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INTERNATIONAL CAPITAL MOBILITY: DIRECT EVIDENCE FROM LONG-TERM CURRENCY SWAPS

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Abstract

This paper provides direct measures of the international mobility of long-term financial capital using interest arbitrage conditions previously applied only to short-term assets. Long-term arbitrage conditions are constructed using a now well-developed mechanism for hedging long-term currency positions, the currency swap. Asset returns are compared in the Euromarket and in the onshore markets of Canada, Japan, Germany, Switzerland, the United Kingdom, and the United States. The evidence, discussed below, indicates that long-term financial capital is as mobile across these markets as is short-term capital. This appears to be the case both within the Euromarket and across political jurisdictions.

International Capital Mobility:
Direct Evidence from Long-Term Currency Swaps

Helen Popper[1]

While most economists probably would agree that international financial markets have become increasingly integrated over the past decade, consensus regarding the extent of integration has been limited to the realm of short-term asset markets, and sometimes only to the Euromarket. For many economic questions, long-term capital mobility is more relevant, and capital movement across different political jurisdictions is often critical.[2]

The possibility that capital may be mobile across only a limited set of maturities was highlighted in the eighties by the contrast between the arbitrage of short-term returns and the finding of a high correlation between countries' saving and investment. In their influential paper, Feldstein and Horioka [1980] argued that if capital is internationally mobile, domestic saving and domestic investment respond independently to world prices, while complete capital immobility constrains the two to be equal. They interpreted their

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1. The author is a staff economist in the International Finance Division. This paper represents the views of the author and should not be interpreted as reflecting the views of the Board of Governors of the Federal Reserve System or other members of its staff. This research is based on dissertation work completed at the University of California at Berkeley, and I thank my thesis advisors, Jeffrey Frankel, Roger Craine, and Greg Connor for their comments. I am also grateful for thoughtful discussions with Charles Pigott, Bruce Kasman, and Ken Weiller in the early stages of this research at the Federal Reserve Bank of New York.

2. By itself, short-term capital mobility does not imply arbitrage of long-term returns. Such an implication would require either a riskless mechanism for arbitrage across the maturity spectrum or a stable term structure relationship. Neither is supported by empirical evidence. (Shiller and McCulloch [1987] provide an extensive survey of the term structure literature.)

finding of a relatively high saving-investment correlation as indirect evidence that "most capital is apparently not available for such arbitrage-type activity among long-term investments." While a variety of alternative explanations of the correlation that are consistent with financial capital mobility have subsequently emerged, the integration of long-term financial capital markets has not been examined directly.[3] The purpose of this paper is to do so.

Explicit measures of the international mobility of long-term financial capital are provided here using interest arbitrage conditions previously applied only to short-term assets. Long-term arbitrage conditions are constructed using a now well-developed mechanism for hedging long-term currency positions, the currency swap. Asset returns are compared in the Euromarket and in the onshore markets of Canada, Japan, Germany, Switzerland, the United Kingdom, and the United States. The evidence, discussed below, indicates that long-term financial capital is as mobile across these markets as is short-term capital. This appears to be the case both within the Euromarket and across political jurisdictions.

The next section of this paper briefly reviews some studies of interest arbitrage among short-term assets. Section 2 presents analogous arbitrage measures for long-term assets using currency

3. Summers [1985] argues that the saving-investment correlation may be an artifact of population growth and other factors simultaneously affecting savings and investment or a result of economic policy reactions taken by sovereign states in response to unbalanced current accounts. Dooley, Frankel, and Mathieson [1987] point out that the correlation may arise in the presence of financial capital mobility when financial and physical capital are not substitutable within each country. Montgomery [1988] shows that the structure of financial intermediation may result in imperfect capital mobility in a subset of financial markets. Engel and Kletzer [1989] and Tesar [forthcoming] explain the correlation using models with non-traded goods.

swaps. Section 3 describes the data. Section 4 presents the empirical findings. A summary and conclusions are contained in Section 5.

1. Short-Term Covered Interest Parity

Empirical studies of international capital mobility typically appeal to what is, in effect, the law of one price. Persistent differences across international boundaries between realized returns on comparable assets have been attributed to exchange rate risk, transaction costs, and political risk, where political risk encompasses both existing and expected capital controls related to the political jurisdiction of issue.[4] Forward foreign exchange contracts allow the question to be cast in terms of an arbitrage condition by removing exchange rate risk. This arbitrage condition, covered interest parity (CIP), equates the domestic-currency return with a fully hedged foreign-currency return:

$$(1+r_{t,t+s}) = (1+r^{*}_{t,t+s}) \cdot S_t/F_{t,t+s}, \qquad (1)$$

where $r_{t,t+s}$ is the domestic currency rate of return from period t to period t+s, $r^{*}_{t,t+s}$ is the foreign currency rate of return over the same period, S_t is the foreign currency price of a domestic currency

4. This terminology and decomposition of interest disparity, due to Aliber [1973], still provides the conceptual framework for evaluating deviations from interest parity, but the emphasis on the elements has shifted. In particular, Clinton [1988] showed that actual transaction costs are very small when short-term swap markets are used, and Levi [1989] showed that non-reversed investment and borrowing diminishes the role of transaction costs even further.

unit at period t, and $F_{t,t+s}$ is the forward exchange rate contracted at period t for exchange at period t+s.[5]

Measures of CIP until now have involved only short-term assets. The smallest deviations from short-term CIP have been found in the Euromarket, where political risk is absent. Measured interest disparities are frequently greater across onshore markets (or between onshore and offshore markets), where political risk may exist and measurement error is more likely. Reported average deviations range from less than 25 basis points in the most open onshore markets to more than 500 basis points in countries where capital controls are binding.

Carefully synchronizing daily Euromarket observations, Clinton [1988] found that most of the deviations in a six-month period were less than 20 basis points and averaged only a few basis points.[6] Not surprisingly, Frankel and MacArthur [1988] found larger deviations among a broad range of onshore markets. The means of the CIP deviations in the five countries they termed "Open Developed Countries" were between -5 and about 50 basis points.[7] Mean deviations within "Other European Developed Countries" often exceeded 200 basis points, and among "Closed Less Developed Countries," they

5. In the remainder of this paper, "domestic currency" refers to the U.S. dollar, and "foreign currency" refers alternately to the Canadian dollar, the mark, the pound, the Swiss franc, or the yen.

6. Clinton [1988] examined the mark, the pound, the yen, the Canadian dollar, and the French franc. In an earlier, seminal paper, Frenkel and Levich [1975] estimated the transaction costs associated with CIP in the Euromarket to be somewhat larger.

7. The "Open Developed Countries" category includes the all the countries evaluated in this paper, except Japan, and also includes the Netherlands. Japan is included in the category "Liberalizing Pacific Developed Countries," and its mean deviation is 15 basis points. "Closed Less Developed Countries" include Bahrain, Greece, Mexico, and South Africa.Their sample period extends from September, 1982 to March, 1987.

averaged more than 700 basis points. Giavazzi and Pagano [1985] also found that mean deviations varied across countries and circumstances. In the onshore markets of Germany and the Netherlands, interest disparities were relatively small, about 10 to 30 basis points. At the same time, comparing onshore French and Italian returns with Eurodollar returns, they observed CIP deviations of more than 400 basis points and concluded that capital controls or expected controls were important over certain time periods there.[8] Ito [1983] evaluated the interest parity conditions of Japanese assets. CIP deviations between U.S. and Japanese onshore assets averaged about 50 basis points from 1981 through 1983, while deviations between Euroyen and Japanese onshore yields were somewhat smaller.[9]

The exclusive attention given to short-term asset returns reflects the relative development of short-term and long-term international financial markets. Most importantly for the use of CIP, explicit forward exchange contracts exist only at short maturities, making direct CIP measures inapplicable to long-term assets.[10] Forward markets are most developed at the 3-month maturity and do not exist at

8. Giavazzi and Pagano [1985] found interest disparities in France and Italy to be largest prior to currency realignments. Between September, 1982 and the European Monetary System realignment of March, 1983, deviations from interest parity averaged over 900 basis points in France and over 400 basis points in Italy.

9. Ito provides evidence that capital controls were effectively removed in Japan in 1980. The figures discussed here are those Ito reported for the period following the removal of capital controls, and they reflect his "one-way arbitrage" measure.

10. An onshore-offshore comparison of same-currency returns does not require a forward market. Marr and Trimble [1990] applied a same-currency comparison to dollar-denominated long-term assets and found aggregate return disparities. However, their results may have been distorted by compositional differences between the two markets. Mahajan and Fraser [1986] found no differences between the yields of Eurobonds and comparable domestic U.S. securities when holding parent, rating, and other bond characteristics constant.

maturities greater than two years, even among well-traded currencies. Because the linkages between short-term and long-term returns in the same currency are not well established, and capital controls are typically not applied uniformly across maturities, short-term CIP is not sufficient to guarantee interest parity among long-term assets, particularly in light the saving-investment correlation.

2. Swap-Covered Interest Parity

Only recently has the currency swap market become sufficiently developed to provide the necessary long-term counterpart to the CIP condition. Like a forward contract, a currency swap allows a domestic investor to hold a foreign-currency denominated asset without currency risk on the invested principal. Swaps are now well traded instruments: during 1989, in the New York market alone, over $500 million per day was reported in currency swap transactions with maturities greater than 1 year.[11] The mechanics of a currency swap differ from that of a forward contract in that a currency swap contract is an agreement to exchange a *stream* of payments in one currency for a *stream* of payments in another, while a forward contract is an agreement to exchange fixed amounts of two currencies at a

11. This figure is calculated using the results from the Federal Reserve Bank of New York's "U.S. Foreign Exchange Market Survey," conducted in April, 1989. It is adjusted for double counting. The figures for currency swaps are likely to underestimate the total since the survey includes only a subset of U.S. non-bank financial institutions.

single future date.[12] Typically, a swap payment stream mimics that of a bond.[13] Currency swaps enable borrowers to arbitrage the long-term returns of assets denominated in different currencies.

At standard maturities, the price of a currency swap is conventionally quoted as a stream of fixed non-dollar payments against a stream of floating dollar payments. To compare *fixed* interest rates in a way analogous to CIP, the currency swap must be combined with an interest rate swap converting the floating dollar rate into a fixed rate.[14]

Once the dollar portion of the currency swap is converted into a fixed interest rate, it and the non-dollar swap return can be used to construct the swap-covered interest parity condition. Denote the fixed non-dollar rate exchanged in the swap transaction as $r^{sw*}_{t,t+s}$, and

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12. The term "swap" is somewhat ambiguous. While, in this paper, the term "currency swap" refers to the long-term "cross-currency interest rate swap" that entails the exchange of payment streams, a "swap" can also mean the *combination* of a spot exchange and an offsetting short-term forward contract (as in Clinton [1988], for example).

13. A currency swap is similar to the more widely traded interest rate swap in that both exchange *streams* of interest payments. For the interest rate swap, a stream of fixed dollar payments over a given time interval is exchanged for a stream of floating dollar interest payments. Interest rate swaps pre-dated the widespread use of currency swaps.

14. More specifically, a currency swap exchanges a stream of non-dollar fixed payments for a stream of (floating) 6-month LIBOR payments. This contract may be combined with an interest rate swap that exchanges a stream of (floating) 6-month LIBOR payments for a fixed rate above the U.S. Treasury bond yield. For example, to exchange 5-year mark and dollar payment streams beginning July 17, 1986, an investor would have used a "cross-currency interest rate swap" which exchanged mark payments at an annual rate of 5.85 percent for 6-month LIBOR payments. In the notation in the text, $r^{sw*}_{t,t+s} = 5.85$. Then, using an interest rate swap (also known as a bond swap), the stream of 5-year LIBOR payments would have been exchanged for fixed dollar payments quoted in terms of a premium over the yield on the Treasury bond of the same maturity. On that day, the premium was 101 basis points, and the bond yield was 6.91 percent. So the equivalent fixed dollar swap payments was $r^{sw}_{t,t+s} = 6.91 + 1.01$.

denote the fixed dollar rate exchanged as $r^{sw}_{t,t+s}$. As in the short-term CIP case, the swap-parity condition comes from equating a domestic currency return with a comparable covered foreign-currency return. An investor may invest in a domestic currency asset and earn the per-period return, $r_{t,t+s}$. Alternatively, the investor may invest abroad and cover for exchange rate risk with a currency swap. In this case, the covered foreign return is the sum of the uncovered foreign-currency return and the net swap payments.[15] That is, the investor earns the per-period uncovered foreign-currency return, $r^{*}_{t,t+s}$, while paying the foreign-currency swap rate, $r^{sw*}_{t,t+s}$, and receiving the domestic-currency swap rate, $r^{sw}_{t,t+s}$. Thus, the *net* foreign covered return is: $r^{*}_{t,t+s} + r^{sw}_{t,t+s} - r^{sw*}_{t,t+s}$. Arbitrage equates the two returns:[16]

$$r_{t,t+s} = r^{*}_{t,t+s} + r^{sw}_{t,t+s} - r^{sw*}_{t,t+s}.$$

The extent to which the swap-covered interest parity condition holds in any time period may be evaluated by estimating the following equation:

$$(r^{*}_{t,t+s} - r^{sw*}_{t,t+s}) - (r_{t,t+s} - r^{sw}_{t,t+s}) = \beta + v_t \qquad (2)$$

15. The amount of notional swap principal may be chosen to achieve a fully hedged position.
16. Note that the swap-covered parity condition is expressed as a difference, while the short-term CIP condition is expressed in terms of ratios (except as it is often approximated). This slight difference in the form of the arbitrage condition reflects the mechanics of the respective transactions.

where $E(v_t) = 0$. Swap-covered interest parity implies β and the variance of v_t are small. These conditions are evaluated first among assets denominated in different currencies but issued in the Euromarket, where political risk should be unimportant. Next, onshore markets, where political risk may play a role, are examined. The swap-covered parity conditions are compared with the short-term CIP counterparts of Equation 1.

3. Data

The sample period extends from October 3, 1985 to February 18, 1988 for the long-term onshore assets and for all the short-term measures. The starting point varies slightly among Eurobonds: for mark-denominated Eurobonds, the sample begins October 3, 1985; for Eurobonds denominated in Canadian dollars, sterling, and Swiss francs, it begins November 28, 1985; and, for yen-denominated Eurobonds, it begins November 13, 1986. Observations are taken on the Thursday of each week. The swap-covered interest parity condition, Equation 2, is evaluated using assets with maturities of 5 years and 7 years.[17]

The U.S. dollar serves as the domestic currency. Cross-currency interest rate swap quotes and yields on Eurobonds and on government bonds were provided by Salomon Brothers and are published in their *International Bond Market Roundup*.[18] Bond swap prices were provided by Fulton Prebon Inc.

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17. The sample period start dates reflect the earliest availability of reliable data. Historical swap quotes were only available weekly, and only regularly for the 5-year and 7-year maturities for the markets examined here.
18. Government bond yields are coupon adjusted.

Short-term CIP also is examined across onshore and offshore markets. Spot and 3-month forward exchange rates and 3-month Euromarket and onshore yields are used. The onshore returns are: 3-month interbank rates in Germany, Switzerland, and the United Kingdom; the 3-month finance paper rate in Canada; the 3-month Gensaki rate in Japan; and the 90-day Federal Funds rate in the United States.

As discussed in the context of short-term markets in Section 1, interest rate disparities are attributed to the existence of either political risk or transaction costs. In addition, observed deviations from parity may also be due to non-comparability of assets and measurement error. Assets as homogeneous as possible are chosen here, but they are not identical. Neither are all prices sampled at precisely the same instant.[19] Because of these errors, some deviations from parity may be observed even when capital is perfectly mobile.

The interesting empirical question is whether the measured deviations from swap-covered parity are large in the sense of being indicative of barriers to capital mobility among long-term assets. To the extent that over the sample period the short-term markets of these six countries are characterized by capital mobility and disparities of some size are nevertheless observed, these disparities implicitly define a range of deviations from parity that is consistent with capital mobility. Thus, comparing the swap-covered parity deviations with the short-term CIP deviations may be helpful in interpreting the significance of the measured long-term disparities. In addition, it is useful to consider the size of the swap disparities in the context

19. McCormick [1979] discusses the importance of measurement error arising from timing mismatches.

of the disparities found in countries where political risk is thought to be important.

4. Empirical Results

This section discusses the measured long-term and short-term interest disparities in terms of both their means and their variability. Table 1 presents the deviations from long-term swap-covered interest parity between the United States and the five other countries.[20] All the estimated mean deviations are less than 50 basis points, and about half of them differ statistically from zero.[21] In both the Euromarket and the onshore markets, the mean deviations are smallest, about 5 basis points, for the Canadian dollar assets. In all the markets, the standard errors of the means are less than 10 basis points. The differences between the onshore and offshore covered differentials are small and mostly insignificant for Canadian, Japanese, and Swiss assets. In contrast, German and U.K. deviations are greater in the onshore markets than in the Euromarket. Mean deviations in these two onshore markets are between 35 and 50 basis

20. The deviations from parity are serially correlated. This may simply reflect serial correlation of transactions costs, or may arise when deviations from parity due to political risk are persistent. Note that because the deviations from short-term and long-term covered interest parity are known *ex ante* the ability to forecast the deviations offers no additional opportunity for arbitrage profits. Therefore, the observed serial correlation provides no additional evidence of inefficiency. Among reasonable ARMA specifications, the AR(1) is most appropriate in terms of the behavior of the deviations over the sample period and is also the simplest. Standard errors are corrected for serial correlation.

21. Note that the range of mean deviations observed here for *long-term* assets, -3 to 49 basis points, is nearly identical to the range of means of -5 to 46 basis points for the *short-term* means reported by Frankel and MacArthur [1988] and discussed in Section 1.

points, while their Euromarket counterparts are about 5 to 15 basis points.[22]

Table 2 shows that several of the short-term mean deviations from CIP also are statistically different from zero. In the Euromarket, the estimated mean deviations range from about 15 to 20 basis points, exceeding the long-term Euromarket point estimates. In the absence of capital controls, these deviations must be attributed to measurement error, transaction costs, and non-comparability of assets.[23]

In most of the onshore markets, the mean deviations from interest parity appear slightly smaller than in the markets for long-term assets, but most of the standard errors are large enough to swamp those differences. The hypothesis that the short-term and long-term deviations are the same cannot be rejected in most of these markets.

The U.K. onshore assets are the exception. Though still within the range of deviations reported for the relatively open short-term markets discussed in Section 1, the mean swap-covered disparities in the United Kingdom of close to 50 basis points are significantly larger than the U.K.'s short-term counterpart of less than 10 basis points. The cause of this particular difference remains unclear.

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22. It is worth noting that the mean deviations of Swiss franc denominated assets differ considerably between the 5-year and the 7-year maturities. While the fairly large standard errors may make the difference initially uninteresting, they mask a qualitative shift in a single period. For the few months sampled in 1985, the onshore spread between the 5-year and the 7-year deviations from parity averaged 68 basis points. The spread declined abruptly beginning in January, 1986, coinciding with the Swiss government's removal of maturity limits.

23. Non-comparability of assets has been offered as an explanation of the negative premium measured for Eurobonds denominated in marks, in particular. Even among similarly rated bonds, differences in average quality may be large enough to explain disparities of this size.

Another important gauge of the degree of capital mobility is the variability of the deviations from parity. In a particular time period, large individual deviations may be partially offsetting, leaving their mean misleadingly close to zero. Moreover, high estimates of the variance, while indicative of economically important deviations in individual periods, lead to findings of statistical insignificance of the means. To address this problem, three measures of variability are examined here: the sample standard deviation, the root mean square error, and the size of the band needed to encompass 95 percent of the deviations from parity. These measures are given in Tables 3 and 4. In addition, Table 5 provides test statistics of the hypotheses that the variances are the same across markets.

In both the onshore and offshore markets the average sample standard deviations of the covered differentials differ by less than 10 basis points between the long-term and short-term maturities, and, as is discussed below, the differences are not significant. The standard deviations of the long-term assets average close to 30 basis points, with the largest standard deviations measured for the U.K. market. For the short-term differentials, the sample standard deviations average about 20 basis points in the Euromarket and about 25 basis points in the onshore markets. The largest short-term standard deviations are measured for the onshore markets of Japan and Switzerland.

To test whether the variances are equal to each another, standard F-tests are used. Four such test statistics are constructed. The first evaluates whether the variances of the swap-covered deviations in the long-term onshore and offshore markets are the same. The second tests whether the variances in the Euromarket are the same for

long-term and short-term assets. Similarly, a third test makes the short-term/long-term comparison in the onshore markets. Finally, the short-term variances in the Euromarket are compared with those in the onshore markets. As shown on Table 5, none of the hypotheses of equal variances can be rejected at the 90 percent confidence level.

The two other measures of variability given in Tables 3 and 4 appear roughly consistent with the variance measures. That is, for the two sets of long-term assets, the average measures of variability appear slightly larger among long-term assets than among the corresponding short-term assets. However, they are neither uniformly nor substantially larger. The root mean square errors among the long-term assets average about 30 basis points in the Euromarket and 40 basis points in the onshore markets, and range from 21 to 64 basis points. These figures are only a few basis points more than the corresponding short-term numbers. The short-term root mean square errors average 27 basis points in the Euromarket and 38 basis points in the Onshore markets and range from 21 to 61 basis points.

Finally, the bands needed to encompass 95 percent of the deviations from parity are provided in the third and sixth columns of the two tables. The band widths are larger among the long-term assets than among the short-term assets in the Euromarket, but no pronounced difference across maturities arises in the onshore markets. In the Euromarket, the short-term 95 percent bands range from about 45 basis points for sterling-denominated assets to about 95 basis points for yen-denominated assets, and the long-term bands range from about 90 basis points for the Swiss franc assets to almost 140 basis points for sterling-denominated assets. In the onshore markets, the short-term bands range from the U.K.'s 70 basis point band to Japan's 140 basis

point band, and long-term bands range from about 60 basis points in Canadian to almost 160 basis points in Germany.

5. Summary and Conclusions

This paper provides a direct empirical examination of the degree of long-term capital mobility. In particular, the paper focuses on the question of whether the movement of long-term financial capital is inhibited in ways that are significant relative to the movement of short-term financial capital. Long-term covered foreign transactions are constructed using currency and interest rate swaps. Like short-term covered transactions, these transactions leave the investor without exchange rate risk on the principal invested. Thus, a standard measure of barriers to capital mobility, CIP, previously evaluated only for short-term assets, can now be examined using long-term assets.

The measured deviations from interest parity, in some cases, appear to be slightly larger among long-term assets than among short-term assets, but the differences are small. Measures of variability -- variance, mean square error, and the size of bands encompassing 95 percent of the covered differentials -- are consistent with this evaluation. More importantly, both the short-term and the long-term deviations from parity observed in the industrialized countries studied here are dwarfed by the very large deviations found in countries and time periods where capital controls have been considered important. In the context of these results, barriers to long-term financial capital mobility appear minor in the markets examined in this paper, suggesting that the increasing international

financial capital mobility of the last decade has not been limited to the markets for short-term assets.

Table 1

Long-Term Swap-Covered Interest Parity
Mean Deviations
Foreign Currency Return less U.S. Dollar Return

(in basis points, annual returns)

	Euromarket		On-Shore Markets	
	5-year	7-year	5-year	7-year
Canada				
mean	-2.41	4.70	5.13	5.68*
s.e. of mean	6.44	8.94	3.65	3.28
AR coef	0.51	0.16	0.46	0.35
West Germany				
mean	3.15	-7.54	44.97*	35.57*
s.e. of mean	3.19	4.92	7.12	6.33
AR coef	0.30	0.60	0.68	0.67
Japan				
mean	13.97*	18.53*	9.75	13.61*
s.e. of mean	4.03	4.83	6.64	6.15
AR coef	0.20	0.32	0.67	0.66
Switzerland				
mean	-3.06	-17.78*	10.97	-11.41
s.e. of mean	4.53	5.23	6.47	9.00
AR coef	0.68	0.74	0.70	0.81
United Kingdom				
mean	13.22*		48.46*	46.21*
s.e. of mean	6.97	n.a.	7.65	4.56
AR coef	0.63		0.61	0.42

Notes:

1.

		Number of Observations	Sample Period
Onshore Returns:		123	10/ 3/85 to 2/18/88
Euromarket Returns:			
Canadian Dollar,	5-year	115	11/28/85 to 2/18/88
	7-year	35	5/28/87 to 2/18/88
Mark		123	10/ 3/85 to 2/18/88
Yen		67	11/13/86 to 2/18/88
Sterling		115	11/28/85 to 2/18/88
Swiss Franc		115	11/28/85 to 2/18/88

2. An asterisk indicates the estimated mean is significant at the 95 percent confidence level.

Table 2

3-Month Covered Interest Parity
Mean Deviations

(in basis points, annual returns)

	Foreign Return Less U.S. Return	
	off-shore Eurobonds	on-shore Government Assets
Canadian Dollar		
mean	17.19*	1.57
s.e. of mean	1.04	1.71
Mark		
mean	-19.64*	-28.64*
s.e. of mean	1.65	1.49
Yen		
mean	-20.32*	-7.38*
s.e. of mean	1.87	3.26
Swiss Franc		
mean	-18.95*	-17.31*
s.e. of mean	2.80	3.03
Sterling		
mean	14.20*	6.44*
s.e. of mean	1.60	1.91

Notes:
1. This sample includes 123 weekly observations, October 3, 1985 to February 18, 1988.
2. An asterisk indicates the estimated mean is significant at the 95 percent confidence level.

Table 3

Long-Term Swap-Covered Interest Parity
Variability of Deviations

(in basis points, annual returns)

	Euromarket			Onshore Markets		
	Sample s.d	Root Mean Square Error	95 Percent Band	Sample s.d.	Root Mean Square Error	95 Percent Band
Canadian Dollar						
5-year	38.41	38.45	-69.50, 65.00	24.10	25.95	-40.90, 48.70
7-year	39.80	40.19	-39.00, 67.00	24.93	25.59	-31.00, 31.08
Mark						
5-year	25.43	25.63	-45.10, 57.50	33.78	55.04	-64.10, 95.00
7-year	26.77	27.88	-52.87, 39.50	32.19	46.35	67.50, 72.00
Yen						
5-year	26.26	29.65	-32.00, 71.50	32.09	33.38	-65.00, 58.50
7-year	27.92	33.34	-41.50, 67.00	30.99	33.39	-55.50, 60.50
Sterling						
5-year	35.32	37.03	-64.00, 74.67	41.15	63.70	-40.00, 82.00
7-year	n.a.	n.a.	n.a.	31.67	55.74	-27.30, 80.00
Swiss Franc						
5-year	22.05	22.26	-44.50, 43.50	29.64	29.65	-55.50, 53.66
7-year	21.94	21.98	-43.00, 47.00	32.11	34.42	-60.00, 38.50
Average	28.55	29.69		31.27	40.32	

Notes:
1. See Table 1.
2. Averages are weighted by the number of observations.

Table 4

Short-Term Covered Interest Parity
Variability of Deviations

(in basis points, annual returns)

	Euromarket			Onshore Markets		
	Sample s.d.	Root Mean Square Error	95 Percent Band	Sample s.d.	Root Mean Square Error	95 Percent Band
Canadian Dollar	11.68	20.78	-13.20, 33.06	15.67	60.51	-34.86, 40.75
Mark	12.85	23.47	-45.86, 10.12	16.65	33.13	-58.69, 10.78
Yen	20.94	29.18	-54.08, 41.06	36.50	37.24	-64.29, 74.65
U.K. Pound	17.83	22.80	-10.09, 35.05	21.32	22.27	-33.16, 39.49
Swiss Franc	31.27	36.56	-32.28, 45.35	33.89	38.05	-64.41, 59.61
Average	18.92	26.56		24.81	38.24	

Notes: See Table 3.

Table 5

Variance of Deviations
from Covered Interest Parity and Swap-Covered Interest Parity

Hypothesis	F-Statistic (probability)
H_0: $\sigma^2_{\text{euromarket, LT}} = \sigma^2_{\text{onshore, LT}}$	1.6283 (.7620)
H_0: $\sigma^2_{\text{euromarket, LT}} = \sigma^2_{\text{euromarket, ST}}$	3.0089 (.8811)
H_0: $\sigma^2_{\text{onshore, LT}} = \sigma^2_{\text{onshore, ST}}$	2.7886 (.8654)
H_0: $\sigma^2_{\text{euromarket, ST}} = \sigma^2_{\text{onshore, ST}}$	1.7569 (.7244)

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