International Capital Mobility and Exchange Rate Volatility

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Three post-1980 developments have instilled in many observers a feeling that all is not quite right with the world financial system: the international debt problem of many developing countries, the large U.S. current account deficit and the corresponding cumulation of foreign indebtedness, and the heightened volatility of exchange rates and other asset prices in world financial markets. To what extent are the large swings in prices and quantities on international financial markets attributable to a higher degree of international capital mobility in the 1980s? This paper examines, first, various ways of quantifying the degree of international capital mobility, and, second, implications of high capital mobility for the possibility that exchange rates are "excessively volatile."

Has the Degree of Capital Mobility Increased?

By the second half of the 1970s, international economists had come to speak of the world financial system as characterized by perfect capital mobility. In many ways, this was "jumping the gun." It is true that financial integration had been greatly enhanced after 1973 by the removal of capital controls on the part of the United States, Germany, Canada, Switzerland and the Netherlands; by the steady process of

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technical and institutional innovation, particularly in the Euromarkets; and by the recycling of OPEC surpluses to developing countries. But almost all developing countries retained extensive restrictions on international capital flows, notwithstanding the abortive liberalization experiments in the Southern Cone of Latin America, as did a majority of industrialized countries. Even among the five major countries without capital controls, capital was not perfectly mobile by some definitions.

At least four distinct definitions of perfect capital mobility are in widespread use. (I) *The Feldstein-Horioka definition*: Exogenous changes in national saving (that is, in either private savings or government budgets) can be easily financed by borrowing from abroad, and thus need not crowd out investment in the originating country (except perhaps to the extent that the country is large in world financial markets). (II) *Real interest parity*: International capital flows equalize real interest rates across countries. (III) *Uncovered interest parity*: Capital flows equalize expected rates of return on countries' bonds, despite exposure to exchange risk. (IV) *Closed interest parity*: Capital flows equalize interest rates across countries when contracted in a common currency. These four possible definitions are in ascending order of specificity. Only the last condition is an unalloyed criterion for capital mobility in the sense of the degree of financial market integration across national boundaries.[1]

As we will see, each of the first three conditions, if it is to hold, requires an auxiliary assumption in addition to the condition that follows it. Uncovered interest parity requires not only closed (or covered) interest parity, but also the condition that the exchange risk premium is zero. Real interest parity requires not only uncovered interest parity, but also the condition that expected real depreciation is zero. The Feldstein-Horioka condition requires not only real interest parity, but also a certain condition on the determinants of investment. But even though the relevance to the degree of integration of financial markets decreases as auxiliary conditions are added, the relevance to questions regarding the origin of international payments imbalances increases. We begin our consideration of the various criteria of capital mobility with the Feldstein-Horioka definition.

Saving-Investment Tests

The Feldstein-Horioka definition requires that the country's real interest rate be tied to the world real interest rate by criterion (II); it is,

[1] There is a fifth possible—yet more narrowly defined—criterion for the degree of integration of financial markets: the size of transactions costs as measured directly by the bid-ask spread in, for example, the foreign exchange market. Surprisingly, the covered interest differential does not appear to be statistically related to the bid-ask spread (MacArthur 1988).

after all, the real interest rate rather than the nominal on which saving and investment in theory depend. But for criterion (I) to hold, it is also necessary that any and all determinants of a country's rate of investment other than its real interest rate be uncorrelated with its rate of national saving. Let the investment rate be given by

$$(I/Y)_i = a - br_i + u_i, \tag{1}$$

where I is the level of capital formation, Y is national output, r is the domestic real interest rate, and u represents all other factors, whether measurable or not, that determine the rate of investment. Feldstein and Horioka (1980) regressed the investment rate against the national saving rate,

$$(I/Y)_i = A + B(NS/Y)_i + v_i, \tag{1'}$$

where NS is private saving minus the budget deficit. To get the zero coefficient B that they were looking for requires not only real interest parity:

$$r_i - r^* = 0, \tag{2}$$

(with the world interest rate r^* exogenous or in any other way uncorrelated with $(NS/Y)_i$), but also a zero correlation between u_i and $(NS/Y)_i$.

The Feldstein-Horioka literature. The Feldstein and Horioka finding that the coefficient B is in fact closer to 1 than to zero has been reproduced many times. Most authors have not been willing, however, to follow them in drawing the inference that financial markets are not highly integrated. There have been many econometric critiques, falling into two general categories.

Most commonly made is the point that national saving is endogenous, or in our terms is correlated with u_i. This will be the case if national saving and investment are both procyclical, as they are in fact known to be. It will also be the case if governments respond endogenously to incipient current account imbalances with policies to change public (or private) saving in such a way as to reduce the imbalances. This "policy reaction" argument has been made by Fieleke (1982), Tobin (1983), Westphal (1983), Caprio and Howard (1984) and Summers (1988). But Feldstein and Horioka made an effort to handle the econometric endogeneity of national saving, more so than have some of their critics. To handle the cyclical endogeneity, they computed averages over a long enough period of time that business cycles could be argued to wash out. To handle other sources of endogeneity, they used demographic variables as instrumental variables for the saving rate.

The other econometric critique is that if the domestic country is large in world financial markets, r^* will not be exogenous with respect to

$(NS/Y)_i$, and therefore even if $r=r^*$, r and in turn $(I/Y)_i$ will be correlated with $(NS/Y)_i$. In other words, a shortfall in domestic savings will drive up the world interest rate, and thus crowd out investment in the domestic country as well as abroad. This "large-country" argument has been made by Murphy (1984), Harberger (1980), Tobin (1983) and Obstfeld (1986a). An insufficiently appreciated point is that the large-country argument does not create a problem in cross-section studies, because all countries share the same world interest rate r^*. Since r^* simply goes into the constant term in a cross-section regression, it cannot be the source of any correlation with the right-hand-side variable. The large-country problem cannot explain why the countries that are high-saving relative to the average tend to coincide with the countries that are high-investing relative to the average.[2]

If the regressions of saving and investment rates were a good test for barriers to financial market integration, one would expect to see the coefficient falling over time. Until now, the evidence has if anything showed the coefficient rising over time rather than falling. This finding has emerged both from cross-section studies, which typically report pre-and post-1973 results—Feldstein (1983), Penati and Dooley (1984), and Dooley, Frankel and Mathieson (1987)—and from pure time-series studies—Obstfeld (1986a,b)[3] and Frankel (1986) for the United States. The econometric endogeneity of national saving does not appear to be the explanation for this finding, because it holds equally well when instrumental variables are used.[4]

The easy explanation for the finding is that, econometric problems aside, real interest parity—criterion (II) above—has not held any better in recent years than it did in the past. Mishkin (1984a, p. 1352), for example, found even more significant rejections of real interest parity among major industrialized countries for the floating rate period after

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[2] Even in a time-series regression for a single country such as the United States, one can correct for the large-country problem by expressing saving and investment rates as deviations from the *rest-of-world* rates of saving and investment, respectively. Under the null hypothesis, an exogenous fall in the U.S. saving rate may drive up the world real interest rate and crowd out investment, but there is no evident reason for the crowding-out to be reflected in U.S. investment *to any greater extent* than in rest-of-the-world investment. In Frankel (1986, pp. 44–45), I found that the close correspondence between U.S. saving and investment for 1970–85 remains, even with this adjustment.

[3] Obstfeld (1986a) finds that the coefficient fell after 1973, in time series correlations for most of his countries, but Obstfeld (1986b) finds that it has risen over time (1967–84 vs. 1956–66), with the United States showing the highest correlation of any.

[4] In a U.S. time series context, Frankel (1986) used two instrumental variables: the fraction of the population over 65 years of age and the ratio of military expenditure to GNP. The former is considered a determinant of private saving and the latter of public saving, and both have some claim to exogeneity. In the context of cross-sections of developing and industrialized countries, Dooley, Frankel and Mathieson (1987) used the dependency ratio and, again, the military expenditure variable.

1973:II than he did for his entire 1967:II–1979:II sample period. Caramazza et al. (1986, pp. 43–47) also found that some of the major industrialized countries in the 1980s (1980:1 to 1985:6) moved farther from real interest parity than they had been in the 1970s (1973:7 to 1979:12).[5] In the early 1980s, the real interest rate in the United States, in particular, rose far above the real interest rate of its major trading partners, by any of a variety of measures.[6] If the domestic real interest rate is not tied to the foreign real interest rate, then there is no reason to expect a zero coefficient in the saving-investment regression. We discuss in a later section the factors underlying real interest differentials.

The U.S. saving-investment regression updated. Since 1980 the massive fiscal experiment carried out under the Reagan administration has been rapidly undermining the statistical finding of a high saving-investment correlation for the case of the United States. The increase in the structural budget deficit, which was neither accommodated by monetary policy nor financed by an increase in private saving, reduced the national saving rate by 3 percent of GNP, relative to the 1970s. The investment rate—which at first, like the saving rate, fell in the 1981–82 recession—had by 1987 at best only reattained its 1980 level.[7] The saving shortfall was made up, necessarily, by a flood of borrowing from abroad equal to more than 3 percent of GNP. Hence the current account deficit of $161 billion in 1987 (actually 3.6 percent of GNP). (By contrast, the U.S. current account balance was on average equal to zero in the 1970s.)

By now, the divergence between U.S. national saving and investment has been sufficiently large and long-lasting to show up in longer-term regressions of the Feldstein-Horioka type. If one seeks to isolate the degree of capital mobility or crowding out for the United States in particular, and how it has changed over time, then time series regression is necessary (whereas if one is concerned with such measures worldwide, then cross-section regressions of the sort performed by Feldstein and Horioka are better). Table 1 reports instrumental variables regressions of investment against national saving for the United States

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[5] Other studies that reject real interest parity for major industrialized countries include Mishkin (1984a, 1984b), Cumby and Obstfeld (1984), Mark (1985), and Cumby and Mishkin (1986). Glick (1987) examines real interest differentials for six Pacific Basin countries vis-à-vis the United States.

[6] The 10-year interest differential vis-à-vis a weighted average of G-5 countries was about 3 percent in 1984, whether expected inflation is measured by a distributed lag, by OECD forecasts, or by DRI forecasts. In 1980 the differential was about −2 percent by contrast (Frankel 1986, pp. 35–36).

[7] Gross investment was 16.0 percent of GNP in 1980, down from 16.5 percent in 1971–80, which was itself considered a low number. Net investment was 5.4 percent of GNP, down from 6.2 percent in the 1970s.

Table 1
Instrumental Variables Regression of U.S. Investment against National Saving, Decades 1869–1987

	Constant	Coefficient	Time Trend in Coefficient	Durbin-Watson Statistic	Autoregressive Parameter	R^2
1.	.411	.976		1.45		.96
	(1.340)	(.086)				
2.	3.324	.785			.46	.97
	(1.842)	(.118)			(.33)	
3.	3.291	.854	−.011	.73		.92
	(6.176)	(.279)	(.021)			
4.	1.061	.924	.001		.03	.96
	(1.507)	(.093)	(.005)		(.08)	

Source: Frankel (1989).

from 1870 to 1987.[8] Decade averages are used for each variable, which removes some of the cyclical variation but gives us only 12 observations. (Yearly data are not available before 1930.) That is one more observation than was available in Frankel (1986, Table 2.2), which went only through the 1970s.

As before, the coefficient is statistically greater than zero and is not statistically different from 1, suggesting a high degree of crowding out (or a low degree of capital mobility, in Feldstein and Horioka's terms). But the point estimate of the coefficient (when correcting for possible serial correlation) drops from 0.91 in the earlier study to 0.79. We can allow for a time trend in the coefficient; it drops from plus 0.01 a year in the earlier study to minus 0.01 a year (or plus 0.001, when correcting for serial correlation) in the longer sample. Thus the additional years 1980–87 do show up as anticipated, as exhibiting a lower U.S. degree of crowding out, even though the change is small. (The trend is not statistically significant, but this is not surprising given the small number of observations.)

A data set that begins later would seem more promising than the 12-decade averages. Table 2 reports regressions for yearly data beginning in 1930. Much of the variation in the yearly data is cyclical, so table 3 uses saving and investment rates that have been cyclically adjusted, for a sample period that begins in 1955. (The cyclical adjustment of each

[8] The instrumental variables used are the dependency ratio (the sum of those older than 64 and those younger than 21, divided by the working-age population in between), which is a determinant of private saving, and military expenditure as a share of GNP, which is a determinant of the federal budget deficit. A data appendix is available in the working paper versions of Frankel (1989) for details on these and the other variables.

Table 2
Instrumental Variables Regression of U.S. Investment against National Saving, 1929–1987

	Constant	Coefficient	Durbin-Watson Statistic	Autoregressive Parameter	R^2
1929–87	2.99	.79	.64		.94
	(.88)	(.06)			
1930–87	4.85	.67		.77	.89
	(2.61)	(.19)		(.09)	
1929–79	1.89	.86	1.31		.97
	(.61)	(.04)			
1930–79	2.00	.85		.38	.95
	(.66)	(.05)		(.13)	
1980–87	13.73	.15	2.09		.17
	(3.85)	(.27)			
1981–87	−.36	.03		−.37	.00
	(.56)	(.02)		Not Converged	

Source: Frankel (1989).

is accomplished by first regressing it on the GNP gap, defined as the percentage deviation from the U.S. Bureau of Economic Analysis "middle expansion trend" of GNP, and taking the residuals.)

In previous work with a sample period of 1956–84, the coefficient in a regression of cyclically adjusted saving and investment rates was estimated at 0.80, statistically indistinguishable from 1 (Frankel 1986, pp. 43–44). But now the coefficient has dropped essentially to zero, suggesting a zero degree of crowding out (or, in the Feldstein-Horioka terminology, perfect capital mobility). This finding is the result of the addition to the sample of another three years of record current account deficits, 1985–87, a period also in which the cyclically adjusted national saving rate was historically low. When the equation is estimated with an allowance for a time trend in the coefficient, the trend is negative (though statistically insignificant), whereas the earlier sample that stopped in 1984 showed a time trend that was positive (and insignificant).

To verify that the 1980s experience is indeed the source of the precipitous fall in the saving-investment coefficient,[9] the sample period

[9] There are two other potential sources of differences from the results in Frankel (1986): the U.S. Commerce Department released revised national accounts data for the entire period in 1986, and we now use the dependency ratio as the demographic instrumental variable in place of the ratio of the over-65 to the over-20 population. But the years 1985–87 are indeed the source of the fall in the coefficient; when these three years are omitted the coefficient is over 1 (as when the 1980s are omitted in Table 3).

Table 3
Instrumental Variables Regression of U.S. Investment against National Saving, 1955–1987
Cyclically Adjusted Savings and Investment

	Constant	Coefficient	Durbin-Watson Statistic	Autoregressive Parameter	R^2
1955–87	*	−.06	.96		.25
		(.25)			
1956–87	*	.03		.50	.42
		(.26)		(.15)	
1955–79	−.68	1.37	1.61		.73
	(.17)	(.23)			
1956–79	−.57	1.05		.35	.70
	(.18)	(.19)		(.20)	
1980–87	.39	.13	2.46		.30
	(.36)	(.17)			
1981–87	.58	.22		−.13	.34
	(.37)	(.16)		(.41)	

* Constant term is automatically zero because cyclically adjusted rates are residuals from a 1955–1987 regression against the GNP gap.
Source: Frankel (1989).

is split at 1980. For the period 1955–79, not only is the coefficient statistically indistinguishable from 1, but the point estimate is slightly *over* 1.[10] It is clearly the unprecedented developments of the present decade that have overturned the hitherto robust saving-investment relationship for the case of the United States. It is likely that financial liberalization in Japan, the United Kingdom, and other countries, continued innovation in the Euromarkets, and perhaps the repeal by the U.S. Treasury in 1984 of the withholding tax on interest payments to foreign residents, have resulted in a higher degree of capital mobility, and thereby facilitated the record flow of capital to the United States in the 1980s. But the magnitude of the inflow is in the first instance attributable to the unprecedented magnitude of the decline in national saving.

[10] If the 1956–87 sample is split at 1974, when the United States and Germany removed capital controls, rather than at 1979, there is still a precipitous decline in the cyclically adjusted saving-investment coefficient over time: from 0.87 (statistically, no difference from 1) to 0.31 (borderline difference from 0). If the 1930–87 sample is split at 1958, when many European countries restored currency convertibility, there is a small increase in the coefficient over time: from 0.83 (statistically different from 1) to 1.14 (no difference from 1). But this is no doubt because the saving and investment rates are not cyclically adjusted for this period (the BEA series is not available back to 1930). Only when expressed on a cyclically adjusted basis is the U.S. national saving rate of 1985–87 devastatingly low.

Differentials in Expected Rates of Return, and Expected Real Depreciation

If the goal is to measure the degree of integration of capital markets, rather than the degree to which decreases in national saving have crowded out investment, then it is better to look at differences in rates of return across countries rather than looking at saving-investment correlations.[11] But measuring real interest differentials will not do the trick. An international investor, when deciding which country's assets to buy, will not compare the interest rates in different countries each expressed in terms of expected purchasing power over that country's goods. When he or she thinks to evaluate assets in terms of purchasing power, all assets will be evaluated in terms of the same basket, the one consumed by that particular investor. The expected inflation rate then drops out of differentials in expected rates of return among assets.

The differential in expected rates of return on two countries' bonds is the uncovered interest differential, the nominal interest differential minus the expected change in the exchange rate: $i - i^* - (\text{exp depr})$. If asset demands are highly sensitive to expected rates of return, then the differential will be zero, which gives us uncovered interest parity:

$$i - i^* - (\text{exp depr}) = 0. \tag{3}$$

To distinguish this parity condition, which is Criterion (III) above, from the other definitions, it has often been designated "perfect substitutability:" not only is there little in the manner of transactions costs or government-imposed controls to separate national markets, but also domestic-currency and foreign-currency bonds are perfect substitutes in investors' portfolios. Just as Criterion (I) is considerably stronger than Criterion (II), so is Criterion (II) considerably stronger than Criterion (III). For real interest parity to hold, one must have not only uncovered interest parity, but an additional condition as well, which is sometimes called ex ante relative purchasing power parity:

$$\text{exp depr} = \text{exp infl} - \text{exp infl}^*. \tag{2'}$$

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[11] Measuring barriers to integration by difference in rates of return has the problem that a given degree of integration can appear smaller or larger depending on the disturbances to saving (or to other variables) during the sample period in question. (The same is true of measuring by saving-investment correlations.) For example, the greater degree of variability in the U.S. real interest differential in the 1980s, as compared to the 1970s or 1960s, should be attributed to the greater swings in variables such as the structural budget deficit, not to a lower degree of capital mobility. (In any case, the degree of variability in *covered* interest differentials is very low in the 1980s.) All we can say for sure is that if the barriers to integration are essentially zero (the degree of capital mobility is essentially perfect), then differentials in rates of return should be essentially zero.

Table 4
Purchasing Power Parity between the United States and the United Kingdom 1869–1987

	1973–87	1945–72	1945–87	1869–1987
Statistics on Percent Deviation from Mean				
Mean Absolute Deviation	.120	.074	.110	.093
Standard Deviation	.156	.091	.156	.121
Time Trend	.001	−.001	.006*	−.001*
	(.010)	(.002)	(.002)	(.000)
Regressions of Real Exchange Rate Autoregressions				
Deviation From Mean	.687*	.722*	.830*	.844*
	(.208)	(.130)	(.092)	(.050)
Deviation From Trend	.688*	.730*	.741*	.838*
	(.208)	(.131)	(.101)	(.052)
Regression Against Nominal Exchange Rate				
Coefficient[a]	2.516*	1.220*	1.687*	.916*
	(.417)	(.103)	(.186)	(.093)
Autocorrelation Coefficient	.959*	.989*	.992	.988*
	(.054)	(.015)	(.011)	(.014)

* Significant at the 95 percent level.
Note: Standard errors are reported in parentheses.
[a] With constant term and correction for autocorrelation.
Source: Frankel (1989).

Equation (2′) and equation (3) together imply equation (2). If goods markets are perfectly integrated, meaning not only that there is little in the manner of transportation costs or government-imposed barriers to separate national markets, but also that domestic and foreign goods are perfect substitutes in consumers' utility functions, then purchasing power parity holds. Purchasing power parity (PPP) in turn implies (2′). But as is by now well known, goods markets are not in fact perfectly integrated. Because of the possibility of expected real depreciation, real interest parity can fail even if criterion (III) holds perfectly.

Table 4 shows updated annual statistics on the real exchange rate between the United States and Great Britain. During the floating rate period 1973–87, though there is no significant time trend, there is a large standard error of 15.6 percent. The serial correlation in the deviations from PPP is estimated at 0.687, with a standard error of 0.208. (The equation estimated is $(er_{t+1} - er_{t+1}) = AR(er_t - er_t)$, where er is the real exchange rate, *er* is the long-run equilibrium level, alternatively estimated as the sample mean or a time trend, and AR is the autoregressive coefficient.) This means that the estimated speed of adjustment to PPP is 0.313 per year, and that one can easily reject the hypothesis of instantaneous adjustment.

From the ashes of absolute PPP, a phoenix has risen. In response to findings such as those reported here, some authors have swung from one extreme, the proposition that the tendency of the real exchange rate to return to a constant is complete and instantaneous, to the opposite extreme that there is no such tendency at all. The hypothesis that the real exchange rate follows a random walk is just as good as the hypothesis of absolute PPP for implying ex ante relative PPP. But there is even less of an a priori case why PPP should hold in rate-of-change form than in the level form.

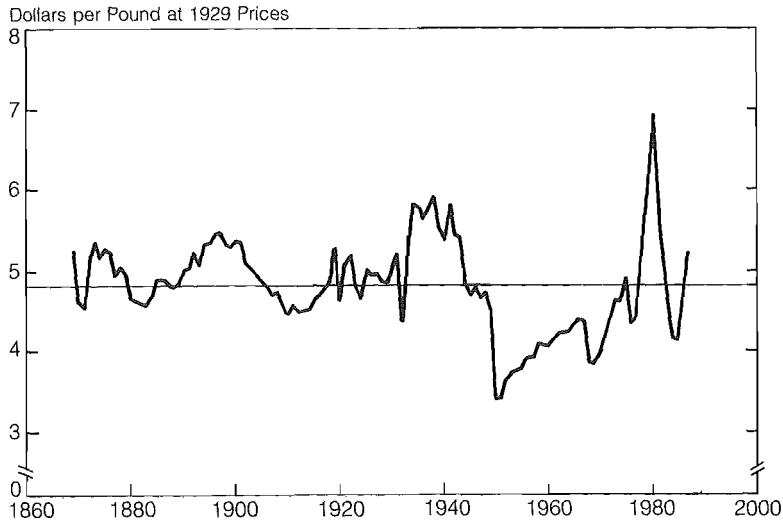
Even though ex ante relative PPP has little basis in theory, it does appear to have some empirical support. Typically, the estimated speeds of adjustment during the floating rate period, 0.31 in table 4 (1973–87), while not so low as to be implausible as point estimates, are nevertheless so low that one statistically cannot reject the hypothesis that the autoregression coefficient is 1.0.

A 95-percent confidence interval on the autoregressive coefficient covers the range 0.27–1.10. If the null hypothesis is an autoregressive coefficient of 1.0, one cannot legitimately use the standard t-test derived from a regression where the right-hand-side variable is the level of the real exchange rate, because under the null hypothesis the variance is infinite. There are a number of ways of dealing with this nonstationarity problem. Here one simply applies the corrected Dickey-Fuller 95-percent significance level, 3.00. The 0.31 estimate for the floating-rate period is insignificantly different from zero. This failure to reject a random walk in the real exchange rate is the same result found by Roll (1979), Frenkel (1981, p. 699), Adler and Lehman (1983), Darby (1981), Mishkin (1984a, pp. 1351–53), and Piggott and Sweeney (1985).

A more promising alternative is to choose a longer time sample to get a more powerful estimate. Table 4 also reports statistics for the entire postwar period 1945–87. PPP held better for the Bretton Woods years than it did after 1973, as measured either by the mean absolute deviation and standard deviation of the real exchange rate, or by the ability to reject the hypothesis of zero autocorrelation. But, despite the longer time sample, one is only at the borderline of being able to reject the random walk. The 95-percent confidence interval for AR runs from 0.64 to 1.02, and the t-ratio of 1.85 falls short of the Dickey-Fuller 95-percent significance level of 2.93.

The standard error of an estimate of AR is approximately the square root of $(1 - AR^2)/N$. So if the true speed of adjustment is on the order of 30 percent a year (AR = .7), we would require at least 49 years of data $(2.93^2(1 - .7^2)/(1 - .7)^2 = 48.6)$ to be able to reject the null hypothesis of

Dollar/Pound Real Exchange Rate
1869–1987, with Period Average



AR = 1. It is not very surprising that 43 years of data is not enough, much less the 15 years of data used in most studies.[12]

The last column of table 4 presents an entire 119 years of United States-United Kingdom data, shown graphically as well in the figure. With this long a time sample, the standard error is reduced considerably. The rejection of no serial correlation in the real exchange rate is even stronger than in the shorter time samples. More importantly, one is finally able to detect a statistically significant tendency for the real exchange rate to regress to PPP, at a rate of 16 per cent a year. The confidence interval for AR runs from 0.75 to 0.94, safely less than unity, and the t-ratio of 3.12 exceeds the Dickey-Fuller significance level of 2.89.

The motivation for looking at PPP in this section has been to obtain insight into the expected rate of real depreciation, because that is the variable that can give rise to real interest differentials even in the presence of uncovered interest parity. In rejecting the random walk description of the real exchange rate, one has rejected the claim that the

[12] An AR coefficient of 0.7 on a yearly basis corresponds to an AR of 0.97 on a monthly basis ($.97^{12} = .70$). Thus it would take 564 months of data ($2.93^2(1 - .97^2)/(1 - .97)^2 = 563.7$) to be able to reject the null hypothesis of AR = 1. This is 47 years, very little gain in efficiency over the test on yearly data.

rationally expected rate of real depreciation is zero.[13] To take an example, in 1983–84, when the dollar had appreciated some 30 percent above its PPP value, survey data show expected future real depreciation of 4.3 percent per year. It is thus not difficult to explain the existence of the U.S. real interest differential, even without appealing to any sort of risk premium. There is little excuse for authors such as Koraczyk (1985, p. 350) and Darby (1986, p. 420) ruling out the possibility of expected real depreciation a priori and thereby concluding that real interest differentials *necessarily* constitute risk premiums.

If the failure of ex ante relative purchasing power parity could, in itself, explain the failure of real interest parity, then it could also, by itself, explain the failure of saving and investment to be uncorrelated. In the recent U.S. context, a fall in national saving could cause an increase in the real interest differential and therefore a fall in investment, even if financial markets are perfectly integrated and even if the fall in saving is truly exogenous, provided the real interest differential is associated with expected real depreciation of the dollar.

Demonstrating that the failure of ex ante relative purchasing power parity is capable of producing a correlation between saving and investment is, of course, not the same thing as asserting that this in fact is the explanation for the observed correlation. Plenty of other competing explanations have been proposed. But some support for the idea that the existence of expected real depreciation is key to the observed correlation comes from Cardia (1987). She simulates saving and investment rates in a sequence of models featuring shocks to fiscal spending, money growth, and productivity, in order to see which models are capable, for empirically relevant magnitudes of the parameters, of producing saving-investment correlations as high as those observed. To get at some of the explanations that have been most prominently proposed, she constructs models both with and without purchasing power parity, both with and without endogenous response of fiscal policy to current account imbalances, and both with and without the small-country assumption. The finding is that the model that allows for deviations from purchasing power parity is able to explain saving-

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[13] The rationally expected rate of real depreciation estimated from a specific time series process is not necessarily the same as the actual expectation of real depreciation held by investors. Frankel (1986, pp. 58–59) used survey data on expectations of exchange rate changes (collected by the *Economist*-affiliated *Financial Report*) and forecasts of price level changes (by DRI) to compute a direct measure of expected real depreciation for the dollar against five currencies. The numbers showed an expectation that the real exchange rate tends to regress back toward PPP at a statistically significant rate of 8 to 12 percent a year.

The expectation of *nominal* depreciation back toward PPP is estimated more sharply at 12 to 16 percent a year in Frankel and Froot (1987). For a thorough rejection of the view that investors' expected exchange rate changes are zero, see Froot and Frankel (1989).

investment correlations as high as one, while the various models that impose purchasing power parity are generally not as able to do so.[14]

Covered Interest Differentials

The differential in real interest rates is defined as:

$$r - r^* = (i - \exp \text{infl}) - (i^* - \exp \text{infl}^*).$$

We saw in the first section that real interest parity could hold, and yet the saving-investment coefficient will be non-zero if other determinants of investment are correlated with saving. We then saw analogously, in the second section, that uncovered interest parity can hold, and yet real interest parity will fail if there is a non-zero expected rate of depreciation of the currency. Decomposing the real interest differential into the expected rate of depreciation and the uncovered interest differential, we have,

$$r - r^* = (\exp \text{depr} - \exp \text{infl} + \exp \text{infl}^*) + (i - i^* - \exp \text{depr}). \quad (4)$$

The sequence of logic is concluded by noting that covered interest parity can hold, and yet uncovered interest parity will fail if there is a non-zero exchange risk premium, defined as (fd—exp depr). The complete decomposition of the real interest differential is:

$$r - r^* = (\exp \text{depr} - \exp \text{infl} + \exp \text{infl}^*) + (\text{fd} - \exp \text{depr}) + (i - i^* - \text{fd}). \quad (5)$$

The covered interest differential ($i - i^* - fd$) is the proper measure of capital mobility, in the sense of the degree of integration of financial markets across national borders. It reflects such things as capital controls, tax laws that discriminate by country of residence, default risk, risk of future capital controls, transactions costs, and information costs.

Many studies have examined covered interest differentials for the largest industrialized countries. Frankel and MacArthur (1988) give references to those studies, and then look at differentials for 24 countries vis-à-vis the Eurodollar market, for the period 1982 to 1987. Forward rate data are used to decompose the real interest differential into the three components shown in equation (5). Frankel (1989) adds a 25th country, and updates the results through 1988. The results are similar. Although

[14] Obstfeld (1986a) shows, in a life-cycle model of saving with actual OECD data on the functional distribution of income and on population growth, that the coefficient in an investment regression can be similar to those estimated by Feldstein and Horioka.

all 25 countries have real interest differentials that are substantial and variable, 11 have quite small covered interest differentials: Canada, Germany, the Netherlands, Switzerland, the United Kingdom, Hong Kong, Singapore, Austria, Belgium, Sweden, and Japan. These 11, and the United States, may be said to have essentially open capital markets. Their real interest differentials consist of some combination of exchange risk premium and expected real depreciation, factors associated with the currency in which the asset is denominated, rather than with the country in which it is issued.

The case for highly integrated financial markets would appear to be well established. But Feldstein and Horioka (1980, p. 315) argue that financial markets are less well integrated at longer-term maturities, as compared to the three-month maturities used in tests of covered interest parity such as those reported above:

> It is clear from the yields on short-term securities in the Eurocurrency market and the forward prices of those currencies that liquid financial capital moves very rapidly to arbitrage such short-term differentials. . . . There are, however, reasons to be sceptical about the extent of such long-term arbitrage.

Studies of international interest parity have been restricted by a lack of forward exchange rates at horizons going out much further than one year.[15] But even without the use of forward rate data, there are ways of getting around the problem of exchange risk. Data on currency swap rates can be used in place of forward exchange rates to test the long-term version of interest rate parity. Popper (1987) finds that the swap-covered return differential on five-year U.S. government bonds versus Japanese bonds averaged only 1.7 basis points from October 3, 1985 to July 10, 1986, and that the differential on seven-year bonds averaged only 5.3 basis points. The means mask some variation in the differential. A band of 46 basis points is large enough to encompass 95 percent of the observations for the five-year bonds; the band is 34 basis points for the seven-year bonds. The means on five-year bonds for some other major countries are as follows: Canada 15.9 basis points, Switzerland 18.7, United Kingdom 51.1, and Germany 28.4.

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[15] Taylor (1988) is one of the most recent of many studies of covered interest parity *within the London Euromarket*. Such studies do not get at the degree of financial market integration *across national boundaries*. When authors find deviations from covered interest parity in such data, it is often due to low quality of the data, e.g., inexact timing. With high-quality data, Taylor finds that covered interest parity held extremely well in 1985, that it held less well in the 1970s, particularly during "turbulent" periods, that the differential had mostly vanished by 1979, and that the differentials that do exist are slightly larger at the longer-term than shorter-term maturities. But, like other studies, Taylor has no data on maturities longer than one year.

The magnitude of these long-term differentials compares favorably with the magnitude of the short-term differentials. The implication is that Feldstein and Horioka are wrong in their conjecture that there is a term-structure wedge separating national capital markets. At both long and short maturities, the covered interest parity tests show a high degree of financial market integration across national boundaries in the late 1980s, even for countries that retained formidable capital controls in the 1970s.[16] This conclusion is consistent with our earlier finding that the U.S. saving-investment coefficient has fallen sharply in the 1980s.

Does High Capital Mobility Lead to Excessive Exchange Rate Variability?

The first half of this paper was intended to establish that capital is indeed highly mobile internationally, in the sense of integration of financial markets across national borders. As we have seen, this fact does not mean that real rates of return will necessarily be equalized across countries, or that a saving shortfall in one country will be fully financed in the form of a current account deficit of equal magnitude. But it does mean that there are no significant barriers separating international investors from the portfolios they wish to hold. Slight increases in the expected rate of return on one currency, or any other source of an increase in demand for the currency, will be instantaneously reflected in the price of that currency on the foreign exchange market. This helps explain why exchange rates have been so highly variable since 1973.

This half of the paper examines the question whether the high degree of capital mobility might result in "excess volatility" of exchange rates. Many practitioners believe that exchange rates are driven by psychological factors and other irrelevant market dynamics, rather than by economic fundamentals. Support seems to have grown in the 1980s for "target-zone" proposals, the imposition of barriers to international capital mobility, or other sorts of government action to stabilize exchange rates.[17]

Among American academic economists, a majority continue to believe that exchange rate movements reflect changes in macroeconomic

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[16] It is still quite likely, however, that there is a wedge in each country separating the long-term interest rate from the after-tax cost of capital facing firms. Such a wedge could be due either to the corporate income tax system or to imperfect substitutability between bonds and capital. Hatsopoulos, Krugman and Summers (1988) argue that the cost of capital facing U.S. corporations is higher than that facing Japanese corporations, even when real interest rates are equal, because U.S. companies rely more heavily on equity financing, which is more expensive than debt financing.

[17] See, for example, Williamson (1985).

policy or in other real fundamentals, even if the fundamentals remain unobserved by the econometrician.[18] In this view, it follows that there would be no advantage in attempting to suppress exchange rate variability. But others support the position that exchange rates have in some sense been more volatile than necessary.

Stabilizing and Destabilizing "Speculators"

Those economists who believe that exchange rates have been excessively volatile vary in their arguments. Some, like Tobin (1978) and Dornbusch (1986), argue that exchange rates are too variable because financial markets are "excessively efficient," that capital sloshes back and forth among countries in response to trivial disturbances, and that a tax on foreign exchange transactions would reduce volatility. But there is another view, associated with McKinnon (1976), that exchange rates are too variable because of a "deficiency of stabilizing speculation," in other words because capital flows are not responsive enough to expected rates of return.

These two seemingly contradictory views can be reconciled. Assume two groups of participants in the foreign exchange market, whom we will call "investors" and "spot traders," the first with regressive expectations and the second with bandwagon expectations.

The investors can be thought of as "stabilizing speculators." When the value of the domestic currency lies above its long-run equilibrium, they expect it to depreciate in the future back toward equilibrium. If they act on this expectation, they will move into foreign currency, driving the price of the domestic currency down in the present. They thus act to mitigate fluctuations of the currency around its long-run equilibrium. The spot traders can be thought of as "destabilizing speculators." When the value of the currency has risen above its long-run equilbrium, they expect it to continue to rise in the future. If they act on this expectation, they will buy more of the currency, driving the price up further in the present. They thus act to exacerbate fluctuations.

The reconciliation of the Tobin and McKinnon views is now possible. When McKinnon says that exchange rates are too variable because there is a deficiency of stabilizing speculation, he means that there are not enough people of the first type, or their actions are insufficiently responsive to their (stabilizing) expectations. When Tobin

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[18] Regression equations have been notoriously poor at using money supplies and other economic fundamentals to explain exchange rate movements. So-called "variance-bounds" tests purport to evaluate directly whether asset prices have been excessively volatile. But if simple regression tests fail to identify an agreed-upon set of relevant economic fundamentals, as they have in the case of exchange rates, then variance-bounds tests add nothing (Frankel and Meese 1987).

says that exchange rates are too volatile because there is too much speculation, he means that there are too many people of the second type, or their actions are excessively responsive to their (destabilizing) expectations.

To write down the argument in symbols, assume that the spot rate, s in log form, is determined by the ratio of the relative supply of domestic assets, m in log form, to the relative demand for domestic assets, d in log form:

$$s = m - d + u, \tag{6}$$

where u is an unknown error term. Assume that a fraction w of participants[19] in the foreign exchange market are investors and a fraction 1 − w are traders:

$$d = w\, d_i + (1 - w)\, d_t. \tag{7}$$

Assume that the investors expect the exchange rate to regress toward its long-run equilibrium value at rate θ, and that the traders expect it to diverge, as along a "speculative bubble path," at rate δ:

$$\text{exp depr}_i = \theta(s - \bar{s}) \tag{8}$$

$$\text{exp depr}_t = -\delta(s - \bar{s}). \tag{9}$$

Assume further that f_i and f_t represent the elasticity of each group's demand for foreign assets with respect to their expectations. The f parameters can be interpreted as the degree of international capital mobility, or substitutability, under definition III in the first part of this paper. Then total demand for domestic assets is given by:

$$d = w\, f_i\, \theta(s - \bar{s}) - (1 - w)\, f_t\, \delta(s - \bar{s}). \tag{10}$$

Solving for the spot rate gives:

$$s = \{m + [-(1 - w)f_t\delta + (w)f_i\theta]\, \bar{s} + u\}/\{1 - (1 - w)f_t\delta + (w)f_i\theta\}. \tag{11}$$

Thus the variability of the spot rate is given by:

$$\text{Var}(s) = \text{Var}(m+u) \,/\, [1 + wf_i\theta - (1 - w)f_t\delta]^2.$$

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[19] To be more precise, we should define d to be the fraction of world wealth allocated to domestic assets, and define w and 1 − w to be the shares of wealth held by the two classes of market participants. Then s would be given by m − log(d/1 − d) + u.

For a given variance of money supplies (m) and other determinants (u), the investors (i) act to reduce the variance of the exchange rate, and the traders (t) to increase it. McKinnon's position could be interpreted as worrying that volatility is too high because f_i, the responsiveness of investors to their expectations, is too low, and the Tobin position that it is too high because f_t, the responsiveness of traders to their expectations, is too high. The overall argument could also be stated alternatively: high volatility stems from a low w, the number of investors relative to traders. The argument would then belong to the chorus of popularly voiced concerns to the effect that U.S. capital markets are hampered by excessively short horizons.[20]

In what follows we briefly do three things: (1) examine some empirical evidence that these two classes of market participants do indeed exist; (2) consider the question that occurs most obviously to economists, why the destabilizing traders are not driven out of the market; and (3) ask if a Tobin tax on transactions would be a solution to excess volatility.

Survey Data on Short-Term versus Long-Term Expectations

Until recently, there were only two methods in use by econometricians to measure exchange rate expectations. The econometrician either used the forward exchange market, in which case the expectations were measured with a possible error generally referred to as the exchange risk premium, or used observed patterns in the ex post or realized spot rate during a particular sample period, in which case the expectations were measured with a possible error consisting of the forecasting errors that happened to be made during that sample period. In either case, the empirical literature followed most of the theoretical literature in making an implicit assumption, that all participants in the foreign exchange market held the same expectation.

By now, there are a number of regularly conducted surveys of the forecasts of participants in the foreign exchange market. Such surveys may measure expectations with error as the two already established techniques do. But they can be argued to be a better way of getting at expectations, on the grounds that the measurement error is smaller and less likely to bias tests of the existence of such things as systematic expectation errors, the exchange risk premium, and stabilizing speculation.[21]

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[20] For example, Hatsopoulos, Krugman and Summers (1988) argue that the discount rate used by U.S. corporations to evaluate investments is too high.

[21] The data from three surveys are analyzed in Frankel and Froot (1987) and Froot and Frankel (1989). Dominguez (1986) has also used the MMS data. Froot and Ito (1988) have recently analyzed extensively the data from a survey conducted in Tokyo by the Japan Center for International Finance (JCIF).

Working with the survey data forces one to confront the fact that market participants do not all share the same expectations. The *Economist* survey, for example, reports a high-low range of responses which for the case of six-month expectations averages 15.2 percent. The dispersion of opinion reflected in the Money Market Services (MMS) survey was particularly high in early 1985. This was precisely when the dollar was peaking in value, and when a forecasting rule based on regressive expectations would have given the answer (a future depreciation back toward equilibrium) that most strongly contradicted forecasting rules based on bandwagon or bubble expectations (continued extrapolation of the past appreciation).

A pattern that emerges strongly from the survey data is that those who forecast at relatively longer horizons tend to have regressive expectations as in equation (8), and those who forecast at shorter horizons tend to extrapolate recent trends, or to have the bubble expectations represented by equation (9). The *Economist* 12-month forecasts, for example, show that for every 1 percent that the dollar has appreciated above purchasing power parity equilbrium, survey respondents forecast a future depreciation of 0.175 percent. (See table 4 in Frankel and Froot (1988). The standard error is 0.0216. The sample period is June 1981 to December 1985.) The opposite answer is given by the MMS survey, which is conducted at shorter horizons and which more directly covers foreign exchange traders. The MMS forecasts, for example, show that for every 1 percent that the dollar has appreciated, respondents forecast a further appreciation of 0.078 per cent over the coming month. (The standard error is 0.013. The sample period is October 1984 to February 1986.)[22] Froot and Ito (1988) have found exactly the same pattern in the Tokyo market participants' responses to the JCIF survey.

Why Isn't There More Stabilizing Speculation?

Ever since Friedman (1953) pointed out that if speculators are destabilizing then they must buy high and sell low, and therefore must lose money and eventually drop out of the market, some economists have tried to concoct elaborate counterexamples. The theory of rational speculative bubbles, developed in its stochastic form by Blanchard (1979), makes counterexamples easy. In a rational speculative bubble, market participants lose money if they don't go along with the herd.

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[22] In addition to regressive expectations of the form of equations (8) and (9), Frankel and Froot (1987, 1988) also estimate adaptive and extrapolative expectations. The same pattern emerges: "destabilizing" speculation at horizons of one week to three months in the MMS survey, and "stabilizing" expectations at horizons of three months to one year in the *Economist* and American Express surveys.

Recent theories feature a class of "noise traders" who engage in activity that creates needless volatility and that thereby forces more sensible traders to play a more restricted role in the marketplace. In DeLong, Shleifer, Summers and Waldman (1987), the noise traders are unjustifiably optimistic about the risk/return tradeoff of the risky asset; as a result, they take a larger share of the risky asset than do rational risk-averse investors, and then prosper over time because the mean return on their wealth is greater. In Frankel and Froot (1988), "fundamentalists" who forecast a return of the dollar to its fundamentals equilibrium are assigned less weight by the aggregate marketplace each period in which the dollar confounds their forecasts by appreciating further from equilibrium; the dollar in turn appreciates further each period in which portfolio managers place less credence in forecasts of future dollar depreciation and therefore increase their demand for dollar assets.

This section presents the outline of an argument why destabilizing short-term spot traders have such a large role in the foreign exchange marketplace and stabilizing longer-term investors have a relatively small role. The argument is based on bank behavior. We set the stage with a few facts about foreign exchange trading.

The volume of trading in foreign exchange markets is enormous. In March 1986, transactions in the U.S. foreign exchange market (eliminating double-counting) averaged $50 billion a day among banks (up 92 percent from 1983), and $34.4 billion among brokers and other financial institutions. Most importantly, only 11.5 percent of the trading reported by banks was with non-bank customers (of which 4.6 percent was with nonfinancial customers). In London the total was $90 billion a day. Only 9 percent of the banks' transactions were directly with customers. Foreign exchange trading in Tokyo has grown so fast in recent years that it is now thought to be about to surpass New York.[23]

Clearly, trading among themselves is a major economic activity for banks. Schulmeister (1987, p. 24) has found that in 1985, twelve large U.S. banks earned a foreign exchange trading income of $1.165 billion. Every single bank reported a profit from its foreign exchange business in every year that he examined.

Goodhart (1987, p. 25 and Appendix D) has surveyed banks that specialize in the London foreign exchange market: "Traders, so it is claimed, consistently make profits from their position-taking (and those who do not get fired), over and above their return from straight dealing, owing to the bid/ask spread"(p. 59). The banks report that their speculation (that is, taking an open position) does not take place in the

[23] *Economist*, July 23, 1988. Sources for the other statistics, and estimates for other financial centers, can be found in Frankel and Froot (1988, p. 21).

forward market (and only 4 to 5 percent of their large corporate customers were prepared to take open positions in the spot market). Apparently they consider the taking of long-term positions based on fundamentals, or of any sort of position in the forward exchange market, as too "speculative" and risky. Bankers recall the Franklin National crisis and other bank failures caused by open foreign positions that were held too long. But the banks are willing to trust their spot exchange traders to take large open positions, provided they close most of them out by the end of the day, because these operations are profitable in the aggregate. (It is almost as if the banks do not realize that a strategy of making a series of repeated one-day bets in foreign currency is just as risky as a strategy of buying a portfolio of foreign securities and holding them.) In the description of Goodhart, and others as well, a typical spot trader does not buy and sell on the basis of any fundamentals model, but rather trades on the basis of knowledge as to which other traders are offering what deals at a given time, and a feel for what their behavior is likely to be later in the day.

The reported profits are not so large that, when divided by the volume of "real" transactions for customers (for the U.S. market, 0.115 x $50 billion/day x 365 = $2 trillion/year), they need lie outside the normal (small) band of the bid-ask spread. In other words, the profits represent the transactions costs for the outside customers. One might expect that this large volume of trading therefore cannot be relevant from a larger macroeconomic perspective, that is, for understanding the movement of the exchange rate. But this look at some of the mechanics of trading does offer some inspiration for a possible model of noise traders and why they prosper.

Consider the decision problem facing a bank executive who has responsibility for two divisions: a foreign exchange trading room, staffed by people who specialize in short-term trading, and an international securities portfolio investment fund, where the people specialize in longer-term investment. The question is how much of the banks' resources the executive should assign to long-term investing versus shorter-term trading. (We can think of this as determining the share w in equation (7) above.) Note that, given the high hourly volatility in the spot market, for a bank's trading room to meet the foreign exchange needs of customers *necessarily* entails placing risky bets on which way the exchange rate will move in the time it takes to unload an open position. As we saw in equation (11), the high volatility will follow from a model in which insufficient weight w is given to the stabilizing investors. The question is why w is not close to 1.

Assume that, within each profession, some people are better-than-average at their job and others worse-than-average. The requisite skills in the case of portfolio investing would include the ability to evaluate, based on economic fundamentals, the longer-term determi-

nants of the exchange rate (as well as the determinants of prices of various countries' government bonds, private corporate bonds, and equities). The requisite skills in the case of spot trading would include the quick reflexes to act on new developments faster than others, the stamina to work long hours without breaks (and, in a world of 24-hour trading, to check positions regularly during the night), and the instinct to know what other traders are going to do. (These skills are to a degree reminiscent of those necessary to do well at video games.)

The only way the directors of the two bank divisions can assess and reward the abilities of their employees is by means of their track records. In the case of the foreign exchange trading room, the series of daily bets placed over the preceding year constitutes a statistically significant sample on which to evaluate whether a given trader has the requisite skills, in which case she should be rewarded and perhaps allowed increased discretion in her activities, or whether he lacks them and should be let go.

In the case of portfolio investment, a year may not be long enough to judge whether a given analyst is good or bad at picking currencies or securities that are overvalued or undervalued. Given high short-term volatility, many years of data may be necessary to discern statistically a slowly disappearing mis-valuation in the marketplace (as Summers (1986) has pointed out in the context of possible fads in the stock market). Thus it may be perfectly rational for the bank executive to restrict the size of the investment portfolio on the grounds of risk aversion, and yet at the same time allow the spot traders to take a sequence of large open positions.

Would a Tobin Tax on Foreign Exchange Transactions Reduce Volatility?

Tobin's call for a small tax on all foreign exchange transactions, in order to "throw some sand in the wheels of our excessively efficient financial markets," has been widely quoted. Dornbusch (1986) has supported it, and Summers (1987) has suggested a similar turnover tax to reduce volatility in the stock market. Some countries like Japan and Switzerland have long had such a turnover tax and are considering the possibility of abolishing it. Interestingly, when the argument is made in these countries in favor of retaining the tax, it is almost invariably on the grounds of raising tax revenue (from the wealth-owning class), rather than on the grounds of reducing excessive market volatility.

To my knowledge, there has been little if any attempt to appraise the Tobin proposal in the context of an appropriate macroeconomic model. Equation (11), though extremely simplistic, constitutes such an attempt. One can interpret proposals in general to decrease the degree of international capital mobility as proposals to decrease the f parame-

ters in the equation. The point is often made that there is no way of discouraging "destabilizing speculation" without at the same time discouraging international capital flows which are desirable for all sorts of other reasons ("stabilizing speculation," international risk-sharing, intertemporal consumption-smoothing and the like). But it is possible to put a positive interpretation on the Tobin proposal in particular.

A small tax in proportion to the size of the foreign exchange purchase will not be much of a deterrent to anyone contemplating the purchase of a foreign security for longer-term investing.[24] But it will discourage the spot trader who is now accustomed to buying foreign exchange with the intention of selling it a few hours later. If the destabilizing speculators in equation (11) are indeed the short-term spot traders that the expectations survey data suggest, and the stabilizing speculators are the long-term investors, then the tax may indeed reduce the volatility of the exchange rate. In other terms, it will reduce f_t without having much effect on f_i. The turnover tax in this light is crucially different from the taxes on international interest earnings that were levied before 1973, by the United States to discourage capital outflow or by Germany to discourage capital inflow. Such taxes reduced the rate of return to long-term investing just as much as the rate of return to short-term speculation (perhaps more, if one considers that capital gains from currency speculation were taxed at a lower rate than interest earnings).

A favorable verdict on the Tobin tax is of course entirely dependent on the assumed existence of destabilizing short-term speculators, which remains unproven in the eyes of most economists. But there is in any case another reason why the Tobin tax is unlikely to be a practical solution to the problem of exchange rate volatility. The proposal does get around the practical enforcement problem of trying to distinguish between foreign exchange purchases for "speculative" purposes versus purchases for the purpose of acquiring foreign goods or longer-term securities (as under the "real demand rule" that governed forward exchange transactions in Japan until 1985, for example). But the prime reason Japan and Switzerland are debating the removal of their stock market turnover taxes is the fear that Tokyo and Zurich are losing business to other financial centers. In the modern technological and economic environment, if the United States were to impose a tax on foreign exchange transactions, the business would simply go to London and Tokyo. If the G-10 countries were to impose the tax simultaneously, then the business would go to Singapore, and so forth. Thus the Tobin tax does not appear to be the solution to exchange rate volatility.

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[24] Dornbusch and Frankel (1988) show the expression for the incidence of such a tax on short-term transactions.

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Discussion

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Two important findings are reported in this paper. The first is that the very large external deficit of the United States in recent years might indicate a new era of capital mobility. Recent U.S. deficits are sufficiently large to throw doubt on the view that shocks to savings and investment ratios originating in the United States are bottled up. Frankel suggests that a relaxation of capital controls outside the United States may explain the transmission of savings investment shocks across industrial countries. If he is right, one of the dominant empirical regularities characterizing the linkages among industrial countries has been altered.

The second finding, and the one I want to focus on, is the evidence that *real* exchange rates change predictably over substantial time periods. This is an empirical regularity that opens up a whole new area of research that might help us understand exchange rate behavior. It should be recalled that the overshooting model developed by Dornbusch did not attract attention simply because it was theoretically elegant, but because it offered an explanation for rational jumps in nominal exchange rates following a monetary disturbance. In a similar way, a theoretical explanation of relative price changes that "overshoot" long-run equilibrium values might provide a basis for evaluating the welfare implications of the changes in real exchange rates that have characterized the floating rate regime. As Frankel points out in the second half of his paper, proposals to reform the international monetary system rest on the assumption that real exchange rate changes reflect a failure of long-term stabilizing speculation or an excess of destabilizing short-term speculation. But if the real exchange rate changes are a part

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of the adjustment to changing fundamentals, there is no presumption that they reflect a failure of the present system. They may, instead, be an integral aspect of an efficient adjustment mechanism.

It is often the case that specific economic interactions are best identified in extreme circumstances. For example, the relationships between money and prices and exchange rates are brought into sharp focus during hyperinflations. In a similar way, the international debt crisis provides an unfortunate laboratory for examining the behavior of relative prices and real exchange rates.

In several cases, the real value of debtors' exchange rates fell by about half during 1982. (See the figure.) In the years that followed, this real depreciation has persisted. The obvious implications of the debt crisis were twofold. First, it could be reasoned that the inability to borrow would force governments of debtor countries to increase money growth in order to increase inflation tax receipts. This could explain a temporary fall in the measured real exchange rate, but as prices started to rise in the debtor country, this would be gradually eliminated.

The second effect, emphasized in Dooley and Isard (1986) and Isard (1988) was that the debtor countries would be forced to adjust from a situation in which foreign savings equal to about 3 percent of GNP would be lost, and net service payments equal to 2 to 3 percent of GNP would have to be made to nonresidents. The question then was whether there was a sensible story that related the real exchange rate to the net transfer of resources, as conventionally measured by the current account.

It is clear that there is no unique "reduced-form" relationship between trade balances and real exchange rates. In a two-country model, if residents of a debtor country consumed the same basket of goods as residents of creditor countries and if current consumption in creditor countries rose, then the same output would simply be consumed by a different set of identical consumers at unchanged relative prices.

The debate over whether real exchange rate changes would be a part of the adjustment to a new current account pattern is an old and important one. German reparations payments following World War I raised the same issues. Would it have been necessary to lower the real exchange rate in order to free domestic output for export in Germany and to induce nonresidents to purchase it? This issue, which Keynes identified as the "extra burden" of adjustment, was analyzed using the standard trade theory. The theoretical results, then as now, were inconclusive.

This is a very difficult problem because of the infinite variety of ways that economic activity in both countries can be rearranged that would result in a swing in current account positions. Income could change relative to potential output in both countries, consumption and

investment decisions could be altered, and so forth. It is clear, therefore, that the implied change in the current account position was not a sufficiently "structural" question to determine the direction of real exchange rate changes.

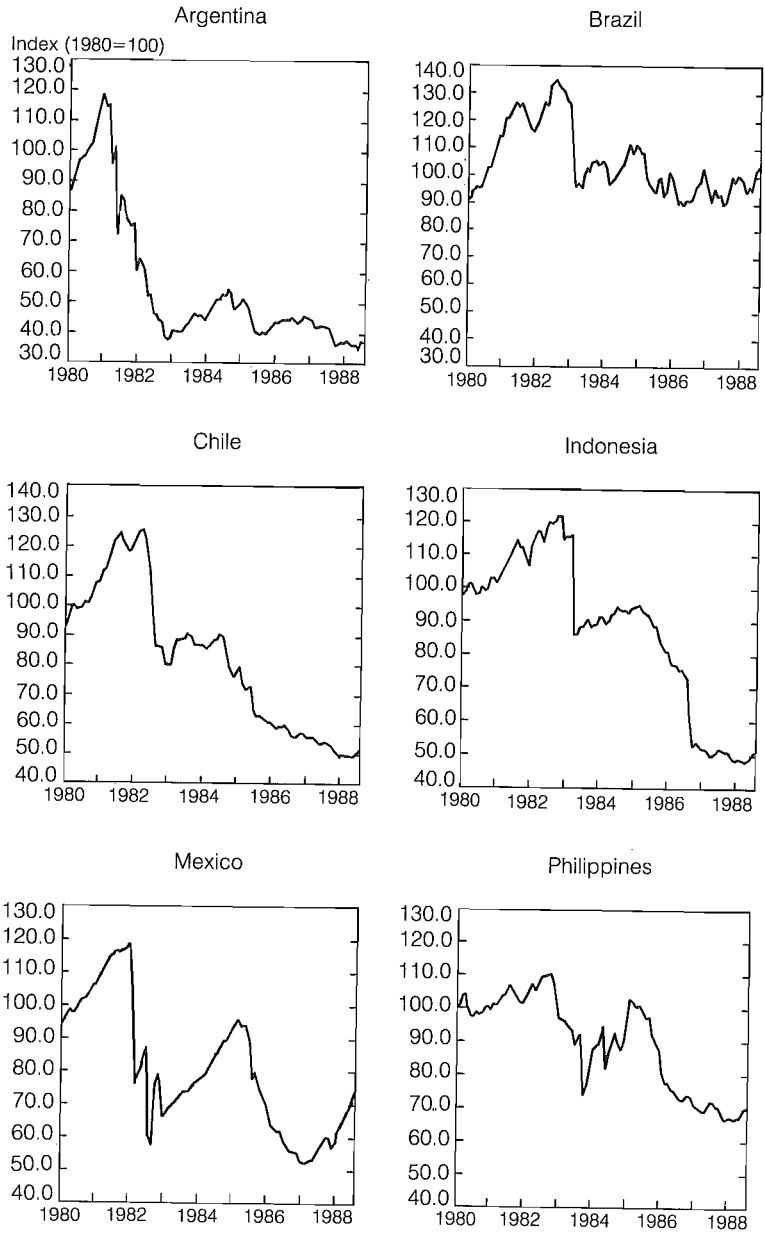
Fortunately, another obvious empirical regularity exists in debtor countries: because the government had to make the interest payments on external debt, and because the government had been borrowing abroad, it was clear that the fiscal status of governments of debtor countries had deteriorated sharply in the summer of 1982. Perhaps this was the key to "identifying" the exchange rate effects. An explanation that seems promising is that the uncertainty surrounding the government's tax policy would provide a strong incentive for the private sector to protect its wealth from the debtor government.

This, we conjecture, can only be accomplished by moving physical assets out of the debtor country. We also reasoned that offering financial claims to nonresidents in exchange for "safe" financial claims on nonresidents would not reduce the risk of taxation, since this merely shifts the risk of taxation from residents to nonresidents. The central hypothesis that results from these observations is as follows.

The private sector of a country can protect its net worth from an insolvent government only by net sales of goods and services to nonresidents. Our definition of an insolvent government is crucial to the argument. We view the existing tax laws as a contract between the government and the private sector. The present value of the contract depends upon its terms and expectations about the future income this contract will yield to the government. If the present value of the existing tax contract is less than the present value of the government's obligations, including external and internal debt, defense expenditures and the like, then we say that the government is insolvent. This is important because such a government must be expected either to default on its expenditure obligations or to default on its "tax contract" with the private sector by increasing taxes on some segment of the private sector.

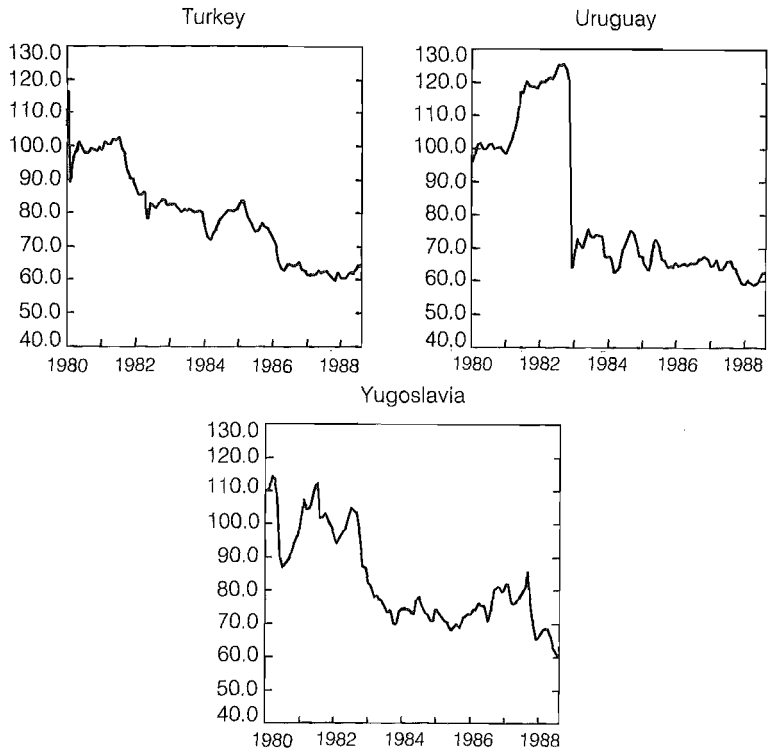
The second part of the hypothesis is that prices of goods and services that can be removed from the potential tax base of the insolvent government would instantly rise relative to prices of goods and services that cannot be removed. An existing plant, for example, cannot easily be picked up and exported to a safer environment. It does no good to ship the stocks or bonds representing ownership of the plant. In a similar fashion, the flow of certain types of output, haircuts, construction work, or schoolteaching, cannot easily be shipped across international boundaries. This it seems to us, ensures that the relative prices of such nontraded goods will fall relative to tradable goods in a country when the government has recently become insolvent. Moreover, as these "movable" or "tradable" goods are thrown into the safer country's markets, their price relative to nontraded goods in that market will fall.

Real Effective Exchange Rates[a] January 1980 to June 1988



[a] Based on consumer price indices.

Real Effective Exchange Rates[a] January 1980 to June 1988 (continued)



[a] Based on consumer price indices.

Finally, we can translate changes in relative prices to changes in the nominal exchange rate given a monetary policy rule and the assumption that prices of traded goods follow the law of one price.

An important aspect of this argument is that it does no good to transport financial claims on immovable goods out of the debtor country since the asset remained behind to be taxed or confiscated. The existing literature on international capital flows has not fully come to grips with the fact that cross-border exchanges of financial instruments are often motivated by the desire to avoid taxes on holders of financial instruments. In contrast, net capital flows across borders can be motivated by the desire to avoid taxes on physical assets located in a country.

There has been tremendous volume of two-way trade in financial capital among industrial countries. However, we regard this as largely reflecting attempts to avoid taxation on financial intermediation, including the taxes implicit in regulation of financial markets of industrial countries, and attempts to avoid the monopoly "taxes" imposed by

protected private financial intermediaries in industrial countries. This admittedly stands the conventional interpretation of the development of international financial markets on its ear. Taxes and regulatory constraints that fall *directly* on financial intermediation in industrial countries are regularly and successfully avoided by two-way trade in financial intermediation services across national borders.[1] A by-product of this is a huge volume of gross capital movements. But net capital movements have been quite small, and when they are large, as they are now for the United States, Germany, and Japan, the markets become very uneasy.

The heavily indebted developing countries offer a striking example of what a change in expected taxation of domestic capital can do. Before 1982, taxes on financial instruments were avoided by round-trip flows of financial capital. At the same time, *net* capital inflows increased the exposure of nonresidents to taxes imposed on physical capital located in debtor countries. After 1982, round-trip tax arbitrage was greatly reduced for reasons discussed in Dooley (1988). But the threat of taxes on net positions was sufficient to generate a net capital outflow and the associated fall in real exchange rates.

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[1] Such tax arbitrage is the explanation of capital flight offered in Dooley (1988).