MAURICE OBSTFELD
University of California, Berkeley

International Currency Experience: New Lessons and Lessons Relearned

THE BROOKINGS PANEL on Economic Activity first met twenty-five years ago, at a moment of temporary reprieve but ominous portent for the international monetary system. The Bretton Woods system of pegged but adjustable dollar exchange rates had permitted the world economy more than two decades of robust growth and generally low inflation. But the structure was starting to unravel. The 1967 devaluation of sterling, the 1968 divorce of the market and official prices of gold, and the 1969 realignments of the French franc and German mark had papered over localized tensions in the Bretton Woods order. At the same time, those events vividly demonstrated that seemingly cherished official commitments could easily succumb to speculative pressures. By March 1973 the Bretton Woods system was history, and dollar exchange rates were floating.

In 1970 a majority of academics and policymakers wanted greater exchange rate flexibility. But most, mindful of Ragnar Nurkse's critique of interwar currency practices, did not go so far as to advocate *floating* dollar exchange rates.[1] Typical proposals favored less extreme departures from the existing arrangement: wider fluctuation margins, smaller and

I thank Geun Mee Ahn, Kaku Furuya, Luisa Lambertini, and Matthew T. Jones for excellent research assistance. The paper has benefited from the helpful suggestions of Barry Eichengreen, Luisa Lambertini, John Williamson, and participants in the Brookings Panel meeting. All errors and opinions are my own. The National Science Foundation, the Ford Foundation, and the Center for German and European Studies at the University of California, Berkeley, provided generous support.

1. League of Nations (1944).

more frequent realignments, or crawling pegs. In practice, however, the "interim" float initiated in 1973 accommodated divergent policy responses to the shocks of the early 1970s, and thus allowed the international community to postpone indefinitely any comprehensive redesign of currency relations.

Plans to limit exchange rate variability resurfaced as the drawbacks of floating rates became more evident. In the mid-1980s the Group of Seven (G-7) industrial countries began to experiment with informal target ranges for exchange rates. More radically, members of the current European Union (EU) linked their currencies within the European Monetary System (EMS) in 1979 and extended its Exchange Rate Mechanism (ERM), both in membership and in stringency, as the 1980s progressed. The long-run impact of these experiments is hard to gauge. G-7 cooperation on exchange rates, although clearly productive on some occasions, has proven sporadic, and at present there is no broad international consensus on how currency relations among major regions should evolve. Much more dramatic has been the failure of the ERM, which was consigned by the speculative turbulence of 1992–93 to a limbo in which some bilateral currency rates float, while others occupy ±15 percent bands. To believe that the Maastricht blueprint for European monetary union will be operative by 1999 requires a considerable leap of faith, although the foundation for eventual unification is much stronger now than it was twenty-five years ago, when the European Economic Community set its sights on a common currency by 1980.

The Bretton Woods agreement was inspired by the currency disorder of the interwar period, which Nurkse and many others blamed on the lack of a generally accepted system of rules for trade and currency relations. As conceived by its founders, Bretton Woods was upheld from 1946 to 1971, roughly a quarter of a century. In 1995 a further quarter of a century of international currency experience, once more without an agreed international framework for monetary relations, is behind us. That experience has been eventful and, in certain respects, disappointing. But it is rich in lessons about exchange rate behavior, about the relation between exchange rates and the macroeconomy, about the interplay between politics and macroeconomic policy, and about the harsh discipline that integrated international capital markets impose on would-be exchange rate fixers. This paper reviews some of those lessons and interprets their implications for the redesign of the exchange rate system.

The Mechanics of Floating Exchange Rates

The most avid proponents of floating rates before the early 1970s, notably Milton Friedman and Harry G. Johnson, predicted numerous benefits from a floating-rate regime.[2] Floating rates would offset trend inflation differentials, smoothly accommodate equilibrium movements in real exchange rates, liberate monetary policy to pursue domestic goals, discourage rather than encourage destabilizing speculation, ease external constraints, and thereby discourage the proliferation of official controls on international trade and payments. Comparing these optimistic predictions with actual outcomes provides a useful perspective on recent international currency experience.

Exchange Rates and Inflation in the Long Run

Some countries welcomed the advent of greater exchange rate flexibility in the 1970s, primarily because it decoupled domestic inflation from a U.S. inflation rate which, although relatively moderate in light of subsequent levels, then appeared to be dangerously high. Insulation from foreign price-level instability is one of the two biggest advantages that a flexible exchange rate provides. The other, which applies when domestic nominal prices and wages are somewhat rigid, is the exchange rate's ability to accommodate the equilibrating changes in international relative prices that otherwise would occur through protracted deflations or inflations.

The theory of (relative) purchasing power parity (PPP) provided the theoretical rationale for the belief that floating exchange rates would offset trend inflation differentials. PPP predicts that if E is the price of foreign currency in terms of domestic currency, P the domestic price level, and P^* the foreign price level,

$$\hat{E} = \hat{P} - \hat{P}^*, \tag{1}$$

where a hat denotes a percentage change.

At least since Ricardo, it has been understood that nonmonetary disturbances and trends can cause long-run departures from PPP. Yet over

2. See Friedman (1953) and Johnson (1970). Monetarists were not the only ones supporting floating rates. A prominent Keynesian proponent was Meade (1955), who also opposed fixed rates within Europe (Meade, 1957).

the floating-rate period as a whole, PPP is a tolerably good description of the cross-sectional behavior of dollar exchange rates. For the G-7 countries other than the United States, consider a cross-section regression of rates of currency depreciation against the dollar for 1972–93 on the difference between the domestic consumer-price inflation rate and the U.S. inflation rate:[3]

$$\log\left(\frac{E_i^{1993}}{E_i^{1973}}\right) = a + b\log\left(\frac{P_i^{1993}/P_i^{1973}}{P_{US}^{1993}/P_{US}^{1973}}\right) + u_i. \tag{2}$$

Ordinary least squares (OLS) yields the estimated equation (with standard errors in parentheses):

$$a = \underset{(0.323)}{-0.154}, \quad b = \underset{(0.261)}{1.115}, \quad R^2 = 0.82.$$

The levels of the independent and dependent variables are plotted in figure 1. PPP regressions based on nominal unit labor costs in manufacturing rather than CPIs yield virtually identical results.

For the OECD countries other than developing Turkey (with a 1973–93 net price level increase of more than 200,000 percent) and Mexico, the corresponding regression estimate is:[4]

$$a = \underset{(0.193)}{-0.066}, \quad b = \underset{(0.038)}{1.011}, \quad R^2 = 0.97.$$

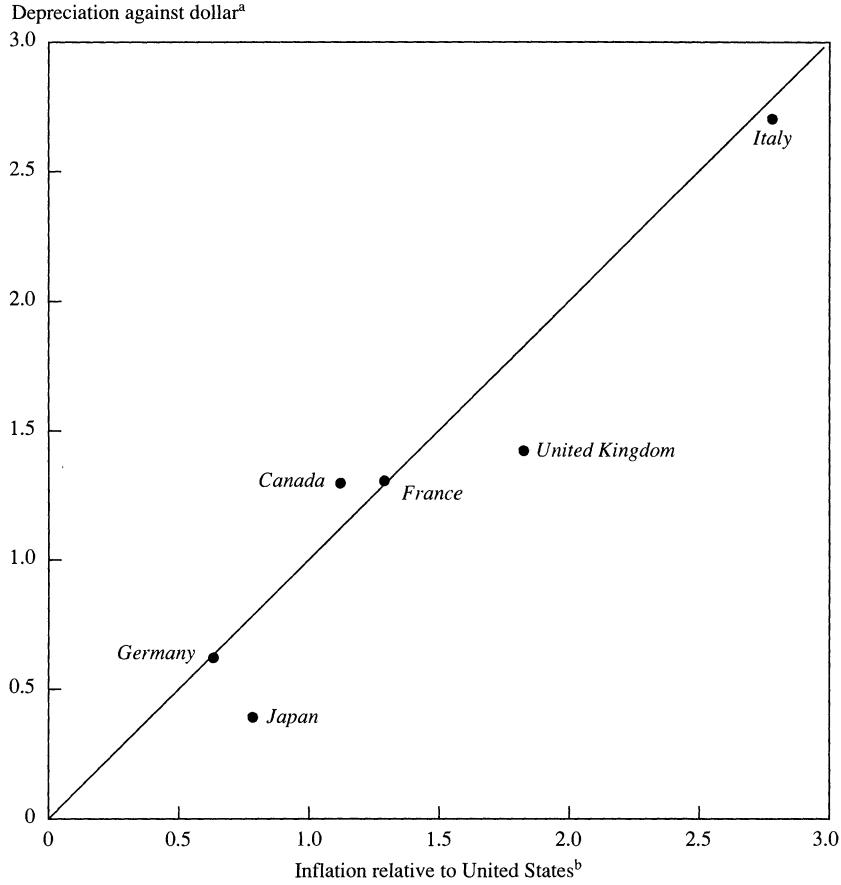
The estimated slope coefficient is close to the value of unity implied by PPP, and the high R^2 underscores how much of the recent long-term variation in dollar exchange rates can be explained by inflation differentials.

Notwithstanding the explanatory power of relative inflation rates for cross-sectional variation in dollar exchange rates, there have been significant trends in several real exchange rates, notably that of the Japanese yen. The yen's real appreciation against the dollar since 1973—its tendency to appreciate by more than the United States–Japan inflation differential—is evident in figure 1, where Japan is far below the 45° diagonal along which relative PPP holds. Figure 2, which plots the Japan-to-United States yen price-level ratio, $P_{JAPAN}/E_{¥/\$}P_{US}$, shows that this trend

3. Data on CPIs and exchange rates are from *Economic Report of the President*, 1994, tables B-59, B-108, and B-110.

4. Data on CPIs and exchange rates are from *International Financial Statistics*.

Figure 1. Changes in Exchange Rates and Price Levels against the United States, 1973–93



Source: *Economic Report of the President*, 1994.

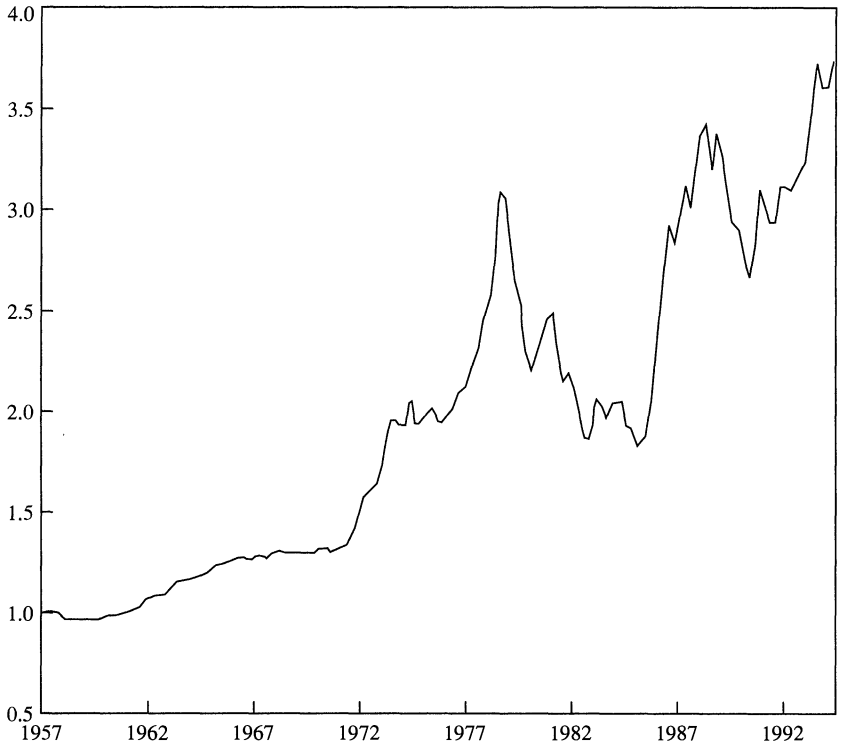
a. Depreciation rates against dollar are log differences (1993 less 1973) of annual average local currency prices of the dollar.

b. Inflation rates are log differences (1993 less 1973) of annual average national consumer price indexes divided by annual average U.S. CPI.

has been in place at least since the early 1960s and only accelerated after the advent of floating rates (with a notable, albeit temporary, reversal during the strong-dollar interlude of the 1980s).

From a theoretical viewpoint, the most persuasive account of such trends in real exchange rates is the Balassa-Samuelson theory, under which the degree of differential productivity growth in tradable goods relative to nontradable goods explains the rate of increase in a cur-

Figure 2. Dollar-Yen Real Exchange Rate, 1957–1994[a]



Source: *International Financial Statistics.*

a. Tics at second quarter of year shown. The real dollar-yen exchange rate shown is Japan's consumer price index divided by the product of the yen-dollar nominal exchange rate and the U.S. CPI. A rise is a real appreciation of the yen and a real depreciation of the dollar. The period covered is 1957:1 to 1994:2

rency's relative external purchasing power.[5] Suppose, for example, that productivity growth is the same in U.S. and Japanese nontradables, but is faster in Japanese tradables than in U.S. tradables. Then Japanese dollar wages will rise more quickly than American dollar wages, causing more rapid increases in the dollar prices of nontradable goods in Japan and, given a common world price of tradables, a more rapid increase in Japan's dollar price level than in that of America. In a careful study, Richard Marston has documented the role of relative (labor) productivity growth differentials in the yen's real appreciation up to 1983. The

5. See Balassa (1964) and Samuelson (1964). Froot and Rogoff (1995) offer a recent survey.

Balassa-Samuelson effect comes through in his data, despite changes in the relative price of Japanese and American tradables.[6]

A modified version of equation 2 permits estimation of the contribution of Balassa-Samuelson effects to the long-run cross-sectional variation in OECD dollar exchange rates. Let PRD_i be a measure of the difference between domestic and U.S. productivity growth. On the hypothesis that variations in overall productivity growth are likely to be concentrated in tradables and positively correlated with the national differential between productivity growth in tradables and nontradables, the regression equation

$$\log\left(\frac{E_i^{1993}}{E_i^{1973}}\right) = a + b\log\left(\frac{P_i^{1993}/P_i^{1973}}{P_{US}^{1993}/P_{US}^{1973}}\right) + c\,PRD_i + u_i \tag{3}$$

should show the role of the Balassa-Samuelson effect in creating long-run departures from PPP. The OECD reports data on annual average labor productivity growth over 1973–93 for member countries other than Iceland, Luxembourg, Mexico, and Turkey.[7] Defining PRD_i as country i labor productivity growth less the U.S. measure, the OLS estimate of equation 3 is (with standard errors in parentheses):

$$\underset{(0.197)}{a = 0.027}, \quad \underset{(0.061)}{b = 1.021}, \quad \underset{(0.052)}{c = -0.071}, \quad R^2 = 0.94.$$

The negative estimate of c above, while not significantly different from zero at standard levels, nonetheless suggests the presence of a Balassa-Samuelson effect. The point estimate for c implies that a country with average annual labor productivity growth of 1 percent above that of the United States would have experienced a 7.1 percent real appreciation against the dollar over 1973–93 (an annual real appreciation rate of 0.34 percent). The insignificant estimate of c probably reflects the general finding of other studies, that Balassa-Samuelson effects show up strongly in some countries (such as Japan) but more weakly in others.[8]

6. Marston (1987).

7. See OECD (1994, annex table 58, p. A64). Use of the OECD's total factor productivity growth measure results in similar estimates.

8. The productivity variable used to estimate equation 3 above is a crude one. Asea and Mendoza (1994) have carried out a more detailed test, based on panel data from the OECD's intersectoral data base, which reports input and output data for twenty production sectors within each of fourteen countries over 1970–85. They find that the total factor productivity difference between tradables and nontradables is an important determinant

The fact of long-run real exchange rate trends, whether due to differential intersectoral productivity performance or other factors, supports the move toward exchange rate flexibility in the early 1970s. Under the Bretton Woods system, Japan's acceptance of a higher inflation rate than most other countries in the industrial world allowed a gradual real appreciation of the yen (see figure 2). Given Japan's recently revealed preference for lower consumer-price inflation, however, the yen's continuing trend of real appreciation against the dollar could not have taken place at a fixed dollar-yen rate without substantial U.S. deflation. The obvious political infeasibility of that outcome sooner or later would have led speculators to attack any official attempt to fix the exchange rate, just as they did in 1971–73. By accommodating long-run equilibrium movements in real exchange rates, floating nominal exchange rates have helped liberate countries to pursue their own inflation objectives.

Exchange Rates and Prices in the Short Run

The day-to-day process through which exchange rate movements have eventually accommodated inflation and real exchange rate trends has been anything but smooth. Over relatively short periods, PPP has failed dramatically. The reason for this bumpy ride is the sluggishness of money output prices, which ensures that monetary as well as real disturbances cause nominal and real exchange rates to move closely with one another in the short run. Because international experience abounds with monetary regime shifts, which are as near to controlled experiments as one is likely to come in macroeconomic data, evidence on comovements between real and nominal exchange rates provides an unparalleled testing ground for the hypothesis that prices are sticky in the short run. The implications for employment stability are critical, for if prices continually adjusted to clear markets, flexible exchange rates could provide insulation from foreign price instability but would not be necessary on stabilization grounds.

---

of their relative price, as the Balassa-Samuelson model predicts. (In earlier work with the same data set, De Gregorio, Giovannini, and Wolf (1994) find a similar result.) Asea and Mendoza, however, detect only a weak relation between productivity variables and measures of the real exchange rate. Like my own results above, the Asea-Mendoza findings are suggestive of a Balassa-Samuelson effect, but not conclusive.

If output prices really were as flexible as market-clearing models assume, then, other things the same, a change in the monetary regime determining the nominal exchange rate would have no noticeable effect on the statistical distribution of the real exchange rate. The data, however, do not support this prediction of flexible-price models. As documented most thoroughly by Michael Mussa, industrial countries that move from fixed to floating exchange rate regimes simultaneously experience dramatic rises in the variance of quarter-to-quarter real exchange rate changes.[9] Conversely, when countries shift from a float to a system of nominal exchange rate targets, the short-run variability of the real exchange rate drops. It is hard to explain this finding—which applies to every postwar exchange-rate regime shift by an industrial country—except by accepting that output prices move sluggishly in the short run, so that the greater nominal exchange rate volatility that accompanies a float translates into greater real exchange rate volatility.

Several representative cases illustrate the broader empirical regularity. One of the most celebrated is that of Ireland, which maintained a currency board system and a one-to-one exchange rate between the punt and the pound sterling from 1927 until 1979. In early 1979 Ireland entered the ERM and switched to an ecu peg, effectively linking the punt to the DM instead of the pound. Figure 3 shows the dramatic increase in the variability of the real punt-pound rate that followed, while figure 4 shows (leaving aside the clearly evident EMS currency realignments of September 1979, October 1981, June 1982, March 1983, April and August 1986, and January 1987) the simultaneous drop in the variability of the real punt-DM rate.[10] The period of low real and nominal volatility from January 1987 (the last EMS realignment before the Maastricht treaty) until the February 1993 punt crisis is noteworthy.

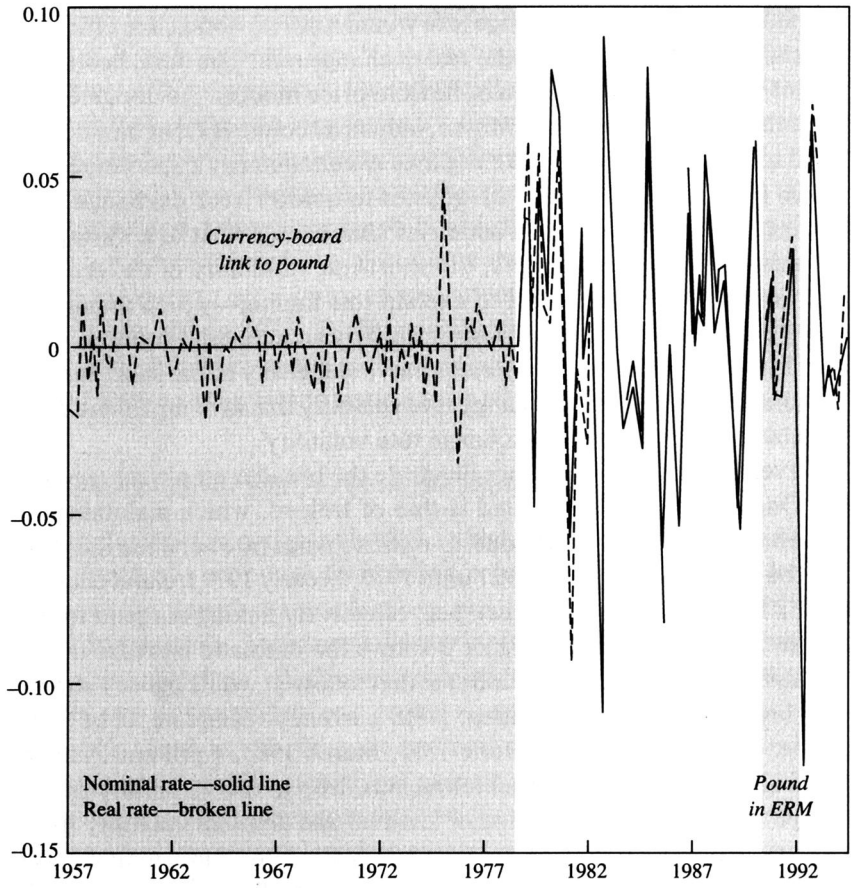
Canada's unusual exchange rate history provides another natural experiment. Canada floated its dollar (contrary to Bretton Woods rules) between 1950 and 1962. After returning to the fixed-rate fold, it opted for a float once again on June 1, 1970. Figure 5 (based on monthly data) reveals that the fixed-rate period from 1962 to 1970 coincides with a dramatic drop in the variability of the real Canadian dollar–U.S. dollar ex-

9. See Mussa (1986).

10. During the Bretton Woods era, declared parities against the U.S. dollar were maintained up to fluctuations of ±1 percent. Thus cross rates for nondollar currencies, such as the sterling-DM rate, could fluctuate by ±2 percent.

Figure 3. Punt-Pound Nominal and Real Exchange Rates, 1957–94[a]

Quarterly log differences



Source: *International Financial Statistics*.

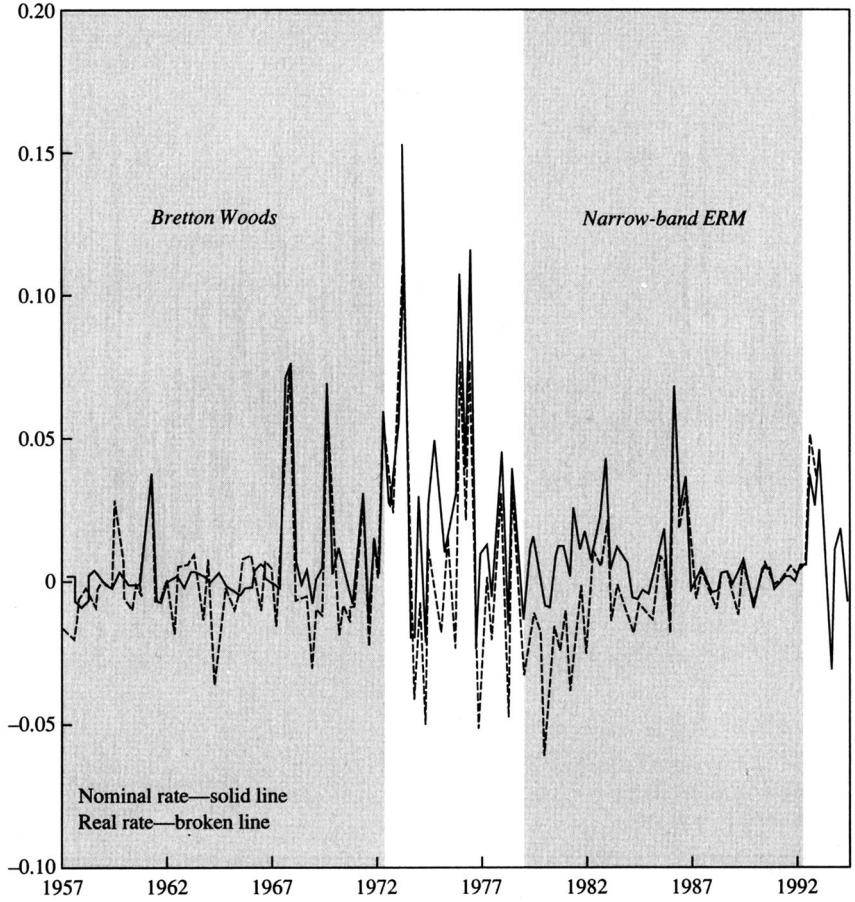
a. Tics at second quarter of year shown. The nominal punt-pound exchange rate is the price of pounds in terms of the punt, so that a rise is a nominal depreciation of the punt and a nominal appreciation of the pound. The real punt-pound exchange rate is the nominal rate times the U.K. CPI divided by the Irish CPI. A rise is a real depreciation of the punt and a real appreciation of the pound. Log differences are plotted in the figure. The period covered is 1957:2 to 1994:4.

change rate. Variability rises abruptly in 1970, precisely when the float recommences. Again, the dominant role of a floating nominal exchange rate in short-run real exchange rate changes is striking.

The behavior of the French franc–DM rate provides a final example. In figure 6, real exchange rate variability is low prior to 1973, save for the franc devaluations of 1957 (16.7 percent), 1958 (14.8 percent), and 1969 (11.1 percent); the DM revaluations of 1961 (5.0 percent) and 1969

Figure 4. Punt-DM Nominal and Real Exchange Rates, 1957–94[a]

Quarterly log differences



Source: *International Financial Statistics*.

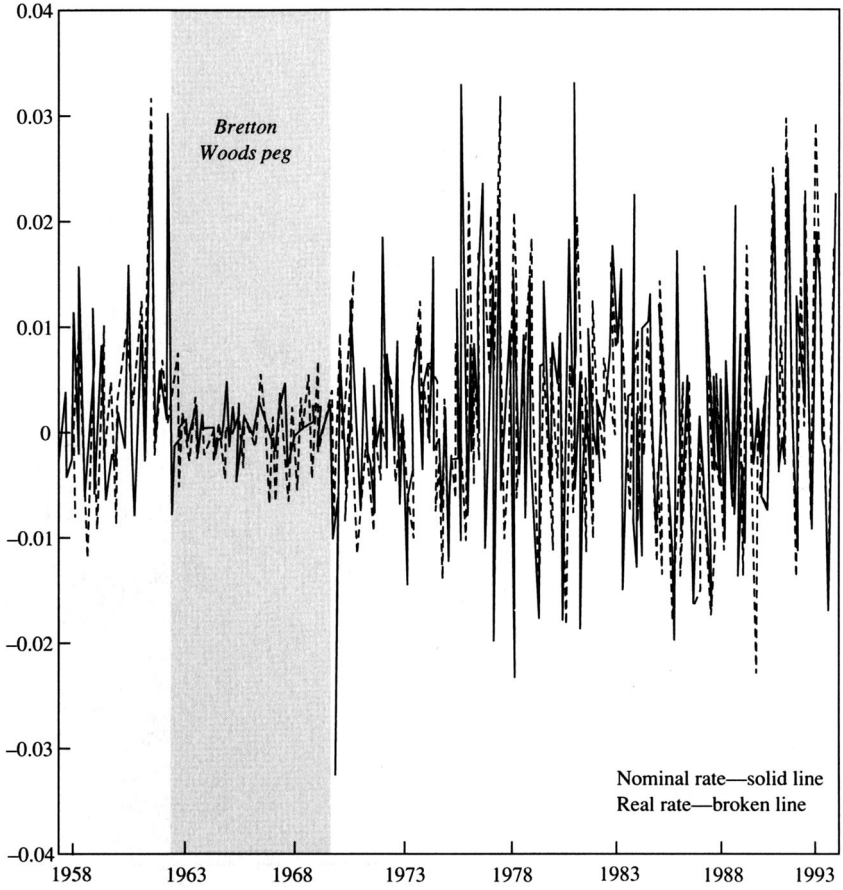
a. Tics at second quarter of year shown. The nominal punt-DM exchange rate is the price of DM in terms of the punt, so that a rise is a nominal depreciation of the punt and a nominal appreciation of the DM. The real punt-DM exchange rate is the nominal rate times the German CPI divided by the Irish CPI. A rise is a real depreciation of the punt and a real appreciation of the DM. Log differences are plotted in the figure. The period covered is 1957:2 to 1994:4.

(9.3 percent); and the period of DM float from May 1971 to the December 1971 Smithsonian realignment.[11] Real volatility tracks the abrupt drop in nominal volatility (apart from occasional realignments) due to the establishment of the ERM's franc-DM link early in 1979. The wider ±15 percent bands, launched in August 1993, have so far had a relatively small

11. For details, see Solomon (1982).

Figure 5. Canadian$–U.S.$ Nominal and Real Exchange Rates, 1957–94[a]

Monthly log differences



Source: *International Financial Statistics*.

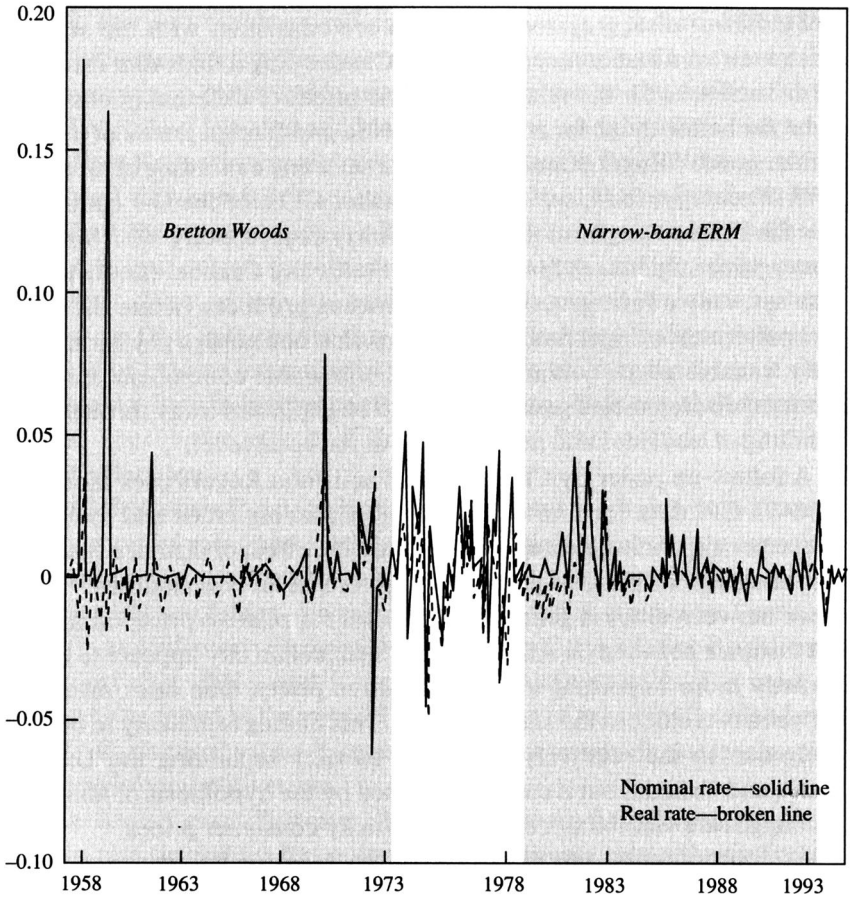
a. Tics at January of year shown. The nominal Canadian dollar–U.S. dollar exchange rate is the price of U.S. dollars in terms of the Canadian dollar, so that a rise is a nominal depreciation of the Canadian currency and a nominal appreciation of the U.S. currency. The real Canadian dollar–U.S. dollar exchange rate is the nominal rate times the U.S. CPI divided by the Canadian CPI. A rise is a real depreciation of the Canadian currency and a real appreciation of the U.S. currency. Log differences are plotted in the figure. The period covered is February 1957 to December 1994.

impact on nominal and real variability within the ERM because the French have tried to shadow the DM.

In addition to showing that real exchange rate variability depends on the nominal regime, figures 3–6 also make clear how closely nominal and real exchange rates tend to move in the short run. Clearly, greater nomi-

Figure 6. Franc-DM Nominal and Real Exchange Rates, 1957–94[a]

Monthly log differences



Source: *International Financial Statistics*.

a. Tics at January of year shown. The nominal franc-DM exchange rate is the price of DM in terms of the franc, so that a rise is a nominal depreciation of the franc and a nominal appreciation of the DM. The real franc-DM exchange rate is the nominal rate times the German CPI divided by the French CPI. A rise is a real depreciation of the franc and a real appreciation of the DM. Log differences are plotted in the figure. The period covered is February 1957 to December 1994.

nal exchange rate variability is largely responsible for the increased short-run real exchange rate variability that occurs under floating. This outcome could occur in a flexible-price model with a predominance of real (as opposed to monetary) disturbances, as stressed by Alan Stockman, but such a model cannot explain why the average amplitude of real

shocks should always rise when nominal exchange rates are set loose, and fall when they are contained.[12]

Studies of disaggregated price data are consistent with the sticky-price view. A notable recent study by Charles Engel finds that forecast error variances for the relative domestic prices of different goods tend to be far below those for relative domestic and foreign prices of a very similar good.[13] Engel examines two data sets, one consisting of monthly 1973–90 energy, food, services, and shelter CPIs for the G-7 countries less the United Kingdom; the other, of thirty-four monthly 1973–90 consumer price subindexes for the United States and Canada. (In the latter data set, only a few, generally homogeneous products violate the general pattern that Engel finds.) The prices that consumers pay for nominally tradable goods contain a sizable nontradable component, but the reported discrepancies seem too large to be explained away through the bundling of tradables and nontradables at the retail level.

A follow-up paper by Charles Engel and John Rogers uses monthly 1978–93 CPI data for fourteen U.S. and Canadian cities and fourteen consumer expenditure categories to study the effect of distance (implicitly, of transport costs) on price arbitrage for similar commodities.[14] Distance between cities is generally significant for relative price variation, but distance between an American and a Canadian city appears to have a vastly more important effect on relative prices than does distance between two cities in the same country. This finding is unlikely to be entirely due to the relatively low trade barriers separating the United States and Canada, but it can be explained by the hypothesis of nominal exchange rate variability coupled with sticky consumer prices.

As Johnson emphasized in making his case for floating rates, the abandonment of fixed exchange rate targets cannot enhance the effectiveness of monetary policy unless there is substantial stickiness of domestic prices and wages. Early on, Rudiger Dornbusch and Paul Krugman qualified Johnson's optimism by showing how the responsiveness of domestic inflation to changes in a floating exchange rate might reduce the impact of monetary policy on output and employment.[15] However, economies with moderate inflation and diversified

12. See Stockman (1987).
13. Engel (1993).
14. Engel and Rogers (1995).
15. Dornbusch and Krugman (1976). The point was turned on its head by Sachs (1985),

production capabilities still retain some latitude for effective discretionary monetary policy actions, especially in response to unexpected events. Britain's monetary relaxation following its withdrawal from the ERM in September 1992 provides a textbook example of how monetary policy works in sticky-price models as different as the 1960s IS-LM model of Robert Mundell and Marcus Fleming, and the 1990s intertemporal New Keynesian model proposed by Kenneth Rogoff and myself.[16]

Table 1 shows that Britain, having entered the ERM in October 1990, subsequently enjoyed lower inflation and interest rates but suffered from negative output growth, falling investment, and growing unemployment. Most observers agreed that the pound was overvalued against the DM, in the sense that, without a currency realignment, only a period of below-German inflation could restore a real exchange rate consistent with employment at the natural rate. This was the backdrop for the speculative attack of September 16, 1992, which led to the pound's flotation.

The ERM crisis freed the British government to lower interest rates. Lower interest rates and sterling's depreciation have, in turn, spurred economic recovery. By 1994, output and investment were growing, unemployment was falling, the current account deficit was below 1 percent of GDP, and inflation remained low. The sharp fall in relative British unit labor cost after 1992 is partly a result of productivity gains. But most of it must be ascribed to the parallel depreciation of the pound, which lowered U.K. nominal wages in terms of foreign currencies, increasing the economy's competitiveness.

The British case illustrates the second powerful argument for exchange rate flexibility: the potential for exchange rate adjustments to bring about at a stroke equilibrating relative price changes that otherwise would require politically unacceptable and economically costly stretches of unemployment (in cases where real depreciation is needed) or inflation (in cases where real appreciation is needed). From this perspective, the EMS currency realignments of 1992–93 served the individual interests of the member countries, if not the group's political goal of a smooth transition to monetary union.

---

who argued that dollar appreciation had helped reduce the sacrifice ratio associated with the U.S. disinflation of the early 1980s.

16. See Mundell (1968), Fleming (1962), and Obstfeld and Rogoff (1995a).

Table 1. United Kingdom: Recent Macroeconomic Developments, 1988–94

Percent (except where indicated)

Indicator	*1988*	*1989*	*1990*	*1991*	*1992*	*1993*	*1994*
Nominal effective exchange rate[a]	101.6	99.0	97.9	100	96.5	88.1	88.8
Relative unit labor cost[a]	98	100	97	100	97	86	88
Short-term interest rate	10.3	13.9	14.8	11.5	9.6	5.9	5.4
Real GDP growth	5.0	2.2	0.4	−2.0	−0.5	2.0	3.5
Unemployment rate	7.8	6.1	5.9	8.2	9.9	10.2	9.4
Current account/GDP	−3.5	−4.4	−3.4	−1.3	−1.8	−1.7	−0.9
Gross investment growth	13.9	6.0	−3.5	−9.5	−1.2	0.3	4.5
Consumer-price inflation	4.9	7.8	9.5	5.9	3.7	1.6	2.0

Source: OECD (1994). 1994 figures are estimates or projections.
a. Trade-weighted index, 1991 = 100.

Despite the high short-run correlation between nominal and real exchange rate changes, there is increasing evidence that shocks to real exchange rates, on average, decay over time. This may explain the finding that, over the recent float as a whole, PPP is a good guide to the cross-sectional evolution of exchange rates. Jeffrey Frankel and Andrew Rose, for example, analyze a post-1973 panel of annual data from 150 countries and conclude that the average half-life of deviations from PPP (once time trends in real exchange rates are removed) is around four years.[17]

The Volatility of Floating Exchange Rates

The pre-1973 advocates of floating rates seriously underestimated their volatility. Most of them believed that stabilizing speculation would ensure the smooth and gradual adjustment of exchange rates to economic shocks, and discounted Nurkse's grave charge against interwar floating rates, that they often were driven by self-fulfilling expectations rather than by equilibrating capital flows. Thus Johnson wrote:

> A freely flexible exchange rate would tend to remain constant so long as underlying economic conditions (including governmental policies) remained constant; random deviations from the equilibrium level would be limited by the activities of private speculators, who would step in to buy foreign exchange when its price fell (the currency appreciated in terms of currencies) and to sell it when its price rose (the currency depreciated in terms of foreign currencies).
>
> On the other hand, if economic changes or policy changes occurred that under a fixed exchange rate would produce a balance-of-payments surplus or deficit, and, ultimately a need for policy changes, the flexible exchange rate would gradually either appreciate or depreciate as required to preserve equilibrium. The movement of the rate would be facilitated and smoothed by the actions of private speculators, on the basis of their reading of current and prospective economic and policy developments.[18]

One of the most important realizations after the onset of floating has been that an exchange rate is the relative price of two assets (national monies) and that, in an environment of international capital mobility, it

17. See Frankel and Rose (1995a), whose panel estimates of the PPP relationship after 1973 are similar to the pure cross-sectional estimates reported above. Wei and Parsley (1995) estimate a similar half-life based on a panel of post-1973 data from twelve tradable sectors in fourteen OECD countries.

18. Johnson (1970, p. 99).

is determined by the same principles that govern the prices of other assets, such as stocks, storable commodities, and long-term bonds.[19] Exchange rates therefore depend on potentially volatile expectations about the future as well as on current economic conditions. They respond immediately and possibly sharply to actual or rumored news about the *fundamentals*—money supplies, output levels, current accounts, fiscal deficits, and so on—determining currency values. Thus, the jagged floating exchange rate changes in figures 3–6, qualitatively at least, are to be expected.

Indeed, theorists of the mid-1970s were able to explain how exchange rates might be more volatile than fundamentals, even in a world of efficient, rational speculators. The *overshooting theory* associated with Dornbusch linked volatility to the rapid adjustment of exchange rates when output prices are sticky: assuming parity in the expected nominal returns on bonds denominated in different currencies, if domestic monetary expansion lowers the interest rate at home, the home currency must depreciate beyond its eventual level to create the expectation of appreciation that interest parity requires.[20] A second explanation, due to Mussa, was based on the *magnification effect*.[21] Johnson's contention that rational speculators smooth the path of the exchange rate is correct when the exchange rate is a discounted average of expected fundamentals that are *statistically stationary* random variables. In that case, exchange rate innovations are less variable than innovations in the fundamentals because the exchange rate change is a weighted average of effects that decay over time. But if the fundamentals contain unit roots, exchange rate innovations rationally may be as variable or more variable than innovations in the fundamentals.[22] On either theory, high volatility, per se, need not be evidence of irrational speculation.

19. The asset-price view of exchange rates is reviewed by Dornbusch and Krugman (1976). Seminal papers taking this approach include Black (1973) and several of the contributions in the landmark issue of the *Scandinavian Journal of Economics* (Herin, Lindbeck, and Myhrman, 1976). McKinnon's (1969) and Branson's (1970) earlier work on the stock-equilibrium approach to international capital flows helped set the stage for the asset approach to exchange rates.

20. Dornbusch (1976).

21. See Mussa (1976). Meese and Singleton (1983) formalize the magnification effect.

22. Exactly this reasoning underlies the Deaton paradox in tests of the permanent income hypothesis of consumption. More generally, Hart and Kreps (1986) show that rational speculation need not stabilize prices (even when it raises economic efficiency). As they

These sanguine rationalizations of volatility were undermined by the growing realization that many short-run exchange rate shifts were not easily explicable, even after the fact, by observed changes in the supposed fundamentals underlying standard models of exchange rate determination. Perhaps constancy of the fundamentals would not guarantee constancy of exchange rates after all. The limited understanding of actual industrial-country exchange rate movements was driven home most forcefully by Richard Meese and Kenneth Rogoff.[23] They showed that standard structural exchange rate models had less forecasting power than a naive random walk model, even when their forecasts were based on actual (rather than predicted) future values of fundamental variables. The only exception to this result occurred at horizons of a year or more, where structural models sometimes outperformed the random walk. Comparisons of fixed and floating exchange rate regimes seemingly confirm this message with the conclusion that higher (real and nominal) exchange rate volatility is the *only* difference: the variabilities of standard fundamentals such as money supplies and outputs do not appear to diverge systematically across regimes.[24] I will suggest in passing below reasons to be cautious about embracing this conclusion, aside from the obvious one that the exchange rate variability rationally warranted by the variability of a fundamental series is quite sensitive to subtle parameter differences in the neighborhood of a unit root.

A major empirical problem has been to explain why forward exchange premia are consistently negatively correlated with future changes in spot rates. Models of rational risk-averse speculation typically cannot generate risk premia variable enough to explain this finding, while models assuming infrequent dramatic policy shifts (so-called peso problems) or learning go only part of the way in replicating observed relations between spot and forward rates.[25] Using survey data on exchange rate forecasts, Jeffrey Frankel and Kenneth Froot show that re-

---

aptly put it, speculators do not buy when prices are low and sell when they are high: rather, they buy when prices are expected to rise and sell when they are expected to fall. This activity may, but need not, stabilize prices.

23. See Meese and Rogoff (1983a, 1983b).

24. See, for example, Baxter and Stockman (1989) who focus on real variables, and Flood and Rose (1993) who consider nominal as well as real variables.

25. Lewis (1995) gives a comprehensive survey.

ported expectations are widely dispersed and that median forecasts are biased predictors. Although they suggest that the survey expectations are in fact stabilizing rather than destabilizing, their results, coupled with the dismal predictive performance of the forward rate, challenge the view that exchange rate movements are usually well grounded in fundamentals.[26]

These largely negative findings have had a major impact both on exchange rate research and on views toward exchange rate policy. Frankel and Rose conclude in a recent survey that "we, like much of the profession, are doubtful of the value of further time-series modeling of exchange rates at high or medium frequencies using macroeconomic models."[27] Some have drawn the policy conclusion that much of the variance of industrial-country exchange rates is unrelated to economic conditions or policy actions, and that governments therefore can limit volatility for free. Recent economic models of profitable noise trading in asset markets reinforce that view.[28]

If warranted, these conclusions suggest that not only many short-run exchange rate movements, but also some of the medium-term swings, simply are not susceptible to explanation in terms of available models. In addition to displaying inexplicable, temporary day-to-day movements, the exchange rate may become substantially "misaligned" over longer periods, as argued by John Williamson, through cumulative changes that are difficult to explain either quantitatively or qualitatively in terms of fundamentals.[29]

"Exhibit A" in the case for irrational exchange rate misalignment has long been the dollar's massive real appreciation between 1980 and 1985, which amounted to somewhere between 40 and 60 percent, depending on the measure used. (The yen's sharp real appreciation in recent years may prove to be "exhibit B.") Reasonable observers differ, however, as to whether important shifts in fundamental factors occurring at the same time (the Volcker disinflation, the Reagan fiscal expansion, and some

26. See Frankel and Froot (1987). The finding of bias, given the finite data sample, again could be related to peso-problems or learning effects.

27. Frankel and Rose (1995b).

28. However, Romer (1993) shows that asset prices may move sharply in the absence of news about fundamentals even when all traders behave rationally. Romer's model also has implications for interpreting the empirical evidence on sterilized foreign exchange intervention, which is examined below.

29. Williamson (1985).

fiscal contraction outside the United States) justified so sharp a rise. The answers range from qualified yes (for example, Branson) to categorical no (for example, Williamson), with many taking an agnostic stance.[30] Without a successful model of exchange rates, it has been difficult to resolve such disagreements.

Problems in Modeling Exchange Rates

Just as theorists of the early 1970s were somewhat surprised by the asset-price character of exchange rate movements, empirical researchers bent on estimating structural time-series exchange rate models were unexpectedly confounded, after some initial successes, by the data's failure to stick to stable statistical patterns. They might have been less surprised if they had paid greater attention to the work going on in empirical finance. Excessive volatility has been the usual verdict of attempts to rationalize movements in other assets' prices in terms of small sets of plausible fundamentals. Industrial-country exchange rates actually tend to be *less* volatile than many other asset and commodity prices, but the difficulties involved in empirical exchange rate modeling are an order of magnitude greater than those that arise in thinking about capital assets.[31] In studying stock prices, for example, dividends and interest rates are clearly among the main fundamentals, but those underlying exchange rates are more diverse and harder to quantify. Indeed, the theory most fundamental to exchange rate models, the theory of money demand, has always been one of the more problematic topics in macroeconomics, and standard formulations have become increasingly unsatisfactory as financial innovation has proceeded.

The *money supply*, for example, plays a central role in all serious models. Yet, measuring a real-world counterpart of that variable—which usually is modeled as exogenous—is far from straightforward. Consider a world in which supply and demand for a particular monetary aggregate are both functions of the nominal interest rate, upward- and downward-sloping respectively. An outward shift of the supply function (an exogenous increase in money supply) may have a large effect on the

30. See Branson (1986) and Williamson (1993). For views from around the time of the dollar's peak (the first quarter of 1985), see Frankel (1985) and Sachs (1985).

31. See Frenkel and Mussa (1980), Bergstrand (1983), and Dornbusch (1986).

interest rate, and hence on the exchange rate, with only a minimal effect on the measured monetary aggregate. An upward shift in demand will cause the monetary aggregate to rise, perhaps sharply, as the currency appreciates. Anyone who takes an endogenous monetary aggregate like M1 or M2 as the counterpart of the model's monetary fundamental is probably doomed to be unable to find a stable relationship between money and the exchange rate. For example, the U.S. monetary squeeze of the early 1980s, which promoted a sharp appreciation of the dollar, shows up strongly in interest rates, but rather weakly in broader monetary aggregates.

A relatively new literature on measuring the exogenous component of monetary policy has addressed exchange rate effects, with encouraging results. Martin Eichenbaum and Charles Evans examine exogenous components of the ratio of nonborrowed to total reserves and the federal funds rate (defined as components orthogonal to contemporaneous variables supposedly in the Federal Reserve Board's monetary policy reaction function). They also consider the Romer-Romer index of monetary policy stance. In all cases they find that expansionary monetary innovations lead to dollar depreciation in vector autoregressive (VAR) models, and that monetary shocks explain an important fraction of the variance of the dollar's foreign value.[32] Richard Clarida and Jordi Gali estimate a three-equation VAR system based on the model in my 1985 Brookings paper and identify aggregate demand shocks, monetary shocks, and supply shocks through a priori long-run restrictions. They find an even larger explanatory role for monetary shocks than do Eichenbaum and Evans (at least for the dollar-yen and dollar-DM exchange rates), and also find that monetary and demand shocks generate impulse-response functions consistent with the predictions of models in the Mundell-Fleming class.[33] Of course, the identifying assumptions underlying the VAR results are open to discussion and do have a material effect on the computed impulse responses to what is defined as a monetary shock.[34]

32. See Eichenbaum and Evans (1995). The Romer-Romer index is described in Romer and Romer (1989). Eichenbaum and Evans also find that their orthogonalized measures of U.S. monetary policy are more variable after 1973 than under the Bretton Woods system.

33. See Clarida and Gali (1994).

34. Kim and Roubini (1995) propose one more scheme for identifying exogenous shocks to money within a VAR system and find conventional effects of exogenous money

Another reason to resist premature despair is the increasing evidence, foreshadowed by some of Meese and Rogoff's original findings, that structural exchange rate models do outperform the random walk at long horizons.[35] Thus although short-run fluctuations remain mysterious, the theory is not without predictive content—a point consistent with the evidence on long-run PPP presented earlier.

Only continued research on the general-equilibrium modeling of exchange rates can help to narrow economists' basic disagreements about the causes of exchange rate movements. Exchange rates display a degree of short-term volatility that has yet to be explained, but macroeconomic exchange rate models based on standard fundamentals have proven quite helpful in understanding the broad, qualitative outlines of exchange rate movements over the medium to long term.

Costs of Exchange Rate Volatility

Whether due to poorly functioning markets or unpredictable policies, exchange rate volatility has proven costly. However, quantification and even identification of many of the costs continue to elude researchers. Pending the development of realistic general-equilibrium models in which the welfare effects of exchange rate volatility can be evaluated rigorously, most discussion of its costs remains anecdotal.

Nurkse argued that interwar exchange rate instability contributed to shrinking world trade, and much empirical analysis has followed his lead by seeking statistical estimates of any trade-reducing effects of exchange rate uncertainty. Pure time-series studies of these effects have yielded no definitive conclusions.

Cross-sectional studies do, however, point to a negative association between measures of trade and real exchange rate variability. In a study

---

supply changes on exchange rates. While Eichenbaum and Evans find a strong violation of uncovered interest parity after money shocks, in the sense that interest differentials mispredict the subsequent evolution of the exchange rate, Kim and Roubini find a pattern more consistent with interest parity. If money shocks are overwhelmingly dominant, the direct evidence showing that interest differentials usually do mispredict subsequent exchange rate movements would support the Eichenbaum-Evans identification over that of Kim and Roubini. But it is far from clear that monetary shocks have been dominant.

35. For recent analyses, see Chinn and Meese (1995) and Mark (1995).

of bilateral trade flows among ten industrial countries, Paul De Grauwe finds a significant negative association between year-to-year variability in bilateral nominal and real exchange rates and the growth of bilateral trade. These estimates control for output growth and for the existence of preferential trading relationships. Measures of short-term (month-to-month or quarter-to-quarter) volatility are not significant in De Grauwe's trade-growth equations, a finding he ascribes to the greater difficulty of hedging longer-term risks due to the possibility of persistent misalignment.[36]

Using data from a larger set of countries, Jeffrey Frankel and Shang-Jin Wei find a consistently significant but small negative effect of month-to-month real exchange rate variability on the level of trade after controlling for other determinants of trade suggested by a gravity model.[37] Barry Eichengreen and Douglas Irwin apply similar techniques to the interwar period, on which Nurkse based his analysis, reporting a negative relation between month-to-month nominal volatility and 1928 trade levels that is statistically significant but "economically unimportant compared with other factors."[38]

A problem in interpreting these studies, as De Grauwe himself emphasizes, is that there is no theoretical presumption that greater exchange rate uncertainty should reduce trade levels. The welfare effects of any observed reductions in trade levels are therefore difficult to assess—and this holds equally with respect to trade growth rates. The observation that trade and capital movements can be substitutes suggests that countries can hedge even longer-term misalignment risks by dispersing production facilities abroad. This diversification might reduce measured trade merchandise flows, which are effectively replaced by trade in factor services, without any important fall in production efficiency. Simultaneity bias may affect the cross-sectional studies. When two countries have a high level of bilateral trade, relatively small bilateral real exchange rate adjustments suffice to offset asymmetrical

36. De Grauwe (1988). De Grauwe's regressions consider trade growth over the years 1960–69 and 1973–84.

37. Frankel and Wei (1993). Gravity models explain bilateral trade flows in terms of geographical distance, measures of country size, and per capita incomes. Frankel and Wei report cross-section regressions for 1980, 1985, and 1990.

38. Eichengreen and Irwin (1995, p. 20). For the two other years Eichengreen and Irwin examine, 1935 and 1938, the association between trade and nominal volatility, while still negative, is statistically insignificant.

shocks. Thus, the observed association between trade and volatility could reflect the effect of trade on volatility, not the effect of volatility on trade.[39]

De Grauwe attributes his finding of a negative association between trade growth and exchange rate volatility to a tendency for misaligned exchange rates to induce a protectionist trade response. Writing in the early 1980s, C. Fred Bergsten enunciated the view that real exchange rate movements drive protectionism.[40] The U.S. Omnibus Trade and Competitiveness Act of 1988, which originated in the fallout of the dollar's 1980–85 real appreciation, illustrates the general point. Edward Leamer, analyzing 1978 output data on nineteen industries in fifteen industrial countries, observes that the cross-sectional correlation of tariffs and output tends to be negative, conditional on other output determinants. He attributes this to a positive effect of imports on the demand for protection. Daniel Trefler shows that for a 1983 cross-section of U.S. manufacturing industries, the fraction of imports subject to nontariff barriers is positively related to a measure of import penetration.[41] To the extent that increases in imports are associated with real appreciations, this evidence supports Bergsten's thesis. It has puzzled some that protectionist lobbying by importers is not discouraged by the exchange rate's tendency under a float to appreciate when across-the-board protection is granted. But the appreciation reflects a congestion externality that individual importers ignore. In contrast, each export industry has an incentive to free ride on other exporters' lobbying efforts for free trade.

Nonetheless, despite the pressures for protection associated with dramatic medium-term exchange rate oscillations, the GATT process of multilateral trade liberalization has continued over the floating rate era, drawing in progressively more countries and categories of trade.

Yet another concern is that even a transitory currency depreciation might feed quickly into wages and prices with effects persistent enough to induce later monetary accommodation by policy authorities. For this

39. Frankel and Wei (1993) and Eichengreen and Irwin (1995) attempt to correct for simultaneity bias. Exchange rate volatility could have adverse economic effects by depressing investment. For alternative theoretical and empirical approaches, see Campa and Goldberg (1995) and Huizinga (1994), who find significant but economically small effects.

40. See Bergsten (1982). Dornbusch and Frankel (1987) offer a comprehensive and balanced, if somewhat dated, evaluation.

41. See Leamer (1988) and Trefler (1993).

mechanism to impart a definite inflationary bias to policy, wages and prices must exhibit greater inflexibility with respect to downward than upward movements. Attempts to detect such a ratchet effect of volatility on mean inflation have generally failed.[42]

Taken together, the evidence points to very small costs from short-term, transitory exchange rate changes, perhaps thanks to the ready availability of financial hedging instruments. The costs of longer-term misalignments seem much more substantial. The effects are least severe, in principle, for owners of physical capital, who have the opportunity to diversify their capital holdings internationally and otherwise hedge against unexpected exchange rate shocks. The effects are very severe for owners of sector-specific human capital, who cannot trade their future wage income on forward markets, and face job loss as a result of sharp protracted shifts in their employers' international competitiveness. Partial hedges are conceivable—a Detroit auto worker could maintain a position in yen put options to soften the blow of a layoff if the dollar were to appreciate unexpectedly—but few have enough wealth, or can borrow enough, to insure much of their human capital in that way. The adverse impact of sustained high-amplitude swings in real exchange rates on liquidity-constrained owners of human capital has not received sufficient empirical attention.[43]

The External Constraint under Floating Rates

A major advantage claimed for floating rates as the Bretton Woods system neared its end was that they would ease the external constraints of deficit countries. This they have done, but in part through unexpected channels.

42. See Goldstein (1984, pp. 16–17) for a review.

43. McKinnon (1988) has emphasized how volatility costs associated with incomplete asset markets impinge on international trade and investment decisions. The point here is that the effects on workers are likely to be even more significant. The incompleteness of asset markets, however, also provides one of the most important arguments *in favor* of exchange rate flexibility. When the exchange rate is fixed, a fall in demand for a country's exports causes unemployment concentrated in the export sector. A currency depreciation can be viewed as a domestic insurance mechanism that spreads the shock's effect across the entire population. What would otherwise be a localized shock borne primarily by unemployed factors in the export sector is converted into a terms-of-trade deterioration that hurts everyone, but much less severely.

Under Bretton Woods, a country's main international obligation was to defend its currency's parity against the dollar; to comply, governments initially needed to hold sufficient stocks of gold reserves or foreign currencies convertible into dollars. Balance-of-payments deficits—positive totals of the current account deficit and of the net nonofficial capital account deficit—depleted foreign reserves, threatening the sustainability of a parity, and therefore necessitated defensive policies such as higher interest rates, spending cuts, and direct payments controls. Advocates of floating rates argued that they would obviate the use of official reserves for intervention purposes, allowing the governments of deficit countries to eschew controls and turn macroeconomic policies toward domestic stabilization. Freely floating exchange rates would adjust automatically to bring net capital inflows into line with the current account deficit.

As international and domestic capital markets grew in depth and sophistication during the 1960s, the balance-of-payments definition of external balance became increasingly outmoded. Even without large international reserve holdings, it became increasingly feasible for governments to defend a parity through sales of domestic rather than foreign securities. With high capital mobility, a sale of domestic securities attracts a private capital inflow by placing upward pressure on domestic interest rates, and thereby raises official reserves. Equivalently, higher capital mobility brings increasing opportunities for governments to borrow foreign currencies in world capital markets.

In the years since the end of Bretton Woods, many governments have dismantled their national controls over international capital movements. For some countries, such as the United States and Germany, the shift to floating facilitated liberalization. Most industrial countries and a growing number of developing countries participate in an integrated world capital market within which interest-rate arbitrage is highly efficient.[44] As a result, the *technical* constraint on defending a fixed exchange rate is the government's overall solvency constraint (at world interest rates), rather than the more stringent constraint that it hold positive foreign reserves.[45] Provided there are sufficient fiscal resources

44. See the evidence presented by Marston (1993).

45. The argument is elaborated in Obstfeld (1993). It implies that the interwar and Bretton Woods eras' concern over international liquidity now is largely irrelevant as far as creditworthy governments are concerned.

to repurchase the monetary base—resources that need not take the form of foreign reserves—the government has the technical ability to maintain any desired exchange rate peg. The evolution of the Mexican crisis following the peso's initial devaluation in December 1994 illustrates this point: the government's initial difficulty in stabilizing the peso, even at sharply devalued levels, was, at bottom, a fiscal problem stemming from the fear that high interest charges for rolling over government debts would necessitate wholesale inflationary finance.

The Current Account

The expansion of international capital markets after 1973 also increased the scope for current account imbalances, that is, divergences between national saving and domestic investment rates. Many developing countries borrowed heavily throughout the 1970s, maintaining growth at the expense of rising foreign debt. The worldwide recession and high interest rates of the early 1980s brought on a sharp contraction in lending to developing countries that eased only at the start of the present decade.

Figure 7 presents some evidence on industrial-country ratios of the current account to GDP. For Canada, Italy, and Japan, it is hard to discern any change in the average absolute size or variability of imbalances after 1973. But for Germany, Sweden, the United Kingdom, the United States and, less markedly, for France, the amplitude of current account fluctuations seems to rise during the floating rate era. Here is one exchange rate fundamental whose behavior does change with the advent of floating. More broadly, the rise in international capital mobility after Bretton Woods is an objective change that one would expect to raise both current-account and exchange rate volatility, given other fundamentals.

There remains controversy about the precise mechanisms generating current account imbalances among industrial countries during the floating-rate era. An important strand of theoretical work starting in the 1970s, the *intertemporal approach* to the current account, models the saving-investment balance as the outcome of forward-looking optimal decisions by households and firms. While separate empirical work on consumption and investment behavior calls into question the simple constructs underlying rudimentary versions of the intertemporal ap-

proach, even these models have surprising explanatory power for several countries. Serious empirical work on the subject is still at a comparatively early stage, however, and the empirical intertemporal models that have been tested so far will need extensive elaboration before they can be helpful for policy analysis.[46]

A key virtue of the intertemporal approach is that it sheds new light on the functions of current account imbalances. Just as countries gain in the aggregate from *intra*temporal trade (a fact that leads almost all economists to oppose trade restrictions), they also can gain in the aggregate from *inter*temporal trade, the trade of consumption over time through international lending and borrowing. In principle, there is no more reason for governments to seek small current account imbalances than to seek low levels of gross imports when trade is balanced.

That governments have often sought to limit gross imports through protection is one clue as to why large current account imbalances can be politically problematic, and especially so under floating rates: they are often associated with steep swings in real exchange rates that create angry, sometimes well-organized, losers. Along with current account ratios, figure 7 shows real effective exchange rate indexes from 1964, based on ratios of unit labor costs.

From an economic perspective, the most salient difficulty for standard models of intertemporal trade is the mechanism enforcing repayment today for resources that were lent yesterday.[47] But there are other real-world problems; for example, the way in which differential taxation drives a wedge between the private and national returns to foreign investment or borrowing. Thus policy cannot, and markets do not, take it for granted that large current account imbalances are efficient or even sustainable. The developing-country debt crisis shows that simple theoretical models of sustainable current account deficits can be quite misleading as to the size of deficit that foreign market lenders will happily finance.[48]

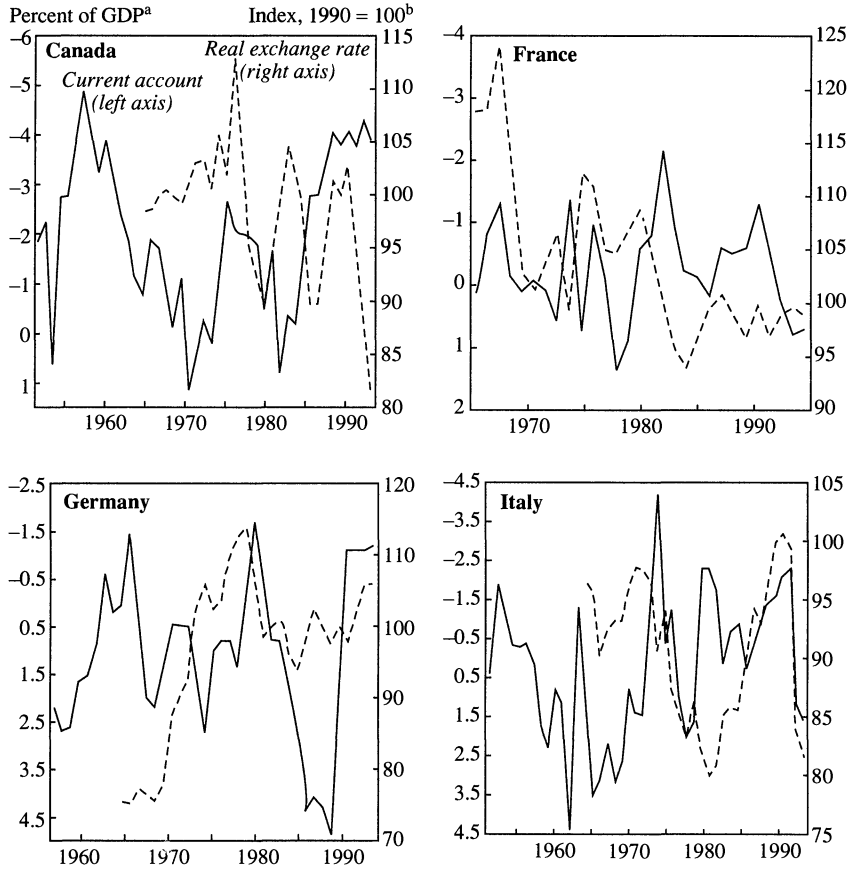
So far, current theories, whether intertemporally optimizing or of the Mundell-Fleming variety, have led to an imperfect understanding of

46. For a survey, see Obstfeld and Rogoff (1995b). Sachs (1981) made an early attempt to apply the intertemporal approach empirically.

47. See Bulow and Rogoff (1988) for a theoretical discussion linked to the developing-country debt crisis of the 1980s.

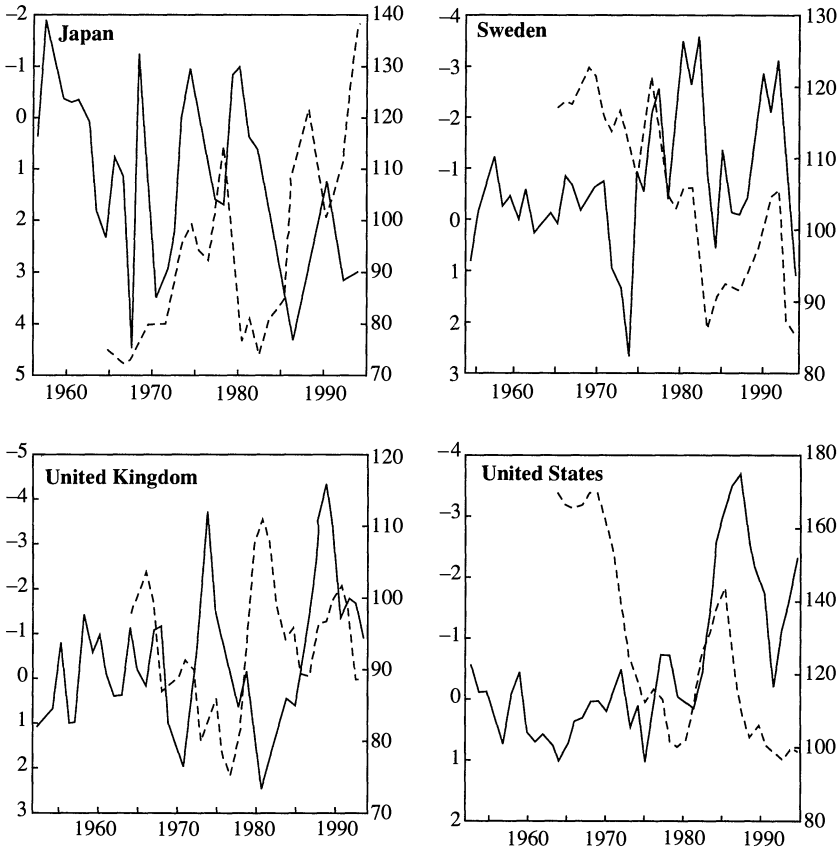
48. See, for example, Solomon (1977) and Sachs (1981).

Figure 7. Current Account Balances and Real Exchange Rates



how current account and real exchange rate movements are related. Krugman has argued that for the 1980–90 period a simple, stable trade equation in which a country's current account surplus depends negatively on its real exchange rate and negatively on its relative income (perhaps with lags of up to two years) is fully consistent with Japanese and U.S. experience. This conclusion leads him to the implications that real currency depreciation, other things the same, eventually improves

Figure 7. (*continued*)



Source: Real exchange rates from *International Financial Statistics* (series *rulc*). Current account/GDP ratios from OECD, *Economic Outlook*, for 1972–94. Prior to 1972, current account/GDP ratios are based on dollar current accounts, exchange rates, and local currency GDP as reported in *International Financial Statistics*.

a. Current account ratios prior to 1972 are based on dollar current accounts converted to local currency at year average exchange rates. A rise in a currency's real effective exchange rate is a real appreciation of the currency against foreign currencies.

b. Real effective exchange rates, 1964–94, are based on normalized unit labor costs.

the current account, and that real depreciation is a needed component of the adjustment to a current account deficit.[49]

In figure 7 a fairly consistent positive relation between the real exchange rate and the current account deficit shows up after 1973 for Sweden and, arguably, also for Germany and France. But for Canada, Italy,

49. Krugman (1991).

and the United Kingdom, more complex forces seem to be at work. High international capital mobility and the variety of possible economic shocks give no reason, in principle, to expect any particular correlation between a country's current account and its real exchange rate. The correlation in the data is an amalgam of the effects of diverse shocks over the sample period. A real depreciation driven by domestic monetary expansion, for example, may improve the current account balance; while a real depreciation driven by a fall in world demand for a country's goods lowers the current account balance. The difficulty in identifying specific economic shocks econometrically bedevils any attempt to understand the correlations in figure 7. A sensible first step would be to develop identified VAR methodologies such as those that have been applied to exchange rates.

Figure 7 also illustrates how long-run structural changes complicate the relationship between the exchange rate and the current account. The dollar real exchange rate that was roughly consistent with a balanced U.S. current account over 1964–70 was substantially higher than the real exchange rates that accompanied the record deficits of the 1980s.

In the early 1990s the U.S. current account deteriorated sharply with no substantial real appreciation, although this may have been the result of an internationally desynchronized business cycle. It remains to be seen how quickly the over 40 percent real appreciation of the yen since 1990 will ultimately help trim Japan's large surplus, which so far has increased.

Policy Effects of the Exchange Rate Regime

The Bretton Woods framework created a comprehensive international monetary system based on explicit exchange rate rules and a well-defined nominal anchor. Its polycentric and less structured successor arrangements have allowed governments greater freedom to pursue perceived national interests, but have also removed any discipline over policies that membership in a global exchange rate system conferred. Over the past twenty-five years, many countries have sought to rein in undisciplined monetary or fiscal policies through multilateral or unilateral schemes of pegged exchange rates. They have not met with noticeably greater success than countries with more flexible currency arrange-

Table 2. Inflation in Industrial and Developing Countries since the 1960s[a]
Percent

Countries	*1963–72*	*1973–82*	*1983–90*	*1991–94*
Industrial	3.9	9.4	4.1	3.3
Developing	9.1[b]	29.4	53.1	50.3

Source: For industrial countries, 1963–72, and non-fuel-exporting developing countries, 1968–72, data come from *World Economic Outlook*, May 1983, tables 7 and 3, respectively. For 1973–82, data are from *World Economic Outlook*, May 1991, table A8. Data after 1982 are author's calculations based on *World Economic Outlook*, May 1991 and October 1994, table A8. Figures used for 1994 are IMF projections.

a. Average annual consumer-price inflation rate.

b. Inflation rate is for 1968–72 only.

ments. A recent barrage of currency crises, unprecedented in scope since the early 1970s, has called into question the feasibility of fixed or even semifixed exchange rates among sovereign nations with open capital markets.

Inflation and Monetary Accommodation in Industrial Countries

The advent of floating exchange rates was accompanied by an acceleration in worldwide inflation. Table 2 summarizes world inflation experience in industrial and (non-fuel-exporting) developing countries since the 1960s. In the industrial countries, inflation had moderated by the mid-1980s. Inflationary pressures in the developing world, however, intensified dramatically through the 1980s, largely in response to fiscal pressures created by the international debt crisis. Only recently have reform efforts, supported by Brady Plan debt-reduction deals, enabled a number of heavily indebted developing countries to lower inflation from very high levels.

There remains debate about the nature and range of the impulses that spawned the inflation of the 1970s, but few doubt that monetary accommodation played a role, at least by allowing those impulses to propagate.[50] The monetary policy autonomy conferred by more flexible exchange rates gave governments latitude to accommodate inflationary market pressures that otherwise might have raised unemployment more than they did. But the propensity to accommodate, once it is understood by price setters, can trap a government in a vicious circle of inflation. Finn Kydland and Edward Prescott, followed by Robert Barro and David Gordon, have provided influential formalizations of the idea that

50. Gordon (1977) evaluates alternative inflation mechanisms.

greater freedom to gear monetary policy toward a high employment target can result in an equilibrium monetary response that causes higher mean inflation with no gain in mean employment.[51]

Figure 8 shows annual rates of CPI inflation for 1950–94 for the G-7 countries plus Australia and New Zealand. After the early 1950s inflation settled at relatively low levels outside of France, which undertook a major stabilization-cum-currency reform at the end of that decade. It was already creeping upward by the early 1970s, and jumped sharply when both supply shocks and floating exchange rates hit. Through the early 1980s inflation remained significantly higher than during the Bretton Woods years, except in Germany (where it had risen only moderately in 1973–74) and Japan. From that time on, France, Italy, the United Kingdom, and the United States progressively reduced inflation toward the levels prevailing in Germany and Japan.

What did the exchange rate regime have to do with all of this? Clearly the divergent inflation experience of the 1973–82 period would not have been possible under fixed exchange rates. Floating rates, in contrast, freed countries to try to mitigate some economic problems, including the first oil shock and high real wages, through expansive monetary action. Policies to maintain employment, and the expectations that they created, propagated the initial effects of the inflationary pressures of the early 1970s in the countries that pursued them most energetically.

The ERM, which began operation in 1979, has been interpreted as a mechanism for "importing" anti-inflation discipline from Germany through a fixed exchange rate.[52] During its early years member currencies were frequently realigned, but not always by enough to offset inflation differentials with Germany. In several countries, notably France and Italy, unemployment remained stubbornly high even after the recession of the early 1980s had passed. After January 1987, realignments ceased for nearly six years as ERM members liberalized capital accounts and European Community (EC) initiatives toward the long-standing goal of economic and monetary unification accelerated. During this period Italy experienced considerable real currency appreciation, as did Portugal and Spain after pegging to the ecu.

51. See Kydland and Prescott (1977) and Barro and Gordon (1983).

52. See Giavazzi and Pagano (1988) for an influential exposition. This interpretation of the ERM can be rationalized by Rogoff's (1985) observation that delegation of monetary policy to a conservative central banker can improve macro performance.

Figure 8. Inflation Rates, 1950–94[a]

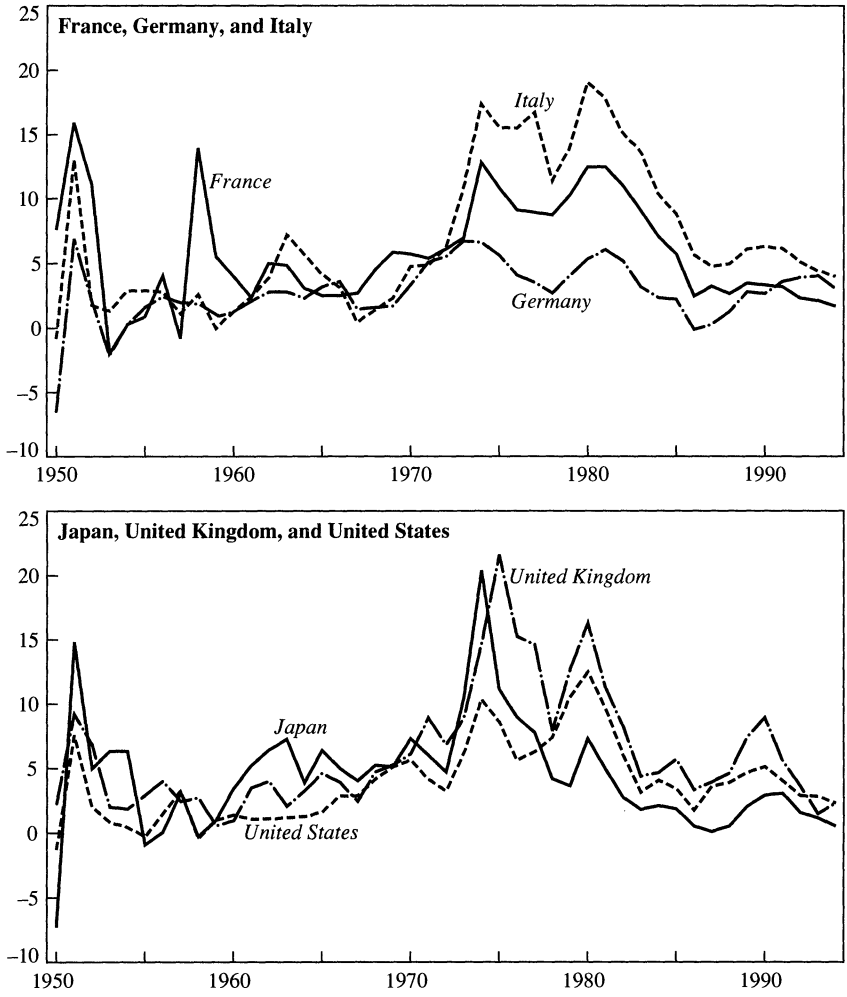
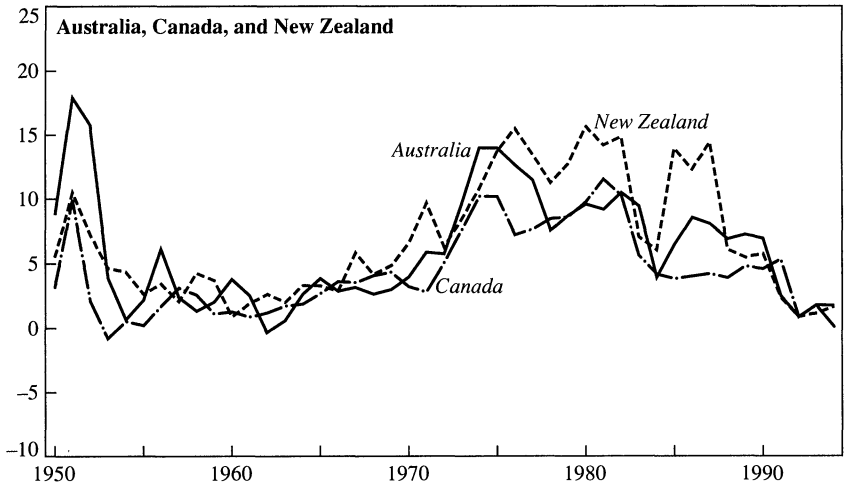


Figure 8. *(continued)*

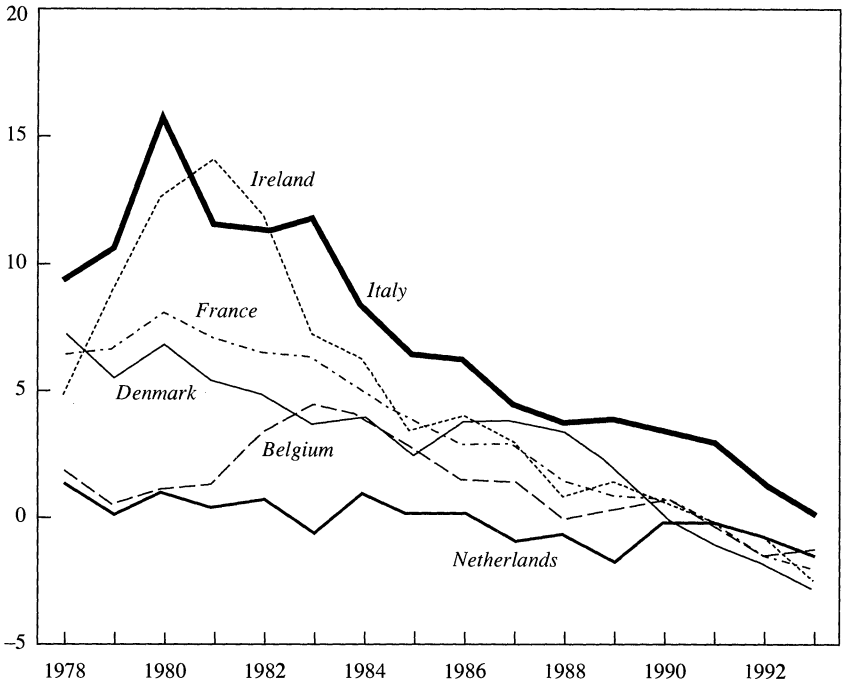


Source: CPI data from *International Financial Statistics*.
a. Annual CPI inflation rates, computed as one hundred times the difference between the natural logarithms of the current and lagged consumer price indexes.

Figure 9 shows how inflation differences vis-à-vis Germany eventually converged toward zero, despite their wide dispersion at the start of the ERM.[53] There is no doubt that EMS membership helped strengthen domestic constituencies for low inflation. A key mobilizing factor was the EC's increasingly ambitious push toward economic and monetary union. The EMS also fostered domestic institutional changes conducive to lower inflation. For example, during the 1980s and 1990s moves to make the central banks of Italy and France more independent of economic policy ministries were encouraged by a perceived need for convergence in institutions and performance prior to monetary union. But the speculative crises that hit the EMS in 1992 and 1993 also showed that there are always circumstances in which sovereign governments will refuse to subordinate their actions to the most solemn of international economic agreements.

53. The original ERM members of 1979, other than Belgium's currency-union partner, Luxembourg, are shown. Inflation also fell after ERM entry in Spain (June 1989), the United Kingdom (October 1990), and Portugal (April 1992).

Figure 9. Inflation Convergence in the EMS, 1978–93[a]



Source: OECD, *Main Economic Indicators* and *Economic Outlook*.
a. Difference between national and German CPI inflation rates.

Figure 8 suggests that fixed exchange rates have not been prerequisites for disinflation elsewhere in the world. Japan and the United States both reduced inflation through the 1980s and 1990s without the help of exchange rate commitments. So did the United Kingdom, although it appeared to be backsliding in the years preceding its October 1990 entry into the ERM. Australia, Canada, and New Zealand, shown in the last panel of figure 8, have all attained inflation rates dramatically below those of the 1970s and early 1980s.

The record after 1970 thus shows, as Friedman and Johnson argued, that low inflation can be attained under floating exchange rates, given the political will.

The Exchange Rate and Inflation Persistence

In economies with sluggishly adjusting prices, the greater freedom for monetary policy that flexible exchange rates confer can result in a more *persistent* rate of inflation. Under a fixed exchange rate, monetary policy must be geared toward the exchange rate's defense, rather than employment stabilization. But it can be used freely when exchange rates can change. If price setters expect authorities to accommodate price shocks that would reduce competitiveness and raise unemployment, those shocks will tend to be propagated through time. This may result in greater inflation persistence.

This point was emphasized by Dornbusch in a model based on John Taylor's staggered wage-contract model, and has recently been tested by George Alogoskoufis and Ron Smith, who present evidence spanning more than a century of U.K. and U.S. history.[54] Alogoskoufis and Smith show that the degree of lagged inflation incorporated in wage settlements (given unemployment) rises sharply both with the end of the classical gold standard in 1914, and with the demise of the Bretton Woods system. There are parallel shifts in the persistence of inflation.[55]

In a separate paper Alogoskoufis presents related results using OECD data from the post–World War II period starting in 1952.[56] He finds a tendency for the persistence of average OECD inflation, as well as of national deviations from the OECD average, to rise after 1971. He argues that the nominal anchor of the Bretton Woods system, the $35 per ounce gold price that the United States was supposed to maintain, provided a global brake on accommodative monetary policies before the 1970s. In turn, Bretton Woods exchange rate commitments limited the extent to which countries could allow monetary policies to diverge.

54. See Dornbusch (1982), Taylor (1980), and Alogoskoufis and Smith (1991). Agénor and Taylor (1992) and Edwards (1992) apply related models to evaluate the credibility of some stabilization programs in developing countries in the 1980s.

55. As the model that follows makes clear, changes in inflation persistence after World War I could plausibly be attributed to a fall in the frequency of price adjustment. There is a large empirical literature on the evolution of price inflexibility in the United States, but there is no consensus that prices were more flexible before World War I than after World War II. In Obstfeld (1993), I discuss some international evidence. Many writers argue that the price level was statistically stationary under the gold standard, but the data are somewhat ambiguous. Cooper (1982) discusses U.S. price-level movements under the gold standard.

56. Alogoskoufis (1992).

A simplified, small-country version of Alogoskoufis's model, likewise based on Guillermo Calvo's formulation of staggered price setting, motivates a search for changes in the persistence of OECD country inflation rates across exchange rate regimes.[57] This model will prove useful later as a vehicle for illustrating interactions among expectations, the real exchange rate, and output.

With lower-case letters denoting the natural logarithms of variables denoted by upper-case letters, let the demand for nominal domestic money-balances, m, be

$$m_t = \mu p_t + (1 - \mu)(e_t + p_t^*) + y_t, \tag{4}$$

where p is the domestic GDP deflator, e is the domestic currency price of foreign currency, p^* is the foreign GDP deflator, y is home output (expressed as a deviation from trend), μ is the weight of domestically produced goods in the CPI, and foreign prices are exogenous. World aggregate demand for domestic output is a function of domestic competitiveness and a demand shifter, u:

$$y_t = \delta(e_t + p_t^* - p_t) + u_t. \tag{5}$$

Above, $\delta > 0$ is the elasticity of world demand for domestic output with respect to the relative price of foreign and domestic goods. The higher is δ, the greater is the responsiveness of demand to a real exchange rate change.

The aggregate price level is a geometric average of the previous period's price level and newly posted prices, denoted by x, with the parameter θ measuring both the (exogenous, constant) probability that a price is *not* revised, and the proportion of old prices that continue in effect:

$$p_t = \theta p_{t-1} + (1 - \theta)x_t. \tag{6}$$

In general, parameter θ, which reflects the contracting "technology," will respond to inflation conditions, but I do not model its determination here. The lower is θ, the less the persistence in the price level, other things the same.

Newly posted prices are a distributed lead on expected future CPIs and aggregate demand, with expectations for different future dates dis-

57. See Calvo (1983).

counted by the probability that a price newly posted today will "survive" until then:

$$(7)\quad x_t = (1 - \theta) \sum_{i=0}^{\infty} \theta^i E_{t-1}[\mu p_{t+i} + (1 - \mu)(e_{t+i} + p^*_{t+i}) + \phi y_{t+i}].$$

In equation 7, ϕ measures the response of new prices to expectations about future demand conditions. Notice that x_t (and hence p_t) is a function of date $(t - 1)$ information only, although this is not essential for the model. Closing the model is the monetary policy rule, according to which monetary growth follows a fixed trend, γ (perhaps the result of a desire to bring unemployment below its natural rate), and accommodates a fraction, α, of market price pressures:

$$(8)\quad \Delta m_t = \gamma + \alpha \Delta p_t.$$

More general reaction functions could be analyzed, but equation 8 allows me to make the main point about the connection between monetary accommodation and inflation persistence.

Assume that the demand shock, u, follows the random walk, $u_t = u_{t-1} + \epsilon_t$. Then in equilibrium (as appendix A shows), GDP inflation follows the autoregressive process

$$\Delta p_t = (1 - \lambda)\pi + \lambda \Delta p_{t-1} + \psi \epsilon_{t-1},$$

where λ and ψ are constants defined in the appendix, and the steady-state equilibrium inflation rate, π, is increasing in the accommodation coefficient, α, that appears in equation 8:

$$\pi = \frac{\gamma}{1 - \alpha}.$$

The key point of the exercise is that λ, the inflation persistence parameter, also is increasing in α. Thus if fixed exchange rates constrain monetary policy, we might expect the persistence in Δp to be lower under a fixed rate than when exchange rates can be changed routinely. From the dynamic equation for Δp given above follows the process for the general price level, $cpi = \mu p + (1 - \mu)(e + p^*)$. The price level follows an ARIMA(1,1,1) process

$$(9)\quad \Delta cpi_t = (1 - \lambda)\pi + \lambda \Delta cpi_{t-1} + \psi_1 \epsilon_t + \psi_2 \epsilon_{t-1},$$

as appendix A shows. It is obviously critical that $\lambda < 1$ (which requires $\alpha < 1$), if inflation is to be finite.[58]

Table 3 reports the first five lagged autocorrelations of CPI inflation for twelve industrial countries. Based on annual data for the postwar period, it allows a comparison of inflation persistence during *fixed* and *floating* periods, where the float is defined to begin in 1971 for Canada (notwithstanding its earlier float), and in 1973 for the other countries. The fixed period begins in 1953 for all countries.[59]

The data show an estimated rise in inflation persistence under floating rates for all countries except the United States, in the sense that the inflation autocorrelations tend to be higher at lag 1 and to decline more slowly with lag length than under the Bretton Woods regime. In the case of the United States, there is little contrast between the two periods. For most other countries, the difference between fixed- and floating-rate estimates is not statistically significant by standard criteria (the approximate standard error of a lagged autocorrelation is $1/\sqrt{N}$, where N is the number of observations used in forming the estimate). But despite the small sample size, the near universality of the change in the lagged autocorrelation profile is impressive.

The United States' role as the Bretton Woods reserve center allowed it considerable freedom in domestic policy. Thus, the uniformity in inflation persistence across time is not surprising for the United States. For the rest, the change between periods is least noticeable in the cases of Canada and the United Kingdom. These countries were also distinctive, however. Canada's float up to 1962 had provided monetary freedom comparable to that which it enjoyed from the early 1970s. And the United Kingdom's status as the issuer of an important secondary reserve currency may have afforded it greater scope for monetary independence than other countries enjoyed.

58. A key assumption to recall at this point is that θ, which measures the sluggishness of price adjustment, does not depend on the degree of accommodation. In reality, as inflation becomes very high, multiperiod nominal contracting tends to disappear, reducing θ.

59. Initial attempts to estimate equation 9 directly produced some evidence of model misspecification. Rather than modifying the model, whose purpose is mainly illustrative, I chose to present in table 3 the raw sample statistics most relevant for judging inflation persistence. I am grateful to Christopher Sims for reinforcing my misgivings about the model-based inflation persistence estimates, which I reported in the initial draft of this paper.

Table 3. Inflation Persistence during Fixed and Floating Exchange Rate Periods

Correlation coefficients

Country	*Exchange rate regime*[a]	*Inflation autocorrelations by years lagged*[b]				
		1	*2*	*3*	*4*	*5*
Australia	Fixed	0.30	−0.23	0.01	0.23	0.12
	Floating	0.69	0.34	0.17	0.10	0.11
Austria	Fixed	0.01	0.32	−0.01	0.04	0.13
	Floating	0.75	0.44	0.23	0.13	0.06
Belgium	Fixed	0.56	0.39	0.13	0.03	0.20
	Floating	0.80	0.47	0.18	0.04	0.08
Canada	Fixed	0.67	0.39	0.14	−0.08	−0.09
	Floating	0.73	0.44	0.19	0.17	0.16
France	Fixed	0.05	0.13	−0.15	0.00	−0.33
	Floating	0.85	0.67	0.50	0.36	0.27
Germany	Fixed	0.50	0.07	−0.12	−0.04	0.10
	Floating	0.76	0.42	0.10	−0.07	−0.15

Italy	Fixed	0.54	0.16	−0.34	−0.56	−0.40
	Floating	0.81	0.63	0.51	0.34	0.25
Japan	Fixed	0.48	0.18	0.19	−0.06	−0.19
	Floating	0.70	0.42	0.30	0.18	0.12
Netherlands	Fixed	0.30	0.22	0.32	−0.09	0.11
	Floating	0.85	0.60	0.38	0.26	0.19
Sweden	Fixed	0.34	−0.08	−0.33	0.09	0.29
	Floating	0.50	0.24	0.11	0.04	0.14
United Kingdom	Fixed	0.63	0.26	0.21	0.13	0.06
	Floating	0.72	0.42	0.24	0.23	0.31
United States	Fixed	0.77	0.45	0.19	0.06	−0.03
	Floating	0.73	0.36	0.15	0.08	0.15

Source: Author's calculations using data from *International Financial Statistics*, various issues.

a. The periods "fixed" and "floating" correspond generally to 1953–72 and 1973–94, respectively, although for Canada the break is after 1970, and for Australia, Austria, and Italy data end in 1993.

b. The estimated lagged inflation autocorrelations reported above are correlation coefficients between the consumer-price inflation rate, calculated as the first-difference of the natural logarithm of the CPI, and its own value lagged by the years shown. The standard error of each point estimate is approximately $1/\sqrt{N}$, where N is the number of observations used in forming the estimate.

The higher persistence of inflation after the early 1970s suggests that policymakers sought to exploit the extra monetary autonomy that floating rates conferred. Yet greater inflation persistence per se provides at best indirect evidence about monetary discipline. In a staggered contracts model, even a policymaker with no credibility problem, in the Barro-Gordon sense, may choose to accommodate some price developments to reduce unemployment. While this will raise the persistence, and possibly the variability of inflation, it need not raise the unconditional mean of the inflation rate. To put the point another way, the countercyclical policy that floating rates allow can raise the persistence of inflation without creating an inflationary bias in monetary policy. Thus table 3 shows that low- and high-inflation countries alike experienced increases in inflation persistence under floating rates.

Fiscal Discipline in Industrial Countries

The record of recent industrial-country experience provides no evidence that an exchange rate regime exerts an automatic restrictive discipline over fiscal policies. Recourse to world capital markets has given industrial-country governments substantial leeway to borrow even while participating in fixed exchange rate arrangements such as the ERM. High government debt levels or deficits have in some cases contributed to currency crises for fixed-rate countries, but prophylactic public-sector budgetary retrenchment has been rare.[60]

Table 4 shows the evolution of net public debt for fourteen OECD countries between 1978 and 1993. One of the striking developments of recent decades has been the widespread tendency of industrial countries to run up sharply higher public debts without regard to their exchange rate obligations. In only three of the countries included in table 4—Japan, Norway, and the United Kingdom—have net public debt-to-GDP ratios declined since the late 1970s. None of these was on a constraining fixed exchange rate regime for much of the period. Conversely, countries that did participate in the EMS, including Belgium, the Neth-

60. Denmark's fiscal turnaround, starting in 1983, was associated with fixing the Danish kroner–DM rate within the ERM, and phasing out exchange and capital controls, but all elements of the stabilization package were motivated by a desire to solve the public and external debt problems that had brought the country's international credit rating into question.

Table 4. Net General Government Financial Liabilities, 1978 and 1993
Percent of GDP

Country	*1978 debt*	*1993 debt*
Belgium	58.2	129.9
Canada	21.3	61.8
Denmark	−2.2	32.9
Finland	−26.6	−7.0
France	1.9	27.2
Germany	9.4	35.8
Italy	57.4	117.9
Japan	11.2	6.1
Netherlands	19.7	60.1
Norway	6.7	−14.7
Spain	3.5	42.2
Sweden	−25.3	20.2
United Kingdom	52.3	40.9
United States	21.3	39.6

Source: OECD (1994), annex table 34. Negative entries are net government assets.

erlands (which has maintained an unchanged DM parity for the guilder since 1983), and Italy, display substantially higher debt levels than in 1978. (For EMS countries, there is no pronounced tendency for general government *deficits* to decline with the increasing stringency of ERM commitments after 1987.)

This widespread trend in government deficits awaits a full explanation.[61] The increasing interdependence of world capital markets can, in principle, impose greater fiscal discipline by confronting chronic government borrowers with sharply higher interest rates. But it also may provide at least one marginal incentive for expanded borrowing. In a closed economy, an indebted government must bear the fiscal cost of any rise in the domestic real interest rate caused by a higher deficit. When the government of a financially open economy borrows, however, it does not internalize the cost to other indebted countries of a higher world real interest rate. Thus, all governments may borrow more. In this way greater financial integration can encourage tendencies toward overborrowing by individual governments, and simultaneously exacerbate

61. For discussions, see Roubini and Sachs (1989), Alesina and Perotti (1995), and Lambertini (1995). Roubini and Sachs find little evidence that the EMS has encouraged fiscal prudence; instead, countries that lost seigniorage after joining the EMS and reducing inflation appeared to recover that loss by extra borrowing.

an international coordination failure.[62] Figure 10 documents the association between the average world ratio of public debt to GDP and a measure of the world real interest rate.[63]

Exchange Rates as Nominal Anchors in Developing Countries

A notable feature of the post–Bretton Woods period has been the use of heavy exchange rate management by many developing countries in their attempts to bring down domestic inflation. The underlying idea is simple: exchange rate stabilization anchors the nominal prices of tradables, eventually pulling the inflation rate for nontradables into line with that for tradables. In practice, however, prices of nontradables have risen persistently despite exchange rate stabilization, often giving rise to sizable real appreciations that have undermined the credibility of the exchange rate commitment central to inflation stabilization. It is the countries that have taken the most pragmatic and flexible approaches to exchange rate targeting that have succeeded best in avoiding costly policy reversals.

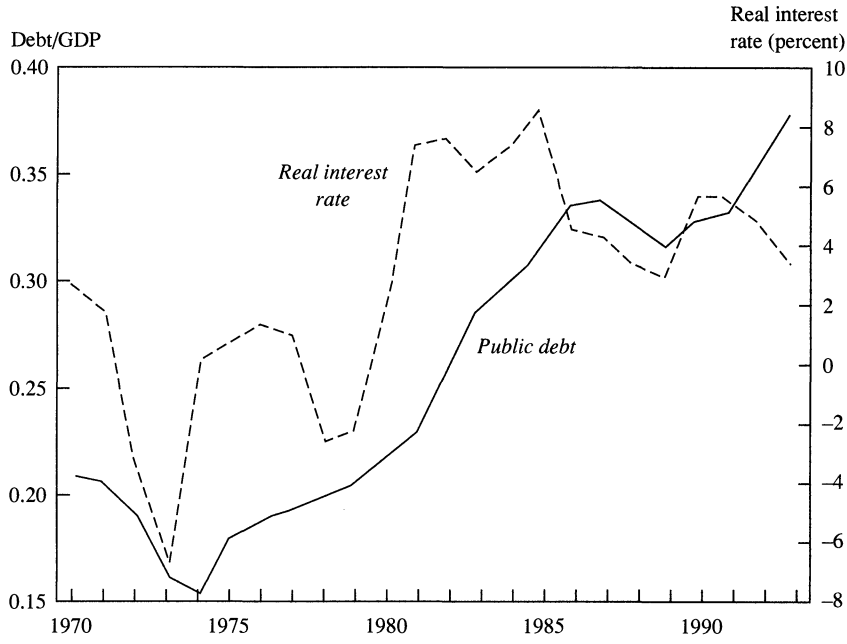
The developing countries generally did not opt for floating exchange rates after 1973. They pursued exchange rate flexibility through pegs to nondollar currencies or baskets, more frequent devaluations, or explicit crawls. Often, however, exchange rates were adjusted to accommodate domestic price-level increases and real shocks, a practice that fueled chronic inflation. Pegging was supported by extensive networks of exchange and capital controls.

In 1978, Chile (in February), Uruguay (in October), and Argentina (in December) turned to a new exchange rate strategy, the *tablita:* a preannounced schedule of declining rates of devaluation against the U.S. dollar. Rather than passively accommodating inflation, the exchange rate would actively push inflation down. The preannounced schedule, it was hoped, would help coordinate inflation expectations and reduce the de-

62. Kehoe (1987) studies a theoretical model in which uncoordinated government spending levels can be too high because of incomplete internalization of the effects on world interest rates. He shows that the degree of overspending (relative to a cooperative equilibrium) rises as countries become smaller. See Canzoneri and Diba (1991) for a model of uncoordinated government borrowing.

63. A positive influence of world debt on average world real interest rates is confirmed in econometric work by Barro (1992) and Ford and Laxton (1995). In figure 10 the simple correlation coefficient between the two series is 0.70.

Figure 10. World Public Debt and the World Real Interest Rate, 1970–93[a]



Source: Data on public debt ratios are from OECD, *Economic Outlook*. Data on GDP are from OECD, *National Accounts: Main Aggregates*. Data on long-term nominal interest rates and CPIs are from OECD, *Main Economic Indicators*.

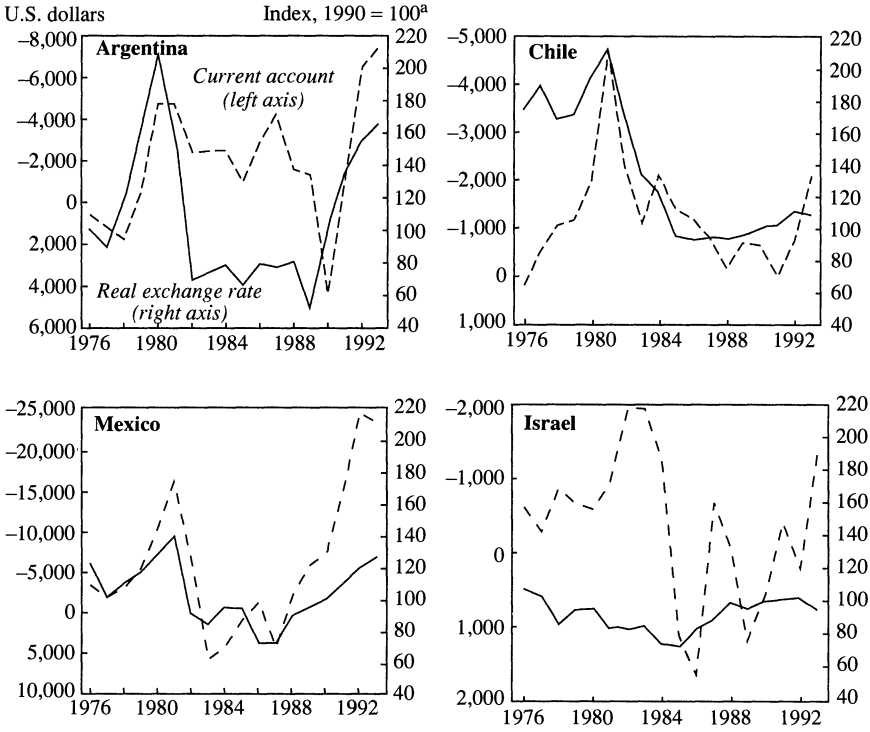
a. The world public debt ratio is a weighted average of ratios of net nominal public debt to nominal GDP for thirteen countries, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Italy, Japan, the Netherlands, Sweden, the United Kingdom, and the United States, 1970–93. National real interest rates are defined as year averages of nominal long-term interest rates less the following year's rate of consumer-price inflation. The world real interest rate is a weighted average of national rates. The country weights used in both the debt and interest rate calculations are the ratio of national GDP, in dollars, to the total dollar GDP of the thirteen countries in the sample.

valuation premium in domestic nominal interest rates. All three countries opened their capital accounts, with Chile taking the most limited measures.

Inflation did not fall into line quickly, however. In Chile, for example, inflation was still running at 2.5 percent per month when the country fixed its exchange rate against the dollar in June 1979.[64] The result was significant real currency appreciation that soon translated into large deficits on current account. Figure 11 shows the current account and real exchange rate of domestic currency against the dollar for Argentina and Chile during the *tablita* experiments. Over the course of 1981–82,

64. Corbo and Solimano (1991, p. 62).

Figure 11. Current Accounts and Real Exchange Rates, 1976–93



Source: *International Financial Statistics*.

a. The real exchange rate, normalized so that 1990 = 100, is the ratio of the country's CPI to the U.S. CPI converted into local currency at the market exchange rate. A rise in the real exchange rate, so defined, is a real appreciation of the domestic currency against the U.S. dollar.

with interest rates at historic highs in the developed world and the dollar appreciating in the foreign exchange market, the high real exchange rates in Latin America's "Southern Cone" became impossible to sustain. All three programs collapsed in the midst of foreign exchange and banking crises.[65]

At least three explanations, not mutually exclusive, have been advanced for these dramatic real appreciations.[66] The first is an equilib-

65. See Díaz-Alejandro (1984) for a survey of the experience of these and other Latin American countries prior to the 1982 debt crisis. Bruno (1993) provides a valuable comparative discussion of that experience and subsequent developments.

66. For alternative discussions of these mechanisms, see Dornbusch and Werner (1994) who focus on Mexico, and Giovannini (1990) who focuses on the EMS. There are also explanations based on adaptive expectations or learning, which I do not discuss.

rium explanation: capital inflows associated with capital-account liberalization, along with productivity gains due to accompanying microeconomic and trade reforms, necessitate a rise in the real exchange rate.

The second explanation is based on the role of backward-looking indexation mechanisms inherited from the high-inflation era. For example, replacing the exclusively forward-looking contracting equation 7 by

$$\begin{aligned} x_t &= \omega(x_{t-1} + p_{t-1} - p_{t-2}) \\ &\quad + (1 - \omega)(1 - \theta) \sum_{i=0}^{\infty} \theta^i E_{t-1}[\mu p_{t+i} \\ &\quad + (1 - \mu)(e_{t+i} + p^*_{t+i}) + \phi y_{t+i}] \end{aligned} \tag{10}$$

leads to an economy in which past inflation is automatically embodied in new prices in proportion to the parameter ω, regardless of how sharply or credibly current and past policies differ. The appendix presents the solution of a pegged exchange rate model consisting of equations 4–6 and a simplified version of (10), which substitutes for (7). (A pegged rate model drops the money growth rule (8) and instead allows equation 4 to determine the money supply endogenously.) Figure 12 shows the staggering initial real appreciation and output decline that result when inflation is suddenly, permanently, and credibly reduced from 100 to 0 percent per period.[67] In contrast, the corresponding model with newly posted prices given by the original equation 7 predicts that a permanent reduction in the rate of crawl causes no real appreciation (or recession), sticky prices notwithstanding.[68] The basic reason is that Taylor-style contracting models of the type described by equations 6 and 7 result in a sticky price *level*, but not in sticky price *inflation*.[69]

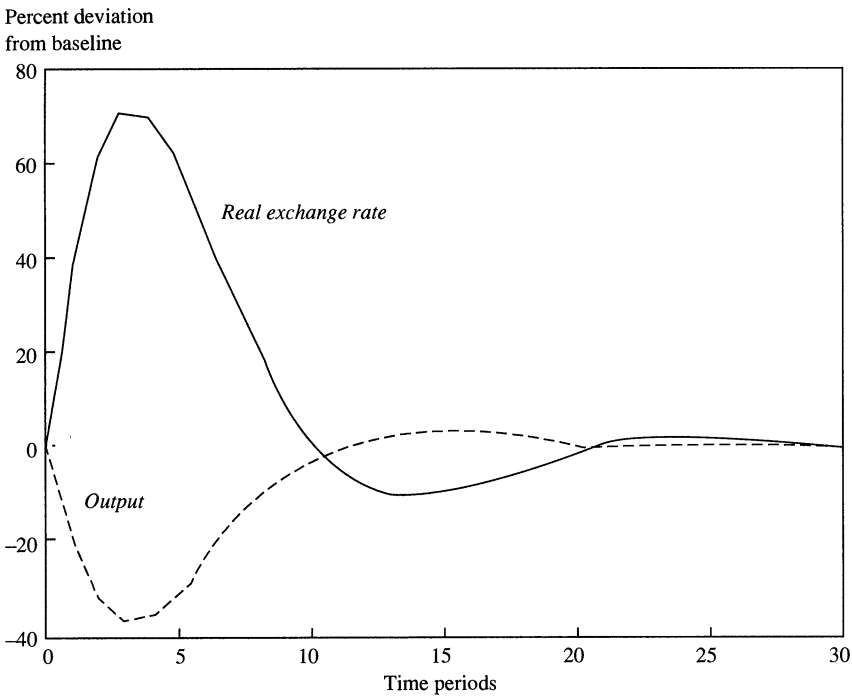
A third explanation for real appreciation which applies even when inflation is not itself sticky is imperfect credibility. This explanation is consistent with the observation that in stabilizing economies with open capi-

67. The parameter values used are $\omega = 0.6$, $\delta = 0.3$, $\theta = 0.5$, $\mu = 0.6$, and $\phi = 0.2$. Here and in figure 13, the real exchange rate is defined as $\mu(p - e - p^*)$. The effects shown in figure 12 are somewhat exaggerated because the simplified version of equation 10 used in the simulation minimizes the forward-looking component in new prices.

68. This result, which is developed by Calvo and Végh (1994) in a more completely specified model, is discussed in appendix A.

69. Fuhrer and Moore (1995) contend that Taylor's (1980) contracting model cannot adequately capture the high persistence of U.S. inflation, and propose an alternative formulation in which nominal wage settlements are fully indexed to the current price level. Equation 10, while not identical to their formulation, is a close relative.

Figure 12. Disinflation with Backward Indexation: Effects on the Real Exchange Rate and Output[a]



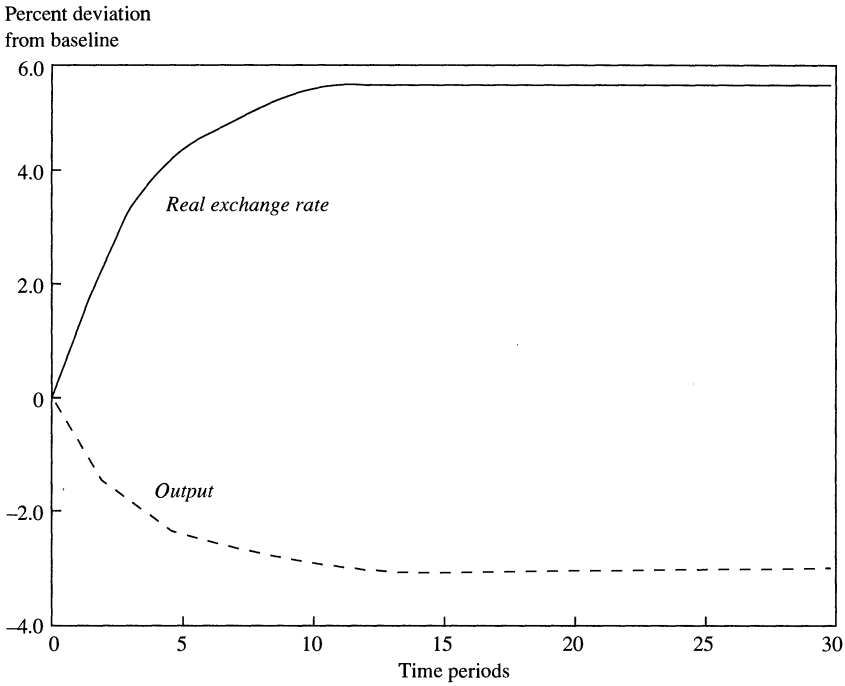
Source: Author's calculations as described in the text.

a. The effects of reducing inflation from 100 percent per period to 0, using the pegged exchange rate model with lagged wage indexation discussed in the appendix. The real exchange rate is defined as $\mu(p - e - p^*)$, so that a rise is a real appreciation of domestic against foreign currency.

tal accounts, domestic nominal interest rates typically exceed dollar interest rates adjusted for the promised depreciation schedules. If markets doubt that exchange rate commitments will be honored, both nominal prices and interest rates will incorporate premiums to guard against the possibility of a surprise devaluation. Figure 13 illustrates the behavior of the real exchange rate and output in the original staggered contracts model based on equations 6 and 7 when markets suddenly begin to believe that the current fixed exchange rate is subject to the risk of a one-time 20 percent devaluation. The conditional probability of devaluation is 25 percent per period and is constant until the devaluation occurs.[70] This experiment generates a real appreciation that eventually

70. Thus, the conditional probability of a devaluation this period, given that none has yet occurred, is always 0.25, whereas the conditional probability of a second devaluation is zero. Other parameter values are $\delta = 0.3$, $\theta = 0.5$, $\mu = 0.6$, and $\phi = 0.2$. See appendix A for the algebraic derivations underlying the simulation in figure 13.

Figure 13. Imperfect Credibility: Effects of Risk of Devaluation on the Real Exchange Rate and Output[a]



Source: Author's calculations as described in the text.
a. The real exchange rate is defined as as $\mu(p - e - p^*)$, so that a rise is a real appreciation of domestic against foreign currency.

reaches 5.6 percent, and a drop in output of nearly 3 percent. The effects are potentially even bigger in reality. If market participants believe that policy ultimately will be accommodative, spiraling real appreciation could result as markets continually revise upward both the probability of devaluation and its expected size.

Low credibility played an especially prominent role in Argentina and Uruguay, neither of which accompanied its plan of the late 1970s with a convincing reduction of fiscal deficits. Indeed in many countries, government spending has probably contributed to real appreciation. Chile did achieve fiscal balance, but committed the fatal error of retaining lagged wage indexation even after fixing the exchange rate.

The 1980s produced many other unsuccessful stabilization plans, but also some that, so far, have been successes. Israel's government embarked on a heterodox stabilization program in July 1985, not only fixing

the exchange rate of the shekel against the dollar but also (temporarily) controlling wages and prices so as to reduce the economy's inflationary inertia. As figure 11 shows, although the plan has resulted in real appreciation of the currency, the process essentially leveled off in 1988 and has been moderate by the standard of some other stabilization experiences. Furthermore, the current account has remained at sustainable levels. Contributing to these developments was the government's willingness to engage in considerable exchange rate flexibility after August 1986, including several devaluations, the introduction of an exchange rate band, and in December 1991, the introduction of a crawling exchange rate band.[71] Chile has operated a moving exchange rate band since the mid-1980s, roughly halving the annual inflation rate (from 27 percent in 1985 to 14 percent in 1992).[72] As figure 11 shows, the country has experienced only moderate real appreciation in this period; its current account deficits have been manageable.

Mexico and Argentina have also stabilized since the late 1980s, but have adhered to more rigid exchange rate targets and endured more dramatic real appreciations than Chile or Israel. Mexico fixed the peso's exchange rate against the dollar in December 1987, moving to a crawl in January 1989, and to a band in December 1991. Its exchange rate policy was accompanied by fiscal cuts and yearly *pactos* on wages and prices, following the heterodox Israeli example. Despite initial success, by 1994 a combination of the peso's real appreciation, a large and growing current account deficit, slower growth, and political unrest had begun to erode confidence in the government's commitment to keep the exchange rate within its preannounced band.[73] A devaluation in December 1994, shortly after President Zedillo's inauguration, set off a speculative crisis that left the peso floating at levels unimaginable a few months earlier and rendered the government unable to roll over its maturing debt without official foreign assistance.

Argentina followed a more drastic, orthodox, route. The government slashed its fiscal deficit, and with the April 1991 Convertibility Act, anchored its peso to the dollar, set up a currency board, abolished indexation, and facilitated the denomination of contracts in foreign currencies. Notwithstanding its vigorous attempts to defeat the problems

71. See Bruno (1993) and Bufman and Leiderman (1995).

72. Dornbusch and Edwards (1994). Inflation rate data are from *International Financial Statistics*.

73. See Dornbusch and Werner (1994).

associated with inertia and credibility, Argentina's peso has undergone a real appreciation of more than 60 percent since 1990, and its current account deficit is substantial. The peso has been under pressure since the Mexican crisis erupted, and Argentina's government has responded by making additional fiscal cuts and seeking IMF support.

Lessons of Developing-Country Experience

What are the main lessons of developing-country experience?

THE EXCHANGE RATE. It is perilous to rely on the exchange rate as the principal long-term instrument for reducing chronic high inflation.[74] A pegged or even fixed exchange rate may be useful in the early stages of disinflation—it signals a break with past instability, immediately affects tradables prices, clearly indicates the monetary policy stance despite shifting money demand, and may lower the output cost of disinflation.[75] But leaving an exchange rate peg in place for long, even after fiscal stabilization has been secured, invites trouble. Most of the countries that have successfully stabilized have, in fact, introduced substantial exchange rate flexibility after a relatively brief initial period. Peru provides an exceptional case of a country that has disinflated without even an initially pegged exchange rate. Given the perceived possibility of a lapse into past excesses, and the thinness of exchange and other financial markets, early transition to a freely floating exchange rate may be impracticable for most stabilizing developing countries.

THE CAPITAL ACCOUNT. If a float is impracticable, some transitional controls over capital movements may be a necessary evil. Completely opening the capital account can impose discipline, but since the move is reversible, the discipline may be slight. Furthermore, controls facilitate the use of direct exchange rate management to avoid excessive real appreciation. Although there are practical difficulties with capital controls (as is discussed below), for economies in the early phases of stabilization they are preferable to a crisis-induced lapse into chronic inflation.

INCOMES POLICIES. The need for incomes policies when stabilizing is more controversial. Chile has done without them, but its authoritarian

74. Stopping a hyperinflation raises somewhat different issues. For recent discussions see Bruno (1993) and Végh (1992).

75. Fischer (1986) offers a formal analysis of this last point.

regime also reduced union bargaining power during the 1980s.[76] In a situation of multiple policy equilibria, temporary incomes policies can coordinate expectations to achieve a good outcome. If the government is actively managing the exchange rate to avoid real appreciation, and monetary aggregates are too unstable to serve as an additional nominal anchor, a limited period of incomes policy may serve to prevent immediate wage and price pressures which it might otherwise be tempting to accommodate.

DISCIPLINE. One major lesson is that pegged exchange rates, in and of themselves, have not imposed discipline in stabilization experiments. High government spending often persists, and appears to contribute to the real appreciations that weaken exchange rate–based stabilization programs.[77] Too many stabilizations have succumbed to Sargent-Wallace unpleasant arithmetic because fiscal deficits have continued despite supposedly irrevocable, but ultimately unsustainable, exchange rate targets.[78] The political will to stabilize must come first; the exchange rate peg is a means to that end.

The Crisis Problem

A key question for developed and developing countries alike is the *feasibility* of maintaining a pegged exchange rate between the currencies of sovereign nations when capital is internationally mobile. The collapse of the ERM parity grid over 1992–93, along with speculative probing of the exchange rates of currency-board countries like Argentina and Hong Kong in 1995, suggests that restrained fiscal and monetary policies may not guarantee immunity from speculative crises. Even exchange rates that are technically sustainable may be attacked, perhaps successfully. It is impossible for a government to operate an acknowledged adjustable peg in this setting. With capital mobility, there may be no comfortable middle ground between full, irrevocable currency union and floating.

Krugman provides an illuminating initial analysis of speculative at-

76. See Edwards and Cox-Edwards (1987).

77. For recent evidence, see Corbo and Hernández (1994).

78. Sargent and Wallace (1981). Indeed, one can argue, as do Tornell and Velasco (1995), that the immediate reaction of a floating exchange rate to a higher fiscal deficit disciplines fiscal policy to a greater extent than does the fear of an eventual crisis under a fixed rate.

tacks on unsustainable fixed exchange rates.[79] In his setting, a country that is losing foreign reserves must float when reserves hit zero. Because money demand is a negative function of expected currency depreciation, and the currency will be depreciating after a collapse, speculators attack the exchange rate *before* reserves have run out, ensuring a money supply decrease that reduces real balances in line with the rise in expected depreciation so as to prevent any anticipated excess profits from currency arbitrage. Transactions long derided by finance ministers as the manipulations of malevolent gnomes are shown to constitute the unique, efficient, forward-looking response to an inconsistent policy package.[80]

Governments are not passive actors in actual exchange crises, however, and recent research has shown that the interaction of markets and governments can lend a self-fulfilling element to speculative attacks. A shift in market sentiment alone, through its effects on prices, can create conditions in which governments find it optimal to alter the currency regime. As a result, the timing of attacks can become indeterminate and exchange rate pegs that could have survived in the absence of an attack may fall. This reasoning, which views crises as being analogous to bank runs, does acknowledge that fundamental factors matter, since they determine the political and social costs of alternative policy responses to a crisis. But it implies that fixed exchange rates may be more fragile under conditions of capital mobility than has generally been believed.[81]

There are several mechanisms whereby markets may dislodge an exchange rate that would remain pegged, absent an attack. Most models in this genre assume that the government decisionmaker bears a fixed cost of deviating from an exchange rate commitment—arising from loss of face, loss of office, loss of the chance to head a prestigious international organization after retirement, or loss of market confidence. It is by push-

79. Krugman (1979).

80. I argued earlier that government budgetary solvency, rather than the official foreign exchange stock, per se, is the basic determinant of technical sustainability when governments have access to world capital markets. The many cases in which continuing fiscal deficits have brought solvency into doubt are, however, entirely within the spirit of Krugman's analysis.

81. In my 1985 Brookings paper, I emphasized that the potential for self-fulfilling attacks would render fixed rates fragile under conditions of capital mobility. (Obstfeld, 1985, p. 440.) Recent experience has led other observers to a similar conclusion. See, for example, Eichengreen and Wyplosz (1993) and Svensson (1994).

ing the cost of hanging on above the fixed cost of reneging that markets can bring about realignments or regime changes.[82]

Figure 13 can be used to motivate one example of a self-fulfilling crisis. Imagine that there is a fixed cost, c, of realigning the exchange rate and moving to a float. Progressive real appreciation and output sacrifices similar to those shown in figure 13 will cause a realignment if the net present discounted loss from sticking to the fixed rate ever edges above c. Indeed, the model can be set up so that the devaluation fears driving the real appreciation are rational, given the circumstances in which the government will find it optimal to validate them. To this end it is necessary to reintroduce stochastic output shocks which could push the government over the edge if unemployment were high, even though they could have been tolerated near full employment. The tendency in this model for attacks to occur when economic misery is objectively high does not prove that they are not driven in part by self-fulfilling elements.[83]

The high nominal interest rates that accompany crises may be enough in themselves to induce governments to give in. Sweden abandoned the krona's ecu peg in November 1992 in part out of concern that high interest rates would further weaken a troubled banking system and magnify the mounting government deficit. Britain's quick exit from the ERM on "Black Wednesday," September 16, 1992, was encouraged by fears that higher interest rates would quickly feed through to indexed mortgages. Italy's exit the same day was motivated partly by the difficulty of rolling over a massive short-term government debt at high interest rates.[84] All of these episodes were accompanied by steep foreign currency reserve losses, but they were the result, not the root cause of market beliefs that the krona, pound, lira, and other European currencies could be dislodged from their pegs.

Mexico has been suffering from both a currency crisis after its failed December 1994 attempt at an orderly devaluation of the peso, and a government-debt funding crisis motivated by fears of outright repudiation.

82. For more complete accounts, see Jeanne (1994) and Obstfeld (1994).

83. For example, France was vulnerable to attack in 1992–93 (and remains vulnerable) because of its high unemployment. But is it likely that ERM bands would now be ±15 percent instead of ±2.25 percent had the franc not been attacked in the summer of 1993?

84. See Eichengreen and Wyplosz (1993) for more details.

These crises have erupted despite the widely held view that a 20 percent devaluation would leave the country with sound fundamentals. Without the hypothesis that Mexico's situation derives from some of the same self-fulfilling elements as a run on an illiquid (but not insolvent) bank, it is hard to understand why Italy, with a lower current account deficit but a much higher public debt–to-GDP ratio, was spared a similar fate after its own 1992 currency crisis.[85]

The stochastic extension of the Krugman attack model suggests that domestic nominal interest rates should have a gradually rising trend relative to foreign rates in the run-up to an exchange rate collapse. The reason is that, as fundamentals progressively deteriorate, both the probability that a new shock will lead to a collapse and the size of the ensuing depreciation increase. It is therefore noteworthy that the interest-rate-based measures of ERM credibility estimated by Andrew Rose and Lars Svensson did not deteriorate markedly until late August 1992, just prior to the start of the EMS crisis. This could be explained by market myopia, or by the theory that the attack was one of two possible equilibria, one of which markets rationally viewed as relatively unlikely until it materialized. In an empirical analysis of a large sample of speculative attacks (including unsuccessful ones), actual realignments, and exchange rate regime changes, Barry Eichengreen, Andrew Rose, and Charles Wyplosz seek significant pre-crisis changes in the behavior of fundamental economic variables such as the real exchange rate, fiscal deficit, export-to-import ratio, and unemployment. They find that speculative attack episodes differ among themselves in displaying such changes. Their evidence, while preliminary, suggests that it may be hard to explain many crises purely on the basis of standard, observable fundamentals.[86]

The line between self-fulfilling crises and crises justified by fundamentals should not be drawn too sharply. The true fundamentals determining an exchange rate's sustainability are governments' preferences over policy outcomes and the constraints that limit their actions. Since constraints are endogenous through their dependence on market expectations, multiplicities can arise whenever governments are unable to

85. Calvo (1988) developed a seminal model of runs on government debt.

86. See Rose and Svensson (1994) and Eichengreen, Rose, and Wyplosz (1995a, 1995b). The stochastic version of the Krugman attack model is due to Flood and Garber (1984).

commit effectively to preordained rules. Institutions that tie their hands or credibly change their incentives can eliminate the multiplicity problem, but the adoption of a fixed exchange rate per se, even in the context of a broader international system, has proven time and again to be ultimately a disposable commitment.

Fixed exchange rates could be maintained under the classical gold standard because governments operated in a very different political environment. Financial interests were dominant, labor had little political influence, and politicians were not held as accountable for economic downturns as they are today. The Bretton Woods system operated with fairly limited capital mobility for most of its existence, as did the EMS until the late 1980s. Especially in the EMS, this allowed necessary relative-price changes to be achieved through periodic realignment rather than through politically unacceptable deflation or inflation. Increasing international capital mobility, coupled with the overriding desire of individual governments to pursue domestic economic interests, tore both the Bretton Woods system and the EMS apart. Until sovereign nations are willing to relinquish economic authority to supranational organizations to an extent that even the EU has yet to achieve, fixed exchange rates and capital mobility will remain an inherently explosive combination.

The Role of Concerted Intervention

If maintaining a pegged exchange rate eventually forces governments to confront unacceptable policy trade-offs, perhaps intervention in foreign exchange markets can offer a relatively painless way to float while still promoting relatively stable exchange rates. By intervention I refer to *sterilized intervention*, that is, purchases or sales of foreign-currency bonds that are matched by equivalent sales or purchases of domestic-currency bonds, leaving the monetary base unchanged. When, for example, the intervening agency trades domestic against foreign currency in the forward market, such operations may not appear immediately on the government's books.

Since 1985, when the Reagan administration abandoned its virtual taboo on intervention, the G-7 countries—as well as considerably broader coalitions—have mounted concerted intervention operations on a number of occasions. The most formal embodiment of the new approach was

the February 1987 Louvre accord, which set up implicit target ranges for exchange rates. These did not survive the October 1987 stock market crash. Exchange rate targets have been changed repeatedly since then, and concerted intervention still occurs when key exchange rates reach levels that the major countries agree are potentially disruptive. The participating authorities do not seem to visualize these joint actions as everyday events, but as infrequent signals of official consensus and resolve. Ronald McKinnon has formulated a set of stylized descriptive rules of conduct for this procedure, which he credits with having "kept the dollar's exchange rates within narrower ranges from 1987 through 1992—compared to the more volatile experience of the preceding fourteen years after 1973."[87]

A major question is whether the intervention has actually been effective in influencing exchange rates—and to pose that question is to realize that much of the answer hinges on the definition of *effectiveness*.

If bonds denominated in different currencies are imperfect substitutes because of currency risk, then, provided the Ricardian equivalence proposition fails, government operations that change the relative supplies of those bonds in private hands can alter exchange rates and interest rates even when monetary and fiscal policies are not purposefully adjusted.[88] Such a *portfolio* channel for intervention effects would give authorities a dependable instrument for exchange rate management to supplement more conventional macro policies. The March 1983 Jurgensen Report, a collaborative central-bank study on intervention, concluded that the portfolio effect, if present at all, is small and short-lived. Subsequent work has found statistically but not economically significant effects of asset supplies on excess foreign-exchange returns. Even these small effects could be due to factors other than the portfolio model.[89]

Absent a portfolio effect, intervention could still have a *signaling* effect by communicating information to markets and thus altering expectations. But what prevents central banks from sending deceptive sig-

87. McKinnon (1993, p. 34).

88. As Backus and Kehoe (1989) point out, however, a sterilized intervention that has these effects will generally alter the government's intertemporal budget constraint and thus mandate current or future changes in other policies.

89. See, for example, Dominguez and Frankel (1993). For alternative discussions of intervention experience and theory, see Obstfeld (1990), Klein and Rosengren (1991), and Edison (1993). The findings of the collaborative central bank study are summarized in Jurgensen (1983).

nals, and markets from discounting them? Is the transmission of a truthful message an effective additional policy tool if it is no more than an announcement of future changes in more fundamental policy settings? And if the government desires to send a truthful signal, why is foreign exchange intervention the best way to do it? None of these questions has been convincingly answered.

Yet several recent interpretations of the empirical record hold that concerted intervention has powerful signaling effects which coordinate the essentially indeterminate expectations of impressionable market traders to achieve the outcomes desired by monetary authorities. The most influential recent paper along these lines is by Pietro Catte, Giampaolo Galli, and Salvatore Rebecchini, who base their work on confidential 1985–91 daily intervention totals supplied by sixteen central banks. Williamson, for example, cites their results as reason for "new optimism" on the potency of intervention.[90]

Catte, Galli, and Rebecchini identify a "concerted intervention episode" by four criteria:

—At least two of Germany, Japan, and the United States intervene simultaneously.

—Intervention continues for at least three more days if only one of the three banks continues to intervene, or for at least one more day if two or three banks continue to intervene.

—Interruptions in intervention last no longer than five working days.

—Daily interventions amount to at least $20 million per bank.

The other key definition is that of *success*: the trend of the exchange rate is reversed, or at least stalled for several months, perhaps with interruption "by minor rebounds that induce[d] central banks to intervene again in the same direction."[91]

After examining the nineteen concerted intervention episodes in their sample, Catte, Galli, and Rebecchini reach the striking conclusion that all were successful to some degree. Moreover, all but one major market turning point coincides with a concerted intervention episode. The authors do not see a similarly strong correspondence between interest-rate and exchange rate changes, or between intervention and subsequent policy shifts.

Post hoc, ergo propter hoc reasoning inevitably inspires plausible al-

90. See Catte, Galli, and Rebecchini (1994) and Williamson (1993).

91. Catte, Galli, and Rebecchini (1994, p. 206).

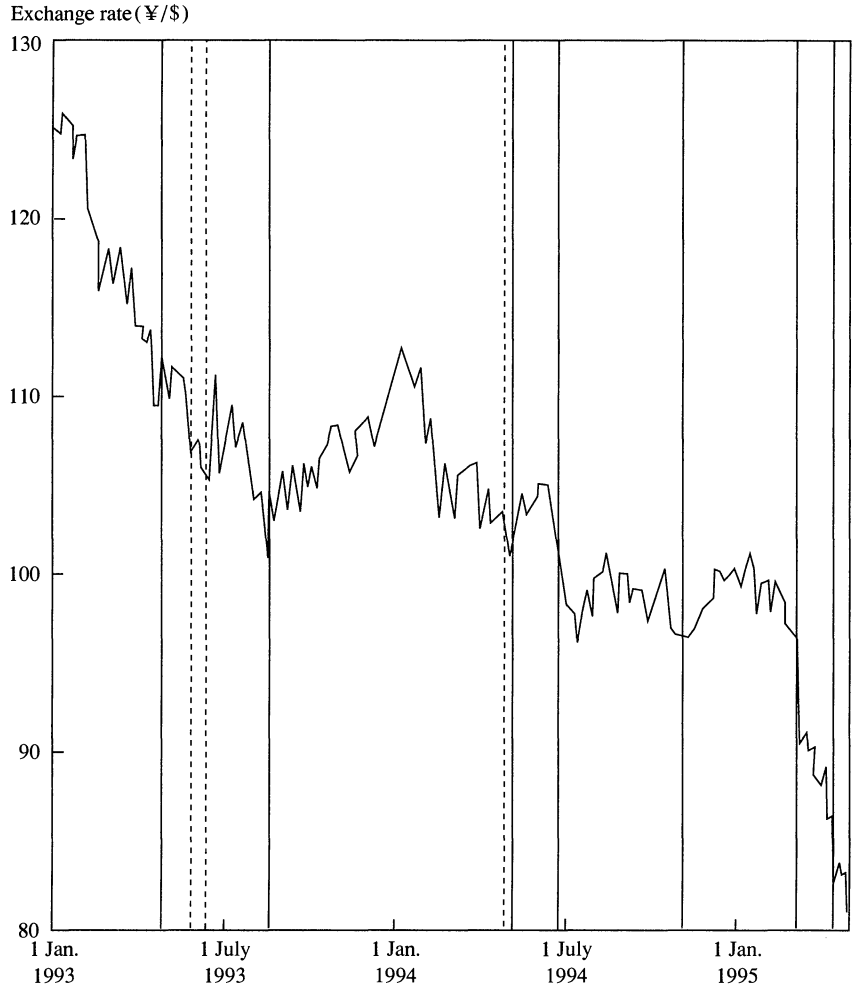
ternative explanations; in this case several suggest themselves immediately. Concerted intervention will tend to occur precisely when exchange rates reach extreme levels or make sudden temporary movements; but under such circumstances, a rebound might be expected even without the intervention. In many of the episodes that Catte, Galli, and Rebecchini study, intervention went on for many days before the turnaround; this could imply that intervention has little power but ceases when, by luck, exchange rates eventually reverse course. Is there not a selection bias in excluding brief intervention spells or small interventions, for authorities might quit quickly when initial efforts meet heavy market resistance? For that matter, authorities may not intervene at all unless they believe there is a good chance of moving the market.[92]

Subsequent evidence, insofar as it can be culled from public sources, reveals a picture somewhat different from the one that Catte, Galli, and Rebecchini paint. Figure 14 shows daily data on the yen-dollar spot exchange rate since January 4, 1993, together with dates on which the United States intervened to sell yen. Broken vertical lines denote interventions that were not coordinated with foreign monetary authorities, whereas solid vertical lines denote interventions that were. The definition of *coordinated* is a technical one: at least two national authorities must be intervening at the same time. Thus, intervention by the United States in New York and the Bank of Japan in Tokyo on the same day is not considered to be coordinated; nor is United States intervention in New York that the Bank of Japan picks up without a break in Tokyo the next morning. Appendix B lists the occasions of U.S. interventions and related interventions by the Bank of Japan in Tokyo.

Of the interventions in figure 14, that of August 19, 1993, looks most like the ones Catte, Galli, and Rebecchini identify as "definite" successes. It was buttressed by Treasury Undersecretary Lawrence Summers's expression of U.S. opposition to further yen appreciation, which served to counter the impression that the United States intended to use dollar depreciation as a lever to pry open Japanese markets. The intervention did not occur until three days *after* the dollar had started to rise

92. Truman concludes: "By my own personal judgmental criteria, intervention was partially successful in about five of the episodes [studied by Catte, Galli, and Rebecchini], and I think this is a good enough record to support the continued judicious use of intervention as a supplementary policy instrument." (Truman, 1994, p. 249.) See Weber (1994) for a separate critique.

Figure 14. Daily Yen-Dollar Exchange Rate and U.S. Interventions



Coordinated interventions shown by solid line; noncoordinated interventions by dashed line.

Source: Exchange rates from *International Financial Statistics*. Intervention episodes are reported in the *Federal Reserve Bulletin* and the *New York Times*.

from an August 16 local minimum against the yen. This strengthens the view that intervention sometimes appears powerful because authorities choose to act after market pressures have eased.

The interventions of April 1993, June 1993, April–May 1994, and November 1994 described in appendix B might be judged limited successes

by some criteria. But the April 1993 intervention kept the dollar above ¥110 for less than a month; the June 1993 turnaround, which in any case was very short-lived, was the result of the Miyazawa government's fall; that of May 1994 lasted for only about one month; and the November 1994 action, which was not joined by European central banks, did not reverse the dollar's downtrend. The subsequent short-lived reversal came only after November 15, when the Federal Reserve raised U.S. interest rates by an unexpectedly large amount.

In contrast, the May 27–28, 1993, intervention had no discernible effect. It was not, technically speaking, coordinated, but it involved two days of intervention by both the Federal Reserve and Bank of Japan, and continuing Bank of Japan intervention through early June. The June 1994 intervention failed to stop the dollar from falling below ¥100.[93] And the March 1995 U.S. intervention effort, which failed to stop the dollar's fall below ¥95, was abandoned because officials believed that it was having no effect. The market temporarily stabilized in a range of 88–89 yen per dollar, but the rate then plunged to the low 80s despite concerted intervention in the first week of April 1995. It can always be argued, after the fact, that intervention failed because the authorities were trying to defend disequilibrium exchange rates. But the argument that a rate of ¥85 per dollar undervalues the yen has yet to be made.[94]

My reading of this evidence leads to a very different view of intervention's powers than the one Catte, Galli, and Rebecchini propose. Intervention can be useful in providing a costly and therefore informative signal of official intentions when markets are confused about policy. An example might be the August 1993 operation, which helped clarify the U.S. attitude toward the role of the exchange rate in trade negotiations with Japan. But intervention, acting alone, cannot halt market trends for long, let alone reverse them. It would be irresponsible and counterpro-

93. In evaluating all such episodes, there is the logical possibility that the exchange rate would have fallen even more without intervention. In the absence of a reliable model for explaining short-term exchange rate movements, there is no way to know. But the ¥100 mark, like the ¥110 mark before it, seemed an official "line in the sand." The fact that it was crossed is indicative of the limited powers of sterilized intervention.

94. The April 25 G-7 communiqué declaring that exchange rates "have gone beyond levels justified by economic conditions" was not accompanied by renewed U.S. intervention, although it was preceded by a cut in Japan's interest rates. Its release boosted the dollar by more than 2 percent in next-day trading, but did not appear to initiate a new upward trend. See "Dollar Up Sharply Against Yen in Biggest Rally in 20 Months," *New York Times*, April 27, 1995, p. C15.

ductive for governments to enter into coordination arrangements on the assumption that exchange rate stability can be had for free, without hard compromises of monetary and fiscal sovereignty.

Spillovers and Monetary Policy Coordination Failures

One implication of short-run price stickiness is that even monetary shocks will be transmitted abroad in the short run, through output, wealth, terms-of-trade, and world interest rate effects. Even if exchange rates provide long-run insulation, they are powerful transmitters of foreign shocks in the short run. In some settings the effects may be permanent.[95] These spillovers suggest potential international coordination failures in monetary as well as borrowing policies.

The worldwide recession of the early 1980s has been widely cited as such a coordination failure.[96] As a result of the U.S. disinflation and dollar appreciation, other industrial countries faced depreciating currencies and unwelcome inflationary pressures. Their contractionary monetary responses put additional upward pressure on world real interest rates and contributed to an unnecessarily deep world recession. In contrast, a cooperative approach to disinflation that did not try to exploit the exchange rate as an aid to disinflation might have allowed the industrial world to achieve a lower sacrifice ratio.

How important were these effects? Gilles Oudiz and Jeffrey Sachs made the first empirical attempt to quantify the costs of coordination failures among industrial countries and found them to be modest.[97] The subsequent literature remains divided on the question, although it is clear that much (unequally) shared pain could have been avoided, had industrial countries internalized the effects of their policies on developing countries in the early 1980s. A general limitation of all this work is that the models lend themselves to somewhat ad hoc welfare criteria. In recent work Rogoff and I develop an example in which the properly computed welfare effects of some prominent monetary policy spillovers, though important individually, cancel out collectively. The basic reason is that, starting from a full-employment position, the spillovers,

95. See Obstfeld and Rogoff (1995a).

96. McKinnon (1984) and Oudiz and Sachs (1984) are among the analyses that emerged soon after the events described.

97. Oudiz and Sachs (1984).

which include terms-of-trade and current account effects, reflect intratemporal or intertemporal reallocations of second-order importance. The assumptions of the example are unlikely to hold in reality (notably the assumption of a full-employment starting position), but it does show the need for more careful thought about the nature and costs of policy spillovers. The example also gives reason to question Nurkse's account of the evils of competitive currency depreciation in the context of the Great Depression.[98]

Germany's reunification after 1989 caused a coordination failure with a more localized but still dramatic impact, and it was the result of fixed, not floating, exchange rates. The coordinated response to that shock, one that the ERM delayed but that markets eventually forced, was an appreciation of the mark relative to other European currencies, so as to simultaneously relieve inflationary pressure in Germany and deflationary pressure in its partners. The example shows that appropriate policy coordination need not require, or be enhanced by, exchange rate targets.

The G-7 countries turned to closer consultation on macroeconomic policies in 1985, but despite fairly regular coordination on intervention, there is no hard evidence of coordination in monetary or fiscal policy. George von Furstenberg and Joseph Daniels argue that the degree of G-7 government compliance with the economic undertakings made at annual summits if anything has been lower since 1985 than before.[99]

Lessons and Options for Reform

The national autonomy in exchange rate arrangements that broke out in the early 1970s and was codified by the IMF in January 1976 has not been the disaster that Nurkse might have feared. But neither has it led to the promised land of economic stability, international harmony, and unchallenged free trade that Friedman and Johnson desired.

98. Obstfeld and Rogoff (1995a). Nurkse's view has been questioned on related grounds by Eichengreen and Sachs (1985). A survey of empirical results on macro policy coordination is included in McKibbin and Sachs (1991).

99. See von Furstenberg and Daniels (1992).

Five Lessons

The lessons learned or relearned are many and complex, but five stand out:

—Flexible exchange rates have been very successful in delivering their two main benefits. They have largely insulated countries from foreign inflation trends over the long run; and they generally have given countries the means to mitigate short-run fluctuations in output and the current account that nominal rigidities otherwise would magnify. Exchange rate flexibility has not, however, prevented the transmission of policy shocks, nor has it removed potential gains from policy coordination. Fixed exchange rates may promote symmetrical polices when countries share the burden of maintaining a parity, but they need not bring about favorable coordinated policy outcomes.

—There may be no turning back in the foreseeable future. Attempts to maintain fixed exchange rates for long periods usually have proven inconsistent with the degree of openness to international capital markets that most industrial countries now allow. The basic reason is that the governments of sovereign nations still place domestic considerations ahead of exchange rate commitments. A speculative attack that causes enough domestic pain can bring down even a pegged exchange rate that is technically sustainable. With high capital mobility there may be no comfortable middle ground between currency union and floating.

—While long-run exchange rate behavior can be rationalized in terms of standard economic theory, the short-run behavior of exchange rates is often difficult to explain, even ex post. In particular, exchange rate variability, while somewhat lower than that of other asset prices, seems much greater than that of plausible observable fundamentals. Even medium-term exchange rate swings lasting several years are sometimes hard to explain. Despite the strong possibility that much of short-term exchange rate dynamics results from the interaction of noise and diffuse expectations, there is no compelling evidence that sterilized foreign-exchange intervention, even when carried out by several countries acting in concert, is a reliable tool of expectations management independent of monetary and fiscal policies.

—Excessive exchange rate volatility imposes undeniable economic costs, especially when it leads to cumulative persistent movements in real exchange rates. When a substantial component of wealth (human

capital) cannot be effectively hedged and its owners cannot access financial markets at reasonable cost, greater exchange rate uncertainty can entail substantial welfare losses. Another cost comes from the way in which exchange rate movements encourage protectionism. However, it is not clear that exchange rate volatility per se has had an economically important dampening effect on trade in goods and services or capital flows.

—Despite early policy mistakes, exchange rate flexibility has not led to a permanent state of undisciplined inflation in industrial countries, nor have pegged rates been either a necessary or a sufficient means for developing countries to reduce chronic inflation. Although the persistence of inflation rates in most industrial countries has been higher during the floating-rate era than during the Bretton Woods era as a result of more aggressive countercyclical policy, this need not imply higher mean inflation and indeed, persistence has risen in low- and high-inflation countries alike. Industrial-country fiscal excesses, which threaten to become an even bigger problem in the future, do not seem to be significantly influenced by exchange rate arrangements.

In the light of these lessons, what options are there to improve the functioning of the system?

A Return to Pegged Rates?

Even if fixed exchange rates were feasible given countries' desire for access to the world capital market, there is no presumption that they would be an improvement over the current system, especially if they lacked full credibility. The optimum-currency area logic discussed in my 1985 Brookings paper shows why big areas like Europe, Japan, and the United States will prefer flexible rates on macroeconomic-stability grounds when asymmetric nonmonetary shocks, such as shifts in world trade patterns, are frequent.[100] Simulations of major macroeconomic models give strong empirical support for this position.[101] Richard Cooper's proposal of a single currency for the industrial democracies avoids the problem of defending fixed exchange rates, and yields additional efficiency advantages by vastly expanding the size of the market served by

100. Obstfeld (1985).

101. See, among many others, McKibbin and Sachs (1991), Bryant, Hooper, and Mann (1993), and Taylor (1993).

a single monetary unit. He recognizes, however, that his plan remains utopian, for now.[102]

Target Zones?

Target zones for exchange rates are designed to give countries greater autonomy over policy while imposing a stabilizing effect on volatile exchange markets. The most detailed recent blueprint has been offered by John Williamson and Randall Henning, who envision zones ±10 percent wide.[103] To the extent that a broad zone gives policymakers more room for maneuver, it is superior to a peg. But is a zone better than a float without edges? One drawback of target zones is that they may not exert a stabilizing effect unless markets are confident that their edges will be defended successfully. The difficulties in defending rigidly fixed rates, however, apply fully to the edges of target zones, as was illustrated in March 1995 by the Spanish peseta's crash out of a band much wider than most proponents of target zones advocate. If markets can figure out the fragility of the edges and perform the requisite backward induction, a target zone loses much of its stabilizing power. It may even become destabilizing.

Williamson argues that two "golden rules" of exchange rate management suffice to overcome the crisis problem, even under conditions of capital mobility: first, never defend a disequilibrium exchange rate; and second, never change the parity by more than the width of the band. These rules imply that zones will be changed frequently by relatively small amounts as governments revise their views of where equilibrium exchange rates lie. But both rules pose problems.[104]

One problem is that governments cannot be certain that the equilibrium rate which they are targeting has not suddenly changed. Confronted with a market show of force, authorities will be tempted, as the United States and Japan were in the spring of 1995, to revise their estimate of equilibrium and give in. Another problem comes from the possible destabilizing properties of frequent small shifts in the band. As Fleming stated in a much earlier debate on target zones:

102. McKinnon (1984, 1988) makes the case for returning to fixed rates. A proposal for a single currency for industrial democracies is outlined in Cooper (1987).

103. See Williamson and Henning (1994). The debate over target zones in *BPEA, 1:1986,* remains very relevant, as is Cooper (1994).

104. Williamson (1993, pp. 195–96).

If a government makes a decision, or if it consents to a small change in its parity, this is likely to be taken by the market as evidence that the authorities consider the rate to be significantly out of line. Governments are quite unable to detect, and even if they could detect, are unable to admit to, divergencies from equilibrium until these are significantly large. There will therefore be a high probability of continued small rate changes in the same direction and some remaining possibility of a large discrete change; the market will know that countries have not given up the right to make a big change. They will know that the authorities think there is something wrong with the rate or they wouldn't agree to the small changes. They know, therefore, that if speculation develops sufficiently, the government may be forced into the larger change.

I think this combination of circumstances is one which would lead to even greater disequilibrating speculation than under the present system. . . . I carry the argument one stage further. It would be my feeling that governments, fearing precisely the effect on speculation that I have described, fearing in other words that if they allow a small change it will be taken as evidence of their view as to the necessity for a larger one, will exercise their discretion by refusing to glide, thus frustrating the whole system.[105]

Fleming's scenario brings into question whether Williamson's second rule will discourage speculation. It need not. First, as Fleming notes, the government cannot credibly commit to making only small changes in the parity; nor can it abjure the right to make many small changes in rapid succession. To assume that it can is to assume away the crisis problem. Second, even if such a commitment were possible, a change in the band, no matter how small, will permit the exchange rate to jump discretely, particularly if speculative pressure has already driven the rate to the relevant edge of the prior band. Thus ensuring that the previous exchange rate lies within the new zone need not eliminate expected speculative profits; indeed, the wider the zone, the less the cap on expected profits.

Aside from these difficulties in choosing the zone's location, how is the current zone to be maintained? Sterilized intervention, I have argued, will not suffice. Fiscal policy lacks the required flexibility. This leaves monetary policy, and all the problems of gearing monetary policy to an exchange rate target. Matters are even more complex in a multilateral system of zones because countries must negotiate over who will adjust monetary policy to keep the mutual exchange rate in its zone. Williamson and Henning propose an imaginative rule for sharing the burden

105. Fleming (1970, p. 162). The zones that Fleming discussed were narrower than those Williamson envisions, but I believe that Fleming's questions still apply.

of monetary adjustment. The key questions are whether the rule can be made operational, and whether countries would abide by it in practice. The reluctance of either Japan or the United States to alter macroeconomic policies in response to the plunge of the yen-dollar rate in 1995 exemplifies the type of disagreement that is bound to arise, even when countries agree in principle on desired exchange rates.

Sand in the Wheels?

James Tobin has suggested discouraging short-term roundtripping between currencies by means of a small tax on all foreign exchange transactions, levied collectively by the international community. His rationale is that the tax would reduce the volume of foreign-exchange transactions motivated by short-term exchange rate speculation rather than consideration of longer-term relative international returns. Because such a tax could make pegged exchange rates easier to maintain, Eichengreen and Wyplosz have suggested its limited use in EU countries as a transitional device on the road to monetary unification.[106]

A coherent case can be made for a Tobin tax in the context of stabilizing developing countries, which need to manage exchange rates and have relatively shallow financial markets, and where the cost of failed stabilization is extremely high. But in the context of developed countries with flexible exchange rates, the case is much less compelling. Even if the Tobin tax could be globally adopted—and any defecting country could hope for handsome profits—financial institutions would constantly seek new ways to evade it. Enforcement costs and evasion costs would have to be added to the deadweight efficiency costs due to distortions of trade as well as capital movements. Furthermore, the tax would discourage stabilizing short-term transactions along with destabilizing bandwagon trades, thus adding an aggravating factor to short-term and possibly even to longer-term volatility.[107]

What would this costly tax accomplish for countries with floating

106. See Tobin (1978) and Eichengreen and Wyplosz (1993). These three have recently collaborated to update their views and respond to critics; see Eichengreen, Tobin, and Wyplosz (1995).

107. The Twentieth Century Fund Task Force on Market Speculation and Corporate Governance rejected the idea of new transaction taxes in U.S. securities markets on essentially these grounds. See Twentieth Century Fund (1992).

rates? We have no idea. As noted above, there is no presumption that the tax would, on balance, reduce exchange rate volatility. Nor is there any presumption that it would significantly enhance the powers of monetary policy. It is a general principle of welfare economics that an added distortion can be helpful in the presence of preexisting distortions such as wage and output-price rigidity. But it does not follow that *any* additional distortion is a good thing. Lacking a complete understanding of exchange rate determination, it is not possible to form a reliable picture of how a Tobin tax would work in practice.

Matters are more complex in the European context, where governments may be willing to trade off economic goals against political ones. A foreign-exchange transactions tax, or the noninterest-bearing deposit requirements that Eichengreen and Wyplosz also discuss, could play at least some role in slowing down capital movements and facilitating the defense of exchange-rate targets.[108] Yet, interventions in capital markets could just as easily be counterproductive. Although the proposed measures are meant to be modest, authorities would be strongly tempted to intensify them in crises, thus creating expectations that could be highly destabilizing. Furthermore, extensive evasion is inevitable. For these reasons, I do not believe that the Tobin tax or other mild restrictions on capital movements could do much to help Europe out of its current monetary dilemma.[109]

The Next Twenty-five Years

Flexible exchange rates among the main trading blocs will not be abandoned anytime soon because they are simply too useful, despite their high and often puzzling volatility. There are nonetheless several feasible changes to the current system that would make it easier to live with:

—The Bretton Woods system was set up in the belief that only stable exchange rates were compatible with free trade. After World War II, internationally coordinated trade reform proceeded at a slower pace than monetary reform, but progress on trade has steadily progressed,

108. See Eichengreen and Wyplosz (1993) and Eichengreen, Tobin, and Wyplosz (1995).

109. For recent critical discussions of the Tobin tax and related proposals, see Garber and Taylor (1995) and Kenen (1995).

whereas Bretton Woods is long gone. The new World Trade Organization, which completes the triad of international agencies originally envisioned by the Bretton Woods agreement, can play an important role in ensuring that exchange rate swings do not undermine free trade. Governments should treat its rulings with respect, and its powers should be gradually extended.

—The IMF seemed to have lost its raison d'être with the demise of fixed exchange rates. One of the organization's fundamental original purposes, however, was to step in where private capital markets could not or would not, so as to ease the pressure of balance-of-payments problems on employment and growth. The Fund is in a better position than national governments to make lending decisions on economic, as opposed to political grounds. It can and does continue to fulfill this role, but its current resources are inadequate to the task, and should be augmented. More stringent Fund surveillance and conditionality are essential if greater resources are to be effectively used.

—Policy coordination has tight limits, but it can be useful when countries perceive opportunities for mutual current gain. The G-7 consultative process remains critically useful as a forum in which information is exchanged and potential policy trades are explored; it is even conceivable that more effective policy coordination will evolve over time, perhaps on the basis of an expanded group of countries. Concerted interventions cannot substitute for fundamental policy shifts, but if used with restraint, they can help clarify official intentions and goals. Exchange rate targets should not be allowed to stand in the way of sensible policies, and policymakers should avoid linking their prestige and credibility to particular exchange rate targets.

—Continued development of international financial markets and instruments offers the promise of more efficient international risk sharing, both for industrial countries and (as they mature) developing countries and economies in transition from socialism. New instruments that would allow trade in the present values of national GDPs, along the lines suggested by Robert Shiller, might mitigate problems associated with the noninsurability of human capital.[110] Such innovation would reduce individual costs of exchange rate volatility. To reduce the systemic risks that are a by-product of financial innovation, especially in an interna-

110. See Shiller (1993).

tional context, national authorities should continue and extend their collaborative efforts in the oversight of banks and other financial institutions.

—Countries should continue to seek and establish domestic political and economic institutions, such as central bank independence, that encourage monetary and fiscal stability at home. This would promote continuity in economic policy, which, in turn, would enhance the credibility of policymakers' promises to their foreign counterparts, possibly expanding the set of feasible international policy trades to include trades over time. Flexible exchange rates need not be an impediment to domestic institutional reform; and successful reform may well contribute to reducing exchange rate volatility.

APPENDIX A

Overlapping Contracts Model

THIS APPENDIX solves the overlapping contracts model of the text and derives some of its key properties.

Model Solution: Floating Exchange Rate

Apart from a constant that can be ignored, the monetary policy function (8) can be written as

$$m_t = \gamma t + \alpha p_t. \tag{A1}$$

Combining (A1) with (4) shows that the foreign price level in domestic currency units is

$$e_t + p_t^* = \frac{(\alpha + \delta - \mu)p_t + \gamma t - u_t}{1 + \delta - \mu}. \tag{A2}$$

Let L denote the lag operator, such that $Lz_t = z_{t-1}$ for any variable z, and let L^{-1} be its inverse, the lead operator. Then the equation for the average price of domestic output, (6), can be written as

$$(1 - \theta L)p_t = (1 - \theta)x_t,$$

while newly posted prices, from equation 7, can be expressed as

$$x_t = \frac{(1 - \theta) E_{t-1}[\mu p_t + (1 - \mu)(e_t + p_t^*) + \phi y_t]}{1 - \theta L^{-1}}.$$

Together these last two equations show that p follows the second-order difference equation

$$\text{(A3)} \quad (1 - \theta L^{-1})(1 - \theta L) p_t = (1 - \theta)^2 E_{t-1}[\mu p_t + (1 - \mu)(e_t + p_t^*) + \phi y_t].$$

Equations A2 and 5 allow equation A3 to be rewritten (recall that p is predetermined) as

$$\text{(A4)} \quad -\theta L\left[L^{-2} - \frac{1 + \theta^2 - (1 - \theta)^2 \omega_p}{\theta} L^{-1} + 1\right] p_t = (1 - \theta)^2 E_{t-1}(\omega_u u_t + \omega_\gamma \gamma t),$$

where ω_p, ω_u, and ω_γ are defined by

$$\text{(A5)} \quad \omega_p = \alpha + \frac{\delta(1 - \alpha)(1 - \phi)}{1 + \delta - \mu}, \quad \omega_u = \frac{(\phi - 1)(1 - \mu)}{1 + \delta - \mu}, \quad \omega_\gamma = \frac{1 + \phi\delta - \mu}{1 + \delta - \mu}.$$

The second-degree polynomial in the forward lag operator on the left-hand side of equation A4 has the factorization

$$\text{(A6)} \quad L^{-2} - \frac{1 + \theta^2 - (1 - \theta)^2 \omega_p}{\theta} L^{-1} + 1 = (L^{-1} - \zeta)(L^{-1} - \lambda),$$

where the roots $\zeta > 1$ and $\lambda < 1$ are given by the quadratic formula as[111]

$$\text{(A7)} \quad \zeta, \lambda = \frac{\frac{1 + \theta^2 - (1 - \theta)^2 \omega_p}{\theta} \pm \sqrt{\left[\frac{1 + \theta^2 - (1 - \theta)^2 \omega_p}{\theta}\right]^2 - 4}}{2}.$$

Use of (A4) and (A6) now shows that the date-t average GDP deflator has the solution:

111. For realistic parameter values these roots are real and distinct.

$$\text{(A8)} \qquad p_t = \lambda p_{t-1} + \frac{(1-\theta)^2}{\theta\zeta} \sum_{i=0}^{\infty} \zeta^{-i} E_{t-1}[\omega_u u_{t+i} + \omega_\gamma \gamma(t+i)].$$

Under the random-walk assumption on u, $u_t = u_{t-1} + \epsilon_t$, equation A8 may be first-differenced to yield

$$\text{(A9)} \qquad \Delta p_t = \lambda \Delta p_{t-1} + \frac{(1-\theta)^2}{\theta(\zeta - 1)}(\omega_\gamma \gamma + \omega_u \epsilon_{t-1})$$

$$\equiv (1-\lambda)\pi + \lambda \Delta p_{t-1} + \psi \epsilon_{t-1},$$

where $\pi \equiv \gamma/(1-\alpha)$. This is the equation for GDP-deflator inflation given in the text.

The central result on inflation persistence in this model is that

$$\frac{d\lambda}{d\alpha} > 0,$$

so that inflation persistence rises with monetary accommodation. To see this, note from (A5) and (A7) that

$$\frac{d\lambda}{d\alpha} = \frac{d\lambda}{d\omega_p}\frac{d\omega_p}{d\alpha} = \frac{\lambda(1-\theta)^2\omega_\gamma}{\theta\sqrt{\left[\frac{1+\theta^2-(1-\theta)^2\omega_p}{\theta}\right]^2 - 4}} > 0.$$

The price level for consumers is defined as $cpi = \mu p + (1-\mu)(e + p^*)$. By equations A2 and A9, this price index follows an ARIMA(1,1,1) process with autoregressive parameter λ:

$$\text{(A10)} \qquad \Delta cpi_t = (1-\lambda)\pi + \lambda \Delta cpi_{t-1} - \frac{\mu \epsilon_t}{1+\delta-\mu}$$

$$+ \frac{\{\psi[\delta + (1-\alpha)(1-\mu)] + (1-\mu)\lambda\}\epsilon_{t-1}}{1+\delta-\mu},$$

which has the same form as equation 9 in the text.

Model Solution: Pegged Exchange Rate

In the case of a pegged exchange rate with date-t value e_t, equation 4 is used only to determine the (now endogenous) supply of money. Following the same steps as in the last case, but taking e and p^* as exogenous, yields the analogue of equation A4:

$$(A11)\quad -\theta L\left[L^{-2} - \frac{1 + \theta^2 - (1-\theta)^2(\mu - \phi\delta)}{\theta} L^{-1} + 1\right] p_t$$
$$= (1-\theta)^2 E_{t-1}[(1 - \mu + \phi\delta)(e_t + p_t^*) + \phi u_t].$$

The polynomial in square brackets on the left-hand side of (A11) can be factored as $(L^{-1} - \zeta)(L^{-1} - \lambda)$, where now

$$\zeta, \lambda = \frac{\frac{1 + \theta^2 - (1-\theta)^2(\mu - \phi\delta)}{\theta} \pm \sqrt{\left[\frac{1 + \theta^2 - (1-\theta)^2(\mu - \phi\delta)}{\theta}\right]^2 - 4}}{2}.$$

The implied equation for p, derived in the same way as equation A8, is

$$(A12)\quad p_t = \lambda p_{t-1} + \frac{(1-\theta)^2}{\theta\zeta} \sum_{i=0}^{\infty} \zeta^{-i} E_{t-1}[(1 - \mu + \phi\delta)(e_{t+i} + p^*_{t+i}) + \phi u_{t+i}].$$

To prove Calvo and Végh's result concerning the neutrality of a credible permanent change in inflation,[112] imagine that on date $(t - 1)$ it is announced that e, which had previously been fixed, will now rise at rate π between dates $(t - 1)$ and t, and in all future periods. (Thus, $e_t = e_{t-1} + \pi$, $e_{t+1} = e_{t-1} + 2\pi$, and so on.) Because the price equation, (6), can be written as

$$\Delta p_t = (1 - \theta)(x_t - p_{t-1}),$$

it is clear that the inflation rate will jump immediately to its new steady-state level, π (thereby precluding any real appreciation), provided that x_t jumps by the amount $\pi/(1 - \theta)$ after the announcement. That this is what happens can be checked using equation 7. Under the tentative assumption that the economy moves right away to a new steady state, the change in x_t indeed is

$$(1 - \theta) \sum_{i=0}^{\infty} \theta^i (i + 1)\pi = \frac{\pi}{1 - \theta}.$$

Thus, the new prices posted on date $(t - 1)$ rise by precisely enough to place the economy on its new steady-state inflation path.

The simulation underlying figure 13 in the text assumes a baseline case with $p^* = u = e = 0$, and a constant probability κ per period of a realignment of the exchange rate to $e = r$. Under that assumption,

112. See Calvo and Végh (1994).

$$E_{t-1}e_{t+i} = [\kappa + \kappa(1 - \kappa) + \ldots + \kappa(1 - \kappa)^i]r = [1 - (1 - \kappa)^{i+1}]r,$$

provided that realignment has not yet occurred. Equation A12 therefore becomes

$$p_t = \lambda p_{t-1} + \frac{(1 - \theta)^2(1 - \mu + \phi\delta)\zeta\kappa r}{\theta(\zeta - 1)(\kappa + \zeta - 1)}.$$

This formula was used to generate figure 13, which plots $\mu(p_t - e_t - p_t^*)$ against time.

To generate figure 12, which also plots $\mu(p_t - e_t - p_t^*)$ against time, equation 10 was replaced by a simpler version,

$$\text{(A13)} \qquad x_t = \omega(x_{t-1} + p_{t-1} - p_{t-2}) + (1 - \omega)E_{t-1}[\mu p_t + (1 - \mu)(e_t + p_t^*) + \phi y_t].$$

Assuming again that $p^* = u = 0$, the pegged exchange rate model consisting of equations 4–6 and A13 can be reduced to the following second-order difference equation in p_t, which I assume to be stable:

$$\text{(A14)} \qquad \left[1 - \frac{2\omega + (1 - \omega)\theta}{1 - (1 - \theta)(1 - \omega)(\mu - \phi\delta)}L + \frac{\omega}{1 - (1 - \theta)(1 - \omega)(\mu - \phi\delta)}L^2\right]p_t = \frac{(1 - \theta)(1 - \omega)(1 - \mu + \phi\delta)e_t}{1 - (1 - \theta)(1 - \omega)(\mu - \phi\delta)}.$$

The plot for figure 12 was generated by letting $p_{-1} = -100$ and $p_0 = 0$, setting $e_t = 0$ for $t \geq 0$, and using (A14) to generate p_t for $t \geq 1$.

APPENDIX B

U.S. Intervention Sales of Yen

THIS APPENDIX lists U.S. intervention sales of yen against dollars, January 1993–April 1995:[113]

U.S. intervention date	*Coordination*	*Related Japanese intervention in Tokyo*
1993: April 27	Yes	Nothing significant until May 26
May 27	No	May 27–June 4
May 28	No	May 27–June 4
June 8	No	June 8, 10–17
August 19	Yes	August 20–September 2
1994: April 29	No	May 2 (next business day)
May 4	Yes	May 6, 11, 13, 18–20
June 24	Yes	June 27–29, July 1
November 2	Yes	November 1–2
November 3	No	None reported
1995: March 2	No	None reported
March 3	Yes	March 3, 6–7
April 3	Yes	Tokyo intervention conducted in concert with United States, continued April 4 by Bank of Japan alone
April 5	Yes	April 6–7, 10–11, 14, 17–20

113. Episodes of U.S. intervention other than March–April 1995 are reported in the *Federal Reserve Bulletin*, which identifies those that were coordinated with foreign central banks; March–April 1995 interventions were reported in the *New York Times*. Information on Bank of Japan intervention comes from *Nihon Keizai Shinbun*, Tokyo.

Comments and Discussion

Rudiger Dornbusch: It is a great pleasure to discuss this paper. It takes a moderate, mature, insightful approach to the knowledge about exchange rates, and it serves a great purpose in using a Swiss Army knife perspective, opening a blade at the time, telling you what you can do with it. There are forty-eight or forty-nine blades.

The paper is eminently readable. In that literature, this is not always the case; in fact, almost never. And it does not defend the latest eleven articles of the author, which is even more rare. Moreover it comes down squarely where it should, which, for me, makes it particularly readable. So, it admirably serves the purpose of looking back and asking, "What is there? What should you know? Where are the questions?"

It says, "Careful, this is not an area where we have had a Copernican revolution that gives us a radically new way of looking at results, closing all outstanding issues definitively. The issues were raised fifty years ago or longer, seventy years ago; and the same issues are still being kicked around, along with some new puzzles. We are doing a lot of work on them. We will report back in twenty-five years."

That is one approach. It also says, "We have been working on that and we are, actually, getting quite a bit ahead. We know a lot more about what is going on."

Obstfeld follows both tracks very, very well. He leans over, as he must, a little bit toward the current rendition of his themes. Bolero has been enacted in eleven movies by now, and each moviemaker gives his or her own touch to it. And Obstfeld, as his generation must, puts a lot of emphasis on credibility, and forward looking, and maximization, and tries those themes. Importantly, he comes out against them but does not

claim too much for the fact, and that means this paper will last longer in the end.

Let me pick on a few issues in the paper and then ask how it scores on the great question. *Pick* is the wrong word because mostly I go along with Obstfeld; I want to *highlight* some issues.

He says that PPP is a good benchmark. No serious economist could stray very far from it as the anchor for an exchange rate discussion. Why? Because there are very large, cumulative price movement divergences across countries. The exchange rate will mostly offset that. Since Cassel, this has been the first thing to say.

The next is to ask just exactly how well it works. Obstfeld argues that it sort of works, and that there are residuals. The residuals in annual averages always look small, and as Obstfeld does point out, when one cumulates them, they are big. Japan over the past hundred years is a case in point, with some 300 percent real appreciation. The trends are really quite big. And on that long-term trend line, the yen is approximately where it should be right now and it does not make much difference whether it is at 70 or 90 yen to the dollar. In the end, it will return to the trend; and twenty years from now will probably be 25 yen to the dollar.

But the trend is not the whole story because there is the extra effect of changing from a fixed rate regime to a flexible regime. For example, from the 1960s to the 1970s one observes a very big yen real appreciation and a DM real appreciation, one-time moves that come with the transition.

So the question remains: Why are major realignments associated with regime changes, as if these changes forced a generalized repricing of things and with that, a major change in relative prices? This issue tends to get lost when we consider PPP and the trends. Moreover, the one-time jump deserves special attention. What exactly is the mechanism that gives us PPP? And, is the pricing story regime-dependent, so that tradable goods prices behave differently under fixed and flexible rates?

That remains an issue for research. It certainly has a bearing on that nice natural experiment of going from fixed to flexible rates. Obstfeld draws attention to the change in the volatility of real exchange rates when they change from fixed to flexible. Another question is, "How does a one-time, big, real exchange rate change happen?"

Obstfeld also looks into the relation between current accounts and real exchange rates. He points out that there really is no direct relation

and that a simple forward-looking theory of current accounts popping out of intertemporal optimization reflecting saving and investment decisions does not work very well, except in Sweden and maybe somewhere else.

That is an interesting observation. What is so special about Sweden? The immediate response, of course, is: "Ah well, they had special kinds of shocks." But perhaps the more basic point is that Sweden is the quintessential welfare state, having only recently opened its capital markets. So maybe optimizing, forward-looking models work well for welfare states and not for capitalist market economies. I would like to see a little bit more investigation of why Sweden, of all places, should be the case that works. On the general question of current accounts and real exchange rates, Obstfeld has the right answer. You have to look at the shocks, and you have to look at the institutions in which the optimizing happens, but all said and done, the claim that there may be a hope for optimizing, forward-looking models is probably exaggerated.

Obstfeld, in passing, flirts with large world public debts. He says: "Well, I don't really know how this is connected with exchange rates. Surely there has got to be a connection. Because public debts are so big and are getting bigger, will they not get to the exchange rate, somehow, in the end?"

He says: "I am surprised that Italy keeps getting away with it." So, he is on to something. There is a link between indebtedness and the exchange rate; when indebtedness becomes large, people look toward Switzerland; and when they look toward Switzerland, the lira goes.

Of course, that is the story of a particular country that is relatively overindebted. And that is the direction in which to look, rather than at world debt. If we were to look at world debt and draw these charts for one hundred years, then perhaps it would not even be true that the world is relatively indebted today, unless we put in pensions. Then, of course, Canada and Italy should have the really big depreciations in their exchange rates.

Obstfeld has rightly included all the Latin and other attempts at exchange rate–based stabilization under a general theme: Are exchange rates a panacea? The answer is no, they are not, neither fixed, nor flexible, nor managed, nor target zone, nor anything. Any kind of exchange rate regime has to be used prudently. Most of what matters is domestic policy, and the exchange rate regime is, perhaps, an extra. That is a very

important part of Obstfeld's paper, and it is totally right in saying that the exchange rate regime is not going to make a difference when domestic policies cannot be brought in line.

He treads a little bit on dangerous territory when it comes to incomes policy. He says that an incomes policy can help, but this has to be followed by a colon, and immediately alarm bells have to be rung, because virtually every experiment with exchange rate–based stabilization has been complicated by an incomes policy that was not called off in time. Mexico is an example, with its *pacto*; Chile in the 1970s is too; the early, unsuccessful Israeli stabilization is another. In every one of these cases there was an incomes policy or indexation that in the end was politically very important and was not given up, and became the vehicle for overvaluation.

Obstfeld discusses accommodation and exchange rate policies to conclude that the evidence about the persistence of inflation under alternative exchange rate regimes is really very ambiguous. I have trouble with that section because I do not really know that flexible exchange rates are the regimes of people who want loose money; or that fixed exchange rate regimes are for the tight money crowd. I can imagine a flexible exchange rate being adopted by a country that says, "We want a really powerful offset to domestic disturbances. We will not accommodate with money. When we have a wage disturbance, we get a tightening of money, and higher interest rates, and real appreciation that will give us extra unemployment, on top of what we would get in a fixed exchange rate." That is one mode. The other mode is, "We like to accommodate, and we don't want to think of external constraints. Let us have a flexible rate." Either one is a plausible story. Trying to see whether fixed or flexible exchange rates show up with more persistence in inflation really has no theoretical basis.

Let me come to my last issue: intervention. Obstfeld, rightly, is very doubtful of the evidence on intervention; whether countries intervene when the exchange rate is just about to turn and make a marginal difference by getting the turning point between Friday and Monday, claiming full credit; or whether, in fact, historic battles are fought and won by the intervening governments against the speculators, who learn their lesson, surrender, and for months and months afterwards speculate the other way.

This last version is the Italian rendition, designed to persuade the

Bundesbank to come in and help them stabilize the lira before the 1992 debacle. Obstfeld is right in his skepticism.

Let me move from the small points to the bigger question of exchange rates. It is reasonable to ask four questions. One is: What job are exchange rates expected to do, and how well do they do them?

That is a question that, actually, we do not often ask. We implicitly have some notion that they are there to achieve general equilibrium. Is that full employment? Is that containing current account imbalances? Is that keeping interest rates lower than they otherwise would be? It is left open.

It does help to also ask how well they do their job. But unless I know what they are supposed to do, I cannot answer that question. I could ask the same question of long-term interest rates and the stock market, and then I would answer that they allocate resources over time. The exchange rate allocates the international division of labor. Does it do that particularly well? Compared to what? Compared to fixed rates? Compared to a world of flexible exchange rates with capital controls?

The second question is: What are the mechanisms by which the exchange rate accomplishes its goal, meaning the international allocation of resources? A lot of the research about pricing and about the effects of exchange rates over time, including even research on direct investment, is directed toward answering it; and I would say that the exchange rate does accomplish international reallocation of activity. In this respect, it is highly effective; there is no need to bring in elasticity pessimism.

The third question is this: Are there major puzzles about the exchange rate? And the answer is: You could not want for more, because virtually every aspect is wide open to question. For example, what determines exchange rates? Time series models are not a great help. Fundamentals are not a great idea. Anomalies make it into print without question.

Lastly, can you do better? Obstfeld goes into that discussion, and he quite rightly concludes that, with so much ignorance on the main issues and even on the details, this is not the place to rush to reform. He emphasizes that exchange rates are part of the world trading system, and that it is exceptionally important to keep the system open, rather than responding to misgivings about exchange rate outcomes with protection.

"Is there something that could improve the situation?" Obstfeld asks.

Let me, briefly, mention three possibilities. One is a financial transac-

tions tax. If you believe that short-term volatility translates into persistent swings in real prices or real exchange rates, which themselves have relatively little to do with what you understand to be fundamentals, try a Tobin tax. The Tobin tax may well produce more volatility in the short run, but that is all right because the short run then really does not matter much. What it does do is stabilize medium-term prices, and those are the ones that affect the allocation of resources.

The second option is to consider currency boards. Currency boards are the universal fad. Any time there is a collapse anywhere, people will say, "Let's do currency boards." But even when you have a currency board, you had better have 100 percent reserve banking and a balanced-budget amendment to get the Holy Trinity right. If you do not, you might end up like Argentina.

The third, and most important, alternative is inflation targets. If we had inflation targets in the United States, in particular, the movements in the dollar that we are seeing now would be far less likely. An explicit inflation target is really the missing anchor. If there is no anchor, then drift and volatility are to be expected.

In summary, here is a really excellent paper. It is exactly right in saying that this is the exchange rate system that we are going to live with; and any institutional changes will take place far away from the exchange market, presumably in the central bank. They will not be of the heroic kind that you talk about but never carry out, but they might be of the pragmatic kind, like inflation targets. And with inflation targets you are back to where the paper starts, at PPP trends. Inflation targets will limit the movements of exchange rates.

Ronald McKinnon: I enjoyed reading Obstfeld's paper as much as Dornbusch did. It is encyclopedic, and it is a balanced account of what we know about the foreign exchanges. It is a nice paper to assign to students to get them up to speed.

The summary idea, which goes through to Obstfeld's conclusion, is that the floating exchange rate system has not been the horror show that Ragnar Nurkse—and other economists favoring Bretton Woods par values—projected from the experiences of the 1920s and 1930s. But neither has it been the smooth adjustment mechanism that eminent advocates of floating—such as Milton Friedman, James Meade, Harry John-

son, and Fritz Machlup—projected in the 1950s and 1960s when exchange rates were safely fixed. Obstfeld's empirics gives us a handle on how the current regime is both more volatile and less satisfactory than projected by floating enthusiasts at that time.

In the 1960s, one idea united Keynesians and monetarists: they did not like the fixed-rate dollar standard. Many in both camps—albeit for different reasons—wanted the national macroeonomic autonomy that floating promised to confer. Consequently, by the end of the 1960s, the intellectual defence of the fixed-rate dollar standard—arguably the most successful international monetary system the world has yet seen—was undermined.[1]

Let me identify just two points of disagreement with Obstfeld's comprehensive paper. First is a sin of commission: the general association of national monetary independence with no-par floating. I will provide a counterexample. Second is a sin of omission: ignoring how volatile long-term interest rates have become since exchange rate par values were finally terminated in 1973.

The Syndrome of the Ever-higher Yen

First, Obstfeld suggests that under floating exchange rates countries can choose their own rate of inflation. He states that "by accommodating long-run equilibrium movements in real exchange rates, floating nominal exchange rates have helped liberate countries to pursue their own inflation objectives." Floating exchange rates have indeed allowed many countries greater long-run monetary independence—if often to their own detriment. In table 2, Obstfeld notes the strikingly higher and more persistent inflation in developing countries since floating began.

More questionably, he applies this principle to Japan in particular. "Given Japan's recently revealed preference for lower consumer-price inflation, however, the yen's continuing trend of real appreciation against the dollar could not have taken place at a fixed dollar-yen rate without substantial U.S. deflation."

This seemingly plausible conclusion comes from Obstfeld's analysis of the Balassa-Samuelson effect. Because of higher productivity growth in Japan's manufacturing (tradable) sector relative to the United States,

1. McKinnon (1993).

Japan's CPI rises relative to its wholesale price index (WPI) by more than in the United States. Hence the only way that Japan could stabilize its CPI inflation at the same rate as that of the United States is for the yen to appreciate continually against the dollar.

This is all well and good. But does the ever-rising yen really reflect the revealed preference of the Bank of Japan to stabilize the CPI—as Obstfeld would have it? In Japan's famous era of rapid economic growth in the 1950s and 1960s when exchange rates were fixed, the Bank of Japan was quite content to let the CPI increase at 4 to 5 percent per year, while the WPI rose by about 1 percent per year. However, since 1985, when American CPI inflation became fairly modest, further yen appreciation has resulted in a falling WPI in Japan. Indeed, particularly sharp yen appreciations in 1985–86 and 1993–95 provoked two industrial recessions. These costly high-yen deflations hardly seem like conscious policy by the Bank of Japan to eliminate inflation in Japan's CPI. I would argue that over the last decade, the ever-higher yen has forced the Bank of Japan into absolute deflation that it does not want; and, indeed, cannot get out of.

Even taking a longer-term perspective, the rise of the yen from 360 to the dollar in early 1971 to less than 100 in 1995 has imposed *relative* deflation on Japan compared to the United States. Increases in the foreign exchange value of the yen force the Bank of Japan to be more deflationary and, in effect, to validate the yen's appreciation. Whence the syndrome of the ever-higher yen.

What is the mechanism behind this syndrome? When President Nixon slammed the gold window shut in August 1971, he imposed an import surcharge on goods coming into the American economy and demanded that trading partners appreciate the dollar value of their currencies before the surcharge would be removed. Because of Japan's persistent trade surpluses since then, the United States continued to couple protectionist threats with demands—either implicit or explicit—for yen appreciation. (The major exception was the strong-dollar policy of the first Reagan administration.)

All the way from 360 to less than 100 yen to the dollar, U.S. secretaries of the Treasury have opined that the dollar is too high—notably Michael Blumenthal in 1977, James Baker in 1985–87, and Lloyd Bentsen in 1993. Often these attempts to "talk" the dollar down have been accompanied by intense trade negotiations aimed at forcing the Japa-

nese to open or share this or that market. Taking a short-run view of what would improve American competitiveness vis-à-vis Japan, participants in the foreign exchange market see a lower dollar as way of ameliorating—or perhaps forestalling—protectionist threats from the United States. For example, in particularly acrimonious negotiations in the first four months of 1995, when the U.S. trade representative, Mickey Kantor, tried to force Japan to set numerical targets for buying American automobiles and automobile components, the dollar fell particularly sharply, from 100 to 80 yen, before partially recovering in May.

But talk is cheap. Why should it force the yen up over the long term? Although the exchange rate is a forward-looking asset price, the (forward) fundamentals are hard to define, let alone model—either by foreign-exchange traders or by econometricians—as Obstfeld nicely discusses. So under certain circumstances, talk on exchange rates by Treasury secretaries, and commercial disputes themselves, can have an impact.

The markets see that the Japanese government tolerates a higher value of the yen in the short run because overvaluation seems to relieve American mercantile pressure and threats of a trade war. The markets—although not the "populist" American government—have also come to realize that yen appreciation will not itself reduce Japan's saving surplus as reflected in its current account surplus. Thus after any one episode when the yen is run up, and the American government is temporarily mollified, they project that the Japanese current account surplus and American current account deficit will continue in the future. Populist political agitation in the United States will eventually reappear as people complain about "unfair" Japanese competition, the American government again threatens sanctions unless Japan "does something" about its trade surplus—and the yen rises further as a palliative. In the longer run, deflation in Japan relative to the United States sustains this erratic upward path of the yen.

Once expectations of an ever-higher yen are firmly in place in the financial markets, the Bank of Japan becomes virtually powerless to prevent deflation from occurring. Take the present situation in mid-1995. Purchasing power parity, conservatively estimated to align the wholesale price levels of Japan and the United States, would be about 130 yen to the dollar, while the current exchange rate is 85 yen to the dollar. At this exchange rate, Japanese private investment is unprofitable and is in

a slump—and the domestic WPI is falling. The Bank of Japan has cut the discount rate to 1.0 percent, the interbank lending rate is about 1.35 percent, and the prime lending rate is 2.38 percent. Japan is in a liquidity trap where nominal interest rates are bounded below by zero, but real interest rates remain substantial because of the anticipated fall in the price level and continuing rise of the yen into the distant future.

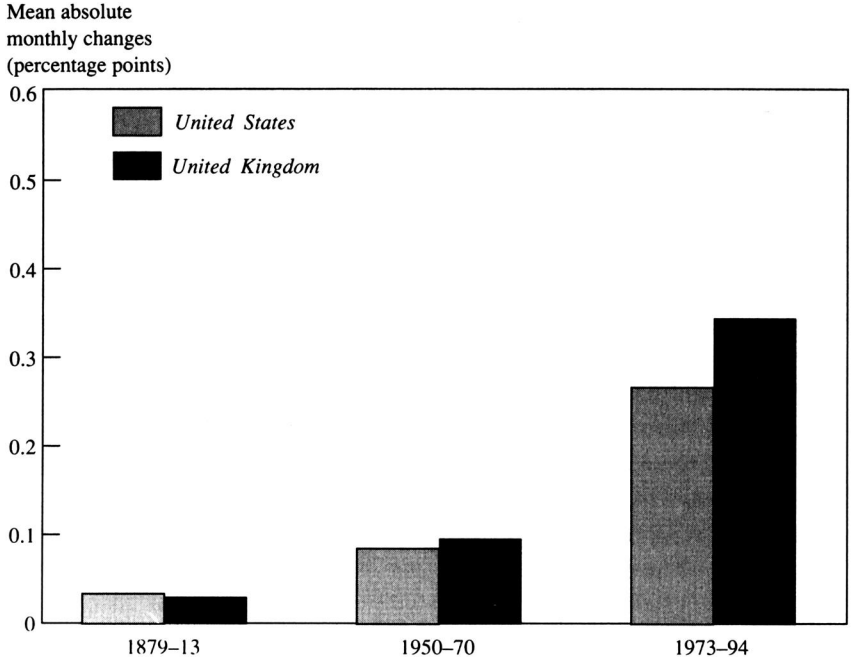
Notice that, with this expectations structure in place, quite large foreign exchange interventions by the Bank of Japan (such as those noted in Obstfeld's appendix B) are ineffective—whether or not they are sterilized. In the mode of the Keynesian liquidity trap, any new issues of inside money are simply absorbed by bond holders, causing very little change in domestic interest rates or—in an open economy—in the exchange rate.

What are possible ways of cranking up aggregate demand, eliminating slack, and restoring normal output growth in the Japanese economy? One unsatisfactory way, used in 1986–87 when the yen was overvalued and nominal interest rates were also very low, is to create asset bubbles in stocks and real estate. Because capitalization rates for dividend and rental streams are so low, the Japanese economy is prone to asset bubbles anyway. Wealth effects from spiraling stock and real estate prices can increase private spending—until the inevitable crash occurs, as it did in Japan in 1990–91. Creating a bubble economy is only feasible once in a generation.

A second unsatisfactory way is more quintessentially Keynesian: a fiscal expansion with sharply increased government deficit spending. The problem here is twofold. Public sector investment spending has already increased sharply in Japan. Secondly, building sharp increases in current consumption—public or private—into the financial structure is inconsistent with Japan's rapidly aging population. (Moreover, the United States currently depends on Japanese saving!)

Neither the bubble method nor fiscal expansion will do much to reduce the yen's overvaluation. Clearly, the only satisfactory way out to break the syndrome of the ever-higher yen is to convince the markets that the yen is unlikely to appreciate in the future. And the most straightforward way of changing expectations would be to announce a monetary pact between Japan and the United States that stabilizes the common producer price level and fixes the yen-dollar exchange rate indefinitely—perhaps at some nice round number like 110 yen per dollar with

Figure D1. Volatility in Long-term Interest Rates, United States and United Kingdom



a narrow zone of variation around it. This is spelled out in some detail by Kenichi Ohno and myself.[2]

In effect, we have a 1930s-type problem of a beggar-thy-neighbor exchange rate policy—as reflected in the syndrome of the ever-higher yen. And the solution now, as then, is a mutually determined par-value system credibly anchored by a common monetary policy. On this, Obstfeld and I seem to differ—with him remaining agnostic on what reforms are feasible or desirable.

Volatility in Long-term Interest Rates

Obstfeld is very good at looking at different kinds of volatility since the fixed-rate dollar standard broke down, and illustrating the big increase in real exchange rate volatility and domestic price volatility under floating. But one important dimension of volatility that he left out is the behavior of interest rates.

2. See McKinnon and Ohno (forthcoming).

Although I do not have the space here to analyze why interest rates have become more volatile since floating began, figure D1 compares the behavior of long-term interest rates for Britain and the United States under the international gold standard (1879–1913), the fixed rate dollar standard (1950 to 1970), and floating exchange rates (1973–94).[3] Prime AAA railway bonds were used for the United States under the gold standard; otherwise, the longest-term government bonds were employed for each country in each period.

Comparing mean absolute monthly changes in percentages points (using annual changes makes no difference to the results), long-term interest rates were nine to ten times as volatile under floating as under the gold standard, and three to four times as volatile as under the fixed-rate dollar standard. And this much higher volatility in the floating-rate period does not merely reflect the worldwide inflation of the 1970s and deflation of the early 1980s. When the data are broken down into subperiods, and other countries included, they show that high long-term volatility in long-term interest rates in the advanced industrial countries has continued into the 1990s.

General Discussion

The Panel discussed several aspects of exchange rate volatility. Barry Bosworth observed that international product markets react only slowly to changes in exchange rates, making the price elasticities of export supply and import demand extremely small in the short run. This is true even for U.S.–Canadian trade, where there are no formal trade barriers. With such a slow response in the trade flows that respond to moderate exchange rate movements, he reasoned that exchange rates can drift and fluctuate as if there were no fundamentals driving them. Bosworth also found it puzzling that price elasticities have not increased with the expansion of trade and the reduction of trade barriers.

Jeffrey Frankel provided an argument that the comovement between exchange rates is not just chance. The residuals of equations for the yen-dollar and DM-dollar exchange rates are highly correlated, producing a

3. See McKinnon (forthcoming) for an analysis of interest rate volatility under floating.

coefficient of 0.7 in Dornbusch's regression relating monthly changes in the DM-dollar rate and the yen-dollar rate. In a world where the variances of the shocks affecting the three currencies are equal and the covariance of these shocks is 0, the regression coefficient would be 1/2. It is impossible to say, however, whether Dornbusch's higher coefficient is due to excessive volatility and contagion, or to correlation among fundamentals. William Brainard pointed out that this evidence, and all of the paper's evidence, on volatility concerns the exchange rate between two specific currencies. But for macroeconomic stability, the volatility of a general index of a currency's value is more relevant.

Greg Mankiw was puzzled by the finding that exchange rates, but not fundamentals like output and money, have become more volatile under the floating regime. This defies most models and implies that the volatility of exchange rates does not affect anything else. In response, Obstfeld expressed skepticism about some popular empirical models linking exchange rates and fundamentals. For one thing, he questioned whether we have pinned down the fundamentals behind the exchange rate. M1, M2, and the like are endogenous variables, not true fundamentals. For another, we do not know the true stochastic process behind the fundamentals. The effect expected on the exchange rate from a money shock depends on whether money growth has a unit root. Even if the stochastic process changed subtly with regimes, exchange rate volatility might change dramatically. Finally, the increased exchange rate volatility observed under floating may reflect the fact that capital mobility increased during the floating rate period, and this increased mobility could affect volatility independently of other fundamentals.

Brainard suggested that the welfare effect of exchange rate movements depends on the extent to which speculation is a socially unproductive activity with negative externalities, and on what allocative role the exchange rate plays. In particular, the importance of volatility depends on whether it interferes with the market's role in allocating long-term investments. Obstfeld reasoned that exchange rate volatility results in greater variance in many sources of income and wealth, which will lead to a welfare loss if this cannot be hedged away. He suggested that the importance of this effect is similar to the importance of macroeconomic stabilization. Brainard and Sims were more pessimistic than Obstfeld about opportunities for risk sharing. The opening of capital markets can lead to greater international risk sharing but, as the Mexi-

can case indicates, it can increase risk as well. Where speculative attacks are possible, where questions of fiscal responsibility make them likely, and where individuals are not fully hedged with international portfolios, opening up capital markets increases the risk that individuals are exposed to. Brainard pointed out that the Shiller financial instruments, which Obstfeld offered as candidates for hedging individual workers' exchange rate exposure, remain theoretical. But if they did exist, they would still provide highly imperfect hedges because the burdens of adjustment are not shared equally, even by workers in the same plant. Since General Motors fires individual employees rather than reducing everyone's work hours, it does not help any worker very much to own a share of Japan's GNP.

Several policy proposals were discussed. Sims questioned whether a Tobin tax on currency transactions would decrease volatility. The tax should reduce the number of transactions, and there is a correlation between transactions and price volatility. But he doubted that this reflects a structural relationship. If volatility is due to speculation, and if speculative attacks resemble bank runs, a Tobin tax can be viewed as a tax on deposits and withdrawals. This would make the "cash flow" more lumpy and might make runs more sudden and dramatic, but it was unclear whether it would reduce their importance. Robert Hall suggested using the exchange rate as the intermediate target for stabilization policy. He noted that the central banks of the United States, Germany, and Japan use short-term interest rates as an intermediate target to be adjusted to meet macroeconomic goals, and that this results in relatively high exchange rate volatility. He reasoned that targeting the rate of change of a crawling exchange rate peg, would yield a better combination of interest rate and exchange rate volatility than the current system does. Ralph Bryant commented that policy coordination among major countries would be useful and might be taken more seriously than it has been if we could improve our analytical understanding of the world economy and of the spillovers from national macroeconomic policies.

William Nordhaus drew a broad message from the Mexican debacle. He noted that on that occasion, and during other crises with a fixed exchange rate system, like when the EMS broke down, there have been large international repercussions, and policymakers have gotten alarmed about a "systemic crisis." By contrast, even large movements of floating currencies cause much less international strain and alarm.

Thus the choice of a fixed regime which cannot be maintained creates a negative international externality. On the other hand, James Duesenberry commented that the fixed exchange rate between the French franc and the franc zone currencies in Africa worked fairly well as a nominal anchor for the franc zone countries, containing inflation for over forty years. But Obstfeld questioned whether the fixed exchange rates alone accounted for this success, noting that France exercised a great deal of control over domestic fiscal and monetary policy of the African nations in the zone, and provided them with substantial income transfers.

References

Agénor, Pierre-Richard, and Mark P. Taylor. 1992. "Testing for Credibility Effects." *International Monetary Fund Staff Papers* 39 (3): 545–71.

Alesina, Alberto, and Roberto Perotti. 1995. "The Political Economy of Budget Deficits." *International Monetary Fund Staff Papers* 42 (1): 1–31.

Alogoskoufis, George S. 1992. "Monetary Accommodation, Exchange Rate Regimes and Inflation Persistence." *Economic Journal* 102 (412): 461–80.

Alogoskoufis, George S., and Ron Smith. 1991. "The Phillips Curve, the Persistence of Inflation, and the Lucas Critique: Evidence from Exchange-Rate Regimes." *American Economic Review* 81 (5): 1254–75.

Asea, Patrick K., and Enrique G. Mendoza. 1994. "The Balassa-Samuelson Model: A General Equilibrium Appraisal." *Review of International Economics* 2 (3): 244–67.

Backus, David K., and Patrick J. Kehoe. 1989. "On the Denomination of Government Debt: A Critique of the Portfolio Balance Approach." *Journal of Monetary Economics* 23 (3): 359–76.

Balassa, Bela. 1964. "The Purchasing-Power Parity Doctrine: A Reappraisal." *Journal of Political Economy* 72 (6): 584–96.

Barro, Robert J. 1992. "World Interest Rates and Investment." In *Savings Behavior: Theory, International Evidence, and Policy Implications*, edited by Erkki Koskela and Jouko Paunio. Oxford: Blackwell.

Barro, Robert J., and David B. Gordon. 1983. "A Positive Theory of Monetary Policy in a Natural Rate Model." *Journal of Political Economy* 91 (4): 589–610.

Baxter, Marianne, and Alan C. Stockman. 1989. "Business Cycles and the Exchange-Rate Regime: Some International Evidence." *Journal of Monetary Economics* 23 (3): 377–400.

Bergsten, C. Fred. 1982. "What to Do about the U.S.-Japan Economic Conflict." *Foreign Affairs* 60 (5): 1059–75.

Bergstrand, Jeffrey H. 1983. "Is Exchange Rate Volatility 'Excessive'?" *New England Economic Review* (September/October): 5–14.

Black, Stanley W. 1973. "International Money Markets and Flexible Exchange Rates." *Princeton Studies in International Finance* 32.

Branson, William H. 1970. "Monetary Policy and the New View of International Capital Movements." *BPEA, 2:1970*, 235–62.

———. 1986. "The Limits of Monetary Coordination as Exchange Rate Policy." *BPEA, 1:1986*, 175–94.

Bruno, Michael. 1993. *Crisis, Stabilization, and Economic Reform: Therapy by Consensus*. Oxford: Clarendon Press.

Bryant, Ralph C., Peter Hooper, and Catherine L. Mann, editors. 1993. *Evaluating Policy Regimes: New Research in Empirical Macroeconomics*. Washington: Brookings.

Bufman, Gil, and Leonardo Leiderman. 1995. "Israel's Stabilization: Some Important Policy Lessons." In *Reform, Recovery, and Growth: Latin America and the Middle East*, edited by Rudiger Dornbusch and Sebastian Edwards. Chicago: University of Chicago Press.

Bulow, Jeremy, and Kenneth Rogoff. 1988. "The Buyback Boondoggle." *BPEA, 2:1988*, 675–98.

Calvo, Guillermo A. 1983. "Staggered Prices in a Utility-Maximizing Framework." *Journal of Monetary Economics* 12 (3): 383–98.

——— 1988. "Servicing the Public Debt: The Role of Expectations." *American Economic Review* 78 (4): 647–61.

Calvo, Guillermo A., and Carlos A. Végh. 1994. "Credibility and the Dynamics of Stabilisation Policy: A Basic Framework." In *Advances in Econometrics: Sixth World Congress*, vol. 2, edited by Christopher A. Sims. Cambridge: Cambridge University Press.

Campa, Jose, and Linda S. Goldberg. 1995. "Investment in Manufacturing, Exchange Rates and External Exposure." *Journal of International Economics* 38 (3–4): 297–320.

Canzoneri, Matthew B., and Behzad T. Diba. 1991. "Fiscal Deficits, Financial Integration, and a Central Bank for Europe." *Journal of the Japanese and International Economies* 5 (4): 381–403.

Catte, Pietro, Giampaolo Galli, and Salvatore Rebecchini. 1994. "Concerted Interventions and the Dollar: An Analysis of Daily Data." In *The International Monetary System*, edited by Peter B. Kenen, Francesco Papadia, and Fabrizio Saccomanni. Cambridge: Cambridge University Press.

Chinn, Menzie D., and Richard A. Meese. 1995. "Banking on Currency Forecasts: How Predictable is Change in Money?" *Journal of International Economics* 38 (1–2): 161–78.

Clarida, Richard, and Jordi Gali. 1994. "Sources of Real Exchange Rate Fluctuations: How Important Are Nominal Shocks?" *Carnegie-Rochester Conference Series on Public Policy* 41: 1–56.

Cooper, Richard N. 1982. "The Gold Standard: Historical Facts and Future Prospects." *BPEA, 1:1982*, 1–45.

——— 1987. "A Monetary System for the Future." In *The International Monetary System: Essays in World Economics*, by Richard N. Cooper. Cambridge, Mass.: MIT Press.

——— 1994. "Comment." In *Managing the World Economy: Fifty Years after Bretton Woods*, edited by Peter B. Kenen. Washington: Institute for International Economics.

Corbo, Vittorio, and Leonardo Hernández. 1994. "Macroeconomic Adjustment to Capital Inflows: Latin American Style versus East Asian Style." Policy Research Working Paper 1377. Washington: World Bank (November).

Corbo, Vittorio, and Andrés Solimano. 1991. "Chile's Experience with Stabilization Revisited." In *Lessons of Economic Stabilization and Its Aftermath*, edited by Michael Bruno and others. Cambridge, Mass.: MIT Press.

De Grauwe, Paul. 1988. "Exchange Rate Variability and the Slowdown in Growth of International Trade." *International Monetary Fund Staff Papers* 35 (1): 63–84.

De Gregorio, José, Alberto Giovannini, and Holger C. Wolf. 1994. "International Evidence on Tradables and Nontradables Inflation." *European Economic Review* 38 (6): 1225–44.

Diaz-Alejandro, Carlos F. 1984. "Latin American Debt: I Don't Think We Are in Kansas Anymore." *BPEA, 2:1984*, 335–89.

Dominguez, Kathryn M., and Jeffrey A. Frankel. 1993. *Does Foreign Exchange Intervention Work?* Washington: Institute for International Economics.

Dornbusch, Rudiger. 1976. "Expectations and Exchange Rate Dynamics." *Journal of Political Economy* 84 (6): 1161–76.

——— 1982. "PPP Exchange-Rate Rules and Macroeconomic Stability." *Journal of Political Economy* 90 (1): 158–65.

——— 1986. "Flexible Exchange Rates and Excess Capital Mobility." *BPEA, 1:1986*, 209–26.

Dornbusch, Rudiger, and Sebastian Edwards. 1994. "Exchange Rate Policy and Trade Strategy." In *The Chilean Economy: Policy Lessons and Challenges*, edited by Barry P. Bosworth, Rudiger Dornbusch, and Raúl Labán. Washington: Brookings.

Dornbusch, Rudiger, and Jeffrey A. Frankel. 1987. "Macroeconomics and Protection." In *U.S. Trade Policies in a Changing World Economy*, edited by Robert M. Stern. Cambridge, Mass.: MIT Press.

Dornbusch, Rudiger, and Paul Krugman. 1976. "Flexible Exchange Rates in the Short Run." *BPEA, 3:1976*, 537–75.

Dornbusch, Rudiger, and Alejandro Werner. 1994. "Mexico: Stabilization, Reform, and No Growth." *BPEA, 1:1994*, 253–97.

Edison, Hali J. 1993. "The Effectiveness of Central-Bank Intervention: A Study of the Literature after 1982." Special Papers in International Economics 18. Princeton, N.J.: Princeton University International Finance Section.

Edwards, Sebastian. 1992. "Exchange Rates as Nominal Anchors." Working Paper 4246. Cambridge, Mass.: National Bureau of Economic Research (December).

Edwards, Sebastian, and Alejandra Cox-Edwards. 1987. *Monetarism and Liberalization: The Chilean Experiment*. Cambridge, Mass.: Ballinger.

Eichenbaum, Martin, and Charles Evans. 1995. "Some Empirical Evidence on the Effects of Monetary Policy Shocks on Exchange Rates." *Quarterly Journal of Economics* 110 (forthcoming).

Eichengreen, Barry, and Douglas A. Irwin. 1995. "Trade Blocs, Currency Blocs and the Reorientation of World Trade in the 1930s." *Journal of International Economics* 38 (1–2): 1–24.

Eichengreen, Barry, Andrew K. Rose, and Charles Wyplosz. 1995a. "Speculative Attacks on Pegged Exchange Rates: An Empirical Exploration with Spe-

cial Reference to the European Monetary System." Working Paper C95-046. Berkeley: Center for International and Development Economics Research (January).

———. 1995b. "Exchange Market Mayhem: The Antecedents and Aftermath of Speculative Attacks." *Economic Policy* 21 (forthcoming).

Eichengreen, Barry, and Jeffrey D. Sachs. 1985."Exchange Rates and Economic Recovery in the 1930s." *Journal of Economic History* 45 (4): 925–46.

Eichengreen, Barry, James Tobin, and Charles Wyplosz. 1995. "Two Cases for Sand in the Wheels of International Finance." *Economic Journal* 105 (428): 162–72.

Eichengreen, Barry, and Charles Wyplosz. 1993. "The Unstable EMS." *BPEA, 1:1993*, 51–124.

Engel, Charles. 1993. "Real Exchange Rates and Relative Prices: An Empirical Investigation." *Journal of Monetary Economics* 32 (1): 35–50.

Engel, Charles, and John H. Rogers. 1995. "How Wide Is the Border?" International Finance Discussion Paper 498. Washington: Board of Governors of the Federal Reserve System (February).

Fischer, Stanley. 1986. "Exchange Rate versus Monetary Targets in Disinflation." In *Indexing, Inflation, and Economic Policy*, by Stanley Fischer. Cambridge, Mass.: MIT Press.

Fleming, J. Marcus. 1962. "Domestic Financial Policies under Fixed and under Floating Exchange Rates." *International Monetary Fund Staff Papers* 9: 369–79.

——— 1970. "Discussion." In *The International Adjustment Mechanism*. Boston: Federal Reserve Bank of Boston.

Flood, Robert P., and Peter M. Garber. 1984. "Collapsing Exchange-Rate Regimes: Some Linear Examples." *Journal of International Economics* 17 (1–2): 1–13.

Flood, Robert P., and Andrew K. Rose. 1993. "Fixing Exchange Rates: A Virtual Quest for Fundamentals." Working Paper 4503. Cambridge, Mass.: National Bureau of Economic Research (October).

Ford, Robert, and Douglas Laxton. 1995. "World Public Debt and Real Interest Rates." Working paper. Washington: International Monetary Fund (March).

Frankel, Jeffrey A. 1985. "The Dazzling Dollar." *BPEA, 1:1985*, 199–217.

Frankel, Jeffrey A., and Kenneth A. Froot. 1987. "Using Survey Data to Test Standard Propositions Regarding Exchange Rate Expectations." *American Economic Review* 77 (1): 133–53.

Frankel, Jeffrey A., and Andrew K. Rose. 1995a. "A Panel Project on Purchasing Power Parity: Mean Reversion within and between Countries." Discussion Paper 1128. London: Centre for Economic Policy Research (February).

——— 1995b. "A Survey of Empirical Research on Nominal Exchange Rates." Working Paper C95-051. Berkeley: Center for International and Development Economics Research (June).

Frankel, Jeffrey A., and Shang-Jin Wei. 1993. "Trade Blocs and Currency Blocs." In *The Monetary Future of Europe*, edited by Guillermo de la Dehesa and others. London: Centre for Economic Policy Research.

Frenkel, Jacob A., and Michael L. Mussa. 1980. "The Efficiency of Foreign Exchange Markets and Measures of Turbulence." *American Economic Review, Papers and Proceedings* 70 (2): 374–81.

Friedman, Milton. 1953. "The Case for Flexible Exchange Rates." In *Essays in Positive Economics*, by Milton Friedman. Chicago: University of Chicago Press.

Froot, Kenneth A., and Kenneth Rogoff. 1995. "Perspectives on PPP and Long-Run Real Exchange Rates." In *Handbook of International Economics*, vol. 3, edited by Gene M. Grossman and Kenneth Rogoff. Amsterdam: North-Holland.

Fuhrer, Jeff, and George Moore. 1995. "Inflation Persistence." *Quarterly Journal of Economics* 110 (1): 127–59.

Garber, Peter, and Mark P. Taylor. 1995. "Sand in the Wheels of Foreign Exchange Markets: A Sceptical Note." *Economic Journal* 105 (428): 173–80.

Giavazzi, Francesco, and Marco Pagano. 1988. "The Advantage of Tying One's Hands: EMS Discipline and Central Bank Credibility." *European Economic Review* 32 (5): 1055–75.

Giovannini, Alberto. 1990. "European Monetary Reform: Progress and Prospects." *BPEA, 2:1990*, 217–74.

Goldstein, Morris. 1984. "The Exchange Rate System: Lessons of the Past and Options for the Future." Occasional Paper 30, edited by Ella H. Wright. Washington: International Monetary Fund (July).

Gordon, Robert J. 1977. "World Inflation and Monetary Accommodation in Eight Countries." *BPEA, 2:1977*, 409–68.

Hart, Oliver D., and David M. Kreps. 1986. "Price Destabilizing Speculation." *Journal of Political Economy* 94 (5): 927–52.

Herin, Jan, Assar Lindbeck, and Johan Myhrman, editors. 1976. Proceedings of a Conference on Flexible Exchange Rates and Stabilization Policy. *Scandinavian Journal of Economics* 78 (2): 133–412.

Huizinga, John. 1994. "Exchange Rate Volatility, Uncertainty, and Investment: An Empirical Investigation." In *Capital Mobility: The Impact on Consumption, Investment and Growth*, edited by Leonardo Leiderman and Assaf Razin. Cambridge: Cambridge University Press.

Jeanne, Olivier. 1994. "Models of Currency Crises: A Tentative Synthesis." Unpublished paper. Paris: Ecole Nationale des Ponts et Chaussées-CERAS (December).

Johnson, Harry G. 1970. "The Case for Flexible Exchange Rates, 1969." In *Approaches to Greater Flexibility of Exchange Rates: The Bürgenstock Papers*, edited by George N. Halm. Princeton, N.J.: Princeton University Press.

Jurgensen, Philippe, chair. 1983. *Report of the Working Group on Exchange Market Intervention*. Washington: U.S. Department of the Treasury (March).

Kehoe, Patrick J. 1987. "Coordination of Fiscal Policies in a World Economy." *Journal of Monetary Economics* 19 (3): 349–76.

Kenen, Peter B. 1995. "Capital Controls, the EMS and EMU." *Economic Journal* 105 (428): 181–92.

Kim, Soyoung, and Nouriel Roubini. 1995. "Liquidity and Exchange Rates in the G-7 Countries: Evidence from Identified VAR's." Unpublished paper. Yale University (February).

Klein, Michael W., and Eric S. Rosengren. 1991. "Foreign Exchange Intervention as a Signal of Monetary Policy." *New England Economic Review* (May-June): 39–50.

Krugman, Paul. 1979. "A Model of Balance-of-Payments Crises." *Journal of Money, Credit and Banking* 11 (3): 311–25.

——— 1991. "Has the Adjustment Process Worked?" In *International Adjustment and Financing: The Lessons of 1985-1991*, edited by C. Fred Bergsten. Washington: Institute for International Economics.

Kydland, Finn E., and Edward C. Prescott. 1977. "Rules Rather than Discretion: The Inconsistency of Optimal Plans." *Journal of Political Economy* 85 (3): 473–91.

Lambertini, Luisa. 1995. "Technological Change and Deficit Bias." Unpublished paper. University of California, Berkeley (January).

League of Nations. 1944. *International Currency Experience: Lessons of the Inter-War Period*. Geneva: Economic, Financial, and Transit Department, League of Nations.

Leamer, Edward E. 1988. "Cross-Section Estimation of the Effects of Trade Barriers." In *Empirical Methods for International Trade*, edited by Robert C. Feenstra. Cambridge, Mass.: MIT Press.

Lewis, Karen K. 1995. "Puzzles in International Financial Markets." In *Handbook of International Economics*, vol. 3, edited by Gene M. Grossman and Kenneth Rogoff. Amsterdam: North-Holland.

Mark, Nelson C. 1995. "Exchange Rates and Fundamentals: Evidence on Long-Horizon Predictability." *American Economic Review* 85 (1): 201–218.

Marston, Richard C. 1987. "Real Exchange Rates and Productivity Growth in the United States and Japan." In *Real-Financial Linkages among Open Economies*, edited by Sven W. Arndt and J. David Richardson. Cambridge, Mass.: MIT Press.

——— 1993. "Interest Differentials under Bretton Woods and the Post-Bretton Woods Float: The Effects of Capital Controls and Exchange Risk." In *A Retrospective on the Bretton Woods System: Lessons for International Monetary Reform*, edited by Michael D. Bordo and Barry Eichengreen. Chicago: University of Chicago Press.

McKibbin, Warwick J., and Jeffrey D. Sachs. 1991. *Global Linkages: Macroeconomic Interdependence and Cooperation in the World Economy*. Washington: Brookings.

McKinnon, Ronald I. 1969. "Portfolio Balance and International Payments Ad-

justment." In *Monetary Problems of the International Economy*, edited by Robert A. Mundell and Alexander K. Swoboda. Chicago: University of Chicago Press.

——— 1984. *An International Standard for Monetary Stabilization*. Washington: Institute for International Economics.

——— 1988. "Monetary and Exchange Rate Policies for International Financial Stability: A Proposal." *Journal of Economic Perspectives* 2 (1): 83–103.

——— 1993. "The Rules of the Game: International Money in Historical Perspective." *Journal of Economic Literature* 31 (1): 1–44.

———. Forthcoming. *The Rules of the Game: International Money and Exchange Rates*. Cambridge, Mass.: MIT Press.

McKinnon, Ronald I., and Kenichi Ohno. Forthcoming. *Dollar and Yen: Resolving Economic Conflict Between the United States and Japan*. Cambridge, Mass.: MIT Press.

Meade, James E. 1955. "The Case for Variable Exchange Rates." *Three Banks Review* 27 (September): 3–27.

——— 1957. "The Balance-of-Payments Problems of a European Free-Trade Area." *Economic Journal* 67 (267): 379–96.

Meese, Richard A., and Kenneth Rogoff. 1983a. "Empirical Exchange Rate Models of the Seventies: Do They Fit Out of Sample?" *Journal of International Economics* 14 (1–2): 3–24.

——— 1983b. "The Out-of-Sample Failure of Empirical Exchange Rate Models: Sampling Error or Misspecification?" In *Exchange Rates and International Macroeconomics*, edited by Jacob A. Frenkel. Chicago: University of Chicago Press.

Meese, Richard A., and Kenneth J. Singleton. 1983. "Rational Expectations and the Volatility of Floating Exchange Rates." *International Economic Review* 24 (3): 721–33.

Mundell, Robert A. 1968. *International Economics*. New York: Macmillan.

Mussa, Michael. 1976. "The Exchange Rate, the Balance of Payments and Monetary and Fiscal Policy under a Regime of Controlled Floating." *Scandinavian Journal of Economics* 78 (2): 229–48.

——— 1986. "Nominal Exchange Rate Regimes and the Behavior of Real Exchange Rates: Evidence and Implications." *Carnegie-Rochester Conference Series on Public Policy* 25:117–213.

Obstfeld, Maurice. 1985. "Floating Exchange Rates: Experience and Prospects." *BPEA, 2:1985*, 369–450.

——— 1990. "The Effectiveness of Foreign-Exchange Intervention: Recent Experience, 1985–1988." In *International Policy Coordination and Exchange Rate Fluctuations*, edited by William H. Branson, Jacob A. Frenkel, and Morris Goldstein. Chicago: University of Chicago Press.

——— 1993. "The Adjustment Mechanism." In *A Retrospective on the Bretton Woods System: Lessons for International Monetary Reform*, edited by Michael D. Bordo and Barry Eichengreen. Chicago: University of Chicago Press.

——— 1994. "The Logic of Currency Crises." *Cahiers Economiques et Monétaires* 43: 189–213.

Obstfeld, Maurice, and Kenneth Rogoff. 1995a. "Exchange Rate Dynamics Redux." *Journal of Political Economy* 103 (3): 624–60.

——— 1995b. "The Intertemporal Approach to the Current Account." In *Handbook of International Economics*, vol. 3, edited by Gene M. Grossman and Kenneth Rogoff. Amsterdam: North-Holland.

Organisation for Economic Co-operation and Development (OECD). 1994. *OECD Economic Outlook 56* (December). Paris: OECD.

Oudiz, Gilles, and Jeffrey D. Sachs. 1984. "Macroeconomic Policy Coordination among the Industrial Economies." *BPEA, 1:1984*, 1–64.

Rogoff, Kenneth. 1985. "The Optimal Degree of Commitment to an Intermediate Monetary Target." *Quarterly Journal of Economics* 100 (4): 1169–89.

Romer, Christina D., and David H. Romer. 1989. "Does Monetary Policy Matter? A New Test in the Spirit of Friedman and Schwartz." In *NBER Macroeconomics Annual 1989*, edited by Olivier Jean Blanchard and Stanley Fischer, 121–70. Cambridge, Mass.: MIT Press.

Romer, David. 1993. "Rational Asset-Price Movements without News." *American Economic Review* 83 (5): 1112–30.

Rose, Andrew K., and Lars E. O. Svensson. 1994. "European Exchange Rate Credibility before the Fall." *European Economic Review* 38 (6): 1185–216.

Roubini, Nouriel, and Jeffrey D. Sachs. 1989. "Government Spending and Budget Deficits in the Industrial Countries." *Economic Policy* 8 (April): 100–27.

Sachs, Jeffrey D. 1981. "The Current Account and Macroeconomic Adjustment in the 1970s." *BPEA, 1:1981*, 201–68.

——— 1985. "The Dollar and the Policy Mix: 1985." *BPEA, 1:1985*, 117–85.

Samuelson, Paul A. 1964. "Theoretical Notes on Trade Problems." *Review of Economics and Statistics* 46 (2): 145–54.

Sargent, Thomas J., and Neil Wallace. 1981. "Some Unpleasant Monetarist Arithmetic." *Federal Reserve Bank of Minneapolis Quarterly Review* (Fall): 1–17.

Shiller, Robert J. 1993. *Macro Markets: Creating Institutions for Managing Society's Largest Economic Risks*. Oxford: Clarendon Press.

Solomon, Robert. 1977. "A Perspective on the Debt of Developing Countries." *BPEA, 2:1977*, 479–501.

——— 1982. *The International Monetary System, 1945-1981*. New York: Harper & Row.

Stockman, Alan C. 1987. "The Equilibrium Approach to Exchange Rates." *Federal Reserve Bank of Richmond Economic Review* 73 (2): 12–30.

Svensson, Lars E. O. 1994. "Fixed Exchange Rates as a Means to Price Stability: What Have We Learned?" *European Economic Review* 38 (3–4): 447–68.

Taylor, John B. 1980. "Aggregate Dynamics and Staggered Contracts." *Journal of Political Economy* 88 (1): 1–23.

——— 1993. *Macroeconomic Policy in a World Economy: From Econometric Design to Practical Operation*. New York: Norton.

Tobin, James. 1978. "A Proposal for International Monetary Reform." *Eastern Economic Journal* 4 (3–4): 153–59.

Tornell, Aaron, and Andrew Velasco. 1995. "Fixed versus Flexible Exchange Rates: Which Provides More Fiscal Discipline?" Economic Research Report 95-06. New York: C. V. Starr Center for Applied Economics, New York University (February).

Trefler, Daniel. 1993. "Trade Liberalization and the Theory of Endogenous Protection: An Econometric Study of U.S. Import Policy." *Journal of Political Economy* 101 (1): 138–60.

Truman, Edwin M. 1994. "Discussion." In *The International Monetary System*, edited by Peter B. Kenen, Francesco Papadia, and Fabrizio Saccomanni. Cambridge: Cambridge University Press.

Twentieth Century Fund. 1992. *The Report of the Twentieth Century Fund Task Force on Market Speculation and Corporate Governance*. New York: Twentieth Century Fund.

Végh, Carlos A. 1992. "Stopping High Inflation: An Analytical Overview." *International Monetary Fund Staff Papers* 39 (3): 626–95.

von Furstenberg, George M., and Joseph P. Daniels. 1992. "Economic Summit Declarations, 1975–1989: Examining the Written Record of International Cooperation." *Princeton Studies in International Finance* 72.

Weber, Axel A. 1994. "Foreign Exchange Intervention and International Policy Coordination: Comparing the G-3 and EMS Experience." Discussion Paper 1038. London: Centre for Economic Policy Research (October).

Wei, Shang-Jin, and David C. Parsley. 1995. "Purchasing Power *Dis*parity during the Floating Rate Period: Exchange Rate Volatility, Trade Barriers and Other Culprits." Working Paper 5032. Cambridge, Mass.: National Bureau of Economic Research (February).

Williamson, John. 1985. *The Exchange Rate System*, second ed. Washington: Institute for International Economics.

——— 1993. "Exchange-Rate Management." *Economic Journal* 103 (416): 188–97.

Williamson, John, and C. Randall Henning. 1994. "Managing the Monetary System." In *Managing the World Economy: Fifty Years after Bretton Woods*, edited by Peter B. Kenen. Washington: Institute for International Economics.