Selected Views of Exchange Rate Determination After a Decade of "Floating"

by Jeffrey H. Bergstrand*

Ten years have passed since monetary authorities of the major industrialized countries, amidst disrupted foreign exchange markets, established the current exchange rate system known as the "managed float." Under this system, exchange rates between currencies of major industrialized countries are largely determined by market forces.[1] However, from time to time the central banks of these countries intervene in foreign exchange markets in attempts to maintain orderly market conditions.

The current regime was established following persistent breakdowns in the previous "adjustable peg" system that had prevailed since 1944. The adjustable peg system was a "fixed" exchange rate regime under which foreign countries were expected to devalue or revalue their currencies with respect to the U.S. dollar only in the event of a "fundamental disequilibrium." As the dollar price of gold was fixed and official dollar holdings of foreign central banks could be redeemed for gold, this system was effectively a gold-exchange standard.

For about a decade, this system worked fluidly. The productive capacity of the United States, undamaged by the war, provided a source of consumer, intermediate, and capital goods for rebuilding the Western European and Japanese economies. The ensuing dollar shortage implied a persistent undervaluation of the dollar in foreign exchange markets. As the 1950s unfolded, the recovery of Western Europe and Japan, together with price inflation in the U.S.— partly attributable to Korean War financing and partly attributable to the 1955-1957 boom—caused a decline in U.S. shares of world markets and a rise in imports. Also, U.S. private long-term capital outflows increased over the period. By the 1960s, the dollar shortage had changed into a dollar glut.

Despite U.S. trade balance improvements during the first half of the 1960s, the dollar remained under pressure in foreign exchange markets. Declining growth rates of productivity, large federal budget deficits partly attributable to the Vietnam buildup, and rapid money supply growth in the United States all contributed to higher rates of domestic price inflation during the last half of the decade. More modern plants and equipment and lower unit labor costs in Germany and Japan increased competition for the United States in both home and foreign markets. All these factors contributed to an overvaluation of the dollar, to the imposition of balance of payments controls, to subsequent devaluations of the dollar in December 1971 and February 1973, and to the eventual establishment of the current managed float.

Supporters of the managed float argued prior to March 1973 that flexible exchange rates would tend to insulate countries from financial disturbances arising from foreign monetary and fiscal policy shocks. Such insulation would "free up" another policy instrument to

* Economist, Federal Reserve Bank of Boston. The author is grateful to Susan Tamir for research assistance.

[1] Though this system is called a floating rate regime, the vast majority of countries peg their currency to the U.S. dollar, or to the currency of another country that is traded with prominently, or to a "basket" of major currencies. However, most U.S. trade and foreign investment is with countries whose currencies float against the dollar. The British pound (sterling), Japanese yen, Canadian dollar, and Swiss franc float against the dollar. Eight European countries (composing the European Monetary System), including France, Germany, Italy, Belgium and the Netherlands, jointly float against the dollar.

be applied to domestic economic goals. According to two popular views at the time, flexible exchange rates were expected to adjust rapidly *but smoothly* to accommodate foreign-induced disturbances. For example, under the purchasing power parity view, an overexpansionary monetary policy abroad, causing a rise in foreign prices, would induce a smooth depreciation of the foreign currency, alleviating—if not preventing—the rise in prices at home which would be expected under fixed exchange rates. Alternatively, from the "elasticities" viewpoint, an expansionary policy abroad that did not raise foreign prices would also induce a smooth depreciation of the foreign currency, inhibiting development of a trade surplus at home and alleviating—if not preventing—a rise in domestic prices. Furthermore, optimism regarding the relative price "sensitivity" of export and import demand suggested that the exchange rate would not have to change substantially to eliminate a payments imbalance.

However, the floating rate system has not been a panacea. Evidence suggests that the exchange rate does not adjust smoothly; Charts 1 to 3 (black lines) indicate substantial month-to-month variability for the foreign currency value of the dollar. The cost to society of such variability, which is difficult to measure, may include potential international goods and services transactions never carried out due to greater price uncertainty, certain foreign investments possibly foregone, and the resources that have to be devoted to establishing and maintaining forward foreign exchange markets to help redistribute risk.[2]

In the first section of this article, the traditional purchasing power parity and elasticities views of exchange rate determination are evaluated. In retrospect, flexible exchange rate supporters in 1973 appear to have had too narrow a view of exchange rate determination, focusing predominantly on commodity prices and markets. Empirical evidence over the past decade suggests that from month to month the exchange rate has deviated substantially from maintaining purchasing power parity or trade balance, although both views tend to explain long-run trends of the exchange rate.

The second section discusses several different explanations that surfaced over the past decade to explain the exchange rate's short-run volatility and its persistent departures from maintaining purchasing power parity and trade balance. These modern explanations focus instead on the role of capital markets in influencing short-run exchange rates, leaving commodity markets to determine long-run exchange rate trends owing to the latter markets' more sluggish adjustment. The importance of capital markets has been evidenced recently. In response to a tightening of U.S. monetary policy in 1980, the three-month Eurodollar deposit rate rose by 9 percent from July 1980 to July 1981; over the same period, the (weighted-average) value of the dollar rose by 30 percent! Yet evidence in this section shows that the relationship between interest rates and exchange rates is not simple; for example, from June to November 1982 the Eurodollar deposit rate fell by 5 percent while the value of the dollar *rose* 6 percent.

The last section offers a selective synthesis of traditional and modern views, emphasizing that relative price sensitivities of domestic and foreign financial asset demands, as well as of export and import demands, are important to exchange rate determination. Indeed, if wealth holders considered foreign bonds to be closer substitutes for domestic bonds than domestic money is, that fact could account for much of the exchange rate volatility of the past decade.

I. Traditional Views

Purchasing Power Parity

No doubt one of the oldest theories of exchange rate determination is the purchasing power parity (PPP) doctrine. Historians note that theologians at the School of Salamanca in Spain may have been among the first to grasp the essence of the PPP doctrine. One theologian, Martin de Azpilcueta Navarro, wrote in 1556:

> Thus, in our own day many people have greatly increased their fortunes by carrying to Flanders and France ducates of two, four, and ten, some in kegs as though they were olives, others in barrels hidden in the wine, on each of which they make a big profit; and they bring merchandise from abroad which is worth little there and here much . . .[3]

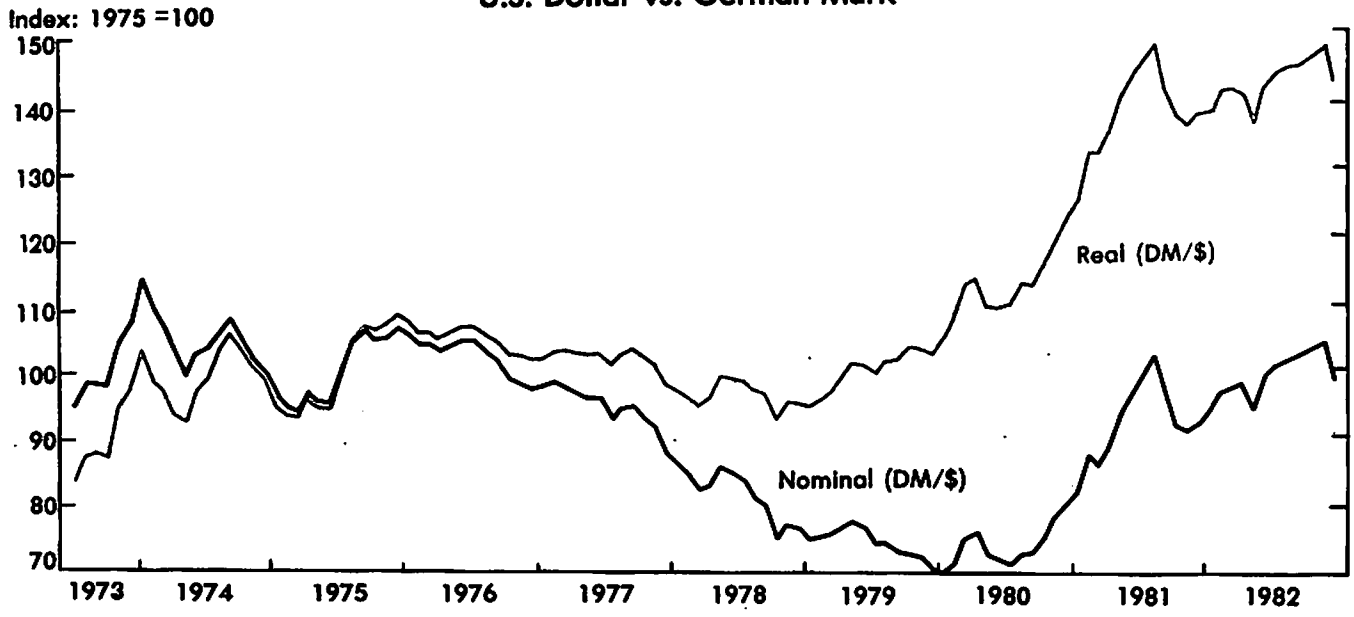
[2] This is *not* to suggest, however, that the alternative—a fixed or quasi-fixed exchange rate regime—is without costs. Under an adjustable peg regime (such as the Bretton Woods system), potential international goods, services, and capital transactions are also foregone due to price uncertainty. Because the direction of an exchange rate change is usually known (but the change may be stalled for political reasons), consequent speculation will be one-way and could be very destabilizing. Such political interference can lead potentially to a greater misallocation of resources than that arising from the transitory exchange rate variability associated with flexible exchange rates. Only under a *pure* fixed exchange rate system (gold standard) is exchange rate uncertainty eliminated. However, under a gold standard, the national money supply is endogenous, adjusting frequently to balance of payments disequilibrium and potentially by large amounts. Such money supply volatility can induce large domestic price variability and/or transitional unemployment, creating misallocations of resources.

[3] Navarro's quote was found in Peter Bernholz, "Flexible Exchange Rates in Historical Perspective," *Princeton Studies in International Finance*, No.49, July 1982, pp. 4-5.

Chart 1

Nominal and Real Exchange Rate Indexes

U.S. Dollar vs. German Mark



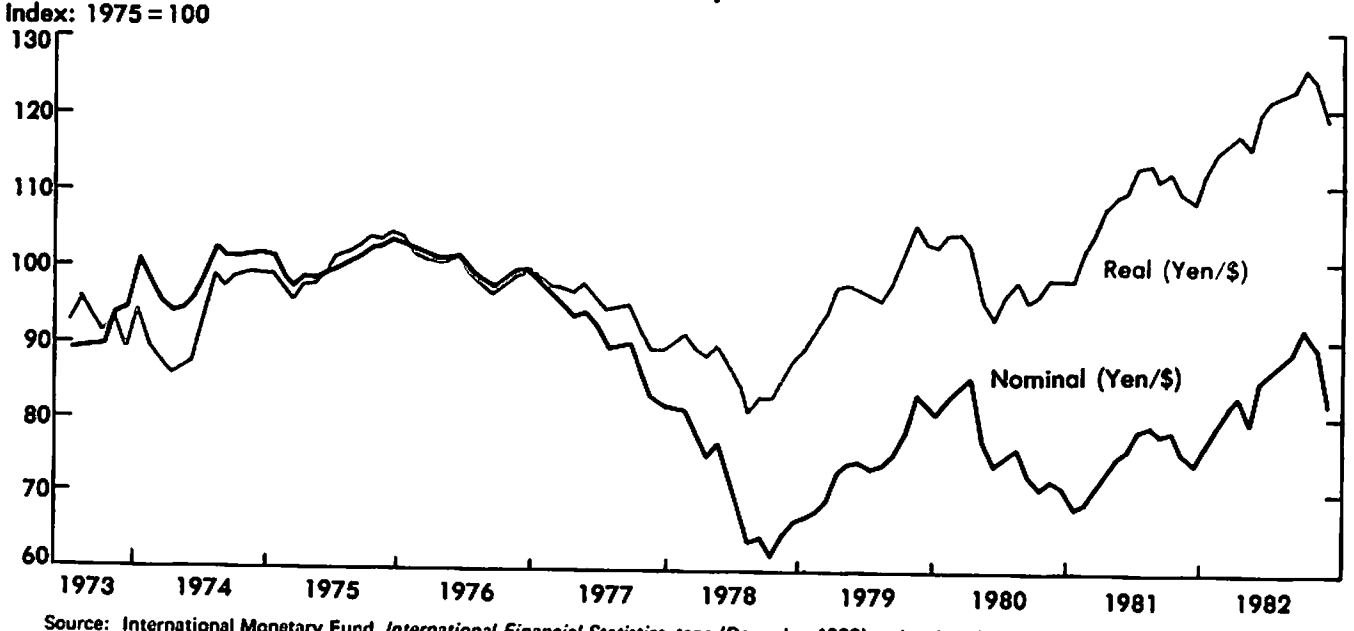
Source: International Monetary Fund, *International Financial Statistics*, tape (December 1982) and various issues.

Note: Price changes were calculated using wholesale price indexes of industrial goods in the United States and the Federal Republic of Germany (I.F.S. lines 63a and 63, respectively).

Chart 2

Nominal and Real Exchange Rate Indexes

U.S. Dollar vs. Japanese Yen



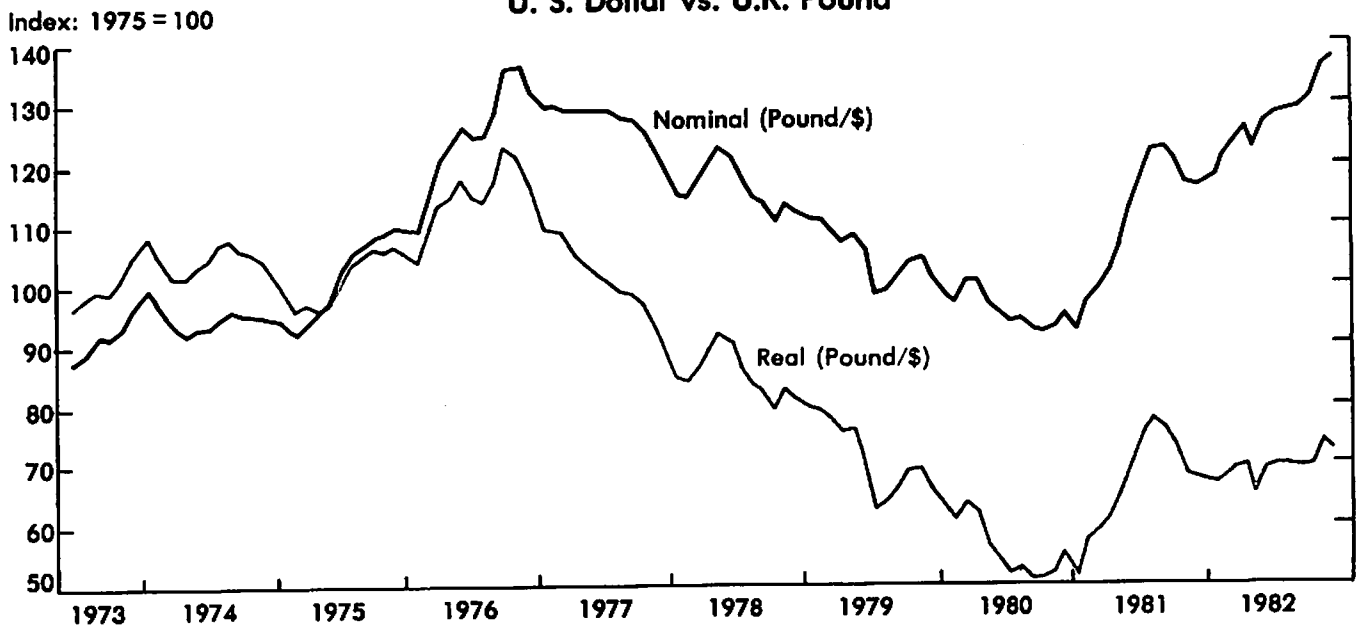
Source: International Monetary Fund, *International Financial Statistics*, tape (December 1982) and various issues.

Note: Price changes were calculated using wholesale price indexes in the United States and Japan (I.F.S. line 63 for each).

Chart 3

Nominal and Real Exchange Rate Indexes

U. S. Dollar vs. U.K. Pound



Source: International Monetary Fund, *International Financial Statistics*, tape (December 1982) and various issues.

Note: Price changes were calculated using wholesale price indexes of industrial goods in the United States and the United Kingdom (I.F.S. lines 63a and 63, respectively).

Navarro was observing the existence of "commodity arbitrage," that is, the movement of money (ducates) abroad to purchase foreign goods (cheap) and to resell at home (dear) for a risk-free profit. Based on his observations, Navarro developed a broad view of the relative values of two monies:

> . . .money is worth more when and where it is scarce than where it is abundant . . . .in countries where there is a great scarcity of money all other saleable goods, and even the hands and labor of men, are given for less money than where it is abundant. Thus we see by experience that in France, where money is scarcer than in Spain, bread, wine, cloth, and labor are worth much less.[4]

Navarro's remarks capture the essence of the PPP doctrine. Let the exchange rate be the home currency value of a unit of foreign currency. If the foreign currency is undervalued (the exchange rate is too low), the purchasing power of the home currency is greater abroad than at home. As home currency flows abroad, domestic prices fall (as demand decreases for home goods) and foreign prices rise (as demand increases for foreign goods), or the exchange rate rises until the purchasing power of the home currency abroad and at home are at "parity."

An impression left by Navarro, and later supported in the writings of David Ricardo, John Wheatley, Gustav Cassel and others, is that the PPP doctrine is essentially a monetary approach. Based upon the quantity theory of money, the price level in each country is assumed to move proportionately to its money supply. If the money supply increases by 10 percent, domestic prices increase by 10 percent. Consequently, for given foreign prices, the foreign exchange value of the home currency must depreciate by 10 percent to maintain PPP across countries.

However, support for PPP evolves from nonmonetary sources as well. For example, assuming that prices of individual commodities in each country are determined by the respective markets' demands and supplies, commodity arbitrage ensures, under certain conditions, that for each tradeable good the "law of one price" holds internationally—that is, the dollar price of each tradeable commodity is the same everywhere. Consequently, general price levels in two countries are linked through commodity arbitrage in individual tradeable goods. In general, supporters of the PPP doctrine have offered sweeping and differing reasons for its existence.

[4] Ibid.

As an empirical proposition, the PPP theory can be examined in two different versions. The first, or absolute, version asserts that the exchange rate is simply the ratio of two countries' general price levels.[5] The term "general price level" refers to a nationally weighted average of prices of all the goods which are produced in each country. Yet even if individual goods are similar across countries, nations neither produce nor consume identical bundles of these goods. Different national weighting schemes can cause PPP not to hold. A second problem with the absolute version is that it assumes transportation costs and policy-determined trade barriers are insignificant; otherwise, the price of the same good could differ between countries, contrary to the theory. In reality, transportation costs are often a substantial portion of unit price and a recent Australian study suggests that 50 percent of world trade is distorted by nontariff barriers alone.[6] A third problem is that the general price level refers to tradeable *and* nontradeable goods. Yet nontradeable goods' international price differences cannot be eliminated directly through commodity arbitrage as for tradeable goods. These differences, too, may require exchange rates to deviate from PPP. Thus, PPP in its absolute version is not a valid representation of the real world.

The second, or relative, version of PPP attempts to avoid some conceptual pitfalls in the absolute version. The relative version asserts that the percentage change in the exchange rate from a given base period equals the difference between the percentage change in the domestic price level and the percentage change in the foreign price level; for example, if U.S. prices rose 40 percent from 1975 to 1980 and German prices rose only 30 percent over the same period, the U.S. dollar value of a Deutsche mark is expected to have risen 10 percent over the period.[7]

Although the relative version avoids some conceptual pitfalls, it encounters others. First, the concept of a general price *level* used in the absolute version is unappealing because it suggests, for example, that at every point in time it is possible to measure the average dollar price of the (heterogeneous) U.S. national output. In the relative version, however, percentage *changes* over time of prices of national outputs are readily approximated by broad price indexes. Yet for the exchange rate to adjust exactly to changes in the difference between national price indexes, the base period must be one of equilibrium, that is, satisfy absolute PPP. Selecting such a base period, however, is an imposing empirical problem. Second, even with perfect commodity arbitrage, different price-index weighting schemes across countries and inclusion of different products in each country's index can require exchange rate changes to deviate from relative PPP if equilibrium is to be maintained. Third, changes in policy-determined trade restrictions since the base period can call for departures from relative PPP. Although the level of tariffs has been substantially reduced since the 1930s, nontariff barriers such as import quotas, export quotas, and export subsidies have proliferated over the past decade. Fourth, over time two countries' internal price ratios (ratios of the price index for nontradeable goods to that for tradeable goods) may change. Such divergences can also require exchange rate changes to deviate from relative PPP.

Indeed, evidence presented in Charts 1 to 3 verifies that the short-run exchange rate tends to deviate persistently from relative PPP, as revealed by changes in the "real" exchange rate. The real exchange rate index (blue line) reflects changes in the foreign currency value of the dollar adjusted for changes in the relative aggregate price levels. For example, assuming the real exchange rate initially equals 100, suppose U.S. prices increase over a certain month at an (annualized) rate of 10 percent and German prices increase over the same period at a rate of 5 percent. If relative PPP held, the Deutsche mark value of the dollar must fall by 5 percent to maintain the real exchange rate at a constant value of 100. (Note that in the charts the exchange rate is the foreign currency value of the dollar and not the dollar value of foreign currency.)

In the past decade, the largest deviations of the spot exchange rate from PPP have occurred since the fall of 1979. Furthermore, the joint movement of the real and nominal exchange rates suggests that the spot exchange rate moves independently of relative domestic and foreign prices, perhaps responding more in the short-run to financial market conditions rather than commodity market conditions. Thus, evidence from over the last ten years—and especially since 1980—indicates that short-run exchange rates did not adjust smoothly or rapidly to accommodate changes in relative

---

[5] Formally, the absolute PPP theory asserts:

(F1) $P = EP^*$ or $E = P/P^*$

where E is the home currency price of foreign currency and P (P^*) is the domestic (foreign) price level.

[6] Patricia Boyce and Hayden Llewellyn, *World Trade Distortions: A Study in Modern Trade Practice*, Melbourne, Victoria, Australia: Australian Industries Development Association, 1983.

[7] Formally, the relative PPP theory states:

(F2) $\dot{E} = \dot{P} - \dot{P}^*$

where $\dot{E}$ is the percentage change in the exchange rate from a given base period and $\dot{P}$ ($\dot{P}^*$) is the percentage change in the domestic (foreign) price level with the same base period.

prices across countries.[8] At best, PPP may have contributed toward containing real exchange rate variability to that evidenced in Charts 1 to 3.

The Traditional Elasticities Approach

Unlike the PPP doctrine, which has a very long heritage, the traditional elasticities approach gained popularity during the post-World War II era of the adjustable peg. The approach originated to determine the balance of trade response to an exchange rate devaluation or revaluation. However, it is easily altered to examine the exchange rate response to a disturbance in import or export demand for goods (or services). The name for this approach derives from the view that—although the exchange rate is the price of foreign exchange that maintains balance of payments equilibrium— the degree to which the exchange rate responds to a change in import or export demand depends entirely (under certain conditions) on the sensitivity, or "elasticities," of import and export demand to changes in goods prices.[9] Supporters of flexible exchange rates prior to March 1973 claimed that "price-elastic" import and export demands implied that the spot exchange rate would maintain balance of payments equilibrium without much variability.

Figures 1A and 1B reflect the importance of import and export demand price sensitivities in determining the exchange rate response to an economic disturbance. Both figures illustrate the foreign exchange market for Deutsche marks (DM). In both cases, the initial demand for Deutsche marks (D_0^{DM}) in each time period is generated by the underlying U.S. import demand for German exports, and the initial supply of Deutsche marks (S_0^{DM}) in each time period is generated by the underlying German import demand for U.S. exports. Initially, the exchange rate (E_0), in dollars per DM, is assumed the same in both figures.

Suppose a policy change stimulates U.S. national income and increases domestic import demand. How much does the exchange rate change? Figure 1A demonstrates the case where U.S. import and export demands are each price inelastic (although their sum exceeds one). If each country's exports and imports are balanced initially, increased domestic import demand creates a U.S. balance of trade deficit and an excess demand for foreign exchange, at the prevailing exchange rate and goods prices, as the demand for Deutsche marks increases from D_0^{DM} to D_1^{DM}. The excess demand for foreign exchange also implies a U.S. balance of payments deficit; balance of payments and balance of trade deficits are synonymous in this approach because capital flows are ignored. The exchange rate must rise to eliminate the deficit. As the exchange rate rises, the relative price of imports at home rises and the relative price of imports abroad falls. Consequently, the quantity of imports demanded at home falls, reducing the quantity demanded of foreign exchange; the quantity of exports demanded from abroad rises, raising the quantity supplied of foreign exchange (to purchase home currency). When import and export demands are price inelastic, as shown in Figure 1A, the decline in the quantity of imports demanded and the rise in the quantity of exports demanded are each *small* for each U.S. cent increase in the value of the Deutsche mark. Hence, the exchange rate must rise steeply to eliminate the payments deficit. However, when import and export demands are price elastic, as shown in Figure 1B, the decline in the quantity of imports demanded and the rise in the quantity of exports demanded are each *large* for each U.S. cent increase in the value of the Deutsche mark. Hence, the exchange rate need change much less to achieve payments balance. Thus, the more price elastic are import and export demands, the less responsive is the exchange rate to changes in those demands.

In 1973, supporters of flexible exchange rates voiced optimism that these price elasticities would be large enough so that only small changes in exchange rates would be required to maintain balance of payments equilibrium. However, critics countered that—in the short run—import and export demands could be expected to be much less price sensitive than, say, in the long run. Also, additional exchange rate variability would arise from potential "direct effects" from any exogenous increase in import demand.[10] For example, as increased U.S. import demand tends to create a balance of trade deficit and causes the exchange rate to

[8] Relative price changes were measured using domestic and foreign wholesale price indexes (either general or industrial goods, depending upon data availability), commonly considered to weight tradeables more heavily than nontradeables. However, price indexes weighting nontradeables relatively more — such as consumer price indexes and GNP deflators—generally yield similar results.

[9] The term "elasticity" is commonly used in economic analyses and is used frequently here. An elasticity simply measures the percentage change in one variable in response to a 1 percent change in another variable. For example, import demand is considered price elastic if the percentage decline in the quantity demanded of imports is greater than one in response to a 1 percent rise in the price of imports. Import demand is price inelastic if the percentage decline in the quantity demanded of imports is less than one in response to a 1 percent rise in their price.

[10] See Sidney Alexander, "Effects of a Devaluation: A Simplified Synthesis of Elasticities and Absorption Approaches," *American Economic Review*, vol. 49, March 1959, pp. 22-42.

Figure 1A

Foreign Exchange Market (for Deutsche marks)
when Underlying Import and Export Demands are Price Inelastic

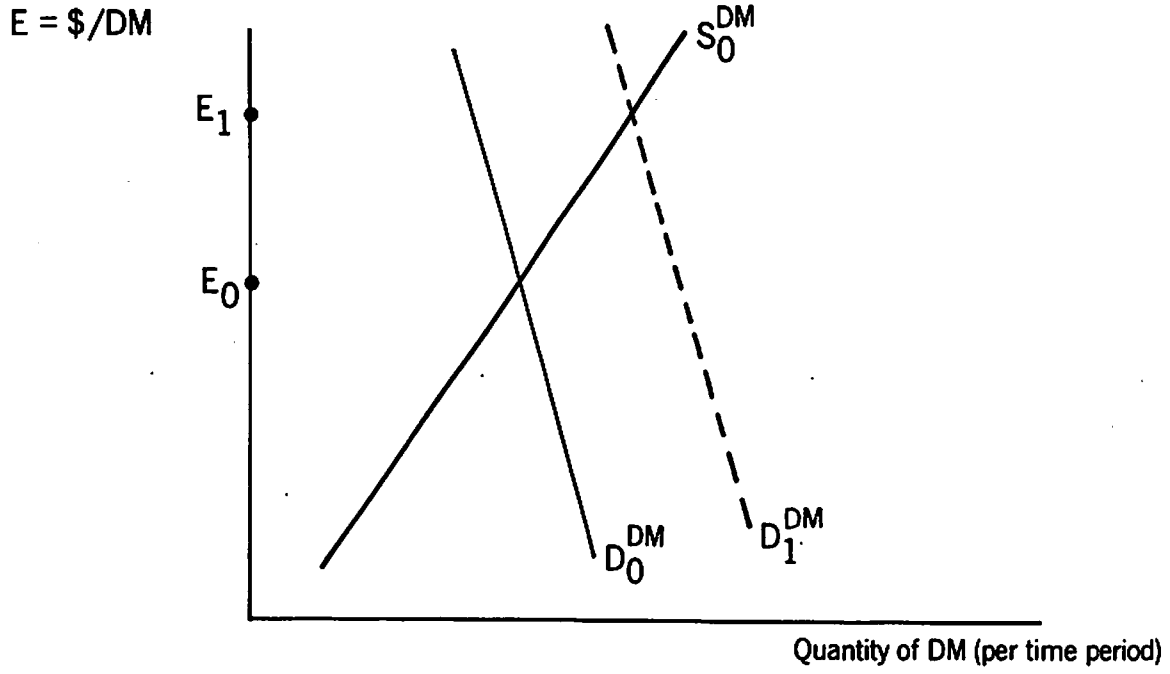


Figure 1B

Foreign Exchange Market (for Deutsche marks)
when Underlying Import and Export Demands are Price Elastic

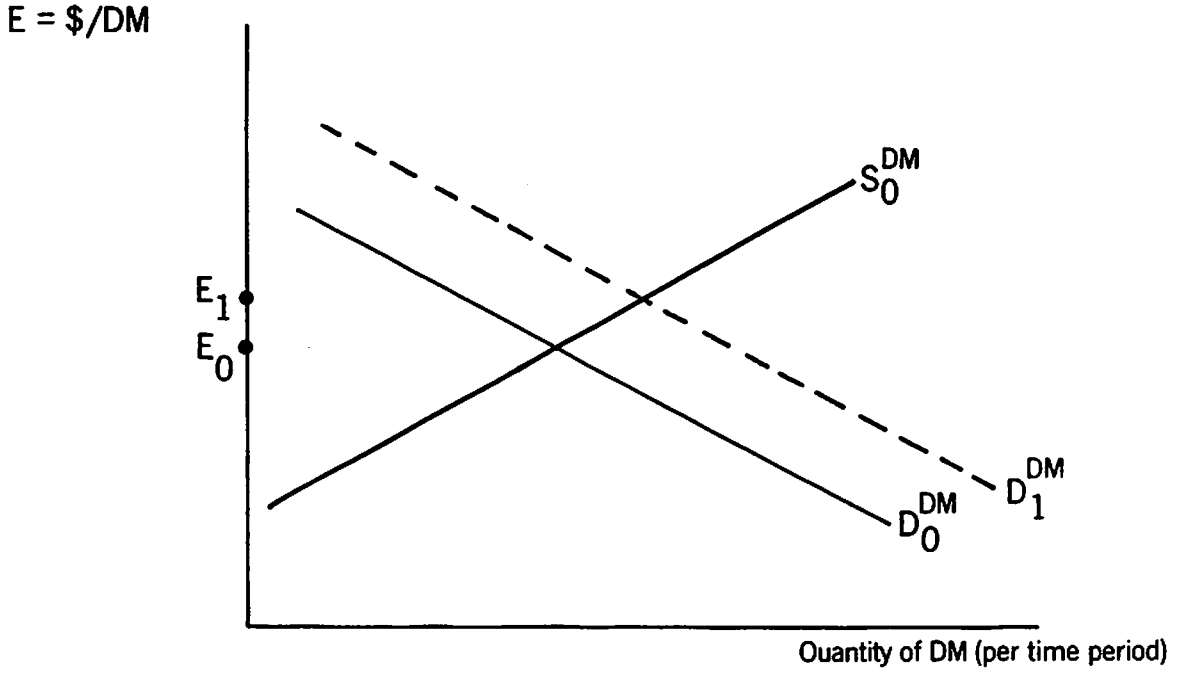
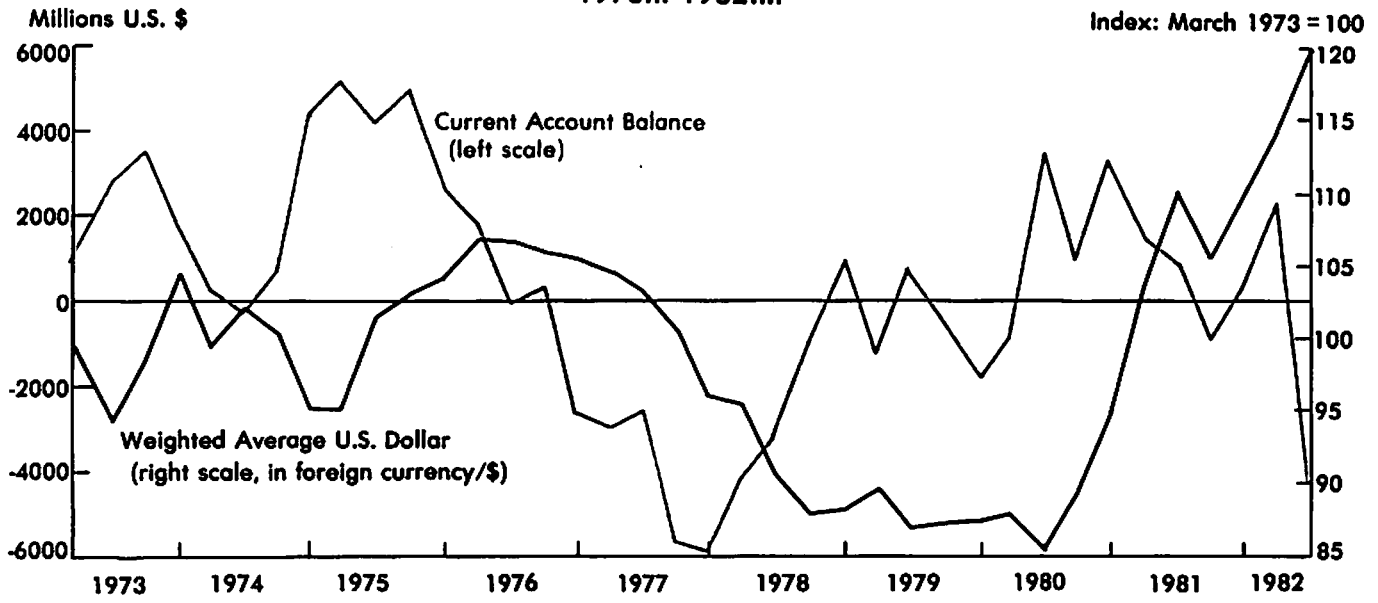


Chart 4

Weighted Average U.S. Dollar Index and Current Account Balance

1973:II–1982:III



Source: Board of Governors of the Federal Reserve System, Division of International Finance, Macro Data Base, December 1982.

Note: The index of the weighted-average exchange value of the U.S. dollar is calculated against the currencies of the other Group of Ten countries plus Switzerland, March 1973=100. Weights are 1972-76 global trade of each of the 10 countries.

increase, the rising exchange rate—by increasing the quantity of U.S. exports—causes U.S. income to rise. The rising exchange rate—by decreasing the quantity of U.S. imports — also causes foreign income to fall. A rise in domestic income induces an increase in "absorption" of U.S. and foreign goods, shifting the new demand curve for Deutsche marks (D_F^{DM}) out as demand for DM increases further. A fall in foreign income causes a decrease in foreign absorption of foreign and U.S. goods, shifting the supply curve of Deutsche marks (S_F^{DM}) back as the demand for dollars decreases. Thus, with absorption effects included, the exchange rate response may be larger than suggested by the elasticities approach alone. Furthermore, even when absorption factors are included, the elasticities approach is undermined by its ignoring all *capital* flows. Consequently, the exchange rate is expected to adjust rapidly to maintain trade balance, which is synonymous—in the absence of capital flows—with balance of payments equilibrium.

Yet Chart 4 illustrates that over the past decade the short-run exchange rate frequently did not adjust to eliminate current account (or trade) imbalances; for example, in the third quarter of 1982, the current account (blue line) registered a $4.2 billion deficit but the weighted-average foreign currency value of the dollar (black line) rose by 5 percent! The dollar frequently appreciated following persistent current account surpluses (notably, early 1975 to mid-1976 and mid-1980 to mid-1981) and frequently depreciated following persistent current account deficits (notably, late 1976 to late 1978), consistent with the elasticities approach. However, in several quarters the dollar appreciated as the current account balance worsened and depreciated as the current account balance improved. In these quarters, the exchange rate was responding to economic forces *other than* goods market imbalance.

In summary, empirical evidence suggests that the spot exchange rate has shown substantial short-run variability during the past ten years, unanticipated by supporters of flexible rates in 1973 and inconsistent with the popular views at that time. Though exchange rates often vary in the short run in conflict with predictions of the PPP and elasticities approaches, this does not imply these approaches are no longer useful. As suggested earlier, PPP may have restricted real exchange rate variability to that evidenced in Charts 1 to 3. Long-term exchange rate trends may have been significantly influenced by current account imbalances, as Chart 4 suggests. Indeed, theories of exchange rate determination developed since 1973 incorporate these views for the determination of the long-run exchange rate. However,

modern views emphasize demands for and supplies of financial assets and international capital mobility to explain short-run exchange rate variability and temporary deviations of the exchange rate from PPP and from elimination of current account imbalances.

II. Modern Views

Modern views discussed in this part are distinguished from the previous two traditional views by including a role for imports and exports of financial capital. Although these views can also be distinguished by monetary and nonmonetary approaches, all the views have in common the goal of explaining short-run exchange rate "volatility" — that is, exchange rate changes that occur in the absence of commodity price changes or exchange rate changes that are more than proportionate to commodity price changes in response to economic disturbances.

Modern Monetary Approaches

Modern monetary approaches have two general versions. In the first method, exchange rate volatility is illustrated as arising from a one-time domestic money supply increase because the latter is *assumed* to raise expectations of higher future monetary growth. Given this assumption, current expectations of future values of the exchange rate rise, causing the current spot exchange rate to rise more than proportionately to the current money supply increase. By contrast, the second method relies upon less tenuous assumptions. Exchange rate volatility arises partly because markets "clear" at different speeds, commodity markets adjusting more sluggishly than financial markets. In the short run, the exchange rate changes to maintain capital market equilibrium while commodity prices are fixed. However, over time the exchange rate and the domestic price level adjust to restore PPP.[11]

In the first version, the monetary interpretation of the PPP doctrine is essentially extended to account for capital markets. In each of two countries, assume that the demand for money is determined by the level of domestic income and the domestic interest rate. A higher income increases demand for transactions balances; a higher interest rate increases the opportunity cost of holding money, reducing the demand for money. The money supply in each country is set by its respective central bank. Each country's money market clears when money supply equals money demand; each country's general price level adjusts to equate its respective money demand and money supply.

Assuming absolute PPP, the spot exchange rate equals the ratio of the domestic price level to the foreign price level. With each country's price level determined in its own money market, the spot exchange rate is determined by the two countries' relative money supplies, relative real incomes, and relative interest rates.[12] For example, given interest rates and the foreign money supply, a 1 percent increase in the domestic money supply raises domestic prices by 1 percent to maintain balance between the actual money stock and income. So for a given foreign price level, the home currency must depreciate by 1 percent to maintain continuous PPP.

As it stands, however, this approach does not yet explain why exchange rates are volatile—that is, why they vary proportionately more than commodity prices in response to economic disturbances. For this, the short-term capital market and the formation of expectations play pivotal roles. If domestic and foreign capital are perfect substitutes, assumptions of perfect international capital mobility and instantaneous capital market adjustment ensure that the domestic interest rate always equals the foreign interest rate plus the expected rate of depreciation (or minus the expected rate of appreciation) of the home currency. This condition—similar to PPP for goods markets—is known as "interest parity."

Yet what determines the expected future value of the exchange rate? Economists have not yet formed a consensus on how expectations about future values of financial asset prices are formed. However, one promi-

[11] The first version is often called the flexible price monetary model, the second version the sticky price monetary model. In the flexible price model, commodity prices adjust rapidly to maintain equilibrium. In this model, an assumption of rational expectations is necessary to generate exchange rate volatility. In the sticky price model, different speeds for commodity and asset markets' adjustments account for exchange rate volatility. However, this model can also be extended to incorporate rational expectations.

[12] Formally, assume money market equilibrium in the home country is given by the following equation where all variables (except interest rates) are in natural logarithms:

(F3) $m_s = p + \alpha y - \beta r$

where m_s is domestic (nominal) money supply, p is the domestic price level, y is domestic real income, and r is the domestic interest rate. Assume a symmetric money market equilibrium condition abroad:

(F4) $m_s^* = p^* + \alpha y^* - \beta r^*$

where asterisks denote foreign variables. Assume PPP:

(F5) $e = p - p^*$

where e is the natural logarithm of the home currency value of the foreign currency. Rewriting equations (F3) and (F4) to solve for prices and substituting them into equation (F5) yields:

(F6) $e = (m_s - m_s^*) - \alpha(y - y^*) + \beta(r - r^*)$

[13] It can be shown in the context of this monetary model that exchange rate volatility (as defined in the text) will not result under the assumption of either static or adaptive expectations.

nent view—the assumption of "rational" expectations—suggests a source of exchange rate volatility in this modern monetary approach.[13] Under rational expectations, financial asset holders collectively possess knowledge about the structure of the economy and combine this knowledge with other available information to form expectations about future values of policy variables.

In this framework, the spot exchange rate may have a volatile response to a one-time money supply increase. A "direct" effect of a 1 percent increase in the domestic money supply is a 1 percent rise in the domestic price level and—via PPP—a 1 percent rise in the exchange rate. In addition, an "indirect" effect is that this one-time money supply increase is *assumed* to raise the expected future values of the money supply, which in turn raise expected future values of the exchange rate (using the same "direct" channels but applied to future periods).

Yet how do higher expected future values of the exchange rate "feed back" into the current exchange rate, causing it to rise *more* than proportionately to the current money supply increase? This "speculative" influence is channelled to the current exchange rate through the international capital market (that is, through the interest parity condition). For a given current exchange rate, a rise in the expected future value of the exchange rate implies a higher (lower) expected rate of depreciation (appreciation) of the home currency. Assuming continuous interest parity, a higher expected rate of depreciation implies that the domestic interest rate must rise relative to the (fixed) foreign interest rate. However, as indicated earlier (and in footnote 12), a rise in the relative domestic interest rate reduces domestic money demand, causing the domestic price level to rise to clear the money market and — via PPP—causing the home currency to depreciate further! Thus, the one-time money supply increase causes the current exchange rate to rise at least proportionately via PPP directly, and—owing to speculation about future monetary growth—indirectly causes the current exchange rate to rise even further via interest parity.

However, this first modern monetary approach is undermined on various conceptual and empirical grounds. First, effects on the current exchange rate rely on continuous PPP. Evidence presented earlier tends to refute PPP as an effective channel for influencing short-run exchange rate movements. Second, whether or not exchange rate volatility arises in this model depends upon the specific manner in which expectations are formed. Third, even when expectations are formed rationally, exchange rate volatility requires strong assumptions regarding links between actual and expected future values of policy variables.[14]

Charts 5 to 7 indicate moreover that higher relative domestic interest rates did not always cause the home currency to depreciate in the past decade, as the model suggests. The black lines in these charts indicate monthly changes in the foreign currency value of the U.S. dollar. The blue lines indicate changes in the three-month Eurodollar deposit interest rate minus the foreign country's three-month interbank loan rate, that is, the relative U.S. interest rate. For example, Chart 5 illustrates that from 1977 through 1979 the U.S. dollar generally depreciated and appreciated as the relative U.S. interest rate rose and fell, respectively, consistent with the model. Yet more recently—notably, 1980 through 1982—the opposite occurred!

In contrast, a second version of a modern monetary approach takes a "dynamic" view of exchange rate determination.[15] In this model, the exchange rate adjusts to maintain interest parity and PPP. However, the capital market is assumed to adjust instantaneously (that is, prices of financial assets adjust continuously to equate asset demands and supplies) while commodity markets clear sluggishly (that is, prices of goods adjust slowly to equate goods demands and supplies). The dynamic aspect of the model (with its emphasis on timing) is crucial—the exchange rate adjusts *instantaneously* to maintain continuous interest parity but adjusts *over time* to maintain PPP only in the long run!

To illustrate the importance of different market-clearing speeds in creating exchange rate volatility, consider the instantaneous versus long-run impacts on the exchange rate of a one-time money supply increase. As in the previous version of the monetary approach, in each country money demand is determined by the level of domestic income and the domestic interest rate. Given instantaneous clearing in asset markets, money supply must continuously equal money demand. With income fixed in the short run owing to sluggish goods market adjustment, a 1 percent money supply increase must lower instantaneously the domestic interest rate

---

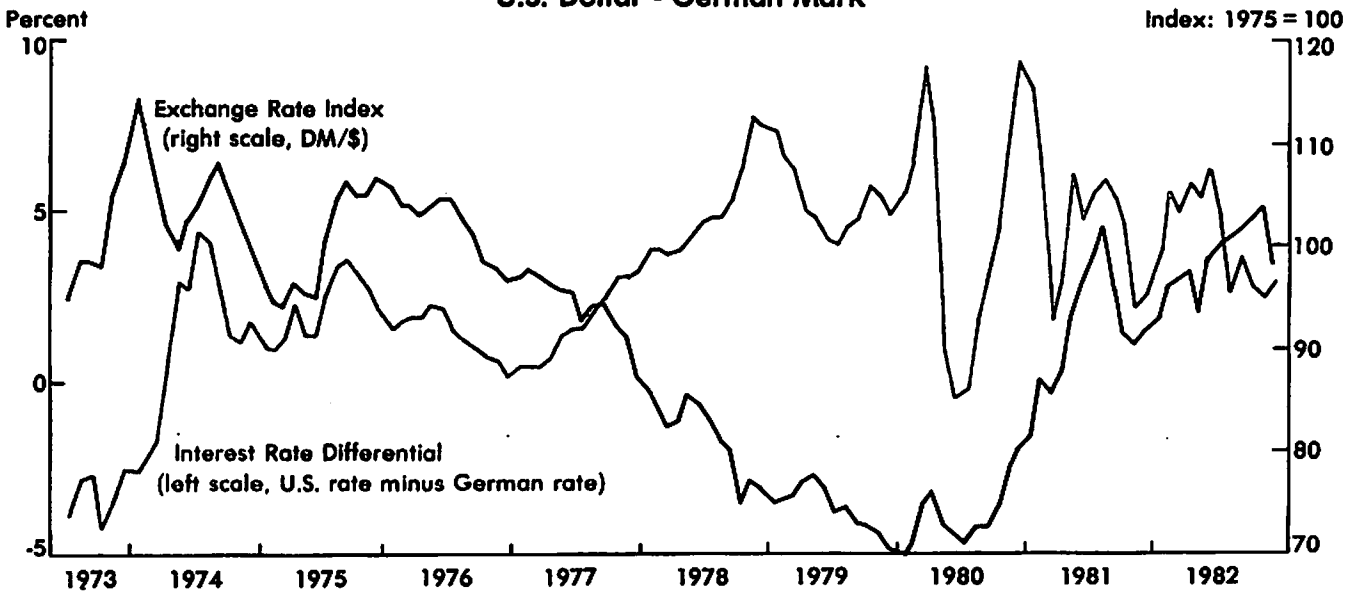
[14] Usually the link between actual and expected future values of exogenous variables is made by an ad hoc assumption rather than an integral part of the model's structure. For example, John O. Bilson, "Recent Developments in Monetary Models of Exchange Rate Determination," IMF *Staff Papers*, vol. 26, June 1979, pp. 201-223, assumes that a "simple illustrative model is sufficient." In his model, the theoretical link between actual and expected future values of the "composite exogenous variable" is described entirely by a first-order autoregressive process.

[15] This approach originated in Rudiger Dornbusch, "Expectations and Exchange Rate Dynamics," *Journal of Political Economy*, vol. 84, December 1976, pp.1161-1176.

Chart 5

Nominal Interest Rate Differential and Nominal Exchange Rate Index

U.S. Dollar - German Mark



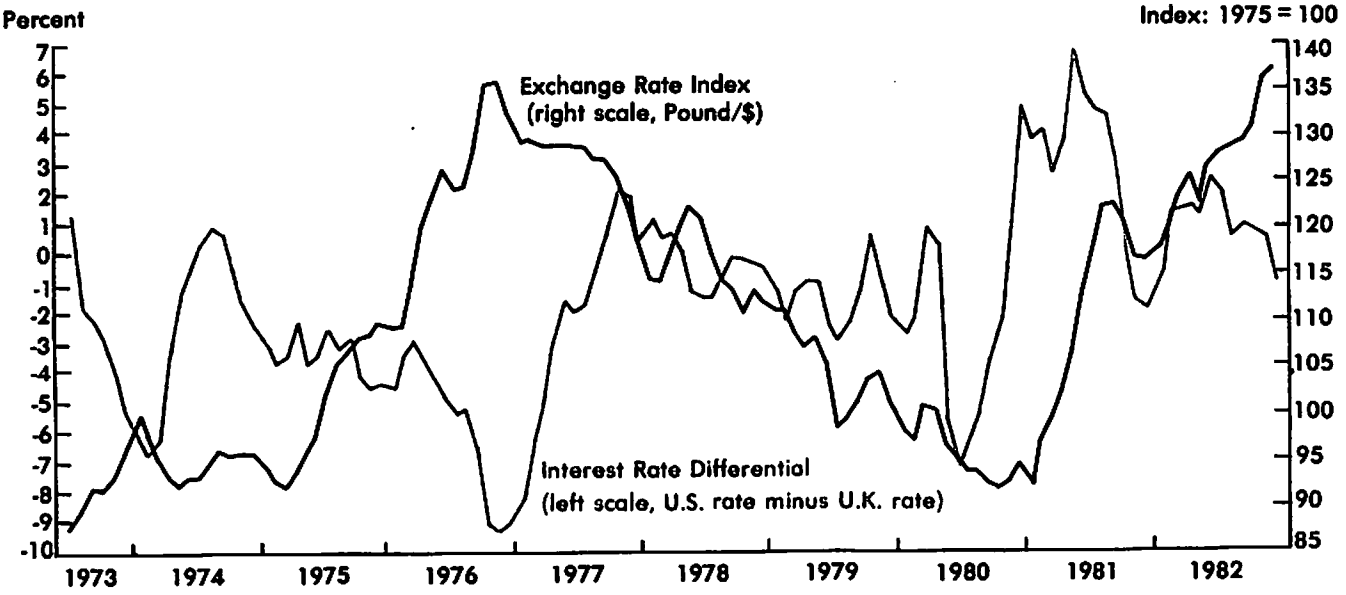
Source; Board of Governors of the Federal Reserve System, Division of International Finance, Macro Data Base, December 1982 and International Monetary Fund, *International Financial Statistics*, tape (December 1982) and various issues.

Note: The interest rate differential is the three-month Eurodollar deposit rate in London minus the three-month Frankfurt interbank loan rate.

Chart 6

Nominal Interest Rate Differential and Nominal Exchange Rate Index

U.S. Dollar - U.K. Pound



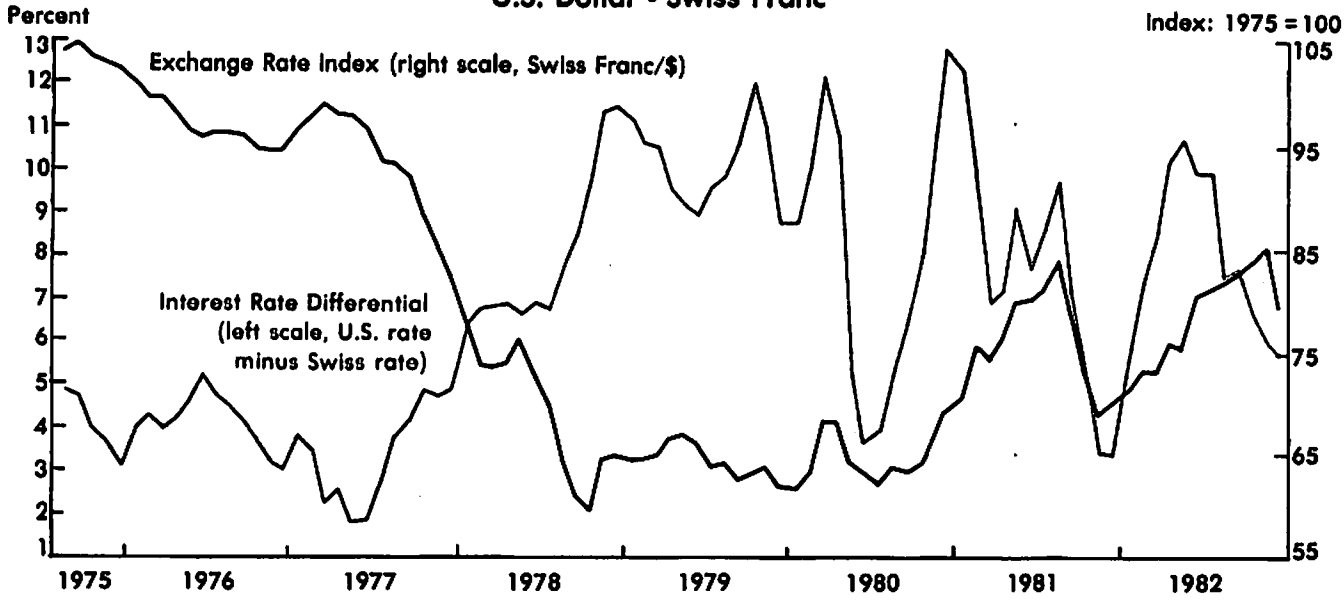
Source: Board of Governors of the Federal Reserve System, Division of International Finance, Macro Data Base, December 1982 and International Monetary Fund, *International Financial Statistics*, tape (December 1982) and various issues.

Note: The interest rate differential in the three-month Eurodollar deposit rate in London minus the three-month London interbank loan rate.

Chart 7

Nominal Interest Rate Differential and Nominal Exchange Rate Index

U.S. Dollar - Swiss Franc



Source: Board of Governors of the Federal Reserve System, Division of International Finance, Macro Data Base, December 1982 and International Monetary Fund, *International Financial Statistics*, tape (December 1982) and various issues.

Note: The interest rate differential is the three-month Eurodollar deposit rate in London minus the three-month Zurich interbank loan rate.

(to increase money demand to absorb the greater liquidity). Assuming domestic and foreign interest rates are equal initially, the continuous interest parity assumption implies that the (lower) domestic interest rate equals the (fixed) foreign interest rate minus the expected rate of *future appreciation* of the home currency. Yet in the long run, the assumption of PPP ensures that the home currency *depreciates* proportionately to the money supply increase. How can an eventual 1 percent depreciation of the home currency be reconciled with an instantaneous expectation of appreciation over time of the home currency toward its long-run value? These two facts are reconciled if the spot exchange rate instantaneously "overshoots" its long-run value—that is, the home currency depreciates immediately by more than 1 percent and appreciates over time toward the long-run exchange rate value consistent with PPP.

This dynamic monetary approach is appealing for several reasons. First, the instantaneous sharp depreciation of the home currency at fixed domestic and foreign prices combined with an appreciating home currency and a rising domestic price level over time is consistent with month-to-month variability of the real exchange rate, as shown in Charts 1 to 3. Second, the domestic money market is assumed to clear instantaneously through changes in the domestic interest rate rather than the domestic price level, consistent with empirical evidence on interest rate volatility. Third, the current exchange rate responds proportionately more than the price level to a money supply disturbance, consistent with recent evidence on exchange rate volatility.

However, the interest parity condition essentially supplants the PPP condition as a primary economic force determining the current exchange rate. The model implies that an instantaneous fall in the domestic interest rate (relative to the world interest rate) is accompanied by an instantaneous depreciation of the home currency and a rising interest rate over time is accompanied by an appreciation of the home currency over time. This contrasts directly with the first modern monetary approach that suggests an instantaneous fall (rise) in the relative domestic interest rate is accompanied by an instantaneous home currency appreciation (depreciation)! Yet as Charts 5 to 7 suggested earlier, the relationship between the relative domestic interest rate and the spot value of the home currency is not that simple. For example, Chart 5 illustrates that during periods of recession—notably, 1975 through 1976 and 1980 through 1982—the U.S. dollar generally depreciated and appreciated as the relative U.S. interest rate fell and rose, respectively, consistent with the second modern monetary model. However, during an expansionary

period—1977 through 1980—the opposite occurred, consistent with the first modern monetary model.

The evidence in Charts 5 to 7 suggests questioning such assumptions as perfect substitution between domestic and foreign assets underlying the approaches in this section. For example, the fall in the relative U.S. interest rate and appreciation of the U.S. dollar in the last half of 1982 can be partly attributed to "shifts" in asset-holders' tastes away from some foreign bonds and toward U.S. bonds because the latter appear to be "safer" — or "less risky" — than the former, given the internal political uncertainties that developed in France and Germany during 1982. The next section discusses exchange rate volatility in the absence of perfect substitution between domestic and foreign assets.

The Portfolio-Balance Approach

Recognizing the possible existence of premiums associated with risk, the portfolio-balance approach contrasts with the last model by assuming domestic and foreign bonds are imperfect substitutes. As a result, the typical portfolio-balance approach distinguishes among three financial assets composing wealth of domestic residents—domestic money, domestic bonds, and foreign bonds—rather than the two assets assumed in modern monetary approaches.[16] As in the dynamic monetary approach, commodity markets are assumed to clear sluggishly and asset markets instantaneously, implying again a dynamic view of exchange rate determination. The current exchange rate adjusts instantaneously along with the domestic interest rate to maintain continuous portfolio balance, that is, equality between demand and supply in all three assets. However, only over time do the exchange rate and domestic price level adjust to maintain long-run PPP.

Given domestic and foreign bonds are imperfect substitutes, this approach can be used to explain observed short-run exchange rate volatility (in the absence of interest parity) that arises in response to various monetary and fiscal policy disturbances. For example, assume that the initial stocks of domestic money, domestic bonds, and domestically held foreign bonds are given; domestic demands for all three assets are such that all three asset markets are in equilibrium (hence, no capital flows); and the current account is in balance. Consider the instantaneous impacts on the exchange rate and domestic interest rate of a domestic money supply increase resulting from an open market purchase by the central bank of domestic bonds. The "swap" of domestic money for domestic bonds produces, at the prevailing exchange rate and domestic interest rate, an incipient excess supply of domestic money and an incipient excess demand for domestic bonds. As the domestic interest rate falls, the quantity of money demanded increases and the quantity of domestic bonds demanded decreases, clearing these markets. Also, a falling domestic interest rate raises the relative return on foreign bonds. As domestic demand for foreign bonds increases, one would expect a net capital outflow (an accumulation of foreign bonds). However, a net capital outflow implies an offsetting current account surplus, which can occur *only over a period of time* under the portfolio-balance approach; and as asset holders are assumed to adjust instantly to maintain portfolio balance, the home currency value of foreign assets must rise to satisfy the greater domestic demand for foreign bonds—that is, the home currency must depreciate.

Over time, the exchange rate approaches its long-run equilibrium value. Since the current account was initially balanced, the instantaneous depreciation of the home currency will induce a rise in exports, a fall in imports, and consequently a current account surplus (under certain conditions). Under flexible exchange rates, the balance of all payments must be in equilibrium, so a current account surplus necessarily implies an equivalent net capital outflow, that is, an accumulation of foreign assets. For a given domestic demand for foreign bonds, an increase (decrease) in the quantity of foreign assets held domestically implies that the home currency price of foreign assets must fall (rise) so that the total value of the domestically held stock remains equal to the demand—that is, the home currency must appreciate (depreciate) over time. Thus, as in the dynamic monetary approach, the exchange rate must instantaneously "overshoot" its long-run equilibrium value in order to adjust over time toward that value. In contrast to the dynamic monetary approach, the portfolio-balance approach suggests a relationship over time

[16] Wealth in this context is assumed to mean net financial wealth. Thus, financial assets held as claims by parts of the domestic private sector and as liabilities by other parts cancel out. The domestic money supply is assumed to be proportional to the domestic monetary base—nontraded, noninterest-bearing liabilities created by the central bank that can increase net wealth. The domestic bond supply is assumed to be the accumulation of liabilities issued by the federal government to finance budget deficits over the years *minus* central bank and foreign holdings of the debt. The domestically held foreign bond supply is assumed to be the accumulation of capital outflows over the years. Seminal contributions to this approach are William H. Branson, Hannu Halttunen, and Paul Masson, "Exchange Rates in the Short-Run," *European Economic Review*, vol. 10, 1977, pp. 304-324; William H. Branson, "Exchange Rate Dynamics and Monetary Policy," in Assar Lindbeck (ed.), *Inflation and Employment in Open Economies*, Amsterdam: North-Holland Publishing Co., 1979; and Michael P. Dooley and Peter Isard, "A Portfolio-Balance Rational-Expectations Model of the Dollar-Mark Exchange Rate," *Journal of International Economics*, vol. 12, May 1982, pp. 257-276.

between current account balances and the exchange rate. Current account surpluses are associated with home currency appreciation that tends to eliminate the surpluses, and deficits with home currency depreciation that tends to eliminate the deficits.

However, the typical portfolio-balance approach is seemingly incompatible with the traditional view of the short-run exchange rate as the price of foreign exchange that maintains balance of payments equilibrium.[17] Traditionally, the balance of payments of a country measures payments and receipts associated with inflows and outflows of goods, services, and financial assets (private and official) over periods of time. In each period (the length of which is arbitrarily chosen), the net value of all flows collectively must equal zero; otherwise, the exchange rate must adjust (in a pure floating system). Thus, in the traditional view, actual short-term capital flows may create incipient payments imbalances that induce short-run exchange rate changes. However, according to the modern portfolio-balance view, in the short run any financial disturbance (say, a domestic bond open-market purchase) causes *instantaneous* changes in the domestic interest rate and in the exchange rate to ensure portfolio balance for wealth holders—in the absence of any immediate capital flows! Thus, in the short run, international *flows* of goods, services, and capital no longer determine the exchange rate, although such flows are, of course, considered important in the long run. Such a view is somewhat unrealistic. Indeed, large volumes of capital frequently flow between countries, spurred by changes in relative international yields and not necessarily the "consequence" of current account imbalances (but rather the cause). Furthermore, the severity of the instantaneous exchange rate depreciation in the typical portfolio-balance approach can only be determined under certain assumptions. According to one representative study:

> The proportional increase in the exchange rate on impact may be more or less than the percentage increase in the money stock, depending in a *fairly complicated way* on the initial proportions of assets in portfolios, and on the relative substitutability of the assets. (Italics added.)[18]

[17] Pentti Kouri, "The Exchange Rate and the Balance of Payments in the Short Run and in the Long Run: A Monetary Approach," *Scandinavian Journal of Economics*, vol. 78, 1976, pp. 280-304, notes that viewing the exchange rate as a price that equilibrates balance of payments flows is inconsistent with *instantaneous* portfolio equilibrium. He emphasizes that the "choice" between a stock (continuous portfolio balance) approach and a flow (elasticities) approach is an empirical matter. Kouri suggests that "The flow model of the foreign exchange market can be reformulated in a logically correct way by dropping the assumption of instantaneous portfolio equilibrium . . . ." (p. 287).

[18] William H. Branson, "Exchange Rate Dynamics and Monetary Policy," p.206.

The next section attempts to reconcile aspects of modern asset-market approaches, especially the portfolio-balance framework, that are seemingly incompatible with the more traditional view that the spot exchange rate is the price that adjusts to *maintain* balance of payments (flow) equilibrium.

III. A Synthesis of Views

The exchange rate perspective described here attempts to balance some of the richer aspects of both traditional and modern views. In general, some extreme assumptions found earlier are "toned down" — for example, no market is assumed to adjust instantaneously in this perspective—while some traditional aspects are "revived"—such as, the degree of exchange rate change in response to a disturbance depends critically upon relative price elasticities of demand. A major conclusion of this synthesis is that observed short-run exchange rate volatility over the last ten years could be explained largely by foreign bonds being better substitutes for domestic bonds than domestic money is, inducing a high degree of capital mobility even in the absence of speculation.

The implications of assuming that no market adjusts instantaneously—as suggested in one recent extension of the dynamic monetary model[19]—are illustrated for a small open economy. Assume the spot exchange rate is set initially by the flow demand and supply for foreign exchange determined by the level of imports and exports of goods (and services) and that the current account is initially in balance. On the financial side, home currency is held for three purposes: as a speculation; to purchase domestic goods and bonds; and to purchase foreign exchange, which in turn is used to purchase foreign goods and bonds. Domestic bonds are assumed to be interest-bearing liabilities issued by the federal government. Foreign bonds are domestic claims on foreigners. Initially, all asset demands and supplies are in equilibrium and the current account is in balance; hence, the balance of payments is in equilibrium.

What are the foreign exchange market (and, hence, balance of payments) effects of a financial disturbance? Suppose the domestic central bank makes an

[19] See Jacob A. Frenkel and Carlos A. Rodriguez, "Exchange Rate Dynamics and the Overshooting Hypothesis," IMF *Staff Papers*, vol. 29, March 1982, pp. 1-30. Frenkel and Rodriguez extend the Dornbusch dynamic monetary model to account for finite speeds of adjustment in goods and asset markets, assuming "the speeds of adjustment in various markets are less than infinite (which is obviously the case)" (p.28). They conclude, "the key factor determining the short-run effects [on the exchange rate] of a monetary expansion is the degree of capital mobility" (p.28).

open market purchase of domestic bonds that causes a one-time, 1 percent increase in the domestic money supply. Initially, the offered swap of home currency for domestic bonds creates—at the prevailing exchange rate and interest rates—an incipient excess supply of home currency and an incipient excess demand for domestic bonds. With no changes yet in the exchange rate, asset prices, or goods prices, the balance of payments is still in equilibrium. However, the incipient excess demand for domestic bonds causes their price to rise and the domestic interest rate to fall. As the domestic interest rate falls, two effects occur. First, domestic money demand increases as the opportunity cost of holding home currency falls. Second, (net) capital flows abroad as the relative rate of return on foreign bonds rises. The capital outflow implies an increase in the supply of home currency in the foreign exchange market to purchase foreign currency (used, in turn, to purchase foreign bonds), causing the home currency to depreciate.

The conclusion that the home currency depreciates parallels the result from a typical portfolio-balance model. However, in this synthesis a short-term capital outflow induced by a monetary policy shock can create an incipient payments imbalance that requires an exchange rate change to maintain balance of payments equilibrium (by generating a current account surplus). Furthermore, the degree of exchange rate change can be shown to depend importantly upon the relative price (interest rate) elasticities of demand for the various financial assets. First, the greater (in absolute terms) the price elasticity of demand for foreign bonds, the *larger* the home currency depreciation. As the domestic interest rate falls, the rate of capital outflow—and hence the degree of foreign exchange market pressure on the home currency—depends upon how price sensitive is foreign bond demand. Second, the greater the price elasticity of domestic money demand, the *smaller* the home currency depreciation, because the domestic interest rate need not fall as far in order to absorb the larger amount of liquidity. Similarly, the greater the price elasticity of domestic bond demand, the *smaller* the home currency depreciation, because the domestic interest rate again need not fall as far in order to eliminate the incipient excess domestic bond demand.

Under certain assumptions, whether or not the short-run exchange rate displays volatility can be shown to depend entirely upon the relative price elasticities of foreign bond demand and domestic money demand.[20] For example, suppose these two elasticities are identical. Then as the domestic interest rate falls, the percentage rate at which home currency is used to purchase foreign exchange must equal the percentage rate at which home currency is accumulated to be held as speculative balances. When the incipient excess money supply is ultimately eliminated, foreign exchange demand and domestic money demand each will have increased by 1 percent, causing the home currency to depreciate by 1 percent—assuming initially fixed supplies of each currency in the foreign exchange market.[21] However, foreign bonds generally are considered better substitutes for domestic bonds compared to money, suggesting a higher price elasticity of foreign bond demand than price elasticity of domestic money demand. Under this view, the rate at which home currency is used to purchase foreign exchange will exceed the rate at which it is accumulated to be held as speculative balances, causing the home currency to depreciate more than proportionately to the money supply increase in the short run. The greater the degree of capital mobility, the greater is exchange rate volatility.

In reality, however, the supply of each currency in the foreign exchange market is not likely to be fixed. For example, as the home currency value of foreign exchange rises, the quantity of foreign currency supplied to the foreign exchange market will likely increase, dampening the degree of home currency depreciation. Nevertheless, relative price elasticities of domestic money and foreign bond demands play a critical role in determining the degree of exchange rate change, and exchange rate volatility can easily arise under certain assumptions. These results and the effects of various fiscal policies are described in formal detail in a technical note available from the author upon request.

In a broader context, casting the severity of short-run exchange rate responses to portfolio disequilibrium in terms of asset price elasticities— similar to the traditional elasticities approach that casts the severity of exchange rate responses to goods market disequilibrium in terms of commodity price elasticities—suggests a more "balanced" view of exchange rate determination. In this view, current account and capital account disturbances are emphasized equally. Either causes a balance

[20] In the long run, domestic prices and the exchange rate are assumed (given PPP) to rise proportionately to the money supply increase.

[21] For these results, the assumption of initially fixed supplies of each currency in the foreign exchange market is important. It implies that the demand curve for each currency in the foreign exchange market has an elasticity of one. Consequently, if the supply of home currency to purchase foreign exchange increases by 1 percent, the home currency must depreciate by 1 percent, given the unit elastic foreign exchange market demand for the home currency.

of payments disequilibrium that must—in the absence of official intervention—be accommodated by spot exchange rate changes. The exchange rate is not solely responsive to current account imbalances, as in the traditional elasticities approach, with no role for capital account imbalances. The exchange rate can again be considered the price that maintains balance of payments (flow) equilibrium, unlike in modern (continuous) portfolio balance approaches.

In general, the degree of exchange rate change to balance of payments disequilibrium depends upon goods and asset price elasticities of demand in combination with relative goods and asset market adjustment speeds. Because asset markets are generally recognized as adjusting to disequilibrium faster than goods markets, the short-run exchange rate is expected to be more sensitive from day to day or from week to week to capital market imbalances. However, commodity market disturbances—such as oil market shocks—are expected to be critical determinants of medium-run and long-run exchange rate trends. Finally, even in a world with no speculative forces, the exchange rate may have a volatile response to policy disturbances given the existence of short-term capital mobility.

IV. Conclusions and Policy Implications

After a decade of floating, economists and financial market observers have been surprised by the extreme volatility of exchange rates over this period. In the early 1970s, an assumption that import and export demands for goods and services were very price sensitive generated an optimism that exchange rates would not be volatile under a flexible exchange rate regime. Skeptics suggested that in the short run import and export demands were price insensitive; furthermore, speculation would cause foreign exchange market instability, as speculators' expectations lacked firm foundations and caused "bandwagon effects."

As the decade passed, economists identified other economic factors that could explain exchange rate volatility. Differences between speeds of "price clearing" in financial asset markets versus goods and services markets, caused by structural market differences, suggested a strong distinction between the short-run versus long-run exchange rates. Various modern views emphasized that short-run exchange rate movements could be dominated by the frequent shifts of wealth between alternative financial assets. In the presence of increasing short-term capital mobility between nations, exchange rate volatility could easily be explained by the interest rate elasticities of demand for various financial assets—even in the absence of speculation about the future exchange rate. Meanwhile, long-run trends in the exchange rate could be dominated by changes in the relative prices of goods and services.

The relationship between capital mobility and exchange rate volatility has a sobering impact in a world usually characterized by an absence of international coordination of monetary and fiscal policies. Divergent policies that cause relative interest rate changes can induce extreme variability in exchange rates. For example, for three quarters beginning in October 1979, the average annual rate of U.S. money supply (M2) growth was 6.2 percent, down from a 10.2 percent average annual growth rate in the preceding 12 quarters. As the relative U.S. interest rate rose from mid-1980 to mid-1981, the dollar appreciated 40 percent relative to the German mark, 34 percent relative to the British pound, and 33 percent relative to the Swiss franc over the same period. And as noted earlier, exchange rate variability imposes costs to society in terms of foregone international goods, services, and capital transactions and the diversion of resources to help redistribute risk.

In the present absence of policy coordination, one way of decreasing exchange rate variability is to reduce short-term capital mobility. A policy such as taxing foreign exchange purchases and sales may eliminate short-term capital flight that tends to destabilize exchange rates. However, short-term capital flows also tend to be stabilizing factors, helping to maintain balance of payments equilibrium. Inhibiting short-term capital flows may prove to be *destabilizing*, placing a greater burden on commodity and official capital flows to restore payments balance.

Thus, improved cooperation between national monetary and fiscal policy authorities may be desirable in the absence of practicable measures to reduce destabilizing short-term capital mobility and given the volatility that exchange rates can be expected to display in restoring balance of payments equilibrium. Such cooperation may reduce relative interest rate changes, thus eliminating unnecessary exchange rate movements—but not necessarily without costs, because greater international cooperation implies giving up some discretion in targeting and attaining certain domestic economic goals, such as a particular rate of inflation or unemployment. However, the potential benefits of such cooperation are increased international trade and possibly greater mutual foreign investment.