the last five years has rekindled interest in ways to measure misalignments and stabilize exchange rates. On the one hand, the evidence on speculative profit opportunities and forward rate bias has raised doubts regarding market efficiency and the presence of stabilizing speculators. Admonitions from Nurkse (1944) are beginning to reappear.[23] His views on freely floating exchange rates were unequivocal.[24]

> **If there is anything that inter-war experience has demonstrated, it is that paper currency exchanges cannot be left free to fluctuate from day to day under the influence of market supply and demand. There has been what may almost be termed a secular change by which the public has become (a) more liquid** and **(b) more sensitive or 'elastic' in regard to expectations. If currencies are left free to fluctuate, 'speculation' in the widest sense is likely to play havoc with exchange rates.**

But equally as important, the asset-approach to exchange rates has made us keenly aware of the need for exchange rate changes that are sometimes large, always quick, and hopefully in advance of expected events. In a well-functioning asset market, the responsibility for "misaligned" exchange rates and "excessive" exchange rate volatility falls on real disturbances (perhaps beyond anyone's control) and the coordination of macroeconomic policies (potentially under official control). The distinction between markets that exhibit "private efficiency" (by clearing and eliminating excess profit opportunities) versus "public efficiency" (by setting prices equal to their fundamental equilibrium value) may be useful in the discussion of

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[23] See, for example, Dornbusch (1982) and Islam (1983).
[24] Nurkse (1944, pp. 137-138).

exchange rate policies.[25] In the current environment, we may have the exchange rates we deserve, even though they are not the exchange rates we want.

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[25] This distinction is emphasized by Friedman (1984) in the context of equity market behavior as described by Shiller (1984). See, also, McKinnon (1979).

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