We know that many barriers to the international movement of capital across national boundaries have been dismantled over the course of the last twenty years. Financial integration was greatly enhanced by the removal of capital controls on the part of the United States, Germany, Canada, Switzerland and the Netherlands after 1973; the recycling of surpluses to developing countries through the Euromarkets in the 1970s; the removal of capital controls in the United Kingdom and Japan beginning in 1979; financial integration among European Community countries, including France and Italy, in preparation for 1992; recent moves toward financial liberalization in smaller countries in the Pacific; and the steady process of technical and institutional innovation that has proceeded around the world.

Some popular tests of international capital mobility, however, appear to show anomalous results. Feldstein and Horioka upset conventional wisdom in 1980 when they concluded that changes in countries' rates of national saving had very large effects on their rates of investment, and interpreted this finding as evidence of low capital mobility. The argument was that, if capital were indeed perfectly mobile, a shortfall in national saving in one country should be easily made up by borrowing from abroad at the going world interest rate, and need not drive up the domestic real interest rate or "crowd out" domestic investment (except perhaps to the extent that the
country is large in world financial markets).

There are at least four distinct definitions of perfect capital mobility that are in widespread use. (I) The **Feldstein-Horioka condition**: exogenous changes in national saving rates have no effect on investment rates. (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, regardless of exposure to exchange risk. (IV) **Covered 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 Condition IV, that the covered interest differential is zero, is an unalloyed criterion for "capital mobility" in the sense of the degree of financial market integration across national boundaries. Condition III, that the uncovered interest differential is zero, requires that Condition IV hold, and that in addition a zero exchange risk premium. Condition II, that the real interest differential is zero, requires Condition III, and in addition the condition that expected real depreciation is zero. Condition I, that the saving-investment correlation is zero, requires Condition II, plus an extra restriction, to which we now turn.

**I. The saving-investment correlations of Feldstein and Horioka**

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

\[(I/Y)_i = a - br_i + u_i,\]

where \(I\) is the level of capital formation, \(Y\) is national income, \(r\) 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,

\[(I/Y)_i = A + B(\text{NS}/Y)_i + v_i,\]

where \(\text{NS}\) is private saving minus the budget deficit. To get the zero coefficient \(B\) for which they were looking requires not only real interest parity:

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

(with the world interest rate \(r^*\) exogenous), but also a zero correlation between \(u_i\) and \((\text{NS}/Y)_i\). This is a strong requirement.

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. 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), Summers (1988) and Bayoumi (1989), among others. But Feldstein and Horioka made an effort to handle the econometric endogeneity of national saving. 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 $r=r^*$, then $r$ 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.\(^2\)

If the saving-investment regressions were a good test for
barriers to financial market integration, one would expect to
see the coefficient falling over time. Until recently, this
prediction has not been supported by the evidence, whether from
cross-section studies, which typically report pre-and post-1973
results -- Feldstein (1983), Penati and Dooley (1984), and
Dooley, Frankel and Mathieson (1987) -- or from pure time-series
studies -- Obstfeld (1989) and Frankel (1986). The econometric
endogeneity of national saving does not appear to be the
explanation for these results, because they hold equally well
when instrumental variables are used.\(^3\)

One easy explanation for the finding is that real interest
parity has not held any better in recent years than it did in
the past. 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. 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 examine real interest differentials next.

2. Real interest differentials

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. We begin with real interest differentials. Frankel (1991) studies real interest differentials in the 1980s for a panel of 25 countries. Country-group comparisons of the measures of real interest differential variability in some respects suit a priori expectations: five closed LDCs constitute the group with the highest variability, and five open Atlantic countries the group with the lowest. 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 most of the 1980s and yet appears to have a higher degree of capital mobility by the criterion of real interest differential variability than Japan, the Netherlands or Switzerland, major countries that are known to be virtually free of capital controls. Furthermore, no
country has a real interest differential close to zero. If barriers to capital mobility are so low among major industrialized countries, why does it not show up in real interest differentials?

3. Decomposition of the real interest differential into country premium and currency premium

The real interest differential is defined as:

\[(3) \quad r - r^* = (i - Dp^e) - (i^* - Dp^{e*}).\]

We can decompose it as follows:

\[(4) \quad r - r^* = (i - i^* - fd) + (fd - Ds^e) + (Ds^e - Dp^e - Dp^{e*}).\]

where \(i\) and \(i^*\) are the domestic and foreign nominal interest rates, \(fd\) is the forward discount on the domestic currency, \(Ds^e\) is expected depreciation of the domestic currency, \(Dp^e\) is expected domestic inflation, and \(Dp^{e*}\) is expected foreign inflation.

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 and third terms are the exchange risk premium \((fd - Ds)\), and expected real depreciation \((Ds - Dp - Dp^*)\), respectively. Together they constitute the currency premium, because they pertain to 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.

The most revealing exercise is to use forward rate data to decompose the real interest differential into the country premium and currency premium. Many previous studies have used forward rate data to test covered interest parity, but only for a few countries. Frankel (1991) includes 25 countries. The results confirm that barriers have been low in Canada, Germany, the Netherlands, Switzerland, the United Kingdom, Hong Kong, Singapore, and Japan, at least as far back as 1982.\(^5\) When one estimates a time trend in the absolute value of the covered interest differentials during the 1980s, one finds ten countries with a rate of decrease in the magnitude of the barriers that is statistically significant at the 99 per cent level (Frankel, 1989). The seven with the most rapid estimated speed of liberalization are (in order): Portugal, Spain, France, New Zealand, Denmark, Australia, and Italy.

Why does the covered differential criterion give such different answers from the saving-investment criterion? Even for those countries that exhibit no substantial country premium, as reflected in covered interest parity, there is still a substantial currency premium that drives real interest
differentials away from zero. If real interest differentials are not arbitrated to zero, then there is in turn no reason to expect saving-investment correlations to be zero.

Germany, Switzerland, the Netherlands, Austria and Japan, for example, all have substantial and variable currency premiums which constitute approximately the entirety of their real interest differentials vis-a-vis the United States. These countries' currencies have experienced a lot of exchange rate variability, both nominal and real, vis-a-vis the dollar since 1973. The other countries in the sample all have highly variable currency premiums as well. Indeed the currency premium is more variable than the covered interest differential (country premium) for all but a few of the 25 countries.\(^6\)

4. Implications for Saving-Investment Correlations

Further empirical support for the idea that the Feldstein-Horioka results may in fact be partly due to currency factors, comes from a test by Bayoumi and Rose (1991) and Sinn (1991). They compute the correlation of saving and investment across intranational regions, within the United Kingdom in the former case, within the United States (on 1950s data) in the latter. They find no positive correlation. Similarly, Bayoumi (1990) finds no correlation among a set of countries during the gold standard period. These are all circumstances where the geographical units essentially share a common currency, suggesting that exchange rate variability may be the source of high saving-investment correlations across countries in the
post-1973 period (although this is not the authors' own interpretations of their results).


5. 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 short-term interest differentials for major industrialized countries by 1991.

(2) Only the country premium has been eliminated; this means that only covered interest differentials are small. Real and nominal exchange rate variability remain. 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 interest rate evidence pertains to bonds. Bonds are not perfect substitutes for equities or for factories, and
the latter are clearly not perfect substitutes across countries. Thus even if bonds were perfect substitutes across countries, there would still be good reasons to think that shortfalls in national saving continue to be capable of crowding out investment.

(4) 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 continued process of liberalization in Japan and other major countries was probably one factor behind this flow of capital to the United States.


Frankel, Jeffrey, "International Capital Mobility and Crowding-out in the U.S. Economy: Imperfect Integration of Financial Markets or of Goods Markets?" in R. Hafer,


Footnotes

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

2. 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. Frankel (1986, 44-45) found that the close correspondence between U.S. saving and investment for 1970-1985 remains, even with this adjustment.

3. 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 a cross-section of developing and industrialized countries, Dooley, Frankel and Mathieson (1987) used the dependency ratio and military expenditure.

4. 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).

5. The covered interest differential for France in the 1980s is much
larger and more variable than that for the major industrialized countries known to be free of capital controls. This is the reverse of the finding from the criterion of real interest differentials. It supports the worth of the criterion of covered interest differentials as the proper test of financial market integration.

6. The breakdown of the currency premium into the exchange risk premium and expected depreciation is difficult, because exchange rate expectations are not directly observable. Recent evidence from survey data for a panel of many countries, however, indicates that both factors are important (Frankel and Chinn, 1991).