NBER WORKING PAPER SERIES

QUANTIFYING INTERNATIONAL CAPITAL MOBILITY IN THE 1980s

Jeffrey A. Frankel

Working Paper No. 2856

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
February 1989

This research was supported by the Pew Foundation. This paper is part of NBER's research program in International Studies. Any opinions expressed are those of the author not those of the National Bureau of Economic Research.

NBER Working Paper #2856
February 1989

QUANTIFYING INTERNATIONAL CAPITAL MOBILITY IN THE 1980s

ABSTRACT

The Feldstein-Horioka finding, that national saving and investment have been highly correlated in the past, has not been primarily due to econometric problems such as endogenous fiscal policy; it has held up equally well when instrumental variables are used. But the inflow of capital to the United States has been so large in recent years that an updating of the sample period to 1987 produces a coefficient on national saving that is lower than in past studies. This decline in the degree of crowding out of investment can be attributed to the increased degree of financial market integration in the 1980s. Capital controls and other barriers to the movement of capital across national borders remained for such countries as the United Kingdom and Japan as recently as 1979, and France and Italy as recently as 1986. But a new data set of forward exchange rates for 25 countries shows that a continuing worldwide trend of integration of financial markets in the 1980s had all but eliminated short-term interest differentials for major industrialized countries by 1988.

It is only the country premium that has been eliminated however; this means that only covered interest differentials are small. Nominal and real exchange rate variability remain, and indeed were larger in the 1980s than in the 1970s. The result is that a currency premium remains, consisting of an exchange risk premium plus expected real currency depreciation. The popular null hypothesis that expected real depreciation is constant at zero is tested, and rejected, with a 119-year sample. (Post-1973 data sets do not allow enough observations to provide a useful test of this null hypothesis.) The existence of expected real depreciation means that, even if interest rates are equalized internationally when expressed in a common currency, large differentials in real interest rates remain. Investors have no incentive to arbitrage away such differentials. Because there is no force tying the domestic real interest rate to the world real interest rate, it follows that there is no reason to expect any country's shortfalls of national saving to be completely financed by borrowing from abroad.

Jeffrey A. Frankel
Kennedy School of Government
Harvard University, 79 JFK St.
Cambridge, MA 02138

QUANTIFYING INTERNATIONAL CAPITAL MOBILITY IN THE 1980s

Jeffrey A. Frankel [1]

This paper was written for the National Bureau of Economic Research conference on Saving, Maui, January 6-7, 1989.

Feldstein and Horioka upset conventional wisdom in 1980 when they concluded that changes in countries' rates of national saving had very large effect on their rates of investment, and interpreted this finding as evidence of low capital mobility. Although their regressions have been subject to a great variety of criticisms, their basic finding seems to hold up. But does it imply imperfect capital mobility?

Let us begin by asking why we would ever expect a shortfall in one country's national saving not to reduce the overall availability of funds and thereby crowd out investment projects that might otherwise be undertaken in that country. The aggregation together of all forms of "capital" has caused more than the usual amount of confusion in the literature on international capital mobility. Nobody ever claimed that international flows of foreign direct investment were large

---

[1] Professor of Economics, University of California, Berkeley; Visiting Professor of Public Policy (1988-89), Kennedy School of Government, Harvard University; and Research Associate, NBER. The author would like to thank Maurice Obstfeld for useful comments, Alan MacArthur for efficient research assistance, and the Institute for International Studies and the Institute of Business and Economic Research, both of U.C. Berkeley, for research support.

enough that a typical investment project in the domestic country would costlessly be undertaken directly by a foreign company when there was a shortfall in domestic saving.[1] Rather, the argument was that the typical American corporation could borrow at the going interest rate in order to finance its investment projects and, if the degree of capital mobility were sufficiently high, the going interest rate would be tied down to the world interest rate by international flows of portfolio capital. If portfolio capital were a perfect substitute for physical capital, then the difference would be immaterial; but the two types of capital probably are not in fact perfect substitutes.

This paper examines a number of alternative ways of quantifying the degree of international capital mobility. One conclusion is that the barriers to cross-border flows are sufficiently low that, by 1989, financial markets can be said to be virtually completely integrated among the large industrial countries (and among some smaller countries as well). But this is a different proposition from saying that real interest rates are equalized across countries, which is still different from saying that investment projects in a country are unaffected by a shortfall in national saving. We will see that there are several crucial links that can, and probably do, fail to hold.

In many cases, notably the United Kingdom and Japan (and perhaps now Italy and France as well) the finding of high

integration with world financial markets is a relatively new one, attributable to liberalization programs over the last ten years. Even in the case of financial markets in the United States, integration with the Euromarkets appears to have been incomplete as recently as 1982.[2] An important conclusion of this paper for the United States is that the current account deficits of the 1980s have been large enough, and by now have lasted long enough, to reduce significantly estimates of the correlation between saving and investment. This is true even for time series that go back as far as the 1870s. The increased degree of worldwide financial integration since 1979 is identified as one factor that has allowed such large capital flows to take place over the past decade. But even if U.S. interest rates are now viewed as tied to world interest rates[3], there are still other weak links in the chain. The implication is that crowding out of domestic investment can still take place.

1. Four Alternative Definitions of International Capital Mobility

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 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, as did a majority of industrialized countries. Even among the five major countries without capital controls, capital was not perfectly mobile by some definitions.

There are at least four distinct definitions of perfect capital mobility that are in widespread use. (I) The Feldstein-Horioka definition: exogenous changes in national saving (i.e., in either private savings or government budgets) can be easily financed by borrowing from abroad at the going real interest rate, 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. [4]

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.

2 Feldstein-Horioka Tests

The Feldstein-Horioka definition requires that the country's real interest rate is tied to the world real interest rate by criterion (II); it is, 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 <u>other</u> than its real interest rate be uncorrelated with its rate of national saving. Let the investment rate be given by

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

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 quantifiable or not, that determine the rate of investment. Feldstein and Horioka (1980) regressed the investment rate against the national saving rate,

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

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:

(2) $\quad r_i - r^* = 0,$

(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 $(NS/Y)_i$.

2.1 <u>The Saving-Investment literature</u>

Feldstein and Horioka's 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, or if they both respond to the population or productivity growth rates.[5] 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), Summers (1988) and Roubini (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) and Tobin (1983). 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 righthand-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. [6]

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)[7] 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.[8]

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 (1984, 1352), for example, found even more significant rejections of real interest parity among major industrialized countries for the floating rate period after 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 (1980.1-1985.6) moved farther from real interest parity than they had been in the 1970s (1973.7-1979.12).[9] 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.[10] 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.

2.2 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 per cent of GNP, relative to the 1970s. The investment rate -- which at first, like the saving

rate, fell in the 1981-82 recession -- had by 1988 approximately reattained its 1980 level at best. [11] The saving shortfall was made up, necessarily, by a flood of borrowing from abroad equal to more than three per cent of GNP. Hence the current account deficit of $161 billion in 1987. (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 from 1870 to 1987.[12] Decade averages are used for each variable, which removes some of the cyclical variation but gives us only 12 observations. (Yearly data are not in any case available before 1930.) That is one more observation than was available in Frankel (1986, Table 2.2), which went only through the 1970's. Figure 1 plots the decade data.

As before, the coefficient is statistically greater than zero and is not statistically different from 1, suggesting a

Table 1 THE "FELDSTEIN-HORIOKA COEFFICIENT" BY DECADES: 1869-1987

Instrumental Variables Regression of U.S. Investment against National Saving (as shares of GNP)

	Constant	Coefficient	Time Trend in Coefficient	Durbin-Watson Statistic	Autoregressive Parameter	R^2
1.	0.411	0.976		1.45		0.96
	(1.340)	(.086)				
2.	3.324	0.785			0.46	0.97
	(1.842)	(.118)			(.33)	
3.	3.291	0.854	-0.011	0.73		0.92
	(6.176)	(.279)	(.021)			
4.	1.061	0.924	0.001		0.03	0.96
	(1.507)	(.093)	(.005)		(0.08)	

Instrumental variables: dependency ratio and military expenditure/GNP

Figure 1

U.S. National Saving (Private Saving Plus Government Budget Surplus), Investment and Current Account: Ten Year Averages

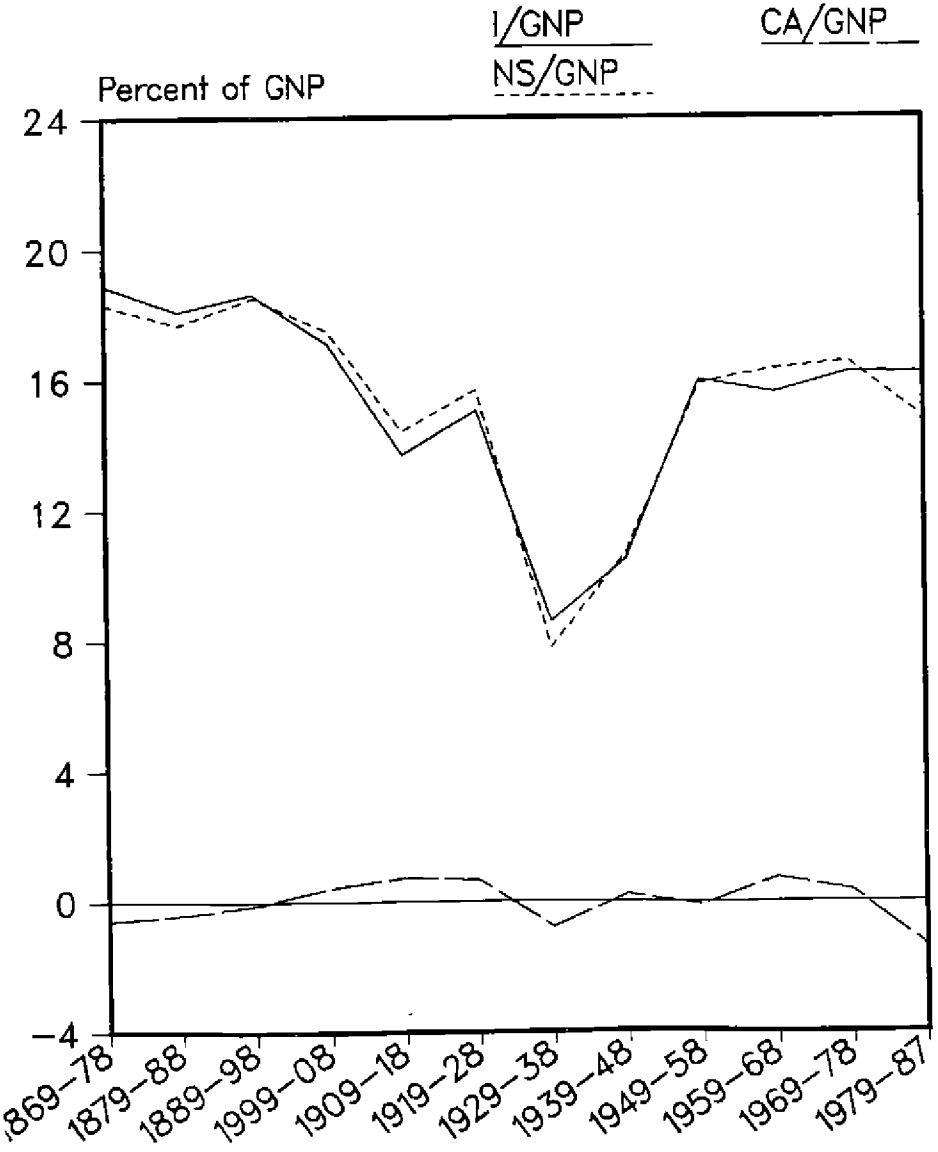


Table 2: THE FELDSTEIN-HORIOKA COEFFICIENT BY YEARS: 1929-1987
Instrumental Variables Regression of U.S. Investment against National Saving (as shares of GNP)

	Constant	Coefficient	Durbin-Watson Statistic	Autoregressive Parameter	R^2
1929-87	2.99 (.89)	0.79 (.06)	0.64		0.94
1930-87	4.85 (2.61)	0.67 (.19)		0.77 (.09)	0.89
1929-79	1.99 (.61)	0.86 (.04)	1.31		0.97
1930-79	2.00 (.66)	0.85 (.05)		0.38 (.13)	0.95
1980-87	13.73 (3.85)	0.15 (.27)	2.09		0.17
1981-87	-0.36 (.56)	0.03 (.02)		-0.37 Not Converged	0.00

Table 3: THE FELDSTEIN-HORIOKA COEFFICIENT BY YEARS: 1955-1987
Instrumental Variables Regression of U.S. Investment against National Saving (as shares of GNP and Cyclically Adjusted)

	Constant	Coefficient	Durbin-Watson Statistic	Autoregressive Parameter	R^2
1955-87	*	-0.06 (.23)	0.96		0.25
1956-87	*	0.37 (.24)		0.50 (.15)	0.42
1955-79	-0.68 (.17)	1.27 (.23)	1.61		0.73
1956-79	-0.57 (.18)	1.05 (.19)		0.35 (.20)	0.70
1980-87	0.39 (.36)	0.13 (.17)	2.46		0.30
1981-87	0.58 (.37)	0.22 (.16)		-0.13 (.41)	0.34

* Constant term is automatically zero because cyclically adjusted rates are residuals from a 1955-1987 regression against the GNP gap.

Figure 2

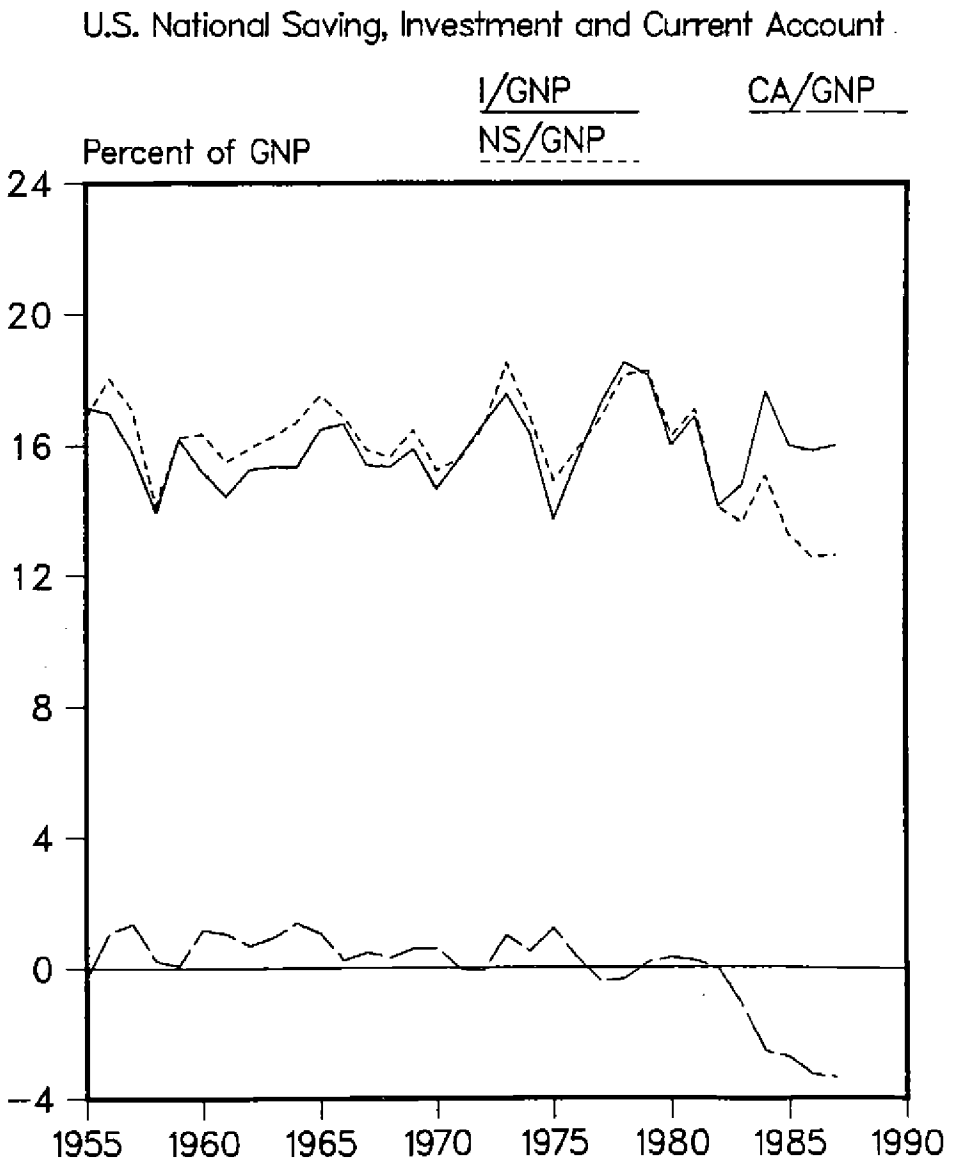

U.S. National Saving, Investment and Current Account
I/GNP
CA/GNP
NS/GNP
Percent of GNP
24
20
16
12
8
4
0
-4
1955
1960
1965
1970
1975
1980
1985
1990

Figure 2a

U.S. National Saving, Investment and Current Account
Cyclically Adjusted

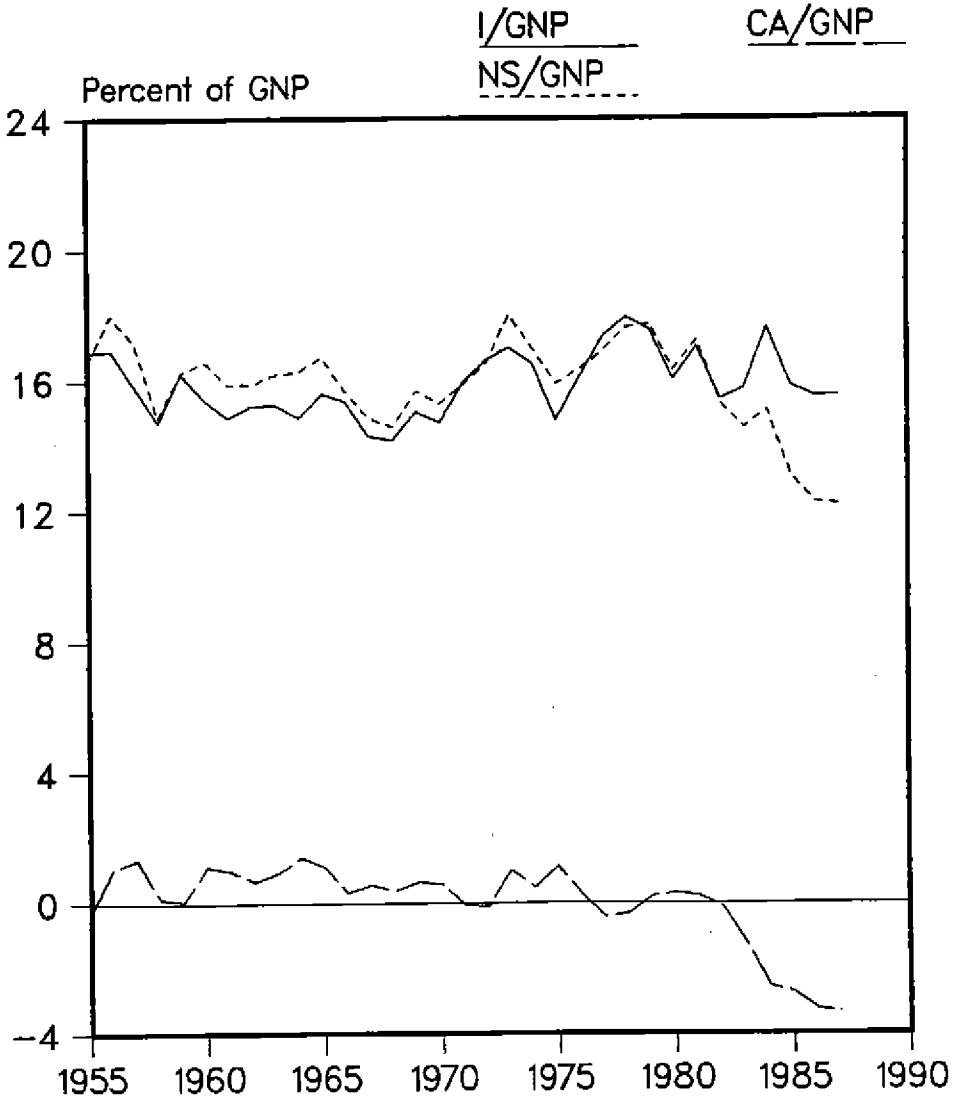


Table 2a: COMPARING REGRESSIONS BEFORE AND AFTER 1958

Regressions of Investment against National Saving (Both as Shares of GNP), Yearly Data, 1930-1987 **Instrumental Variables**

	Constant	Coefficient	Time Trend in Coefficient	Autoregressive Parameter	R^2
1930-87	4.847	0.669		0.77	0.89
	(2.611)	(.187)		(.09)	
1930-87	4.108	0.569	0.004	0.60	0.91
	(2.032)	(.209)	(.002)	(.11)	
1930-58	2.174	0.828		0.38	0.95
	(.837)	(.069)		(.18)	
1959-87	16.193	1.14		1.00	0.78
	(12.844)	(.159)		(.005)	

Table 3a : COMPARING REGRESSIONS BEFORE AND AFTER 1974

Regressions of Investment against National Saving (Both as Cyclically Adjusted Shares of GNP), Yearly Data, 1955-87 **Instrumental Variables**

	Constant	Coefficient	Time Trend in Coefficient	Durbin-Watson Statistic	Autoregressive Parameter	R^2
1955-87		-0.058		0.96		0.26
		(.249)				
1956-87		-0.026			0.50	0.42
		(.261)			(.15)	
1956-87	-0.137	0.476	-0.013		0.52	0.40
	(.302)	(.848)	(.026)		(.15)	
1956-73	-0.635	0.872			0.25	0.73
	(.140)	(.153)			(.23)	
1975-87	0.579	0.311			0.24	0.36
	(.305)	(.156)			(.34)	

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 .91 in the earlier study to .79. We can allow for a time trend in the coefficient; it drops from plus .01 a year in the earlier study to minus .01 a year (or plus .001, when correcting for serial correlation) in the longer sample. Thus the additional years 1980-1987 do show up as anticipated: as exhibiting a lower U.S. degree of crowding out, even if 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 is accomplished by first regressing it on the GNP gap, defined as the percentage deviation from the Bureau of Economic Analysis's "middle expansion trend" of GNP, and taking the residuals.]

In previous work with a sample period of 1956-1984, the coefficient in a regression of cyclically adjusted saving and investment rates was estimated at .80, statistically indistinguishable from 1. (Frankel(1986, 43-44)). But now the coefficient has dropped essentially to zero, suggesting a zero

degree of crowding out, or a zero degree of "saving-retention" (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). Figure 2 (or Figure 2a for the cyclically adjusted data) make clear how far beyond previous experience were the downturns in U.S. national saving and the current account in the 1980s.

To verify that the 1980s experience is indeed the source of the precipitous fall in the saving-investment coefficient,[13] the sample period is split at 1980. For the period 1955-79, not only is the coefficient statistically indistinguishable from 1, but the point estimate is slightly <u>over</u> 1.[14] 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, and continued innovation in the Euromarkets (and perhaps the 1984 repeal of the U.S. withholding tax on borrowing from abroad), 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.[15]

3. 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.[16] But measuring real interest differentials will not do the trick. An international investor, when deciding what 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:

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

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:

(2') $\quad \text{exp depr} = \text{exp infl} - \text{exp infl}^*.$

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 (3) holds perfectly. The remainder of this section considers the question whether ex ante relative PPP, equation (2'), holds.

The enormous real appreciation of the dollar in the early 1980s and subsequent real depreciation have by now convinced the remaining doubters, but abundant statistical evidence against PPP was there all along. Krugman (1978, p.406), for example, computed for the floating rate period July 1973-December 1976 standard deviations of the (logarithmic) real exchange rate equal to 6.0 per cent for the pound/dollar rate and 8.4 per cent for the mark/dollar rate. He also computed serial correlation coefficients for PPP deviations of .897 and .854, respectively, on a monthly basis, equal to .271 and .150 on an annual basis. The serial correlation coefficient is of interest because it is equal to one minus the speed of adjustment to PPP. It may be best not to rely exclusively on the standard deviation of the real exchange rate as a summary statistic for the degree of integration of goods markets, because it in part reflects the magnitude of monetary disturbances during the period.[17]

Table 4 shows updated annual statistics on the real exchange rate between the United States and Great Britain.

During the floating rate period 1973-1987, though there is no significant time trend, there is a large standard error of 15.6 per cent. The serial correlation in the deviations from PPP is estimated at .687, with a standard error of .208. [The equation estimated is $(er_{t+1} - \underline{er}_{t+1}) = AR(er_t - \underline{er}_t)$, where er is the real exchange rate, $\underline{er}$ 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 .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, .31 in Table 4 (1973-1987), while not so low as to be implausible as point estimates, are nevertheless

Figure 3

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

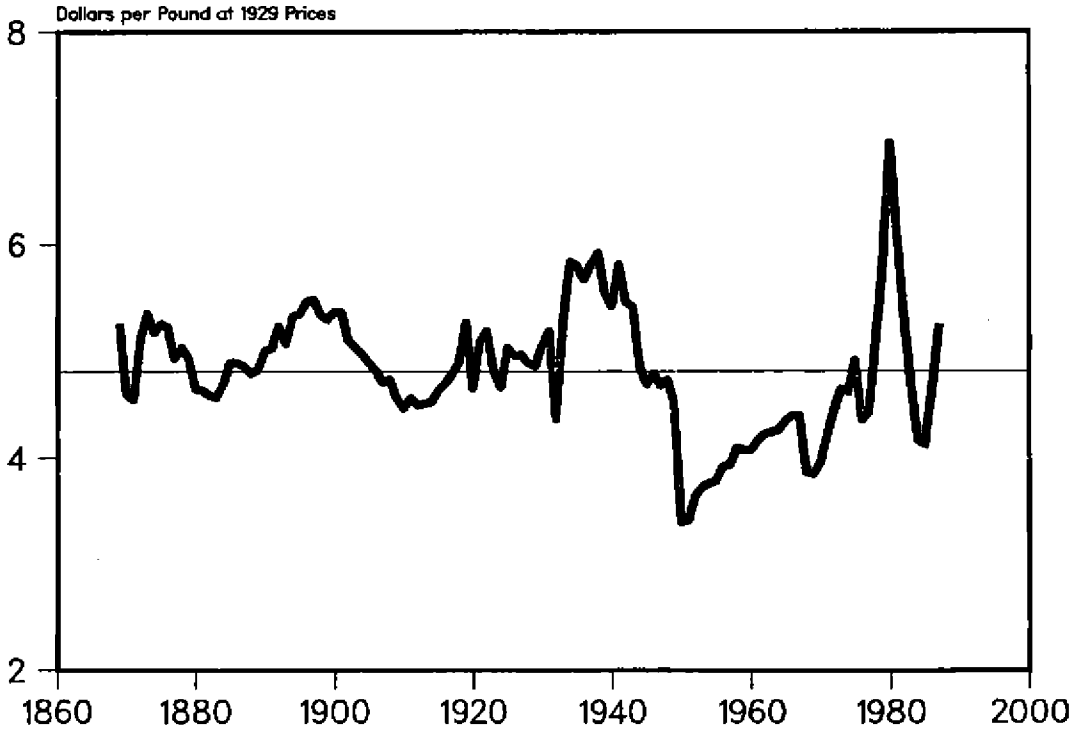


Table 4: Purchasing Power Parity Between the United States and the United Kingdom
1869 - 1987

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

*Significant at the 95 percent level.
Note: Standard errors are reported in parentheses.

a. With constant term and correction for autocorrelation.

so low that one statistically cannot reject the hypothesis that they are zero. In other words one cannot reject the random-walk 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 righthand-side variable is the level of the real exchange rate, because under the null hypothesis the variance is infinite. [This does not invalidate the t-test just reported of the null hypothesis that the tendency to return to PPP was 100 percent, that is, AR=0.] 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 .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 (1984, pp.1351-53), and Piggott and Sweeney (1985). Most of these studies used monthly data. On the one hand, the greater abundance of data reduces the standard error of the estimate but, on the other hand, one is no longer testing whether AR = .69 is different from 1.0, but rather whether .97 { = 1-[(1-AR)/12] } is different from 1.0, so that it may not be much easier to reject. Another problem is that one does not know

that the nature of the true autoregressive process is truly first-order on a monthly (or continuous-time) basis. In any case, the monthly data in the studies cited were generally not powerful enough to reject the random walk.[18]

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 1945-1987. 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 [or 0.52 to 0.96, when allowing for a trend in the long-run equilibrium], and the t-ratio of 1.85 [or 2.56, when allowing for the trend] 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 per cent 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 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.[19]

The last column of Table 4 presents an entire 119 years of

U.S.-U.K. data. 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. [20] The U.S./U.K. real exchange rate is plotted in Figure 3, for all 118 years.

The last row of the table reports regressions of the real exchange rate against the nominal exchange rate. The coefficient is highly significant for all time samples. The figures suggest that changes in the nominal rate (due, for example, to devaluations under fixed exchange rates or monetary disturbances under floating exchange rates) in the presence of sticky goods prices cause transitory changes in the real exchange rate. Such results specifically rule out the possibility, which has been occasionally suggested in the past, that apparent deviations from PPP might be attributed to (random) measurement errors in the price data.[21]

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 rationally expected rate of real depreciation is zero.[22] 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. There are plenty of other competing explanations that 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 (1988). 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-investment correlations as high as one, while the various models that impose purchasing power parity are generally not as able to do so. [23]

4 A Decomposition of Real Interest Differentials for 25 Countries

Because there are so many competing definitions of the

degree of international capital mobility, it would be worth knowing if the sort of countries that register high by one criterion are also the sort that register high by the others. In this section we look at rates of return in the 1980s across a sample of 25 countries. We begin with the broadest measure of barriers to international capital mobility, the differential in real interest rates, defined as:

(4) $$r - r^* = (i - \exp infl) - (i^* - \exp infl^*).$$

Subsequently we will decompose the real interest differential into a component due to "political" or country factors and a component due to currency factors:

(5) $$r - r^* = (i - i^* - fd) + (fd - \exp infl + \exp infl^*),$$

where i is the domestic nominal interest rate, i* is the foreign nominal interest rate, and fd is the forward discount on the domestic currency. The first term (i - i* - fd) is the covered interest differential. We call it the political or country premium because it captures all barriers to integration of financial markets across national boundaries: transactions costs, information costs, capital controls, tax laws that discriminate by country of residence, default risk, and risk of future capital controls. The second term could be described as the real forward discount. We call it the currency premium because it captures differences in assets according to the currency in which they are denominated, rather than in terms of the political jurisdiction in which they are issued. As we will see, the currency premium can in turn be decomposed into

two factors, the exchange risk premium and expected real depreciation.

The decomposition of the real interest differential would not be possible without the use of data on forward exchange rates. Many previous studies have used forward rate data to test covered interest parity, but only for a few countries. The present study uses forward rate data for panel of 25 countries, which so far as I know is the largest set ever examined. The set of 25 includes countries both large and small, industrialized and developing, Atlantic and Pacific. The forward rate data for most of the countries come from Barclay's Bank in London, via Data Resources, Inc.[24]

4.1 Real interest differentials

Table 5 reports statistics on three-month real interest differentials for the 25 countries, in each case expressed as the local interest rate measured relative to the Eurodollar interest rate. For local interest rates we use the interbank market rate or, where no market rate exists, the most flexibly-determined interest rate available.[25] We use, to begin with, the realized inflation rates during the ex post three-month period. Column (1) reports the mean real interest differential during the sample period, September 1982 to January 1988. (In this and subsequent tables, because the ex post data run three months behind the ex ante expectations,

they go up to April 1988.) The numbers are negative for a majority of countries, averaging -1.74 across all 25, which reflects the high level of real dollar interest rates during this period.

The countries are classified into five groups chosen on a priori grounds. The group with real interest rates the farthest below the world rate is Bahrain, Greece, Mexico, Portugal and South Africa. These five (very diverse) countries bear the burden of representing a wide class of LDCs in our sample. Altogether there are eight countries classified as LDCs that happen to have forward rate data available, and thereby appear in our sample; three of these are East Asian countries that are thought to have open financial markets in the 1980s (Hong Kong, Singapore and Malaysia) and so are here classified separately.

One might object that the large negative real interest differentials in the group of five reflect administered local interest rates that are kept artificially low by "financial repression." But countries cannot maintain artificially low interest rates without barriers to capital outflow. These statistics reflect a low degree of capital mobility precisely as we want them to. In this respect our group of five is typical of LDCs. A number of studies, including much larger LDC samples than available here, have shown the extremes to which real interest rates can go, particularly some very negative levels in the 1970s.

As with the other measures of interest rate differentials that we will be considering below, the mean is not always the most useful statistic. A small mean over a particular sample period may hide fluctuations in both directions. Even if a mean is statistically significant,[26] it is useful to know in addition the variability of the differential. The standard deviation is reported in column (2). We also report the root mean squared error in column (3). [This would be a superior measure of how closely the rates are tied together if, for example, we are worried about the possibility of a large differential that is fairly constant over time because of government administration of interest rates.] Finally we report in column (4) how big a band would be needed to encompass 95 percent of the deviations from real interest parity.

Country-group comparisons of the measures of real interest differential variability in some respects suit a priori expectations: the five closed LDCs constitute the group with the highest variability, and the five open Atlantic countries the group with the lowest.[27] But there are some results that are anomalous if the real interest differential is taken as a measure of financial market integration. France, for example, had stringent capital controls in place during our sample period [at least until the latter part] and yet appears to have a higher degree of capital mobility by the criterion of real interest differential variability than Japan, which announced

liberalization of its capital controls before our sample period (1979-80). One might conceivably argue that the Japanese liberalization must not have been genuine. But the French real interest differential is smaller and less variable even than those of the Netherlands and Switzerland, major countries that are known to be virtually free of capital controls. Only Canada shows a smaller and less variable real interest differential than France.

Because the realized inflation rates could not have been precisely known a priori, Table 5a projects them on three contemporaneous variables: the forward discount, nominal interest differential, and lagged inflation differential. In a majority of cases, a statistically significant amount of the variation in the real interest differential is forecastable.[28] The standard deviation of the projected differential gives us our final measure of variability. The results for the ex ante real interest differential are mostly similar to those for the ex post. France, for example, still shows a lower degree of variability than the Netherlands.

4.2 Covered interest differentials: The country premium

We now use the Barclay's forward rate data to decompose the real interest differential into one part due to country factors and another due to currency factors, as in equation (5). The first component, the covered interest differential,

encompasses all factors related to the political jurisdiction in which the asset is issued. Its size and variability measure barriers to international capital mobility most narrowly and properly defined. Plots of the covered interest differentials for each of the 25 countries in the 1980s are shown in Figure 4.

Column (1) of Table 6 reports the mean of the covered interest differential for each of our 25 countries. A good rule of thumb, when the absolute magnitude of the mean or the variability of the differential indicates the existence of significant barriers, is as follows: a negative differential vis-a-vis the Eurocurrency market indicates that, to the extent that barriers exist, they are capital controls or transactions costs currently operating to discourage capital from flowing out of the country. Investors would not settle for a lower return domestically if they were free to earn abroad the higher return covered to eliminate exchange risk. This is the case for all the LDCs in the sample, with the exception of Hong Kong, and for all of the traditionally "closed" European countries, with the exceptions of Austria and Belgium (which should by now probably be classified with the "open" countries). The negative differential that existed for the United Kingdom before Margaret Thatcher removed capital controls in 1979 is now extremely small. Similarly, Canada's differential is effectively zero [as shown, e.g., by Boothe, et al, 1985, p.112].

Table 5: REAL INTEREST DIFFERENTIALS (local minus Eurodollar; 3-mo. rates

Interest Differential Less Realized Inflation Differential
September, 1982 to January, 1988

	# of Obs.	1 Mean	Standard Error	2 Series Standard Deviation	3 Root Mean Squared Error	4 95% Band
Open Atlantic DCs						
Canada	63	0.09	0.38	2.09	2.09	3.96
Germany	63	-1.29	0.65	2.77	3.06	5.95
Netherlands	62	-0.71	0.86	3.91	3.97	7.63
Switzerland	62	-2.72	0.81	3.39	4.36	8.43
United Kingdom	63	0.46	0.79	3.45	3.48	5.69
Group	313	-0.83	0.66	3.16	3.46	
Liberalizing Pacific LDCs						
Hong Kong	62	-2.89	0.94	4.80	5.62	11.61
Malaysia	62	0.83	1.00	4.61	4.68	8.19
Singapore	61	0.08	0.68	3.33	3.34	6.71
Group	185	-0.67	0.82	4.28	4.62	
Closed LDCs						
Bahrain	60	2.19	1.46	7.10	7.44	12.93
Greece	56	-9.22	1.91	9.36	13.19	21.77
Mexico	62	-20.28	9.43	21.19	29.45	52.13
Portugal	61	-3.90	2.97	11.28	11.95	23.62
South Africa	61	-4.84	1.17	4.85	6.88	11.16
Group	300	-7.25	1.30	12.16	16.06	
Closed European DCs						
Austria	64	-2.20	0.83	3.84	4.43	7.32
Belgium	63	0.53	0.68	2.90	2.95	4.99
Denmark	61	-3.42	0.90	4.34	5.54	9.64
France	64	-0.48	0.72	2.94	2.98	5.54
Ireland	61	1.53	1.03	3.95	4.24	7.13
Italy	61	1.01	0.86	3.62	3.76	5.83
Norway	50	-0.64	0.84	3.23	3.29	6.83
Spain	63	0.53	1.44	5.92	5.95	11.90
Sweden	63	-0.21	1.07	4.52	4.53	8.28
Group	550	-0.37	0.81	4.00	4.29	
Liberalizing Pacific DCs						
Australia	60	1.16	0.90	3.69	3.87	7.48
Japan	63	-0.58	0.62	3.41	3.46	6.03
New Zealand	60	1.04	1.83	7.15	7.23	11.36
Group	183	0.52	0.73	5.00	5.09	
All Countries	1531	-1.74		6.47	8.07	

Table 5a: PROJECTION OF REAL INTEREST DIFFERENTIAL (to find ex ante differential and its standard deviation)

COUNTRY	# of Obs	Coefficients: Constant	Forward Discount	Interest Differenti	Inflation Differenti	Chi Value	Projected Standard Deviation	Adjusted R Squared
CANADA	63	0.17	-0.48	0.83	-0.26	2.59	0.56	-0.06
GERMANY	63	2.07	1.71	-0.70	-0.27	8.50 *	1.47	0.18
NETHERLA	62	3.79 *	1.92	-0.30	-0.04	24.33 *	2.53	0.34
SWITZERL	62	3.09	2.67	-1.79	0.35	14.66 *	2.09	0.21
UNITED K	63	-1.68	8.12 *	-8.21 *	0.83	14.79 *	1.87	0.19
HONG KON	62	-1.11	-1.43	2.74	-0.53	8.03 *	1.68	0.01
MALAYSIA	62	1.30	-0.08	1.04	-0.09	11.14 *	2.43	0.12
SINGAPOR	61	2.57	0.34	0.31	0.42	0.84	0.55	-0.11
BAHRAIN	60	-2.22	0.40	-0.39	-0.74	2.22	1.96	-0.05
GREECE	56	-17.56	-0.49	0.89	0.62	4.87	3.19	0.11
MEXICO	43	-15.92	-0.79 *	1.05	0.06	10.70 *	9.86	0.38
PORTUGAL	59	-7.92	-0.25	2.45 *	-1.06 *	20.48 *	7.31	0.38
SOUTH AF	61	1.26	0.00	0.39	-0.79 *	18.34 *	3.24	0.40
AUSTRIA	62	0.99	0.30	0.96	-0.23	4.98	1.58	0.06
BELGIUM	63	1.42 *	0.72	-0.33	-0.87 *	18.79 *	1.87	0.33
DENMARK	61	-1.07	-0.28	1.42 *	0.46	6.78	1.93	0.12
FRANCE	64	0.62	-0.73 *	2.28 *	-0.78 *	45.16 *	2.30	0.55
IRELAND	59	3.44 *	0.12	0.32	-1.01 *	41.76 *	3.15	0.58
ITALY	61	-0.24	-0.36 *	1.85 *	-0.66 *	19.23 *	2.40	0.36
NORWAY	59	-0.25	-2.31 *	2.60 *	0.31	7.61	1.48	0.11
SPAIN	63	-3.05	-0.70 *	1.93 *	-0.28	29.76 *	4.22	0.44
SWEDEN	63	-4.23 *	-2.61 *	4.45 *	-0.14	16.11 *	2.69	0.26
AUSTRALI	60	-1.14	-0.28	0.68	0.12	3.96	1.52	0.06
JAPAN	63	2.26	3.61	-2.89	0.26	7.18	1.32	0.03
NEW ZEAL	60	-5.66	0.52	-0.54	0.76	7.22	3.65	0.16

* Statistically significant at 95% level (using Hansen-Hodrick standard errors)

Table 6: "COUNTRY PREMIA" OR COVERED INTEREST DIFFERENTIALS
(local minus Eurodollar; 3-month rates)

Interest Differential Less Forward Discount
September, 1982 to April, 1988

		1		2	3	4
	# of Obs.	Mean	Standard Error	Series Standard Deviation	Root Mean Squared Error	95% Band
Open Atlantic DCs						
Canada	68	-0.10	0.03	0.21	0.24	0.44
Germany	68	0.35	0.03	0.24	0.42	0.75
Netherlands	68	0.21	0.02	0.13	0.25	0.45
Switzerland	68	0.42	0.03	0.23	0.48	0.79
United Kingdom	68	-0.14	0.02	0.20	0.25	0.41
Group	340	0.14	0.01	0.21	0.34	
Liberalizing Pacific LDCs						
Hong Kong	68	0.13	0.03	0.28	0.31	0.60
Malaysia	63	-1.46	0.16	1.28	1.95	3.73
Singapore	64	-0.30	0.04	0.31	0.43	0.73
Group	195	-0.52	0.05	0.76	1.14	
Closed LDCs						
Bahrain	64	-2.15	0.13	1.06	2.41	4.17
Greece	58	-9.39	0.80	6.08	11.26	20.39
Mexico	43	-16.47	1.83	12.01	20.54	28.86
Portugal	61	-7.93	1.23	9.59	12.49	27.83
South Africa	67	-1.07	1.17	9.55	9.61	2.69
Group	293	-6.64	0.48	8.23	11.82	
Closed European DCs						
Austria	65	0.13	0.05	0.39	0.41	0.39
Belgium	68	0.12	0.03	0.26	0.29	0.59
Denmark	68	-3.53	0.19	1.57	3.89	6.63
France	68	-1.74	0.32	2.68	3.20	7.18
Ireland	66	-0.79	0.51	4.17	4.24	7.80
Italy	68	-0.40	0.23	1.92	1.96	4.11
Norway	50	-1.03	0.11	0.76	1.29	2.10
Spain	67	-2.40	0.45	3.66	4.39	7.95
Sweden	68	-0.23	0.06	0.45	0.51	0.81
Group	588	-1.10	0.09	2.25	2.77	
Liberalizing Pacific DCs						
Australia	68	-0.75	0.23	1.94	2.08	2.59
Japan	68	0.09	0.03	0.21	0.23	0.43
New Zealand	68	-1.63	0.29	2.42	2.92	5.24
Group	204	-0.76	0.12	1.78	2.06	
All Countries	1620	-1.73	0.09	3.81	5.36	

Table 7: "CURRENCY PREMIA" OR REAL FORWARD DISCOUNTS

Forward Discount Less Realized Inflation Differential
September, 1982 to January, 1988

		1		2	3	4
	# of Obs.	Mean	Standard Error	Series Standard Deviation	Root Mean Squared Error	95% Band
Open Atlantic DCs						
Canada	63	0.18	0.38	2.08	2.09	4.02
Germany	63	-1.66	0.69	2.89	3.34	6.57
Netherlands	62	-0.92	0.88	3.98	4.09	7.52
Switzerland	62	-3.15	0.94	3.49	4.72	8.79
United Kingdom	63	0.41	0.83	3.56	3.61	5.97
Group	313	-0.98	0.69	3.24	3.65	
Liberalizing Pacific LDCs						
Hong Kong	62	-2.99	0.93	4.79	5.66	11.76
Malaysia	62	2.29	1.14	5.06	5.56	10.17
Singapore	62	0.40	0.67	3.32	3.35	6.86
Group	186	-0.10	0.82	4.43	4.95	
Closed LDCs						
Bahrain	60	4.37	1.52	7.27	8.51	16.18
Greece	60	0.83	1.67	9.98	10.01	18.77
Mexico	43	0.03	3.58	15.23	15.23	22.08
Portugal	59	4.94	2.13	11.73	12.74	21.56
South Africa	62	-3.82	1.81	11.36	11.99	14.75
Group	284	1.29	1.37	11.05	11.60	
Closed European DCs						
Austria	62	-2.25	0.83	3.94	4.55	7.68
Belgium	63	0.42	0.69	2.95	2.98	5.05
Denmark	61	0.14	1.01	4.63	4.63	7.13
France	64	1.35	0.54	2.50	2.65	4.82
Ireland	59	2.14	1.40	6.41	6.76	13.85
Italy	61	1.42	0.72	3.15	3.46	5.52
Norway	64	1.07	0.75	3.25	3.43	5.91
Spain	63	3.12	1.26	5.53	6.36	11.06
Sweden	63	0.04	1.07	4.57	4.57	8.29
Group	560	0.83	0.67	4.23	4.54	
Liberalizing Pacific DCs						
Australia	60	1.97	0.28	4.06	4.52	7.85
Japan	63	-0.69	0.64	3.48	3.55	6.32
New Zealand	60	2.82	1.98	7.96	8.46	14.11
Group	183	1.33	0.79	5.48	5.84	
All Countries	1,526	0.49		6.11	6.50	

Table 7a: PROJECTION OF REAL FORWARD DISCOUNT
(to find ex ante differential and its standard deviation)

COUNTRY	# of Obs	Coefficients: Constant	Forward Discount	Interest Differenti	Inflation Differenti	Chi Value	Projected Standard Deviation	Adjusted R Squared
CANADA	63	0.17	0.52	-0.17	-0.26	2.40	0.55	-0.06
GERMANY	63	2.07	2.71	-1.70	-0.27	11.33 *	1.68	0.25
NETHERLA	62	3.79 *	5.92	-1.39	-0.04	26.58 *	2.64	0.36
SWITZERL	62	3.00	3.87 *	-2.79	0.35	17.91 *	2.25	0.26
UNITED K	63	-1.68	9.12 *	-9.21 *	0.83	18.20 *	2.07	0.24
HONG KON	62	-1.11	-0.43	1.74	-0.53	7.28	1.66	0.01
MALAYSIA	62	1.30	0.92	0.04	-0.09	18.21 *	3.21	0.32
SINGAPOR	61	2.57	1.34	-0.69	0.42	1.16	0.64	-0.10
BAHRAIN	60	-2.22	1.40	-1.89	-0.74	4.01	2.52	0.02
GREECE	55	-17.56	0.60 *	-0.12	0.62	10.04 *	4.41	0.09
MEXICO	43	-15.92	0.21	0.05	0.06	0.77	2.88	-0.10
PORTUGAL	59	-7.92	0.75 *	1.45 *	-1.06 *	21.51 *	6.83	0.34
SOUTH AF	61	1.25	1.00 *	-0.61 *	-0.79 *	520.89 *	10.75	0.88
AUSTRIA	62	0.99	1.30	-0.04	-0.25	6.91	1.76	0.10
BELGIUM	63	1.42 *	1.72	-1.35	-0.87 *	20.82 *	1.94	0.35
DENMARK	61	-1.07	0.72	0.42	0.46	11.61 *	2.51	0.17
FRANCE	64	0.62	0.27 *	1.28 *	-0.78 *	22.87 *	1.69	0.39
IRELAND	59	3.44 *	1.12 *	-0.68 *	-1.01 *	277.71 *	5.93	0.84
ITALY	61	-0.24	0.14	0.85	-0.66 *	7.99 *	1.60	0.16
NORWAY	50	-0.25	-1.31	1.60	0.31	2.74	0.87	-0.04
SPAIN	63	-3.05	0.30	0.93 *	-0.28	19.54 *	3.65	0.36
SWEDEN	63	-4.23 *	-1.61	3.45 *	-0.14	15.71 *	2.77	0.28
AUSTRALI	60	-1.14	0.72 *	-0.52	0.12	12.30 *	2.27	0.23
JAPAN	63	2.26	4.61	-3.89	0.26	9.26 *	1.48	0.07
NEW ZEAL	60	-5.66	1.52 *	-1.54 *	0.76	22.92 *	5.06	0.32

* Statistically significant at 95% level
(using Hansen-Hodrick standard errors)

Table 8: RETURN TO FORWARD EXCHANGE SPECULATION

Forward Discount Less Realized Exchange Depreciation
September, 1982 to January, 1988

	# of Obs.	1 Mean	Standard Error	2 Series Standard Deviation	3 Root Mean Squared Error	4 95% Band
Open Atlantic DCs						
Canada	65	1.04	2.03	9.15	9.21	16.95
Germany	65	4.11	5.92	25.85	26.18	44.23
Netherlands	65	4.35	6.09	26.32	26.68	44.91
Switzerland	65	3.98	6.22	27.74	28.02	46.77
United Kingdom	65	3.77	6.21	27.72	27.98	42.95
Group	325	3.45	5.36	24.27	24.55	
Liberalizing Pacific LDCs						
Hong Kong	65	-3.79	2.22	10.76	11.41	24.43
Malaysia	65	-0.74	2.31	10.31	10.34	18.92
Singapore	65	-0.35	2.01	9.64	9.65	18.07
Group	195	-1.62	1.71	10.19	10.44	
Closed LDCs						
Greece	65	3.64	5.32	25.84	26.10	46.22
Mexico	43	6.04	12.29	50.74	51.10	89.44
Portugal	61	11.27	5.07	22.53	25.23	41.80
Saudi Arabia	65	-1.49	0.52	2.82	3.19	5.55
South Africa	65	-4.83	9.19	42.50	42.77	83.90
Group	299	2.59	3.83	31.59	32.21	
Closed European DCs						
Austria	63	5.38	6.00	26.27	26.82	46.00
Belgium	65	7.51	5.40	23.77	24.94	44.75
Denmark	65	7.50	5.51	24.27	25.42	43.91
France	65	7.47	5.54	24.23	25.37	42.92
Ireland	63	7.27	5.75	24.67	25.73	45.05
Italy	65	8.37	5.33	23.20	24.82	40.91
Norway	65	7.20	4.73	21.10	22.31	38.55
Spain	65	8.98	5.04	22.28	24.05	45.08
Sweden	65	6.20	4.47	20.21	21.15	39.05
Group	581	7.37	5.82	23.22	24.39	
Liberalizing Pacific DCs						
Australia	65	1.09	6.55	32.41	32.43	61.46
Japan	65	10.98	5.57	25.12	27.45	53.50
New Zealand	65	8.81	8.42	36.98	38.03	73.92
Group	195	6.96	5.59	31.72	32.75	
All Countries	1595	4.53		25.25	26.01	

Table 8a: PROJECTION OF RETURN TO FORWARD EXCHANGE SPECULATION
(to find ex ante exchange risk premium and its standard deviation)

COUNTRY

	# of Obs	Coefficients: Constant	Forward Discount	Interest Differenti	Inflation Differenti	Chi Value	Projected Standard Deviation	Adjusted R Squared
CANADA	65	-5.67 *	12.14 *	-7.52	0.51	18.28 *	5.65	0.27
GERMANY	65	47.68 *	-11.17	28.26	-3.79	20.03 *	16.49	0.32
NETHERLA	65	45.50 *	24.52	-12.10	2.73	31.16 *	18.35	0.41
SWITZERL	65	49.75 *	5.91	4.24	4.40	16.43 *	16.44	0.26
UNITED K	65	-11.11	24.47	-16.35	-1.63	30.62 *	19.90	0.45
HONG KON	65	2.46	1.84	0.12	-1.83	5.39	3.95	0.01
MALAYSIA	63	-1.58	1.25	-0.37	0.23	2.6a	3.29	-0.03
SINGAPOR	64	-14.40	2.78	-4.77	-3.03	4.02	3.22	-0.01
BAHRAIN	63	-1.00	0.80	0.15	0.09	3.83	0.93	-0.01
GREECE	58	-52.10 *	0.13	9.70 *	0.27	18.62 *	15.67	0.24
MEXICO	43	-122.40	-0.82	1.37	2.34 *	9.76 *	27.75	0.28
PORTUGAL	59	-2.46	0.65	4.53 *	-2.87 *	26.00 *	14.57	0.35
SOUTH AF	64	-47.30	0.18	-0.87	4.26	3.22	13.99	-0.01
AUSTRIA	63	35.77 *	2.51	5.30	-3.68	20.14 *	16.51	0.31
BELGIUM	65	9.35	10.25	-4.91	-4.60 *	7.64	11.09	0.11
DENMARK	64	32.81 *	-1.15	8.40 *	-3.33	12.33 *	13.48	0.21
FRANCE	65	11.56	-0.63	6.59	-4.64	3.55	9.65	0.00
IRELAND	62	10.49	0.47	2.34	-4.01 *	10.19 *	13.42	0.19
ITALY	64	-8.67	0.15	2.19 *	-5.03 *	10.97 *	12.10	0.17
NORWAY	50	-12.04	-2.55	10.06	-1.63	9.08 *	11.15	0.16
SPAIN	65	27.92 *	-0.26	1.03	-3.92 *	6.31	10.18	0.10
SWEDEN	65	-14.71 *	-13.61 *	22.20 *	-0.82	40.71 *	13.39	0.40
AUSTRALI	63	-23.57 *	-1.38	5.86	4.13	5.95	13.53	0.05
JAPAN	65	35.33 *	+3.02 *	-27.19	2.13	12.90 *	12.39	0.16
NEW ZEAL	63	-27.59 *	-1.15	3.42	3.48	11.31 *	21.50	0.23

* Statistically significant at 95% level
(using Hansen-Hodrick standard errors)

Table 9: REAL DEPRECIATION OF CURRENCY

Realized Exchange Depreciation Less Realized Inflation Differential
September, 1982 to January, 1988

	1			2	3	4
	# of Obs.	Mean	Standard Error	Series Standard Deviation	Root Mean Squared Error	95% Band
Open Atlantic DCs						
Canada	63	-0.27	1.81	8.45	8.46	15.17
Germany	63	-6.35	5.75	25.10	25.90	44.21
Netherlands	62	-6.11	5.90	25.14	25.88	43.78
Switzerland	62	-8.35	6.11	26.78	28.07	45.67
United Kingdom	63	-2.84	6.06	27.29	27.44	47.88
Group	313	-4.77	5.24	23.48	24.13	
Liberalizing Pacific LDCs						
Hong Kong	62	0.62	2.23	10.61	10.63	22.57
Malaysia	62	2.44	2.46	10.60	10.88	19.74
Singapore	62	0.63	2.39	10.86	10.88	19.23
Group	186	1.23	2.11	10.63	10.74	
Closed LDCs						
Bahrain	60	5.92	1.62	7.94	9.54	21.24
Greece	60	-1.82	4.99	25.08	25.15	46.41
Mexico	62	-3.32	9.31	47.96	48.07	89.57
Portugal	57	-9.12	4.73	22.63	24.06	46.25
South Africa	62	-0.27	10.74	47.16	47.16	78.62
Group	301	-1.46	4.27	33.93	34.26	
Closed European DCs						
Austria	64	-7.30	5.64	25.16	26.21	44.92
Belgium	63	-7.69	5.09	22.61	23.90	44.90
Denmark	61	-7.94	5.60	24.05	25.35	41.85
France	64	-6.26	5.39	24.06	24.87	42.24
Ireland	61	-5.85	5.56	24.12	24.84	43.47
Italy	61	-8.01	5.44	23.24	24.60	41.38
Norway	64	-5.92	4.64	21.05	21.88	37.90
Spain	63	-6.01	5.25	22.67	23.47	39.51
Sweden	63	-6.23	3.95	18.36	19.41	33.17
Group	564	-6.79	5.76	22.73	23.74	
Liberalizing Pacific DCs						
Australia	60	2.38	6.78	33.00	33.09	70.90
Japan	63	-12.13	5.63	25.30	38.10	52.98
New Zealand	60	-4.77	8.49	37.00	37.31	82.32
Group	183	-4.96	5.63	31.86	32.79	
All Countries	1547	-4.16		25.61	26.28	

Table 9a: PROJECTION OF REAL CURRENCY DEPRECIATION
(to find ex ante real depreciation and its standard deviation)

COUNTRY	# of Obs	Coefficients: Constant	Forward Discount	Interest Differenti	Inflation Differenti	Chi Value	Projected Standard Deviation	Adjusted R Squared
CANADA	63	5.80 *	-10.12 *	5.75	-1.23	24.48 *	5.35	0.32
GERMANY	63	-43.94 *	12.29	-27.77	4.07	16.10 *	15.06	0.27
NETHERLA	62	-33.83 *	-21.38	11.17	-1.48	19.25 *	15.91	0.32
SWITZERL	62	-45.63 *	1.54	-10.72	-2.47	11.33 *	14.39	0.19
UNITED K	63	11.04	-13.47	5.82	1.28	22.66 *	18.38	0.33
HONG KON	62	-4.07	-3.99	2.78	1.43	2.63	3.92	-0.05
MALAYSIA	62	3.12	-0.43	0.69	-0.06	0.12	0.66	-0.14
SINGAPOR	61	19.56 *	-8.25	4.21	3.55	4.04	4.06	0.02
BAHRAIN	60	-1.44	0.53	-2.11	-0.89	3.51	2.60	0.02
GREECE	56	46.19 *	0.44	-7.76 *	-0.73	19.25 *	14.09	0.20
MEXICO	43	106.48	1.03	-1.33	-2.28 *	7.76	27.76	0.16
PORTUGAL	57	-8.03	0.14	-3.00	1.39 *	7.62 *	10.59	0.12
SOUTH AF	61	39.40	0.81	0.89	-4.62	6.72	19.86	0.07
AUSTRIA	62	-34.72 *	-5.54	-5.41	3.98	16.63 *	15.05	0.26
BELGIUM	63	-10.28	-7.73	3.04	4.47 *	7.01	10.22	0.09
DENMARK	61	-35.34 *	0.69	-7.61 *	5.79	14.38 *	14.16	0.26
FRANCE	64	-11.74	0.99	-6.05	4.31	5.48	8.33	-0.00
IRELAND	59	-15.12	0.37	-1.57	3.77 *	5.67	10.96	0.10
ITALY	61	2.18	-0.46	-6.38	4.77 *	8.82 *	11.35	0.14
NORWAY	50	11.79	1.24	-3.46	1.94	8.16 *	10.78	0.12
SPAIN	63	-37.73 *	0.53	-6.06	4.63 *	6.78 *	11.55	0.16
SWEDEN	63	10.00	11.09 *	-18.81 *	0.76	26.36 *	11.34	0.30
AUSTRALI	60	24.58 *	2.20	-3.37	-4.14	5.40	13.07	0.04
JAPAN	63	-31.37 *	-41.22 *	35.14	-0.47	10.10 *	11.95	0.12
NEW ZEAL	60	32.25	2.65	-3.78	2.84	9.54 *	19.44	0.17

* Statistically significant at 95% level
(using Hansen-Hodrick standard errors)

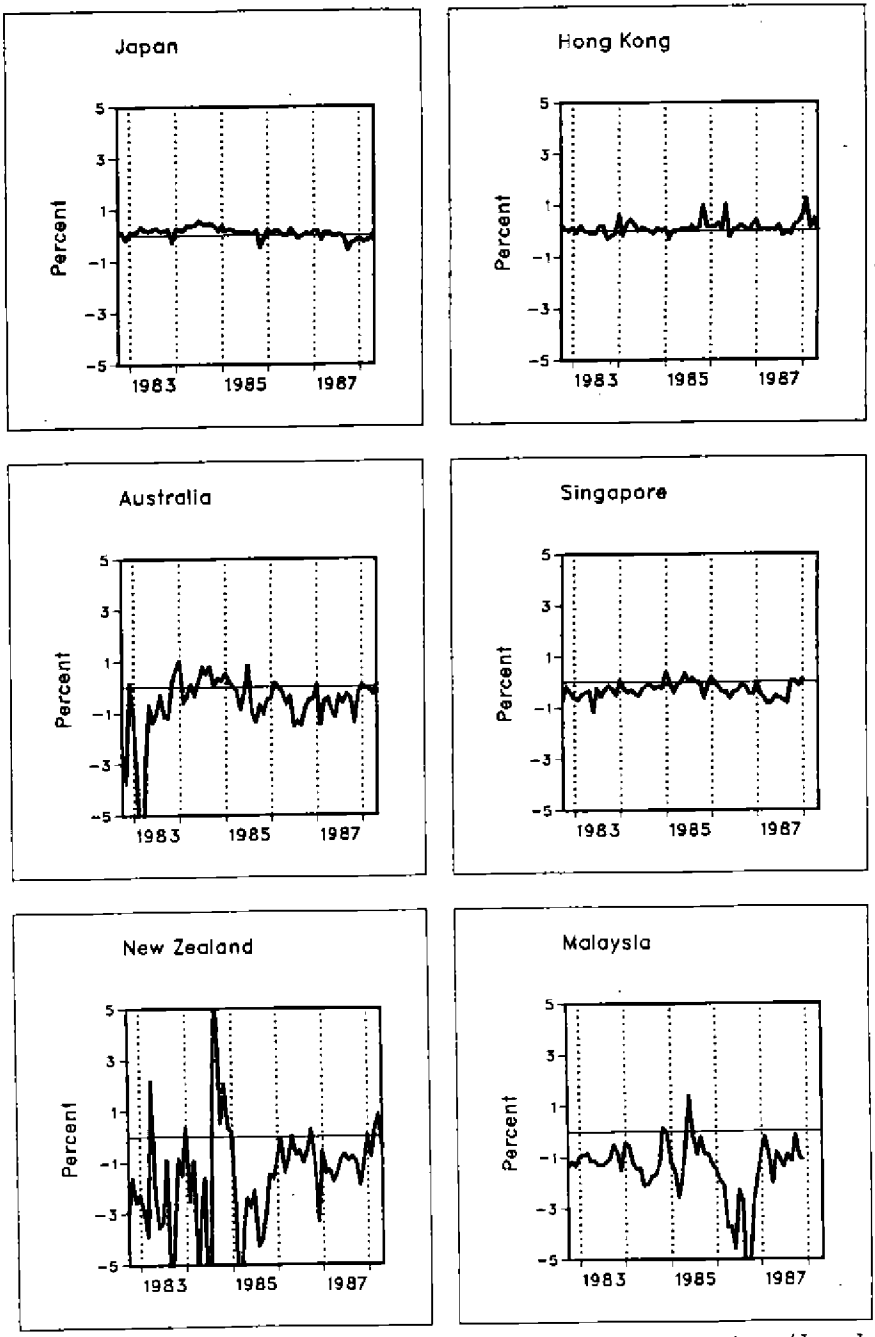
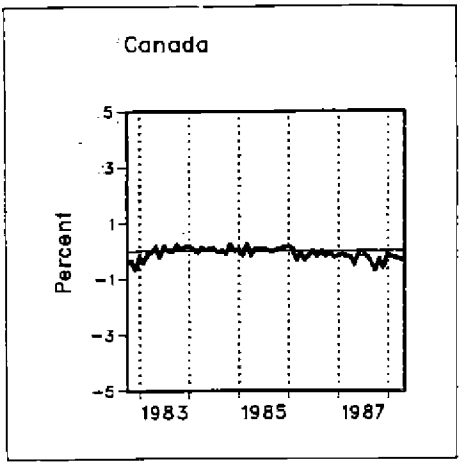
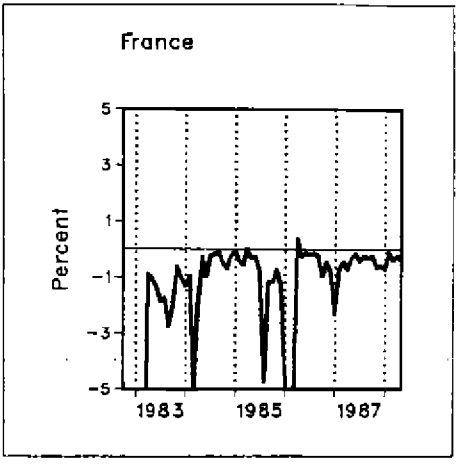
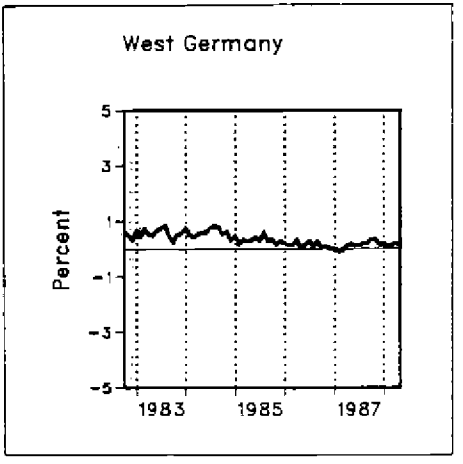
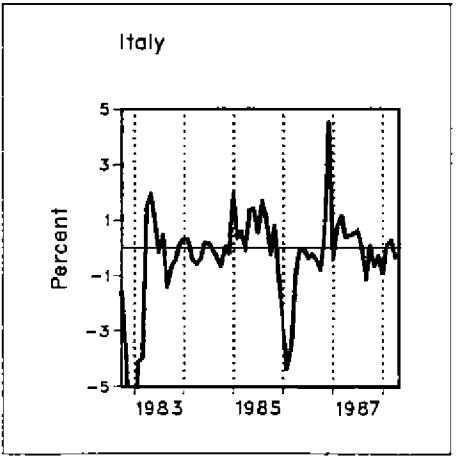


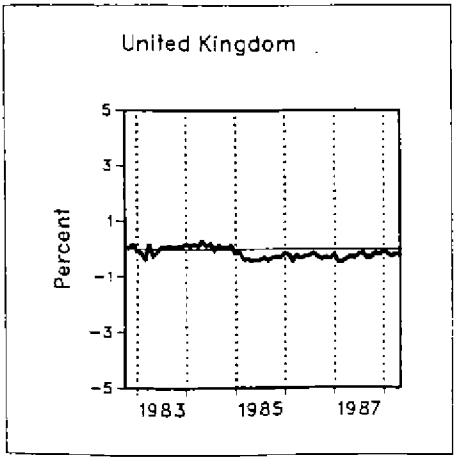
Figure 4: Covered interest differentials for 25 countries (local-Euro)

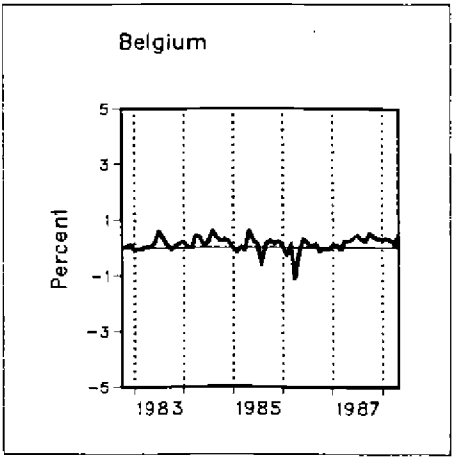

Canada
Percent
5
3
1
-1
-3
-5
1983
1985
1987

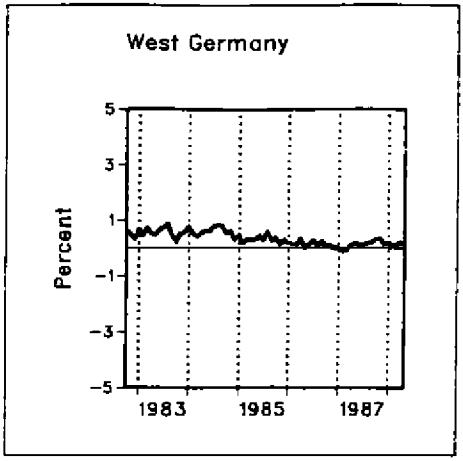

France
Percent
5
3
1
-1
-3
-5
1983
1985
1987

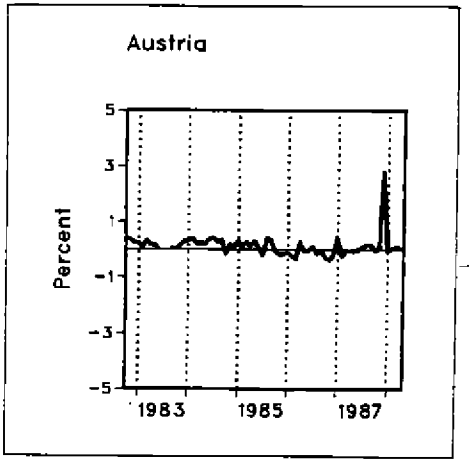

West Germany
Percent
5
3
1
-1
-3
-5
1983
1985
1987

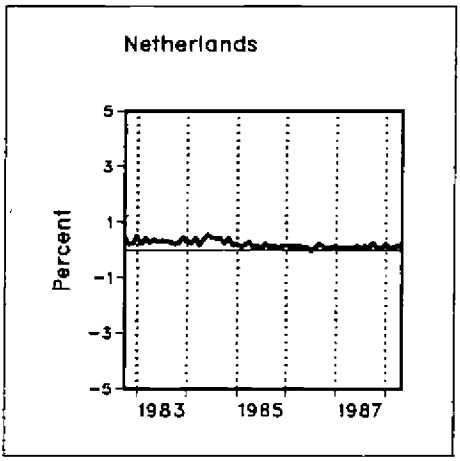

Italy
Percent
5
3
1
-1
-3
-5
1983
1985
1987

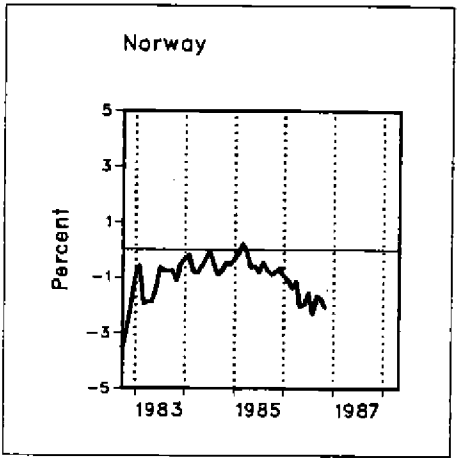

United Kingdom
Percent
5
3
1
-1
-3
-5
1983
1985
1987

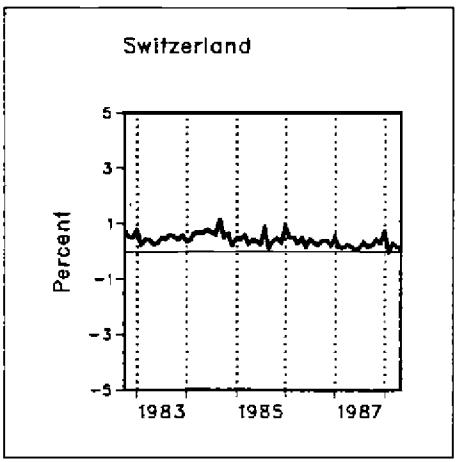

Belgium
Percent
5
3
1
-1
-3
-5
1983
1985
1987

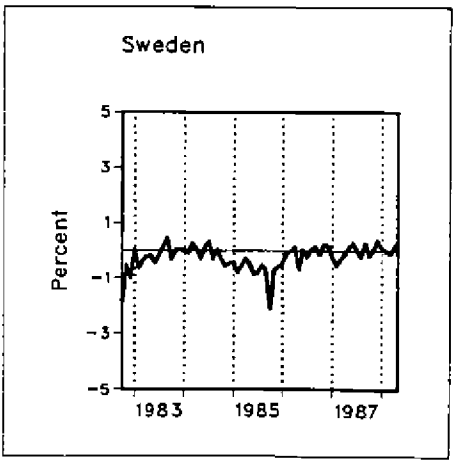

West Germany
Percent
5
3
1
-1
-3
-5
1983
1985
1987

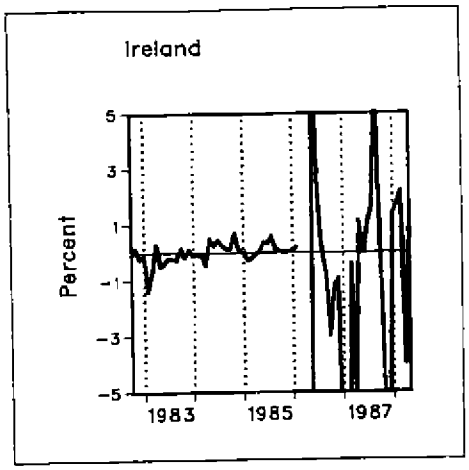

Austria
Percent
5
3
1
-1
-3
-5
1983
1985
1987

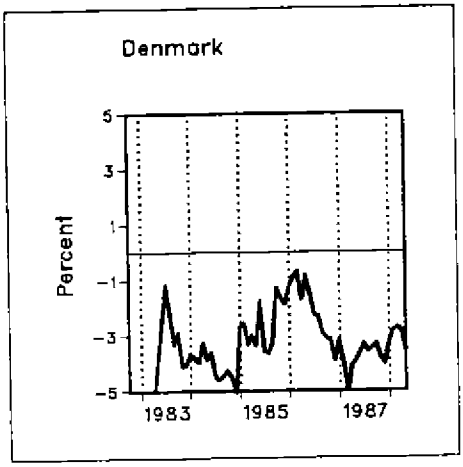

Netherlands
Percent
5
3
1
-1
-3
-5
1983
1985
1987

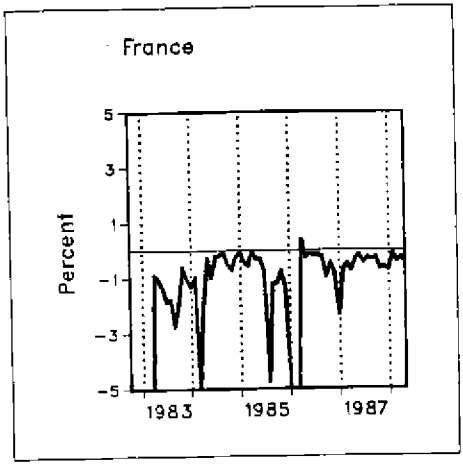

Norway
Percent
5
3
1
-1
-3
-5
1983
1985
1987

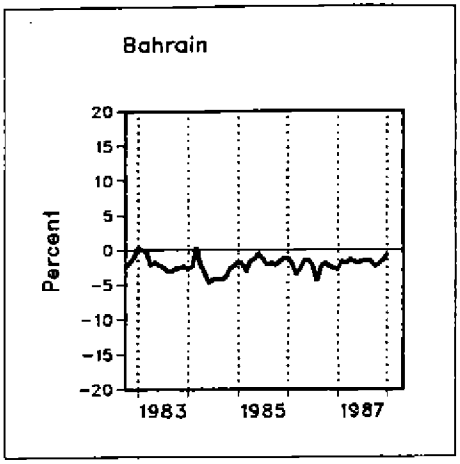

Switzerland
Percent
5
3
1
-1
-3
-5
1983
1985
1987

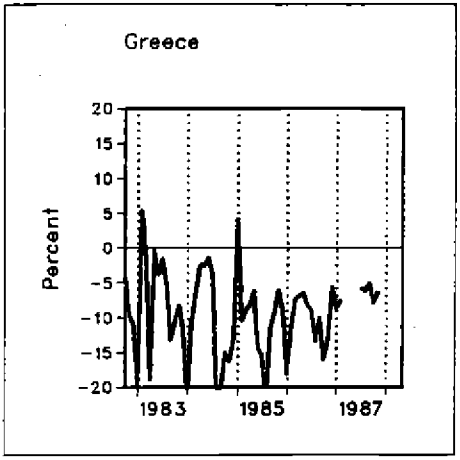

Sweden
Percent
5
3
1
-1
-3
-5
1983
1985
1987

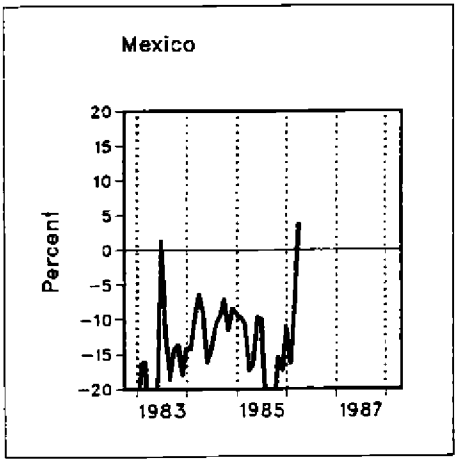

Ireland
Percent
5
3
1
-1
-3
-5
1983
1985
1987

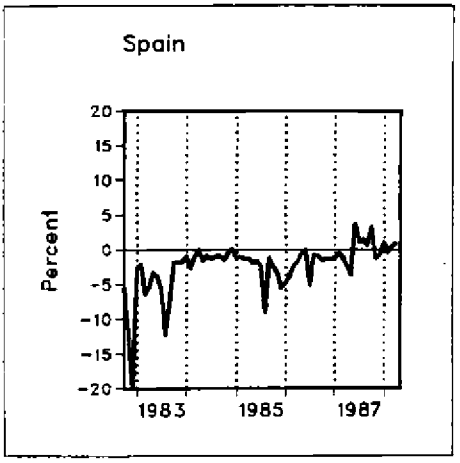

Denmark
Percent
5
3
1
-1
-3
-5
1983
1985
1987

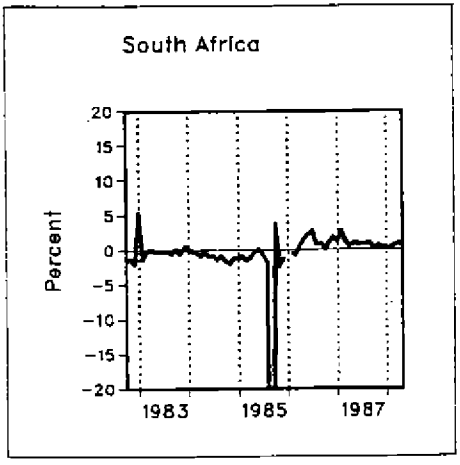

France
Percent
5
3
1
-1
-3
-5
1983
1985
1987

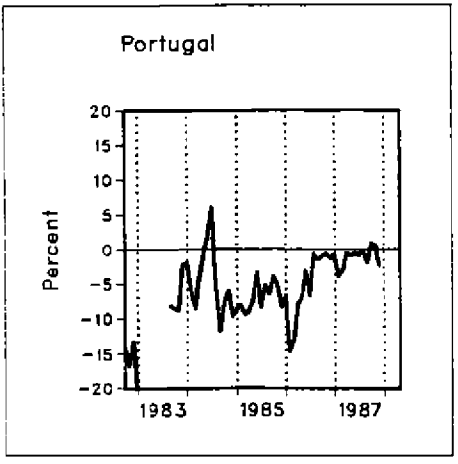

Bahrain
Percent
20
15
10
5
0
-5
-10
-15
-20
1983
1985
1987


Greece
Percent
20
15
10
5
0
-5
-10
-15
-20
1983
1985
1987


Mexico
Percent
20
15
10
5
0
-5
-10
-15
-20
1983
1985
1987


Spain
Percent
20
15
10
5
0
-5
-10
-15
-20
1983
1985
1987


South Africa
Percent
20
15
10
5
0
-5
-10
-15
-20
1983
1985
1987


Portugal
Percent
20
15
10
5
0
-5
-10
-15
-20
1983
1985
1987

Column (4), the size of the band wide enough to encompass 95 per cent of deviations from international covered interest parity, can be compared with the approach of Frenkel and Levich (1977). They tested a larger band meant to represent transactions costs between pound and dollar securities. They found, for the case of the United Kingdom, that a smaller percentage of deviations (87.6 - 89.7 percent, p.1217) fell within the band. This confirms that capital mobility has increased since the 1970s.

Germany and several other neighboring European countries [Switzerland, the Netherlands, Austria, and Belgium] show higher interest rates locally than offshore, which suggests some barriers discouraging capital inflow: investors would not settle for a lower mark return in the Euromarket if they were free to get the higher return in Germany. But the magnitude is quite small, as it has been observed to be ever since Germany removed most of its controls on capital inflow in 1974 (Dooley and Isard, 1980; and Giavazzi and Pagano, 1985, p.27).

Japan has a covered differential that by all measures is smaller and less variable than those of Switzerland and Germany, let alone France and most of the other countries. This might come as a surprise to those accustomed to thinking of Japanese financial markets in terms of the large barriers to capital inflow that were in place in the 1970s. The liberalization of Japanese markets, which has been documented elsewhere, continued during our sample period.[29] Australia

and New Zealand, while lagging well behind Japan, show signs of liberalization during the course of our sample period.[30]

The covered interest differential for France is much larger and more variable than that for the other major industrialized countries known to be free of capital controls. This is the reverse of the finding from the criterion of real interest differentials in Table 5. It supports the value of the criterion of covered interest differentials as the proper test of financial market integration. The differential, with its negative sign signifying controls on French capital outflows, has been previously studied, especially its tendency to shoot up shortly before devaluations of the franc.[31] Our data indicate that the last major occurrence of this phenomenon was February 1986; since then the differential has been close to zero.

Similarly, the same phenomenon for Italy, which has also been previously studied (e.g., Giavazzi and Pagano, 1985), appears to have ended after the February 1986 realignment. France and Italy have apparently been dismantling their capital controls quickly enough to meet a 1990 deadline for liberalization recently set by the EEC Twelve.[32] Of four countries that are expected to require a later deadline, Spain and Portugal have by our measures already been liberalizing [plots show that the magnitude of the covered interest differential fell sharply in 1987 for these two countries], but Greece and Ireland have not. Sweden is one non-EEC European

country that appears to have moved toward liberalization during our sample period, while Norway does not. All of these European countries show up with negative mean differentials, which implies that the remaining controls act to discourage capital outflow rather than inflow. For the EEC countries, this finding supports records of the European Commission, which report more freedom for short-term inflows than short-term outflows.[33]

Registering impressively open financial markets are our three East Asian LDCs [which, especially in the case of Singapore, have rapidly outgrown the appellation "less developed"]. Hong Kong and Singapore show smaller covered differentials even than some open European countries like Germany. Malaysia's differential has been considerably higher, particularly in 1986, but still compares favorably with some European countries.

Not surprisingly, our remaining LDCs [Mexico, Greece, Portugal, Bahrain and South Africa] show by far the largest and most variable covered interest differentials.[34] Again, the results are precisely what one would expect if covered interest differentials are the proper criterion for capital mobility, but the reverse of what the saving-investment criterion shows.

Why does the covered differential criterion give such different answers from the saving-investment criterion, which shows a high degree of saving-retention among industrialized

countries? 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.[35] 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 5-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 7-year bonds averaged only 5.3 basis points. The means mask some variation in the differential. But a band of 46 basis points is large enough to encompass 95 per cent of the observations for the 5-year bonds. The band is 34 basis points

for the 7-year bonds. The means on 5-year bonds for some other major countries are as follows: Canada 15.9, Switzerland 18.7, United Kingdom 51.1, and Germany 28.4.

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.[36] The most relevant distinction appears to be, not long-term vs. short-term, but rather real vs. nominal.

4.3 "Real forward discounts:" The currency premium

Even for those countries that exhibit no substantial country premium, as reflected in covered interest parity [fd-(i - i*) = 0], there may still be a substantial currency premium that drives real interest differentials [(i - exp infl) - (i* - exp infl*)] away from zero. If real interest differentials are not arbitraged to zero, then there is in turn no reason to expect saving-investment correlations to be zero.

Table 7 reports the statistics for the currency premium, as measured by the "real forward discount:"

fd - (exp infl - exp infl*).

Germany, Switzerland, the Netherlands, Austria and Japan, for example, all have substantial real forward discounts (or--more precisely -- real forward premia), which constitute

approximately the entirety of their real interest differentials. These are countries with currencies that have experienced a lot of exchange rate variability, both nominal and real, vis-a-vis the dollar since 1973, and especially since 1980. As a consequence, some combination of exchange risk premiums and expected real depreciation -- factors pertaining to the currency, not to the political jurisdiction -- produces the gap in real interest rates. For these five financially open industrialized countries, and for Hong Kong as well, the currency factors produce a negative real interest differential, while the covered interest differential (though small) is positive: the small regulations or frictions that remain in these countries are, if anything, working to resist capital inflow (at least at the short end of the maturity spectrum), not outflow as one would mistakenly conclude from the real interest differential criterion. The other countries all have highly variable currency premiums as well. Indeed the real forward discount (currency premium) is more variable than the covered interest differential (country premium) for all but three of our 25 countries (Greece, Mexico, and France). The last rows of Tables 6 and 7 show that the average variability across all countries is higher for the currency premium than for the country premium.

Table 7a projects the real forward discount on the same three variables as in Table 5a to get an ex ante measure. Its standard deviation now shows six countries for whom the

currency premium is less variable than the country premium (Greece, Mexico, Portugal, France, Italy and Spain). But the currency premium remains the major obstacle to real interest parity for most countries.

4.4 Further decomposition into exchange risk premium and expected real depreciation

Our decomposition so far has lumped two terms, the exchange risk premium and expected real depreciation, together into the currency premium:

fd - exp infl + exp infl* = (fd - exp depr) + (exp depr- exp infl + exp infl*).

In this section we attempt to complete the decomposition by separating these two terms. To do so requires a measure or model of expected depreciation. The usual approach is to use the ex post changes in the spot rate (depr) as a measure of ex ante expectations (exp depr), and to argue that under rational expectations the expectational error (e ≡ depr - exp depr) should be random (uncorrelated with information currently available at time t).

Column (1) of Table 8 reports the mean value of (fd-depr) for each of our countries. Most of the means are positive, showing that the weak-dollar period (1985-88) dominates over the strong-dollar period (1982-1985). [The five exceptions, currencies that depreciated against the dollar at a

rate more rapid than predicted by the forward discount, were the Hong Kong dollar, Malaysian ringgit, Singapore dollar, Saudi Arabian riyal, and South African rand.] But only three currencies have mean risk premiums, of either sign, that are statistically significant [the Saudi Arabian riyal, and two that appreciated strongly against the dollar, relative to the forward rate: the Japanese yen and the Portuguese escudo]. Furthermore, in a majority of cases [16/25], the sign of the mean return differential is the opposite of the sign of the mean real interest differential during the same period (Table 5, column 1). So this measure of the exchange risk premium does not explain any positive part of the real interest differential.

The measures of variability of (fd - depr) show up very large in columns (2), (3) and (4). These are measures of the variability of ex post return differentials, not ex ante. They tell us little about the variability of the exchange risk premium. But the high variability of the exchange rate does tell us two things. First, it provides an obvious explanation -- low power -- why the first moments might not be statistically significant. On the other hand, the existence of substantial uncertainty regarding the future spot rate suggests, via the theory of optimal portfolio diversification, that a non-zero exchange risk premium must exist, to reward risk-averse investors for holding currencies that are perceived as risky or that are in oversupply.

To estimate the ex ante exchange risk premium, in Table 8a we project (fd - depr) onto our same three variables: the forward discount, interest differential and inflation differential. The regression is statistically significant for a majority of currencies, as many others have found.[37] The standard deviation shows the most variable exchange risk premiums belong to Mexico and New Zealand, but the United Kingdom, Netherlands, Austria, Germany and Switzerland follow close behind.

In Table 9 we report the statistics for the other component of the currency premium, expected real depreciation. As noted earlier, given the widely-accepted failure of purchasing power parity on levels, there is no theoretical reason to expect it necessarily to hold in terms of expected rates of change, the hypothesis sometimes known as ex ante relative purchasing power parity. Table 9 reports the statistics for ex post real depreciation. The means in column (1) are negative, indicating real appreciation of the currency against the dollar, for all European countries and for most others as well. The only five exceptions, countries that experienced real depreciation against the dollar, were our three East Asian developing countries, Australia, and Bahrain. This last was the only one, of either sign, that was statistically significant.

We already know, from the results reported above for the

119 years of U.S.-U.K. data, that we cannot expect to reject ex ante relative PPP on just a few years of data: new disturbances to the real exchange rate are so large, that one needs a much longer time sample to find evidence of systematic movement. But the signs of the mean real depreciations are usually the same as the signs of the mean real interest differentials in Table 5 [20/25], suggesting a high correlation of the real interest differential and expected real depreciation across countries. [Columns (2)-(4) show very high variability in real depreciation, but again this tells us little about the variation of ex ante expected depreciation, beyond the observation that the high level of variability implies low power in our tests of ex ante relative purchasing power parity.]

To estimate ex ante expected real depreciation, in Table 9a we project ex post real depreciation, again, on the same three contemporaneous variables. The standard deviations for the various currencies are quite similar to those reported in Table 8a for the projected exchange risk premium. [It seems that in both cases an apparently predictable component of the spot rate changes constitutes most of the variation (as opposed to variation in the forward discount or inflation differential, respectively): the significant coefficients on the forward discount, interest differential and ex post inflation differential in Table 9a are always of opposite sign and

similar magnitude as those in Table 8a]. In most cases [18/25] the projected exchange risk premium is slightly more variable than projected real depreciation.

****

****

5. Conclusion

We can sum up with four conclusions.

(1) Capital controls and other barriers to the movement of capital across national borders remained for such countries as the United Kingdom and Japan as recently as 1979, and France and Italy as recently as 1986. But a continuing worldwide trend of integration of financial markets in the 1980s had all but eliminated interest differentials for major industrialized countries by 1988.

(2) Only the country premium has been eliminated; this means that only covered interest differentials are small.

Real and nominal exchange rate variability remain, and indeed were larger in the 1980s than in the 1970s.[38] The result is that a currency premium remains, consisting of an exchange risk premium plus expected real currency depreciation. This means that, even with the equalization of covered interest rates, large differentials in real interest rates remain.

(3) The United States in the 1980s began to borrow on such a

massive scale internationally that the traditional "Feldstein-Horioka" finding of a near-unit correlation between national saving and investment has broken down. The process of liberalization in Japan and other major countries was probably one factor behind this massive flow of capital to the United States.

(4) In addition to the gaps that distinguish covered interest parity from real interest parity, there is a further gap that separates real interest parity from the proposition that changes in national saving do not crowd out investment because they are readily financed by borrowing from abroad. Bonds are not perfect substitutes for equities, and equities are not perfect substitutes for plant and equipment. Thus at each stage, there are good reasons to think that shortfalls in national saving continue to be capable of crowding out investment, even if to a smaller extent than before 1980.

References

Adler, Michael and Bruce Lehman, 1983, "Deviations from Purchasing Power Parity in the Long Run," Journal of Finance 39, 5, 1471-1478.

Argy, Victor, 1987, "International Financial Liberalisation—

The Australian and Japanese Experiences Compared," Bank of Japan Monetary and Economic Studies 5, 1, 105-168.

Boothe, P., K. Clinton, A. Cote, and D. Longworth, 1985, "International Asset Substitutability: Theory and Evidence for Canada," Ottawa, Bank of Canada.

Caprio, G. and D. Howard, 1984, "Domestic Saving, Current Accounts, and International Capital Mobility," International Finance Discussion Papers no. 244, (Washington, D.C., Federal Reserve Board).

Caramazza, F., K. Clinton, A. Cote, and D. Longworth, 1986, "International Capital Mobility and Asset Substitutability: Some Theory and Evidence on Recent Structural Changes," Bank of Canada, Technical Report 44.

Cardia, Emanuela, 1988, "Crowding Out in Open Economies," Cahier 8823, Universite de Montreal, June.

Claassen, Emil and Charles Wyplosz, 1982, "Capital Controls: Some Principles and the French Experience," Annales de l'INSEE 47-48, 237-267.

Cumby, R. and F. Mishkin, 1986, "The International Linkage of

Real Interest Rates: The European-U.S. Connection," Journal of International Money and Finance 5, 5-24.

Cumby, R. and M. Obstfeld, 1984, "International Interest Rate and Price Level Linkages under Flexible Exchange Rates: A Review of Recent Evidence," in: J. Bilson and R. Marston, eds., Exchange Rate Theory and Practice, Chicago: University of Chicago Press.

Darby, Michael, 1981, "Does Purchasing Power Parity Work?" Proceedings of the Fifth West Coast Academic/Federal Reserve Economic Research Seminar, Federal Reserve Bank of San Francisco.

Darby, Michael, 1986, "The Internationalization of American Banking and Finance: Structure, Risk and World Interest Rates," Journal of International Money and Finance 5, 4, 403-428.

Dominguez, Kathryn, 1986, "Expectations Formation in the Foreign Exchange Market: New Evidence From Survey Data," Economic Letters.

Dooley, Michael, Jeffrey Frankel, and Donald Mathieson, 1987, "International Capital Mobility: What Do Saving-Investment Correlations Tell Us?" International Monetary Fund Staff

Papers, 34, no.3, 503-530.

Dooley, M. and P. Isard, 1980, "Capital Controls, Political Risk and Deviations from Interest-Rate Parity," Journal of Political Economy 88, 2, 370-384.

Dornbusch, Rudiger, 1983, "Real Interest Rates, Home Goods and Optimal External Borrowing," Journal of Political Economy, February.

Engel, Charles, and Kenneth Kletzer, 1987, "Saving and Investment in an Open Economy with Non-Traded Goods," NBER Working Paper no. 2141, February. International Economic Review, forthcoming.

Feldstein, M., 1983, "Domestic Saving and International Capital Movements in the Long Run and the Short Run, European Economic Review 21, 139-151.

Feldstein, Martin, ed., 1987, The Effects of Taxation on Capital Accumulation, Chicago: University of Chicago Press.

Feldstein, M. and P.Bacchetta, 1989, "National Savings and International Investment," NBER Conference on Saving [this volume].

Feldstein, M. and C. Horioka, 1980, "Domestic Saving and International Capital Flows," Economic Journal 90, 314-329.

Fieleke, Norman, 1982, "National Saving and International Investment," in: Saving and Government Policy, Conference Series no. 25, Federal Reserve Bank of Boston.

Frankel, Jeffrey, 1982, "On the Franc," Annales de l'INSEE, 47-48, 185-221.

Frankel, Jeffrey, 1984, "The Yen/Dollar Agreement: Liberalizing Japanese Capital Markets," Policy Analyses in International Economics no. 9, Washington, D.C.: Institute for International Economics.

Frankel, Jeffrey, 1986, "International Capital Mobility and Crowding-out in the U.S. Economy: Imperfect Integration of Financial Markets or of Goods Markets?" In R. Hafer, ed., How Open is the U.S. Economy?, Lexington, Ma.: Lexington Books, 33-67.

Frankel, Jeffrey, 1988a, "International Capital Flows and Domestic Economic Policies." In M.Feldstein, ed., The United States in the World Economy, University of Chicago Press: Chicago.

Frankel, Jeffrey, 1988b, "International Capital Mobility and Exchange Rate Variability," International Payments Imbalances, Bald Peak, N.H., Federal Reserve Bank of Boston (forthcoming).

Frankel, Jeffrey and Kenneth Froot, 1987, "Using Survey Data to Test Standard Propositions Regarding Exchange Rate Expectations," American Economic Review 77, 1 (March 1987).

Frankel, Jeffrey and Kenneth Froot, 1988, "Chartists, Fundamentalists and the Demand for Dollars," Forthcoming in Policy Issues for Interdependent Economies, edited by A.Courakis and M.Taylor, London, 1988.

Frankel, Jeffrey, and Alan MacArthur, 1988, "Political vs. Currency Premia in International Real Interest Differentials: A Study of Forward Rates for 24 Countries," European Economic Review, 32.

Frenkel, Jacob, 1981, "Flexible Exchange Rates, Prices and the Role of 'News': Lessons from the 1970s," Journal of Political Economy 89, no. 4, 665-705.

Frenkel, J. and R. Levich, 1977, "Transaction Costs and Interest Arbitrage: Tranquil versus Turbulent Periods," Journal of Political Economy 85, 6, 1209-1226.

Froot, Kenneth and Jeffrey Frankel, 1989, "Forward Discount Bias: Is It An Exchange Risk Premium?" Quarterly Journal of Economics.

Ghosh, Atish R., 1988, "How Mobile is Capital? Some Simple Tests," Harvard University, November.

Giavazzi, Francesco and Marco Pagano, 1985, "Capital Controls and the European Monetary System," in Capital Controls and Foreign Exchange Legislation, Occasional Paper, Milano: Euromobiliare.

Glick, Reuven, 1987, "Interest Rate Linkages in the Pacific Basin," Economic Review No. 3, pp.31-42.

Goulder, Larry and Barry Eichengreen, 1988, "Savings Promotion, Investment Promotion, and International Competitiveness," NBER Working Paper No. 2635, June.

Harberger, Arnold C., 1980, "Vignettes on the World Capital Market," American Economic Review, Vol. 70, 331-337.

Hatsopoulos, George, Paul Krugman, and Larry Summers, 1988, "U.S. Competitiveness: Beyond the Trade Deficit," Science, vol. 24 (July 15), 299-307.

Huizinga, John, 1987, "An Empirical Investigation of the Long Run Behavior of Real Exchange Rates" Carnegie-Rochester Conference Series.

Koraczyk, Robert, 1985, "The Pricing of Forward Contracts for Foreign Exchange," Journal of Political Economy 93, 2, 346-368.

Krugman, Paul, 1978, "Purchasing Power Parity and Exchange Rates: Another Look at the Evidence," Journal of International Economics 8, no. 3, 397-407.

Mark, Nelson, 1985, "Some Evidence on the International Inequality of Real Interest Rates," Journal of International Money and Finance 4, 189-208.

MacArthur, Alan, 1988, "International Financial Market Integration: Empirical Analysis with Data from Forward and Futures Currency Markets," Ph.D. thesis, University of California, Berkeley.

Mishkin, Frederic, 1984a, "Are Real Interest Rates Equal Across Countries? An Empirical Investigation of International Parity Conditions," Journal of Finance 39, 1345-1358.

Mishkin, Frederic, 1984b, "The Real Interst Rate: A Multi-Country Empirical Study, Canadian Journal of Economics 17, no.

2, 283-311.

Morgan Guaranty Trust Company, 1988, "Financial Markets in Europe: Toward 1992," World Financial Markets 5, Sept. 9, 1-15.

Murphy, Robert, 1984, "Capital Mobility and the Relationship between Saving and Investment in OECD Countries," Journal of International Money and Finance 3, 327-342.

Obstfeld, Maurice, 1986a, "Capital Mobility in the World Economy: Theory and Measurement," Carnegie-Rochester Conference Series on Public Policy, 31, 1-24.

Obstfeld, Maurice, 1986b, "How Integrated are World Capital Markets? Some New Tests," NBER Working Paper No. 2075; forthcoming in R. Findlay et al., eds., Debt, Stabilization and Development: Essays in Memory of Carlos Diaz-Alejandro. Oxford: Basil Blackwell.

Otani, Ichiro, 1983, "Exchange Rate Instability and Capital Controls: The Japanese Experience 1978-81," in: D. Bigman and T. Taya, eds., Exchange Rate and Trade Instability: Causes, Consequences and Remedies, Cambridge, MA: Ballinger.

Penati, A. and M. Dooley, 1984, "Current Account Imbalances and Capital Formation in Industrial Countries, 1949-1981, IMF Staff

Papers 31, 1-24.

Pigott, Charles and Richard Sweeney, 1985. In Exchange Rates, Trade and the U.S. Economy, edited by S. Arndt, R. Sweeney and T. Willett, Washington, D.C.: American Enterprise Institute.

Popper, Helen, 1988, "Long-term Covered Interest Parity: Two Tests Using Currency Swaps," University of California, Berkeley.

Roll, Richard, 1979, "Violations of Purchasing Power Parity and their Implications for Efficient International Commodity Markets," in M. Sarnat and G. Szego, eds., International Finance and Trade, vol. 1, Cambridge, Mass.: Ballinger.

Roubini, Nouriel, "Current Account and Budget Deficits in an Intertemporal Model of Consumption and Taxation Smoothing: A Solution to the 'Feldstein-Horioka Puzzle'?" Yale University, October 1988.

Summers, L., 1988, "Tax Policy and International Competitiveness." In Jacob Frenkel, ed., International Aspects of Fiscal Policies, NBER, Chicago: University of Chicago Press.

Taylor, Mark, 1988, "Covered Interest Arbitrage and Market

Turbulence: An Empirical Analysis." Centre for Economic Policy Research Discussion Paper No. 236.

Tobin, James, 1983, "'Domestic Saving and International Capital Movements in the Long Run and the Short Run,' by M. Feldstein: Comment," European Economic Review 21, 153-156.

Westphal, Uwe, 1983, "Comments on Domestic Saving and International Capital Movements in the Long Run and the Short Run," European Economic Review 21, 157-159.

Wyplosz, Charles, 1986, "Capital Flows Liberalization and the EMS: A French Perspective," INSEAD Working Papers No. 86/40. European Economy, European Economic Community, June 1988.

Endnotes

1. Despite the increased attention to inward foreign direct investment in the United States in recent years, it continues to be a smaller component of the capital inflow than portfolio investment. As of the end of 1987, foreign direct investment accounted for only 17 per cent of the total stock of foreign-held assets in the United States.

2. There were relatively large differentials separating U.S. interest rates from the Eurodollar rates; at the long-term end of the spectrum, well-known U.S. corporations could borrow more cheaply in the Euromarket than domestically. These differentials fell steadily toward zero between 1982 and 1986, probably as the outcome of innovation that occurred in the Euromarkets -- partly in response to these differentials--making it easier for U.S. corporations to borrow there. Much of this innovation went under the name of securitization. See Frankel (1988) for documentation and further references. [It appears that the securitization trend suffered a set-back in 1987 and 1988, in part associated with the October 1987 stock-market crash; it is now said to be slightly more costly for U.S. corporations to issue bonds in the Euromarket than domestically. It remains to be seen whether this reversal of the trend toward perfect integration is serious or lasting.]

3. And even if this relationship doesn't break down in the future under pressure from fears of international creditors that U.S. indebtedness is becoming excessive.

4. 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).

5. Obstfeld (1986) and Summers (1988) argue that the saving-investment correlation may be due to the common influence of growth rates.

6. Obstfeld (1986) makes the large-country point in a time-series context, where it properly belongs. But 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, 44-45), I found that the close correspondence between U.S. saving and investment for 1970-1985 remains, even with this adjustment.

7. 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.

8. 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.

9.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-a-vis the United States.

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

11. Gross investment was 16.0 per cent of GNP in 1980, which was itself considered a low number [down 0.5 % from 1971-80].

12. 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, for details on these and the other variables.

13. There are two other potential sources of differences from the results in Frankel (1986): the 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 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 1980's are

omitted in Table 3].

14. If the 1956-1987 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 .87 (statistically, no difference from 1) to .31 (borderline difference from 0). [Table 3a.] [If the 1930-1987 sample is split at 1958, when many European countries restored currency convertibility, there is a small increase in the coefficient over time: from .83 (statistically different from 1) to 1.14 (no difference from 1). [Table 2a.] 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 1985-1987 devastatingly low.]

15. Feldstein and Bacchetta (1989) find a similar drop in the saving-investment coefficient in the 1980s, for a cross-section of industrialized countries (though they do not use instrumental variables, and are thus liable to the econometric criticisms that others have raised concerning the endogeneity of national saving).

16. Measuring barriers to integration by differences 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. For example, the greater degree of variability in the U.S. real interest differential in the 1980s, as compared to the 1970s or 1960s, could be attributed to the greater swings in variables such as the structural budget deficit, rather than to a lower degree of capital mobility. [In any case, the degree of variability in <u>covered</u> interest differentials is very low in the 1980s, as we will see below.] 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.

17. For example, Krugman found that the standard deviation for the real mark/dollar exchange rate during the German hyperinflation, February 1920-December 1923, was much larger (20.8 percent) than during the 1970s, even though the serial correlation was higher (.765).

18. Cumby and Obstfeld (1984, p.146) used a Q-statistic to test for higher order serial correlation in monthly real exchange rate changes and found none. However they also found that expected inflation differentials were unrelated to expected exchange rate changes, rejecting the random walk characterization of the real exchange rate. Huizinga (1986) was

also able to reject the random walk in some cases.

19. As already noted, an AR coefficient of .7 on a yearly basis corresponds to an AR of .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. Summers (1987) demonstrates the low power of random walk tests.

20. As the sample period covers a number of changes in exchange rate regime, it would be desirable to allow for shifts in the coefficient (and in the variance of the disturbance term). But many of the proponents of a random walk in the real exchange rate claim it as evidence in favor of an "equilibrium" hypothesis, under which fluctuations in the real exchange rate are caused only by real, as opposed to monetary, factors. Under this null hypothesis, changes in regime should not matter for the real exchange rate. Thus our statistical test is a valid rejection of the null hypothesis, even though it lumps together all 118 years of observations.

21. Sticky goods prices are only one of a number of possible sources of deviations from ex ante relative PPP. Another is the existence of the prices of nontraded goods in the relevant price index. Dornbusch (1983) shows how movement in the relative price of non-traded goods affects the real interest rate, saving, and borrowing from abroad, while Engel and Kletzer (1987) show specifically how such movement can give rise to the Feldstein-Horioka finding.

22. 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-affilliated 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 per cent a year. [The expected speed of nominal depreciation back toward PPP is estimated more sharply at 12-16% 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).]

23. Simulation models are also used by Ghosh (1988), Goulder and Eichengreen (1988), and Obstfeld (1986a) to address the Feldstein-Horioka findings. Obstfeld 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. But Feldstein and Bacchetta (1989) argue that the growth rate is not in fact responsible for the observed coefficient.

24. Some of these data were also analyzed in Frankel & MacArthur (1988). Some forward rate observations for Italy, Austria, and Belgium in the Barclay's data looked suspicious. In addition, Barclay's does not quote a rate for Portugal. For this study, forward exchange rates for Italy and Belgium are taken from the Bank of America (also obtained via DRI), and for Austria and Portugal from the Financial Times. The Barclay's data for Ireland also appear suspect (1986-1988).

25. The data appendix to NBER Working Paper 2309 gives details.

26. The standard errors for individual country means are usable, indeed are conservative, despite the use of overlapping observations, because they are calculated as if there were T/3 observations rather than the actual T observations used.

27. Saving-investment regressions, by contrast, show the counterintuitive result: coefficients for LDCs that are lower (suggesting higher capital mobility, in Feldstein and Horioika's terms) than for industrialized countries. Fieleke (1982), Dooley, Frankel and Masson (1987) and Summers (1988).

28. It is possible that, for some countries, seasonal variation constitutes one forecastable component.

29. For example, Otani (1983) and Frankel (1984).

30. The frequently large negative covered differential that had been observed for Australia up to mid-1983 (see, e.g., Argy, 1987) largely vanished thereafter.

31. Clausen and Wyplosz (1982), Giavazzi and Pagano (1985, pp.27-28), [Frankel (1982) and Wyplosz (1986)], among others.

32. "Capitalism," The Economist, May 21, 1988, p.95.

33. For France, Italy, Ireland, Spain and Greece (as reported in World Financial Markets, September 9, 1988, p.5). Denmark's covered differential remains quite high in our sample. The country has been reported to have no capital controls left (Economist, op.cit.), but this evidently applies only to securities: the European Commission reports that deposits and other short-term transactions remain subject to authorization in Denmark as of 1988.

34. Bahrain shows a smaller differential than the others, and even than some of the European countries with controls, like Spain and Ireland. [It should be noted that the forward rate quoted by Barclay's applies to the Saudi riyal; we match it up with the Bahraini interest rate because no local interest rate is available for Saudi Arabia and the two countries are said to be closely tied financially. The riyal is classified by the IMF under the same exchange rate arrangement as Bahrain's currency, the dinar, which would suggest that the same forward rate could be applied to both. But the riyal exchange rate does in fact vary somewhat, so that our measured covered interest differential is not entirely legitimate.]

35. 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.

36. 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. corporation 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. See also papers in Feldstein (1987).

37. Many others have found a highly significant predictable component of (fd-exp depr), often when regressing against fd, and particularly in-sample. It is possible that such findings are not due to a time-varying premium, as the rational expectations approach would have it, but rather to a time-varying model of spot rate determination (together with insufficiently long sample periods, and learning by investors. Such speculations go outside the scope of this paper. (See Frankel and Froot, 1988, and Froot and Frankel, 1989.)

38. One view is that the high degree of integration of financial markets is one of the causes of the high degree of volatility of exchange rates. Although this view goes against

the economist's standard arguments about why speculation should be stabilizing rather than destabilizing, a case can be made for it. The issue is discussed, and further references given, in Frankel (1988b).

APPENDIX

U.S. Saving and Investment Data Sources

A. 1929 to 1987 Regressions

1. Savings and Investment

Gross saving is from line 1 of table 5.1 of the The National Income and Product Accounts of the United States, 1929-1982 (NIPA) while gross private domestic investment is line 16 of the same table. For the years 1983 to 1987 (preliminary), savings and investment are found in table B-28 of the 1988 edition of the Economic Report of the President. Both series are divided by GNP, line 1 of table 1.1 in the NIPA and table B-1 of the Economic Report of the President. All three series are in nominal terms.

2. Instrument 1: The Dependency Ratio

The dependency ratio is defined here as the sum of those older than 64 and younger than 21 divided by those in the range 21 to 64 years old. Between 1929 and 1969, these data are taken from Series A29, A37, and A41 of Historical Statistics of the United States, Colonial Times to 1970 (herafter HSUS). For 1970 to 1987, the data are from various issues of the Statistical Abstract of the United States, in a table titled "Total Population, by Age and Sex."

3. Instrument 2: Defense Spending

Defense spending is provided in Series Y458, Y459, and Y460 of the HSUS for 1929-1970. Before 1954 defense spending is defined as the sum of spending by the Departments of the Army, Navy, and (after 1949) Air Force. After 1954 these departments are lumped as the Department of Defense. For 1971 to the estimated 1987 expenditures, the data come from the Statistical Abstract. In the regressions, defense spending is used as a percent of GNP, collected as above.

4. Cyclical Adjustments

Savings and investment (as a percent of GNP) are cyclically adjusted by regressing each against the percent gap between actual GNP and trend GNP. The residuals from these regressions are the cyclically adjusted variables. Trend GNP is estimated for the period 1955 to 1980 by the Holloway in The Survey of Current Business, March, 1986, in "The Cyclically Adjusted Federal Budget and Federal Debt: Revised and Updated Estimates." 1981 through 1987 data are from various issues of The Survey of Current Business, in the "Reconcillation and Other Tables" section.

B. 1869 to 1987 Regressions

1. All Variables, 1929 to 1987

All the series for these more recent years is collected as described above in section A. The series are then averaged over ten year periods, beginning with 1929-1938. Since no data are available for 1988, the final observation is an average over nine years, 1979-1987.

2. Savings and Investment

Roger Ransom and Richard Sutch provide estimates of gross private saving and productive capital formation in table 4 of their paper "Domestic Saving as an Active Constraint on Capital Formation in the American Economy, 1839-1928: A Provisional Theory."[1] These data are given in terms of percent of "augmented GNP." Column 1, gross private domestic capital formation, corresponds with the gross private domestic investment used for later years. Column 5, gross private saving, is not directly comparable with gross saving in the current National Income and Product Accounts because consumer durables and public land sales are included. Thus, these two items, in columns 2 and 3, are subtracted from gross private saving to yield comparable gross saving as a percent of GNP.

3. Gross National Product

Augmented GNP was not directly available in any of the tables I had from Ransom and Sutch. However, many of the savings and investment aggregates are given in dollar levels in table E-1 of Working Paper Number 2 of the same series. GNP is calculated here as gross private saving (column 8 of table E-1) divided by gross private savings as a percent of GNP (column 5 of table 4) and multiplying by 100. Since percentages are given with 2 decimal points (xx.xx), errors introduced by this method should be negligible.

4. Instrument 1: Dependency Ratio

Between 1900 and 1928 the data are collected as detailed above in A.2. Before 1900, the data are from Series A119-125 and A133 of the HSUS. There are two problems with these series. First, only the years 1870, 1880, 1890, and 1900 are available. For this work intervening years were interpolated assuming a constant growth rate for population in each age group. Age groups are 0-5, 5-9, 10-14, 15-19, 20-24, and over 65. 1869 numbers were constructed assuming the same growth rates implied by the 1870 and 1880 data. The second problem is that the group 20-24 does not allow separation of those under and over 21, the dividing line between dependency and working age in the dependency ratio. Here it is assumed that 20 percent of the 20-24 age group is age 20.

5. Instrument 2: Defense Spending

Defense spending is calculated as above in A.3. To produce defense spending as a percent of GNP, the ten year average dollar value is divided by the implied GNP from Ransom and Sutch.

C. Comparison to 1985 Data

1. Definition of National Savings and Investment

In the earlier study I erroneously included consumption of durable goods and public land sales in national savings and investment. This is fine in theory, but the 1929-87 data do not include either of these items. Thus,

---

[1] The University of California Project on The History of Saving Working Paper Series, Number 1, Institute of Business and Economic Research, University of California, Berkeley.

savings and investment as a percent of GNP were much higher during the early decades, as compared to the post depression levels. Using corrected data, it is still true that post-war levels of savings and investment are lower than pre-depression.

2. The Dependency Ratio

The current definition of the demographic instrument for private saving is the dependency ratio (see A.2). In 1985 the ratio used was those over 65 divided by those over 20. Since demographers are familiar with the new measure, and since it is more clearly consumers in the numerator and savers in the denominator (with life-cycle consumption theory), the new measure should be superior. In practice, the dependency ratio varies a good deal over the long sample, while the earlier measure is little more than a trend line.