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11 Interest Differentials under Bretton Woods and the Post–Bretton Woods Float: The Effects of Capital Controls and Exchange Risk

Richard C. Marston

After almost twenty years' experience with flexible exchange rates, many observers have begun to look back nostalgically at the Bretton Woods period of fixed exchange rates. The exchange rate stability offered by the Bretton Woods system of fixed rates helped facilitate investment and trade decisions by reducing one potentially important source of risk. In the period since exchange rates became flexible in 1973, this stability has been replaced by a high degree of short-term volatility like that found in commodity or equity markets. Unhedged positions in any particular currency have resulted in unanticipated gains and losses that far exceed those experienced under Bretton Woods.[1] So, as a result, foreign exchange risk premiums have developed to compensate investors for positions in particular currencies. Some observers point to such risk premiums (although they are difficult to measure) as evidence of the costs imposed by flexible rates.

Experience under Bretton Woods, however, suggests that there are also costs associated with fixed exchange rates. The price paid for stable exchange rates under Bretton Woods was a degree of control over international financial transactions that might be regarded as onerous in today's environment of deregulated markets.[2] The extensive capital controls that inhibited flows be-

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1. McKinnon (1988) presents the case against flexible rates. He argues that many business risks associated with flexible rates cannot be hedged because of the lack of contingent forward markets in goods and services.

2. Giovannini (1988) presents evidence that restrictions on capital flows have been an important feature of three fixed exchange rate regimes: the gold standard (at least in times of crisis), Bretton Woods, and the European Monetary System. Eichengreen (1989), however, shows that the period of fixed exchange rates between the world wars was notably free of capital controls.

tween most national financial markets led to sizable interest differentials that distorted international financial decisions. This paper will compare the integration of short-term financial markets under Bretton Woods with the integration of these same financial markets under flexible exchange rates.

Exchange rates naturally became more volatile after the breakdown of Bretton Woods in 1971. Table 11.1 compares the volatility of changes in exchange rates in the Bretton Woods and flexible rate periods. The changes in exchange rates are measured over three-month holding periods corresponding to the maturity of the interest rates to be studied below. The calculations for the Bretton Woods period begin whenever Eurocurrency rates first became available for that currency and end in January 1971.[3] The table shows that the standard errors of the exchange rate changes are from two to fifteen times larger under flexible rates than under fixed rates. Notice, however, that two of the exchange rates, for the dollar/pound and the deutsche mark/dollar, have sizable standard errors even in the Bretton Woods period. This is because both currencies were realigned prior to 1971.

The clear division between the Bretton Woods period and the flexible rate period does not hold as well for other financial variables. In the case of interest rates, in particular, the exchange rate regime may not be as important to behavior as the presence or absence of capital controls. Consider table 11.2, which reports on the standard deviations and correlations of three sets of Eurocurrency and national interest rates.[4] The interest rates for all three currencies in table 11.2 have somewhat higher volatility in the flexible rate period. But the most telling difference in behavior lies in the correlations between Eurocurrency and national interest rates. In the absence of controls, these correlations are over .99, indicating a high degree of integration between the national and the Eurocurrency markets. But the correlations are distinctly lower when controls on the national markets are in effect, whether or not exchange rates are flexible. The paper will try to disentangle the effects of capital controls and exchange rate volatility.

The shift to flexible exchange rates in 1973 has stimulated numerous studies of international financial linkages. Many of these studies have examined the degree of integration between short-term financial markets through tests of uncovered interest parity or related conditions.[5] Almost invariably, these tests have been based on Eurocurrency interest rates rather than national interest rates because the former are free of capital controls. So tests of uncovered interest parity have provided evidence about foreign exchange risk premiums rather than political barriers to the international integration of financial mar-

3. The Bretton Woods system collapsed in May 1971, so changes in exchange rates defined over three-month holding periods must end in January 1971. The five currencies represented in table 11.1 are the only ones that have Eurocurrency rates available from the early 1960s.

4. These three sets of interest rates will be studied in detail in the next section.

5. Hodrick (1987) presents a critical survey of these empirical studies. Other references are given below.

Table 11.1 Volatility of Changes in Exchange Rates: Standard Errors of Percentage Changes (in %/annum)

	$/£ Rate, 1961(4)–1989(7)	DM/$ Rate, 1963(1)–1989(7)	Dfl/$ Rate, 1962(1)–1989(7)	SF/$ Rate, 1963(1)–1989(7)
Bretton Woods period (to 1971[1]):				
No. of obs.	118	97	109	97
Sample mean	−1.46	−1.19	−.05	−.08
Sample SE	4.57	2.64	.76	.80
Flexible rate period (1973[1]–1989[7]):				
No. of obs.	199	199	199	199
Sample mean	−2.60	−2.68	−2.04	−4.26
Sample SE	11.89	12.67	12.41	14.02

Sources: For the dollar/pound rate, Bank of England, *Quarterly Bulletin;* for other spot rates, International Monetary Fund, *International Financial Statistics.*

Note: The percentage changes in exchange rates have been calculated over three-month holding periods (since all interest rates used in the study are for three-month maturities), then annualized.

kets. No studies have tried to compare the relative effect of capital controls and exchange risk on interest differentials. Few studies, moreover, have compared interest differentials among the major financial markets under fixed and flexible exchange rates. In fact, most studies begin their sample periods in 1973 or later because financial data are so much more readily available for the more recent period.

This study will examine both Eurocurrency and national financial markets over periods beginning in the early 1960s. It will encompass markets in five currencies—the dollar, guilder, mark, sterling, and Swiss franc. It will examine the effects of capital controls and political risk on interest differentials between Eurocurrency and national markets and the effects of foreign exchange risk premiums on Eurocurrency differentials.

11.1 Capital Controls and Political Risk

One of the alleged benefits of flexible exchange rates is that they free national monetary authorities from balance of payments constraints and thus permit them to relax capital controls. This section will investigate how the breakdown of Bretton Woods led to the removal of controls in several of the major financial markets. This will be done by comparing covered interest differentials in the 1960s with those in later periods.

Covered interest differentials can arise for any of three reasons. First, the securities being considered may differ in default risk.[6] Second, the markets

6. Government securities, for example, are generally regarded as less subject to default risk than private assets. Assets may also differ in tax status and eligibility for discounting at the central bank as well as in other characteristics.

Table 11.2 Volatility of Exchange Rates and Interest Rates: Standard Errors (in %/annum) and Correlation Coefficients

	SE % Change $/£ Rate	SE Euro-£ Interest Rate	SE British Interest Rate	Correlation between Interest Rates
Pound sterling:				
Bretton Woods with controls (1961[4]–1971[1])	4.57	1.43	.77	.898
Flexible rates with controls (1973[1]–1979[6])	10.42	1.62	1.26	.921
Flexible rates without controls (1979[7]–1989[7])	12.78	1.26	1.26	.998
	SE % Change DM/$ Rate	SE Euro-DM Interest Rate	SE German Interest Rate	
Deutsche mark:				
Precontrol (1966[1]–1970[3])	3.52	.94	.92	.954
Control period (1970[4]–1974[1])	11.89	1.39	1.50	.583
Postcontrol (1974[2]–1989[7])	11.94	1.25	1.29	.994
		SE Euro-$ Interest Rate	SE U.S. Interest Rate	
Dollar:				
Control period (1966[1]–1973[12])		.67	.92	.778
Postcontrol (1974[1]–1989[7])		1.55	1.70	.993

Sources: For exchange rates, see table 11.1; for interest rates, see later tables.

may be segmented by capital controls. Finally, even if no capital controls separate the markets, investors may perceive a political or sovereign risk involving future restrictions.[7] In the interest rate comparisons below, I will attempt to confine comparisons to securities with equal default risk, although, as will be evident, that is not entirely possible. So covered interest differen-

7. Political or sovereign risk arises because of concern that the national authorities of one country might impose controls, taxes, or other regulatory measures on foreign investment in their market or on their residents' investments in other markets.

tials will primarily reflect the joint influence of capital controls and political risk, which I term the *country premium*.[8]

Capital controls come in two varieties. Governments may restrict resident purchases of foreign assets (and sometimes nonresident outflows as well). Such *outward* controls, which are usually designed to prop up a weak currency, lead to a covered interest differential favoring the foreign market unless there is sufficient flexibility in the controls to permit arbitrage between domestic and foreign markets. Alternatively, governments may restrict nonresident purchases of domestic assets in order to reduce pressures toward appreciation of the domestic currency. Such *inward* controls may lead to an interest differential favoring the domestic market. Only a few countries like Germany and Switzerland have resorted to such inward controls.

11.1.1 British Controls

To examine how controls affect markets, consider the case of the British market. The British government maintained a system of controls on resident outflows until as late as June 1979. The controls applied primarily to direct and portfolio investment abroad by U.K. residents, the holding of foreign currency deposits by residents, and foreign currency lending by residents, including U.K. banks.[9] Residents could invest abroad only by using foreign exchange obtained from the sale of existing securities or from foreign currency borrowing.[10] These controls, which were a holdover from the wartime period, did not prevent London from maintaining its preeminence as a financial center because the Bank of England was farsighted enough to allow the Eurocurrency market to develop in London outside the system of controls. Banks in London could accept deposits and make loans denominated in any currency except sterling. Of course, the controls restricted investments by residents in Eurocurrency deposits just like they restricted residents' investments in markets outside the United Kingdom. The controls also prohibited Eurosterling deposits and loans from being offered by banks located in London, although a Eurosterling market developed in Paris.

The Eurocurrency market itself operated free of any capital controls. Thus, host governments (such as the British government in the case of Eurocurrency transactions in London) permitted bank transactions involving foreign currencies by nonresidents even when they restricted transactions involving their own currencies. In addition, political risks were perceived to be of negligible

8. For previous treatments of capital controls and political risk and their implications for covered interest parity, see Aliber (1973), Dooley and Isard (1980), Frenkel and Levich (1975), and Marston (1976). Frankel and MacArthur (1988) also use the term *country premium* in their study of covered interest differentials over the period 1982–86.

9. Artis and Taylor (1989) describe these capital controls in more detail.

10. An investment dollar market grew up with a premium over the official exchange rate reflecting the tightness of the controls.

importance in this market. Consider the comparison between Eurodollar and Euromark deposits in London. Investors might perceive that both forms of Eurocurrency deposits were subject to some political risk, although that risk would be low since the British authorities were unlikely to tamper with a market that could be moved elsewhere so easily. But, even if all Eurocurrency deposits were at some risk, there was little reason to believe that the risk was greater for one type of Eurocurrency deposit relative to another type. That is because the British government (or any other government) was unlikely to discriminate among foreign currencies in any extension of controls to the Eurocurrency market. So it was not surprising that *covered interest parity* always held between any pair of Eurocurrency deposit rates.

Consider the comparison between Eurodollar and Eurosterling interest rates. If the Eurodollar interest rate is adjusted for the cost of forward cover, then the two returns expressed in sterling should be equal:

(1) COVERED INTEREST PARITY: $i_{£t} = i_{\$t} + f_{£t}$,

where $i_{\$t} = \ln(1 + I_{\$t})$ (where $I_{\$t}$ is the Eurodollar interest rate), $i_{£t} = \ln(1 + I_{£t})$ (where $I_{£t}$ is the Eurosterling rate), and $f_{£t} = \ln(F_t/S_t)$ (where F_t is the forward exchange rate, and S_t is the spot exchange rate, both expressed in pounds/dollars). The two returns should be identical except for transactions costs.

In the case of comparisons involving the British interest rate (i_{Bt}), in contrast, a covered differential could reflect a country premium resulting from capital controls or political risks associated with the British market. Since covered interest parity always holds for the Eurocurrency markets, we may measure the deviation of British rates from covered interest parity in two ways—using the Eurodollar rate and the forward premium or the Eurosterling rate alone:

(2a) $$i_{\$t} + f_{£t} - i_{Bt} = U_{1t},$$

(2b) $$i_{£t} - i_{Bt} = U_{2t}.$$

The first equation measures U_{1t}, the deviation between the covered Eurodollar rate and the British interest rate. The second equation measures U_{2t}, the deviation between the Eurosterling rate and the British interest rate. Since British capital controls limited *outflows* of capital, we would expect both deviations to be *positive* (or equal to zero when the control is not binding).

Table 11.3 reports monthly interest differentials for the sterling markets for the period from April 1961, when Eurosterling interest rates were first reported by the Bank of England, to June 1979, when British capital controls ended. The underlying data are published in the Bank of England's *Quarterly Bulletin*. The interest rates reported are for three-month maturities expressed in percentage per annum, so the differentials are calculated in logs as follows (for the case of the Eurodollar and British interest rates):

Table 11.3 **Covered Interest Differentials in the Dollar/Pound Markets (in %/annum, 1961[4]–1979[6])**

	Euro-$/British	Euro-£/British	Euro-$/Euro-£
No. of obs.	219	219	219
Sample mean	1.12	1.04	.08
SE of mean	.18	.17	.02
t-statistic	6.35*	6.17*	3.04*
Band for 95% of obs.	4.23	3.78	.38

Source: Bank of England, *Quarterly Bulletin* (various issues).

Note: The standard errors of the mean are calculated as if there were $N/3$ observations. The means marked with an asterisk (*) are statistically different from zero at the 5% level. The British interest rate is the three-month local authority deposit rate through 1971 and the sterling interbank deposit rate thereafter.

$$\text{(2a}') \quad \{\ln [1 + (I_{\$t}/400)] + \ln (F_{£t}/S_{£t}) - \ln [1 + (I_{Bt}/400)]\} \times 400.$$

The forward and spot exchange rates are expressed in pounds/dollars after having been inverted to conform with practices in other exchange markets. The table reports differentials between Eurodollar and British rates, between Eurosterling and British rates, and between Eurodollar and Eurosterling rates. The first and last differentials are calculated using the forward premium on the pound, while the second differential omits the forward premium because both interest rates are expressed in sterling.

Table 11.3 illustrates how effective capital controls can be in driving wedges between national and Eurocurrency interest rates. According to this table, interest differentials between the British market and either Eurocurrency market averaged over 1% per annum during the period of the controls. The standard errors of the sample means of these differentials were less than 0.20%, so both these means are statistically different from zero at the 5% level.[11] In the absence of controls, differentials of this size would induce immediate arbitrage activity by bank traders. The fifth row of the table reports the band for interest rate differentials within which 95% of the observations fail.[12] That band includes differentials as large as 4.23% in the case of comparisons between Eurodollar and British rates and 3.78% in comparisons between Eurosterling and British rates. These differentials were large enough to provide firms within the British market with substantial advantages over firms with access only to international markets. During the period of the controls, therefore, multinational firms with operations in Britain as well as elsewhere

11. Since the monthly observations of three-month interest differentials overlap, the standard errors of the means are calculated as if there are only $N/3$ observations. Frankel and MacArthur (1988) make a similar adjustment for the three-month rates in their study.

12. This statistic gives some indication of how distortionary the controls are when they are most binding.

found it advantageous to finance as much as possible *behind* the British control barrier. Rather than being a high-cost center, the British sterling market offered financing at lower rates, when measured in dollars, than did markets with seemingly low interest rates such as Germany.

The table also shows covered differentials between the Eurodollar and the Eurosterling markets. The differentials averaged only 0.08% per annum over the period of the capital controls. Although 0.08% is statistically different from zero, it is not economically significant since transactions costs are most likely large enough to eliminate any profits from arbitrage activity.[13] Some of the observed differentials were several times as large as 0.08% since the 95% band included differentials as large as 0.38%. But that is more likely to reflect imperfections in the data rather than genuine arbitrage opportunities open to bank traders. In studying the 1960s and 1970s, researchers have to contend with poorer data than are available today. In the case of the British market, the data—coming from one source, the Bank of England—are of relatively high quality. But the Bank of England data are not all synchronous since the Paris market, where the Eurosterling quotes originate, closes one hour later than the London market, where the Eurodollar and exchange rate quotes originate. So the few large differentials observed between the two markets are probably due to interest rate movements in Paris in the last hour of trading.

To study the effect of controls in greater detail, I break up the sample period into three subperiods: (*a*) the last decade of the Bretton Woods period, 1961(4)–1971(4);[14] (*b*) a period of flexible exchange rates when capital controls were still in place, 1973(1)–1979(6); and (*c*) the postcontrol period, 1979(7)–1989(7). For each period, I study the differentials between the Eurosterling and the British interest rates.

Table 11.4 reports the sample means of the interest differentials between the two markets, the standard errors of these means and their *t*-statistics, and the band within which 95% of the observations lie. To show the asymmetric nature of the controls, which inhibited *outward* flows but not inward flows, I report separate statistics for the positive differentials of the Eurosterling rate over the British interest rate. If the controls are asymmetric, the differentials should be predominantly positive, especially the large differentials found when the controls are most binding.

In the two periods when the British market was subject to controls, the interest differentials were quite substantial. During the Bretton Woods period, the differential averaged 0.78% with the 95% band occurring at a differential

13. The recent study by Clinton (1988) used bid-ask spreads to measure transactions costs associated with covered interest transactions. He estimated that transactions costs were as low as 0.06% for a six-month period in 1985–86. Whether transactions costs were that low over the entire twenty-nine-year period is difficult to say in the absence of better data.

14. The effective end of Bretton Woods is assumed to have occurred in May 1971, when the mark and guilder began a period of floating and when the Swiss franc was revalued. There was an attempt to reestablish fixed parities in the Smithsonian Agreement reached in December 1971, but the new parities could not be sustained.

Table 11.4 **Interest Differentials between the Eurosterling and British Markets (in %/annum, 1961[4]–1989[7])**

	Bretton Woods Period, 1961(4)–1971(4)	Flexible Rates with Controls, 1973(1)–1979(6)	Flexible Rates without Controls, 1979(7)–1989(7)
No. of obs.	121	78	121
Sample mean	.78	1.50	−.03
SE of mean	.25	.25	.02
t-statistic	3.17*	5.94*	−1.05
Band for 95% of obs.	4.14	3.78	.36
Positive obs.			
% of obs.	72.7	93.6	52.9
Sample mean	1.15	1.61	.06

Source: Bank of England, *Quarterly Bulletin* (various issues).
Note: See the note to table 11.3.

as large as 4.14%. In the flexible period, the average differential was even larger at 1.50%. In this latter period, 93.6% of the differentials were positive. In both periods, the mean differentials are statistically different from zero at the 5% level.

Once the controls were removed in 1979, the differential dropped to −0.03% with only 52.9% of the differentials being positive. Figure 11.1 illustrates how dramatically different were the differentials in the postcontrol period. This figure shows the differential between the Eurosterling rate and the British interbank rate during the flexible rate period. A vertical line indicates when the controls were removed. Both table 11.4 and figure 11.1 show clearly that the controls had a very substantial effect on interest differentials and, therefore, on the relative costs of financing in the British and external markets.

11.1.2 German Controls

As in the British case, the German government resorted to capital controls in an attempt to shield the domestic financial markets from international pressures. But German controls were designed to limit inflows rather than outflows of funds.

In the late 1960s, the mark came under attack periodically because of a widespread belief that it was undervalued relative to the dollar and other major currencies. In October 1969, the German authorities revalued the mark by 8.5%. But, when the pressure on the mark resumed in 1970, the authorities began to impose capital controls inhibiting inflows from abroad in an attempt to limit further appreciation of the mark. The controls eventually included bans on interest payments to foreigners, the imposition of cash deposits on

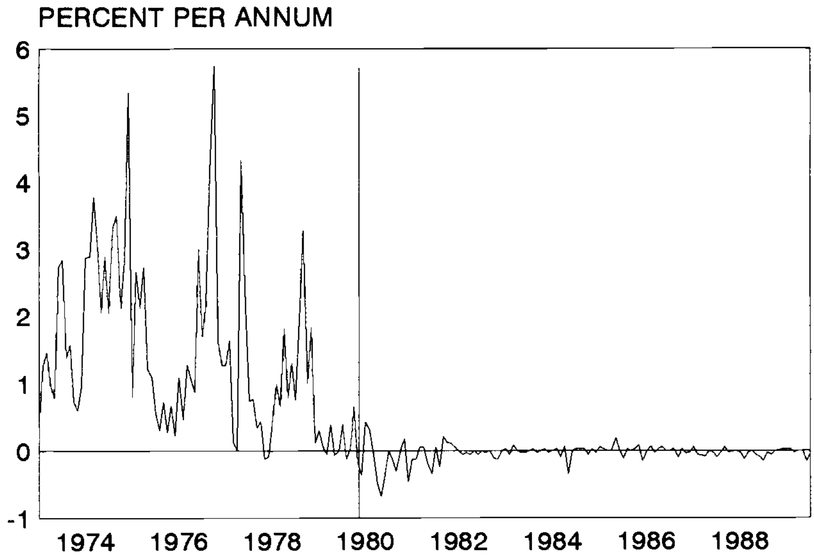

Fig. 11.1 Eurosterling/British Interest Differentials, Flexible Rate Period, 1973(1)–1989(7)
Source: Bank of England, *Quarterly Bulletin*

borrowings abroad (initially 40%), restrictions on the purchase of domestic bonds by nonresidents, and, finally, general restrictions on borrowing abroad.[15] The controls resulted in a *negative* gap between interest rates in the Euromark market and the German market. The move to flexible exchange rates in early 1973 reduced the incentives to invest in the German market, but it was not until February 1974 that the authorities began to remove the network of capital controls.

Table 11.5 reports evidence on the differential between the Euromark and the German interbank rates for the period from 1966 to 1989. The sample is broken up into three periods: (*a*) the Bretton Woods period prior to the imposition of controls, 1966(1)–1970(3); (*b*) the control period, 1970(4)–1974(1); and (*c*) the postcontrol period, 1974(2)–1989(10). The control period includes about a year when the deutsche mark/dollar rate was still fixed as well as three years when this rate was allowed to vary (at least periodically).

It is evident from the table that the precontrol Bretton Woods period resembles the postcontrol period much more than the period of controls. The differential averages −0.40% during the precontrol period and −0.23% during the postcontrol period but −2.97% during the period of controls.[16] Simi-

15. The controls are described in Deutsche Bundesbank (1985) and Dooley and Isard (1980).

16. The sample means are statistically different from zero in all three periods. In the two noncontrol periods, however, the means are much smaller, although probably not small enough to be explained by transactions costs. The differentials may be attributable to differences in the risk

Table 11.5 **Interest Differentials between Euromark and German Markets (in %/annum, 1966[1]–1989[7])**

	Precontrol (Bretton Woods) Period, 1966(1)–1970(3)	Control Period, 1970(4)–1974(1)	Flexible Rates without Controls, (1974(2)–1989(7)
No. of obs.	51	46	186
Sample mean	−.40	−2.97	−.23
SE of mean	.14	.67	.03
t-statistic	−2.94*	−4.42*	−6.70*
Band for 95% of obs.	1.11	8.89	.79
Negative obs.			
% of obs.	82.4	100.0	86.6
Sample mean	−.56	−2.97	−.29

Sources: Euromark interest rate: OECD, *Financial Statistics Monthly* (computer diskette) for 1966–75; thereafter from Morgan Guaranty Trust, *World Financial Markets*. German interbank rate: Morgan Guaranty Trust, *World Financial Markets*.

Note: See the note to table 11.3.

larly, the 95% band is much larger in the period of controls than in either noncontrol period. In the control period, the 95% band includes a differential as large as 8.89%. Differentials that large are unheard of in periods free of controls. In this situation, it paid multinational firms to finance as much as possible *outside* Germany and to build up working balances behind the control barrier in Germany.

Figure 11.2 illustrates the variation in the differential during the period of the controls and the period directly after the removal of controls. The differential was almost uniformly negative since the controls inhibited outward flows of funds. It is evident from the figure that the stringency of the controls varied widely, with the controls being most binding in 1972 and 1973.

11.1.3 U.S. Controls

The last sets of controls to be studied are those imposed on U.S. residents in the 1960s. The U.S. balance of payments deteriorated in the 1960s as the dollar became increasingly overvalued relative to other major currencies. The Kennedy administration responded by imposing an interest equalization tax on foreign securities purchased by Americans, but it was only later, during the Johnson administration, that comprehensive capital controls were put in

characteristics of Euromark deposits and German interbank deposits. See the discussion of default risk in the dollar markets below.

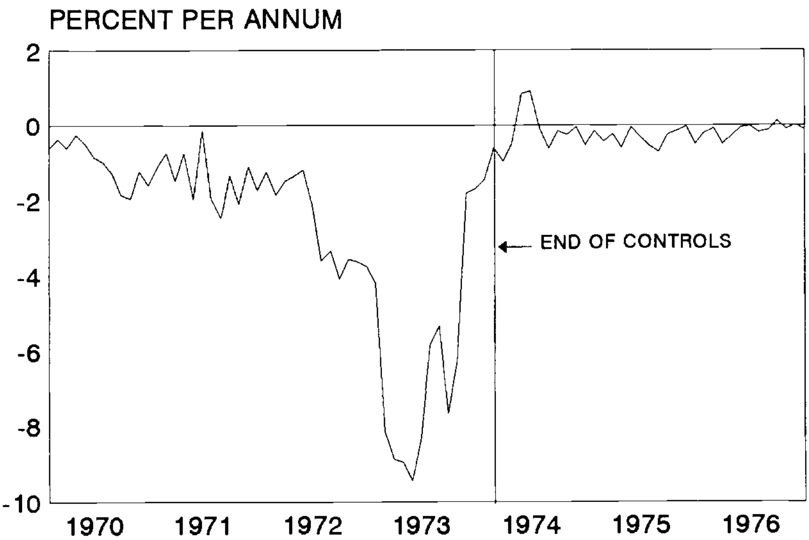

Fig. 11.2 Euromark/German Differentials, 1970(1)–1976(12)
Sources: Morgan Guaranty Trust, *World Financial Markets;* and OECD, *Financial Statistics Monthly*

place. These controls restricted outflows of capital by both banks and nonbank residents. For example, under the Voluntary Foreign Credit Restraint Program, there were restrictions on lending abroad by commercial banks and nonbank financial institutions. There were also restrictions on direct investment under the Foreign Direct Investment Program.[17] These controls made it difficult to fund foreign operations from the United States and led to large differentials between interest rates in U.S. markets and those in markets abroad, including the Eurodollar market. The effects of the capital controls were complicated by banking regulations that put ceilings on interest rates paid on bank deposits, including certificates of deposit (CDs). Regulation Q of the Federal Reserve limited CD rates on three-month deposits to 6% through 1969 and 6.75% beginning in January 1970.

Figure 11.3 illustrates the combined effects of the controls and Regulation Q ceilings on interest rates in the major dollar markets. The figure shows that the interest rate ceiling resulted in an inversion of the normal relation between Treasury bill (TB) rates and CD rates. In 1968–70, the TB rate was often above the CD rate when the latter hit its ceiling. The effects of the capital controls are evident in the widening differentials between Eurodollar rates and TB rates. In 1969, that differential rose over 4% per annum. With controls inhibiting funds flowing from the United States to London, the Eurodollar rate

17. The controls are described in International Monetary Fund (1975).

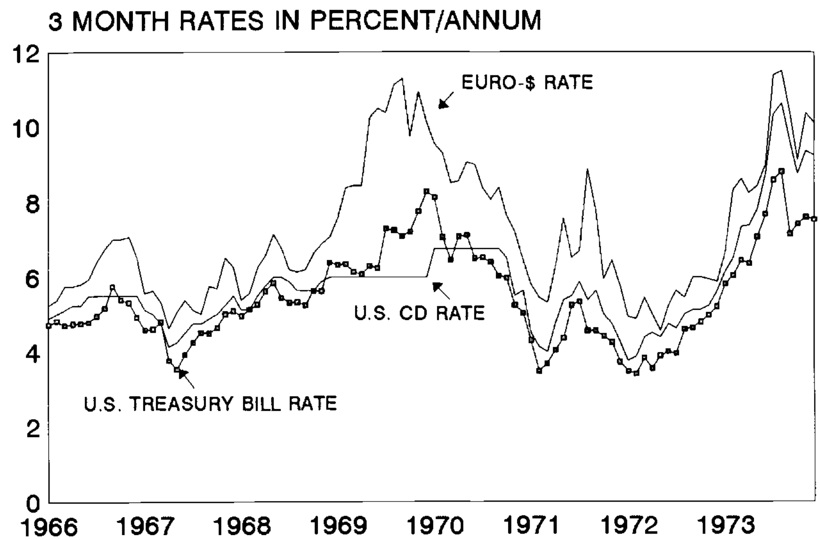

Fig. 11.3 Eurodollars and U.S. Interest Rates, Period of Controls, 1966(1)–1973(12)
Source: Morgan Guaranty Trust, *World Financial Markets*

rose way above U.S. rates. A U.S. (or foreign) firm was able to raise funds much more cheaply in the United States, although, because of the controls, these funds could not generally be used for foreign operations.

Table 11.6 reports interest differentials between the Eurodollar and the U.S. markets for two time periods: (*a*) the period of U.S. capital controls, 1966(1)–1973(12), and (*b*) the postcontrol period, 1974(1)–1989(7). As in the case of the German controls, the control period extended into the period after the Bretton Woods system collapsed, so the division between control and postcontrol periods does not coincide very well with the division between fixed and flexible periods. The interest rates—end-of-month rates for three-month instruments—are drawn from Morgan Guaranty Trust's *World Financial Markets*. For the period of the controls, the table reports two sets of differentials: the Eurodollar-CD differential and the Eurodollar-TB differential. The latter differential is free of the distortions caused by the Regulation Q ceilings.

The table reveals large differentials during the control period. The differential between Eurodollar and CD rates averaged 1.35% with the 95% band occurring as a differential of 4.17%. The differential involving the TB rate was of similar size. Both sets of differentials are statistically different from zero at the 5% level. The capital controls were evidently binding for much of the period.

Comparing the control and the postcontrol periods, it is evident that U.S. controls resulted in raising the relative costs of financing in the Eurodollar

Table 11.6 **Interest Differentials between the Eurodollar and U.S. Markets (in %/annum, 1966[1]–1989[7])**

	Control Period, 1966(1)–1973(12)		Postcontrol Period, 1974(1)–1989(7),
	Euro-$/CD	Euro-$/TB	Euro-$/CD
No. of obs.	96	96	187
Sample mean	1.35	1.66	.53
SE of mean	.20	.15	.06
t-statistic	6.71*	10.85*	9.01*
Band for 95% of obs.	4.17	3.16	1.50
Positive obs.			
% of obs.	100.0	100.0	98.4
Sample mean	1.35	1.66	.54

Source: Morgan Guaranty Trust, *World Financial Markets* (various issues).

market by a little over 1%, and even more in 1969 and 1970, when interest differentials reached their peak. By cutting off the Eurodollar market from its national counterpart, moreover, the U.S. controls encouraged the development of the former. Firms that were not allowed to draw on U.S. markets for their financing naturally turned to the Eurodollar market. The interest differentials between these two markets never reached the size found in the German market, but the controls had a major effect on the relative costs of financing.

In the postcontrol period, the differential between the Eurodollar and the CD rates averaged 0.53% with the 95% band occurring at a rate of 1.50%. This differential is much smaller than during the control period but larger than differentials in the mark and sterling markets after controls were removed. Much of this differential can be explained by banking regulations that require banks to hold reserves against deposits at U.S. banks but that exempt Eurodollar deposits from reserve requirements.[18] During some of the postcontrol years, however, the interest differential between Eurodollar and CD rates was much larger than 0.53%. The first period was in 1974–75, during the Herstatt Bank crisis, and the second period was in 1980–83, when U.S. bank lending came under scrutiny. Both sets of years were free of capital controls, so higher interest rates in the Eurodollar market must be attributed to the market's assessment of risks. Consider the period of the Herstatt crisis. During that period, the market demanded risk premiums for bank deposit rates whether the deposits were in the U.S. or the Eurodollar markets. The U.S. CD rate at

18. At times, the U.S. authorities have imposed reserve requirements on liabilities of U.S. banks to their foreign branches but not on the dollar deposits of these branches. For a discussion of the effects of reserve requirements on relative interest rates, see Kreicher (1982).

times rose several percentage points above the TB rate as investors moved to the safety of government securities.[19] The Eurodollar rate, in turn, rose above CD rates, even when both deposits were at branches of the same bank, because of a perception that Eurodollar deposits were subject to greater default risk. Similar differentials emerged during the period 1980–83, especially after the Mexican debt crisis, which began in August 1982.[20] The interest differential found in the postcontrol period suggests that investigators should be wary about ignoring default premiums when comparing national and Eurocurrency rates.

11.2 Exchange Risk and Uncovered Interest Parity

Once exchange rates became flexible early in 1973, governments could contemplate removing controls on their markets since they no longer faced balance of payments constraints. Two of the first countries to remove controls were the United States and Germany at the end of 1973. Britain retained controls until June 1979 because of the chronic weakness of sterling. But, since that time, all three countries have been free of capital controls.

As we have seen, the removal of controls permits investors to take advantage of interest differentials between the Eurocurrency and the national markets. But, with flexible rates, firms are faced with a new factor affecting the cost of financing, unanticipated changes in exchange rates. Exchange rates are notoriously difficult to predict, and ex post returns vary widely depending on whatever exchange rates prevail at the time of repayment. So flexible exchange rates lead to the emergence of foreign exchange risk premiums, which may drive wedges between ex ante returns in different markets.

11.2.1 Deviations from Uncovered Interest Parity

To examine the effects of risk premiums on relative returns, consider the comparison of returns in the U.S. and British markets. If both returns are expressed in sterling, then the expected (ex ante) interest differential between U.S. and British interest rates can be written as follows:

$$i_{At} + x_{£t} - i_{Bt} = U_{3t}, \quad (3)$$

where $x_{£t}$ is the expected change in the pound price of the dollar, $E_t\,[\ln(S_{£t+1}/S_{£t})]$. In the absence of barriers to investment such as capital controls or political risk, U_{3t} is a measure of the risk premium separating the returns in the two

19. Over the whole postcontrol period, the average premium of CD rates over TB rates was 0.77% with the 95% band occurring at 2.14%. Treasury bills are free of state and local income taxes, so, even in the absence of default risk, there would be a gap between TB and CD rates. With a marginal state and local tax rate of 5% and a CD rate of 10%, a gap of 0.50% can be attributed to taxes alone (see Cook 1986).

20. Even without the debt crisis, higher interest rates might have increased default risk on CDs because higher rates increase the risk of default on bank loans.

markets. But, in the presence of capital controls or political risk, U_{3t} reflects both the exchange risk premium and a country premium. To isolate the exchange risk premium, therefore, we turn to the corresponding Eurocurrency interest differentials, which are free of country premiums.

Measuring that risk premium is difficult because we cannot observe exchange rate expectations directly. What we do observe is the *actual* (ex post) interest differential, which can be decomposed into the expected differential and a forecast error:

$$(4) \qquad (i_{\$t} + x_{£t} - i_{£t}) + (s_{£t} - x_{£t}) = \varepsilon_{1t},$$

where $s_{£t}$ is the *actual* change in the spot exchange rate, $\ln (S_{£t+1}/S_{£t})$. The error term, ε_{1t}, reflects the combined influence of two factors, the risk premium and the forecast error. If the exchange market is efficient, the forecast error should have an expected value equal to zero. So the expected value of ε_{1t} should reflect the exchange risk premium alone.

In any sample period, however, the *average* value of ε_{1t}, representing the average uncovered interest differential, need not be equal to zero even in the absence of a risk premium. First, there may be discrete changes in the exchange rate that are expected but not realized in that particular sample period. This phenomenon has been called the "peso problem" (in reference to the behavior of the Mexican peso prior to its devaluation in 1976).[21] Peso problems can be found in fixed exchange rate periods when parity changes are possible, but they may also occur in flexible rate periods if major economic disturbances (including shifts in policy regimes) are expected. The second reason that average uncovered differentials may not be equal to zero is that the market may be learning about changes in regimes that have occurred. In that case, forecast errors may be systematically positive or negative even though market participants are processing information in a rational manner.[22] With longer sample periods, however, forecast errors associated with learning should become less of a problem unless there are frequent changes in regimes.

11.2.2 Evidence on Uncovered Interest Parity

In table 11.7, I present sample means for the uncovered interest differentials between the Eurodollar rate and four other Eurocurrency rates.[23] The differentials are reported for both fixed and flexible exchange rate periods as well as for the entire sample. The fixed rate sample period beings in the early 1960s, whenever a Eurocurrency interest rate series first becomes available

21. For a concise discussion of the peso problem, see Froot and Thaler (1990).

22. Market participants, e.g., may use Bayesian methods to update their expectations, as in Lewis (1989).

23. These differentials are calculated as follows (for the Eurosterling case):

$$\{\ln [1 + (I_{\$t}/400)] + \ln (S_{£t+3}/S_{£t}) - \ln [1 + (I_{£t}/400)]\} \times 400,$$

so they are expressed in percentage per annum.

Table 11.7 Uncovered Interest Differentials between the Euromarkets: Eurodollar Rate Minus Other Eurocurrency Rates (in %/annum, various periods)

	Bretton Woods Period	Flexible Rates Period	Post–Bretton Woods Period	Whole Sample
	1961(4)–1971(1)	1973(1)–1989(7)	1971(5)–1989(7)	1961(4)–1989(7)
Eurosterling				
No. of obs.	118	199	219	340
Mean	−.15	.10	−.07	−.12
SE of mean	1.51	3.05	2.82	1.89
t-statistic	−.10	.03	−.03	−.07
Euromark	1963(1)–1971(1)	1973(1)–1989(7)	1971(5)–1989(7)	1963(1)–1989(7)
No. of obs.	97	199	219	319
Mean	−.01	.85	.01	−.13
SE of mean	.84	3.16	2.93	2.03
t-statistic	−.01	.27	.00	−.07
Euroguilder	1962(1)–1971(1)	1973(1)–1989(7)	1971(5)–1989(7)	1962(1)–1989(7)
No. of obs.	109	199	219	331
Mean	.62	.43	−.35	−.06
SE of mean	.29	3.14	2.91	1.93
t-statistic	2.15*	.14	−.12	−.03
Euro-Swiss franc	1963(1)–1971(1)	1973(1)–1989(7)	1971(5)–1989(7)	1963(1)–1989(7)
No. of obs.	97	199	219	319
Mean	1.03	.83	−.07	.10
SE of mean	.27	3.56	3.33	2.29
t-statistic	3.79*	.23	−.02	.04

Sources: For Eurodollar/Eurosterling comparisons, Bank of England, *Quarterly Bulletin*. For other Eurocurrency comparisons, OECD, *Financial Statistics Monthly* (interest rates until 1976); Morgan Guaranty Trust, *World Financial Markets* (interest rates from 1976 on); IMF, *International Financial Statistics* (for exchange rates).

Note: The Bretton Woods sample period ends in January 1971 since the three-month (ex post) return beginning in January spans the three months ending in April 1971. Differentials marked with an asterisk (*) are statistically different from zero at the 5% level.

for that currency, and ends in January 1971. As discussed above, the Bretton Woods period is assumed to end in April 1971 prior to the floating of the mark and guilder in mid-May 1971. In order for the (ex post) three-month returns to be defined entirely within the Bretton Woods period, the last observation must be in January 1971. The flexible period extends from January 1973 until the end of the sample period in July 1989. Table 11.7 also reports separate statistics for the post–Bretton Woods period beginning in May 1971.

The Bank of England's series for Eurodollar and Eurosterling rates begins in April 1961, so there are 340 monthly observations available for these rates. The first row of table 11.7 reports the mean uncovered differentials between these rates over various periods. During the Bretton Woods period, the mean uncovered differential is equal to −0.15% per annum, with a standard deviation for this mean of 1.51%. During the flexible period, the mean differential is somewhat smaller in absolute value at 0.10%, but with a much larger standard deviation of 3.05%. Neither of these means is statistically different from zero. Both are also small in economic terms, being comparable to the *covered* interest differentials between Eurocurrency rates reported in section 11.1. The average uncovered differential is also small over the twenty-eight-year sample period as a whole, during which the mean differential is −0.12%, and over the post–Bretton Woods period, during which the mean differential is −0.07%.[24]

Uncovered interest differentials between Eurodollar and Euromark rates are reported in the second row of table 11.7. The sample period begins in January 1963, when Euromark interest rates were first published by the Organization for Economic Cooperation and Development (OECD), and ends in July 1989. During the Bretton Woods period from January 1963 to April 1971, the mean uncovered differential between Eurodollars and Euromarks is −0.01% with a standard deviation of 0.84%. During the flexible period, the mean increases to 0.85% per annum with a standard deviation of 3.16%. Although this mean is not significantly different from zero, it is nonetheless much larger than covered interest differentials for Eurocurrency rates. The mark appreciated substantially against the dollar between the end of the Bretton Woods period and the beginning of 1973, so, by extending the sample period back until May 1971, the mean uncovered differential falls to 0.01% per annum. For the whole sample period beginning in January 1963, moreover, the mean differential is only −0.13%.

Table 11.7 also reports statistics for the only other Eurocurrency rates available from the early 1960s, the Euroguilder and Euro–Swiss franc. The results are similar to those of the other Eurocurrencies. There are uncovered interest

24. The table does not report the bands within which 95% of the observations lie since the width of these bands would primarily reflect the size of the forecast errors rather than risk premiums (or peso phenomena). Only by averaging the ex post interest differentials over long sample periods are we able to abstract from such forecast errors.

differentials ranging from −0.07% to 1.03% for subperiods. Two of these interest differentials, those defined for the Bretton Woods period in the first column of the table, are statistically different from zero. As discussed below, the excess returns on Eurodollars relative to Euroguilders and Euro–Swiss francs may be compensating for an expected appreciation of these currencies—an appreciation that did not in fact occur until after the end of Bretton Woods. The mean differentials for the whole sample period are only −0.06% for Euroguilders and 0.10% for Euro–Swiss francs. Comparable differentials are found for Euro–French francs for the period from January 1973 to July 1989.[25]

There is some evidence of peso problems in shorter sample periods during the 1960s—specifically, prior to the devaluation of sterling in November 1967 and the revaluation of the mark in October 1969. If a devaluation or revaluation is anticipated, there will be ex post deviations from uncovered interest parity until the change in parity actually occurs. Table 11.8 compares uncovered interest differentials for the whole Bretton Woods period (starting when Eurocurrency data became available) with differentials for the periods ending prior to these changes in parities.[26] The results suggest that these parity changes may have been anticipated. If the sample period for sterling returns ends prior to the sterling devaluation of November 1967, the average uncovered differential is 1.20% in favor of sterling relative to the dollar. The higher return for sterling compensated the investor for the expected loss due to the devaluation of sterling. If the sample period for the mark ends prior to the mark revaluation in September 1969, the average uncovered differential is 1.14% in favor of the dollar relative to the mark. In this case, the higher return for the dollar compensated the investor for the expected gain on the mark due to its revaluation. In both cases, the average interest differentials are statistically different from zero (at the 5% level). Over the whole sample period, however, the uncovered interest differentials are very close to zero.

Neither the Dutch guilder nor the Swiss franc was revalued during the Bretton Woods sample period,[27] but both currencies were revalued in the Smithsonian Agreement of December 1971, which tried to reestablish fixed parities (although with wider bands of 2.25%). Table 11.9 examines uncovered interest differentials for the Bretton Woods period through December 1971.[28] The average uncovered interest differential for the Eurodollar relative to the Euro-

25. Euro–French franc rates are available from the OECD only beginning in January 1973. Over this period, the mean uncovered interest differential between the Eurodollar and the Euro–French franc is −0.40% with a standard error of 2.97%.

26. In the case of sterling, the period ends in July 1967 because the three-month return beginning at the end of August overlaps with the November devaluation. The mark was floated on 28 September and formally revalued on 24 October 1969, so the last observation is in May 1969, with the return defined over the period May–August.

27. The guilder was revalued by 4.7% in 1961 prior to the beginning of the sample period.

28. The last observation is in September 1971 because the return defined for that month spans the period September–December 1971.

Table 11.8 Uncovered Interest Differentials under Bretton Woods: Sample Periods Including and Excluding Changes in Parities

	Eurodollar-Eurosterling		Eurodollar-Euromark	
	Bretton Woods Period, 1961(4)–1971(1)	Prior to 1967 Devaluation of £, 1961(4)–1967(7)	Bretton Woods Period, 1963(1)–1971(1)	Prior to 1969 Revaluation, 1963(1)–1969(5)
No. of obs.	118	76	97	77
Mean	−.15	−1.20	−.01	1.14
SE of mean	1.51	.32	.84	.44
t-statistic	−.10	−3.69*	−.01	2.60*

Sources: Same as table 11.7.

Note: The devaluation of sterling occurred in November 1967, so the three-month return from the end of August to the end of November 1967 reflects the devaluation of sterling. Accordingly, the sample period excluding the devaluation ends in July 1967. The mark was revalued in October 1969, but it was floated on 28 September, so the last observation is in May 1969.

Table 11.9 Uncovered Interest Differentials: Bretton Woods Period through Smithsonian Agreement

	Eurodollar-Euroguilder		Eurodollar–Euro–Swiss franc	
	Bretton Woods Period, 1962(1)–1971(1)	Through Smithsonian, 1962(1)–1971(9)	Bretton Woods Period, 1963(1)–1971(1)	Through Smithsonian, 1963(1)–1971(9)
No. of obs.	109	117	97	105
Mean	.62	−.14	1.03	.22
SE of mean	.29	.60	.27	.66
t-statistic	2.15*	−.24	3.79*	.34

Sources: Same as table 11.7.

Note: The Smithsonian Agreement was signed in December 1971, so the last observation is the three-month return spanning the period September–December 1971.

guilder declines from 0.62% for the Bretton Woods period alone to −0.14% for the period including the Smithsonian Agreement. Similarly, the differential for the dollar relative to the Swiss franc declines from 1.03% to 0.22%. So, in both cases, the revaluations between May and December 1971 compensated investors for the lower interest rates paid on the guilder and the Swiss franc prior to the breakdown of Bretton Woods.

11.2.3 Interpretations of the Evidence on Uncovered Differentials

The evidence presented in tables 11.7–11.9 suggests that average uncovered interest differentials are close to zero over long sample periods under both fixed and flexible exchange rates. If average uncovered interest differentials are this small, then ex ante uncovered interest differentials must also be quite small on average since forecast errors should have an average value close to zero over these long sample periods. But, in that case, exchange risk premiums must also be small on average.

These results do not rule out the existence of *time-varying* risk premiums that are both positive and negative for shorter sample periods.[29] But, to be consistent with the evidence, these risk premiums would have to have a mean close to zero over the long sample periods studied here. Nor do the results rule out the possibility of systematic forecast errors that do not have a mean of zero over shorter sample periods. Forecast errors could be systematically positive or negative over shorter periods either because (as explained above) the market is learning about changes in regimes or because of expectations that there might be a regime switch in the future (the peso problem). But, over the longer sample periods studied here, risk premiums and forecast errors have little net effect on uncovered interest differentials.

The unconditional estimates of uncovered differentials in tables 11.7–11.9 provide a different perspective on risk premiums than *conditional* estimates based on time-series regressions. These regressions relate uncovered interest differentials to variables in the current information set such as in the following equation:

$$(5)\qquad (i_{\$t} + s_{£t} - i_{£t}) = \alpha + \beta Z_t + \varepsilon_{2t},$$

where Z_t is a variable or a set of variables known at period t.[30] If β is significantly different from zero, then there is said to be evidence of time-varying risk premiums (or, alternatively, evidence of forecast errors systematically related to current variables). To investigate this possibility, I estimated equations explaining the uncovered differentials for four Eurocurrencies (relative to the dollar) as a function of three variables in the current information set: the simple interest differential (e.g., $i_\$ - i_£$), the percentage change in the spot rate over the previous twelve months, and the inflation differential over the previous twelve months.[31] The results are reported in table 11.10 for two alternative post–Bretton Woods periods beginning in May 1971 and January 1973.

The first column of table 11.10 gives the mean of the fitted values from each regression. This conditional mean measures the *average* risk premium over the period (or, alternatively, the average forecast error.[32] The second column reports the F-statistics testing whether the explanatory variables in the regressions are jointly significant. Except in the case of the mark, regression

29. Fama (1984), for example, attributes much of the variance in forward market forecast errors to a time-varying risk premium.

30. Conditional estimates are provided in numerous studies, including Bilson (1981), Cumby and Obstfeld (1984), and Fama (1984). Hodrick (1987) surveys this literature.

31. Frankel and MacArthur (1988) use a similar set of variables in their study of interest differentials in the period 1982–86.

32. Each conditional mean, defined as $\alpha + \beta\bar{Z}_t$, where $\bar{Z}_t$ is the average value of Z_t, is equal to the corresponding unconditional mean of table 11.7 because of the properties of the least squares.

Table 11.10 Unconditional and Conditional Estimates of Uncovered Differentials: Eurodollar Rate Minus Other Eurocurrency Rates (in %/annum)

	Mean of Conditional Estimate	*F*-Stat. for Conditional Estimate	SE of (Uncondit.) Uncovered Interest Differential	SE of Residual from Conditional Estimate
1971(5)–1989(7):				
Eurosterling	−.07	4.20	12.05	11.08
Euromark	.01	1.92	12.51	12.02
Euroguilder	−.35	3.15	12.42	11.65
Euro–Swiss franc	−.07	4.21	14.20	13.06
1973(1)–1989(7):				
Eurosterling	.10	4.28	12.40	11.28
Euromark	.85	1.52	12.83	12.39
Euroguilder	.43	2.78	12.75	11.97
Euro–Swiss franc	.83	3.35	14.47	13.42

Sources: Same as table 11.7.

Note: The standard error of the residual is obtained from a regression of the uncovered interest differential on variables in the current information set (as described in the text). The *F*-statistic tests the restriction that all coefficients are equal to zero. The standard errors and *F*-statistics have been adjusted for overlapping observations.

coefficients in all the equations are statistically significant at the 5% level.[33] So there does seem to be a systematic element in the uncovered interest differentials, whether it is due to risk premiums or systematic forecast errors.

The last two columns of the table, however, suggest that most of the movement in the uncovered interest differential remains unexplained. The third column reports the unconditional standard errors of the uncovered interest differentials, while the fourth column reports the standard errors of the residuals from the estimated equations. These latter conditional standard errors are almost as large as the unconditional errors, thus indicating that *unsystematic* forecast errors rather than risk premiums or systematic errors account for most of the variability of the interest differentials.

To summarize this evidence, there does seem to be a systematic component to uncovered interest differentials that can be attributed to risk premiums or peso-type phenomena. But the mean of this systematic component is close to zero, and most of the variation in uncovered differentials remains unexplained. So there may be time-varying risk premiums (or systematic forecast errors) evident in the data, but they account for only a fraction of the total variation in the uncovered differentials, and their *average* effect on any interest differential is close to zero.

We can compare the estimates of the average exchange risk premiums of

33. These results are consistent with most previous evidence based on regression analysis (such as the studies cited above).

tables 11.7–11.10 with the country premiums for the three national markets reported earlier in tables 11.4–11.6. The uncovered interest differentials measured over the long sample periods in table 11.7 are substantially smaller than those due to capital controls in the national markets as reported in tables 11.4–11.6. Consider the case of Euromark interest rates. In table 11.5, the average differential between Euromark and German interest rates is −2.97% during the capital control period from April 1970 to January 1974. In table 11.7, the average uncovered differential between Eurodollar and Euromark interest rates is only −0.13% over the entire sample period and from 0.01% to 0.85% over shorter sample periods. The country premiums measured in tables 11.4–11.6, moreover, are average premiums, so they underestimate the effects of the capital controls during periods when the controls were most binding (such as 1969–70 in the United States).[34] At the very least, we can say that capital controls under fixed rates can lead to ex ante interest differentials at least as large as those due to exchange risk premiums under flexible rates.

Fixed exchange rates do not necessarily require capital controls to sustain them, at least if the national monetary authority is willing to refrain from pursuing a monetary policy independent of those abroad. So fixed exchange rates could bring the best of both regimes: free capital mobility combined with limited exchange rate volatility. But the Bretton Woods system itself degenerated into a system plagued with controls. And that system led to interest differentials that are large by any standard and, more specifically, larger than average differentials under flexible rates in the absence of controls.

11.3 Conclusion

This paper has examined evidence on interest differentials under fixed and flexible rates. The paper has shown that, in three major national markets, capital controls imposed during the Bretton Woods period led to large covered interest differentials that distorted investment and borrowing decisions. The three countries involved—Britain, Germany, and the United States—all relaxed controls under flexible rates, although Britain maintained its controls until as late as 1978. The paper compared these covered interest differentials with uncovered interest differentials in Eurocurrency markets that are free of capital controls. In both fixed and flexible periods, average uncovered interest differentials between the Eurodollar market and four other Eurocurrency markets studied are in many cases close to zero. So, if exchange risk premiums are present, they must be time varying with a mean close to zero over the long sample periods studied in the paper.

34. Exchange risk premiums may also vary through time, although, as explained above, it is difficult to measure these premiums over short intervals. In a short sample period, the average forecast error need not be close to zero, so the average uncovered interest differential as measured by ε_{1t} in eq. (4) may not reflect an exchange risk premium alone.

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Comment Paul Krugman

This is a classic Marston paper: seemingly simple statistical techniques are used with high intelligence on carefully assembled data, yielding a set of facts that change your view of the way the world works much more effectively than any fancy econometrics.

The most striking result of the paper is its demonstration that the Bretton Woods system bore very little resemblance to the golden age of financial markets that many people now think that they remember. Capital controls were pervasive, and they led to large, systematic interest differentials. As Marston shows, the long-term differences in interest rates under Bretton Woods–era capital controls were much larger than the long-term differences in uncovered yields under floating. This suggests that, much as we may complain about risk, peso problems, speculative inefficiency, etc. under floating rates, the net barrier posed by all these to the long-run ability of capital to flow to where its yield is highest is trivial. A little bit of government restriction in the 1960s did more to deter long-run arbitrage than all the exchange rate volatility the 1980s could muster.

I am impressed and convinced by this result. But what should we conclude from it? Marston does not offer any explicit welfare assessment. Implicitly, however, his paper seems to suggest the following syllogism: (i) Bretton Woods "degenerated into a system plagued by controls"; (ii) attempts to restore more or less fixed rates are likely to experience the same fate; (iii) this is a cost of fixed rates that helps tip the balance in favor of continued floating.

What I want to do is to be very unfair and disagree not with what Marston actually says—which is point i—but with what he does not say, points ii and iii.

First, it is by no means clear that future efforts at fixed rates will be marked by the growth of an underbrush of capital controls. The major European nations show no inclination to bolster the European Monetary System by imposing controls, and, while Portugal and Spain are at present trying to impose some limits on capital mobility, this is largely motivated by the peculiar Maastrict requirement that they get their inflation rates in line with Germany's, even while maintaining a fixed exchange rate, in the face of massive, entirely voluntary inward investment.

In fact, it is somewhat puzzling in retrospect why capital controls were so frequently imposed in the 1960s. After all, the major nations had the option of stabilizing their currencies by changing domestic interest rates, and, despite the substantial differentials that Marston documents, it seems unlikely that controls gave them much really usable independence of monetary policy.

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Why, then, were policymakers who on average were a good deal smarter than the ones we have today so quick to impose limits on the free flow of capital?

I would offer a hypothesis, one that leads into the discussion of point iii. The reason why governments were so quick to regulate capital flows in the Bretton Woods era was that their *domestic* capital markets were highly regulated. In an environment of controlled interest rates, dealing with capital flows was not as simple as adjusting the Fed funds rate: many key interest rates were fixed, and changing those that were flexible could create problems for financial institutions, for example, through disintermediation. So governments were often tempted to solve the dilemma through direct controls, which anyway did not seem particularly sacrilegious in an environment where a lot of financial instruments were controlled anyway.

Today, of course, financial markets have been substantially deregulated. Investors are free to pursue a variety of possibilities for arbitrage, and international financial movements are a natural part of that freedom.

The problem is that it is by no means clear that all this financial freedom is a good thing. While investment is deregulated, there is still a lot of distortion of incentives: deposit insurance explicit and implicit, taxes, etc. It is a good bet that much of the frenetic financial activity of our times is motivated by these distortions rather than by true economic opportunities and has low or even negative marginal product.

This is also true of international capital movements. Take, for example, the late-1980s surge in Japanese purchases of U.S. real estate and corporations. Was this a productive resource transfer made possible by the freeing up of global capital markets? Now that some of the dust has settled, it seems dubious. Instead, it looks like an international spillover of the Japanese domestic financial bubble, which was at a basic level a giant crisis of moral hazard, brought on by a half-deregulation comparable to our own past savings and loan crisis and future banking crisis.

So maybe the Bretton Woods era was a kind of golden age, but not the kind we now imagine. It was not a time of free markets flourishing in an environment of exchange stability. Instead, it was a time when financial markets worked acceptably precisely because regulation and controls were sufficient to limit the moral hazard that has driven so much lucrative but destructive financial action in our own time. The capital controls of the Bretton Woods era may not have made a great deal of sense—but then the free capital flows of our own time do not make much sense either.

Comment Allan H. Meltzer

Richard Marston has produced some interesting and informative results on the differences in domestic and foreign interest rates under fixed and fluctuating exchange rates. Since the organizers called this session "Post-1971 Experience in the Light of Bretton Woods," I will discuss the two main findings of his paper for this topic. First is the evidence he presents showing that there were relatively large distortions in country interest rates resulting from exchange controls during the fixed exchange rate period. Second is the issue he raises about the alleged costs of fluctuating rates.

Marston remarks that those who look back nostalgically on the Bretton Woods system ignore the costs of exchange controls. These critics of fluctuating rates argue that variability of exchange rates since 1971 or 1973 imposed risk premiums in exchange rates. They claim that risk premiums reduce foreign investment or inhibit foreign trade. Evidence of these effects on trade and investment is hard to produce. Marston shows that it is also difficult to produce solid evidence of the existence of variable risk premiums in the foreign exchange market, although many researchers have studied this market. I will return to this issue.

Marston notes that recent research on interest rate differentials has concentrated on Eurocurrency interest rates. The purpose is to study time-varying risk premiums under fluctuating exchange rates. Marston steps back to study costs arising from exchange controls in a fixed exchange rate system. To estimate these costs, he compares domestic and Eurocurrency rates on short-term securities that are as close to comparable as he can find.

Marston estimates that on average U.K. controls lowered domestic short-term rates by 1% a year for nearly twenty years. Controls in Germany, for a shorter period, raised domestic rates (reduced capital inflow) by 3% a year for three years. U.S. exchange controls lowered domestic interest rates by 1½% a year for seven years.

I find the evidence persuasive as to direction but not entirely as to magnitude. The interest rate differences fall substantially when controls are off. But they do not go to zero in the United States or in Germany. Marston's data show that on average an investor could make ¼% by borrowing in the Euromarket and lending in Germany. In the United States, an investor could gain ½% by going the other way—borrowing at home and lending in the Euromarket. The differences are consistently positive. Marston suggests that, in the United States, there are reserve requirements on domestic liabilities. I would add costs of deposit insurance. Both were present in the period with controls, so

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The author is indebted to Bennett McCallum for helpful discussions of research on uncovered interest parity.

there may be a small bias in the estimated cost of exchange controls. Moreover, reserve requirements and deposit insurance do not cost ½% a year.

For Germany, in the two periods without controls, 80% of the differences in rates are negative. Something systematic is missing for the United States and Germany, but apparently not for the United Kingdom. Are there differences in taxes, or differences in what is counted as reserves, or differences in capital requirements that can explain these spreads? I do not know, but the subject is worthy of more attention than the paper gives to it.[1]

One point worth noting before going to the second half of the paper is that British controls were supposed to keep capital from going abroad. Yet, when controls were removed in 1979, capital flowed in. The pound appreciated. I have been told that a significant part of the inflow came from the Euromarkets. Removing controls may have been a credible signal that the Thatcher government would not restore them. But can we reconcile the inflow and appreciation of 1979 with the evidence of significantly lower domestic rates in the United Kingdom as a result of controls? Was this just fortuitous timing, or did the United Kingdom raise domestic rates in advance of the decision?

The second half of the paper considers uncovered interest parity. Marston presents evidence for four countries showing that uncovered interest differences go to zero if the sample is long enough to include both fixed and flexible rate periods. On average, the risk premium is positive (but not significant) in all four countries during the flexible rate period, so it would have been interesting to check whether the data may be telling a somewhat different story than Marston or the typical study of uncovered differentials. The mean values of risk premiums for each of the four countries range from .10 to .85 with a mean value of ½% for the four countries as a group. This difference should be compared to the average uncovered interest premium under Bretton Woods, which Marston shows is a measure of anticipated changes in parities.

The reason for emphasizing this point is that, under fluctuating rates, uncovered differentials are often taken as measures of risk that are part of the excess burden of fluctuating rates. If the differences under fixed rates mainly reflect anticipated devaluations or revaluations, Marston asks, why is the same argument not applicable to fluctuating rates? Why do we not treat all or part of the unexplained deviation from uncovered interest parity as evidence of delayed adjustment of exchange rates? If this were done, the basis used for claiming an excess burden of fluctuating rates would be weaker.

Some relevant literature strengthens the argument. Karen Lewis showed that, when there was a change in monetary regime in the early 1980s, market participants were uncertain about the duration of the change.[2] They systemat-

1. At the conference, Peter Garber suggested differences in the liquidity of the instruments as another explanation.

2. Karen Lewis, "Changing Beliefs and Systematic Rational Forecast Errors with Evidence from Foreign Exchange," *American Economic Review* 79 (September 1989): 621–36.

ically underpredicted the exchange value of the dollar during the period of dollar appreciation. Lewis is able to explain about half the error as a result of rational, adaptive learning.

Earlier, William Krasker showed that tests for the efficiency of the foreign exchange market may not be valid if there is an unanticipated large change in the exchange rate.[3] Alex Cukierman and I, unaware of Krasker's paper, produced a similar result.[4] We showed that, when a large unanticipated permanent change occurs in a finite sample, tests for the rationality of expected exchange rate changes may incorrectly reject rationality.

All these cases are first cousins to the well-known peso problem. A large change occurs. Market participants learn over time how much of the change will persist. Since it takes more than one period to learn whether an unanticipated change is permanent, time must pass before market participants learn about the magnitude of change and its persistence. They make errors that, to the econometrician, look like serially correlated disturbances, or sluggish adjustment of forward exchange rates, or rejection of uncovered interest parity.

On this interpretation, departures from uncovered interest parity are not solely a measure of additional risk arising under fluctuating exchange rates. This interpretation would be consistent with the inability of research to find a systematic effect of fluctuating rates or risk on investment or trade.

Before drawing any strong conclusions about variability of fluctuating rates and excess burden, it should be recalled that fluctuating rates are not freely fluctuating. Consider this. At the end of 1972, G10 countries held about $70 billion in dollar reserves. By the end of the 1970s, their dollar reserves had doubled, and, by the end of the 1980s, they had doubled again to more than $300 billion. Some of these accumulations may have been sterilized; others probably were not. Did the market always guess correctly which was which? Or should some of these interventions be classified as unanticipated permanent changes?

Marston starts his paper by referring to the high degree of short-term volatility in exchange rates. I am not convinced that this widely repeated claim is correct. Look at the data on monthly multilateral real ex post exchange rates under fluctuating rates (fig. 11C.1). To the naked eye, there appear to be relatively modest fluctuations, a one-time sharp increase, and a rapid decline to about the level that prevailed from 1973 to 1977.

The sharp increase and decline is clearly associated with the Reagan program of first disinflation and higher risk-adjusted, after-tax real rates of return to capital followed by depreciation and increased taxes on capital in 1985 and

3. William Krasker, "The 'Peso Problem' in Testing for the Efficiency of Forward Exchange Markets," *Journal of Monetary Economics* 6 (April 1980): 269–76.

4. Alex Cukierman and Allan H. Meltzer, "What Do Tests of Market Efficiency Show?" (Carnegie Mellon University, typescript, 1982).

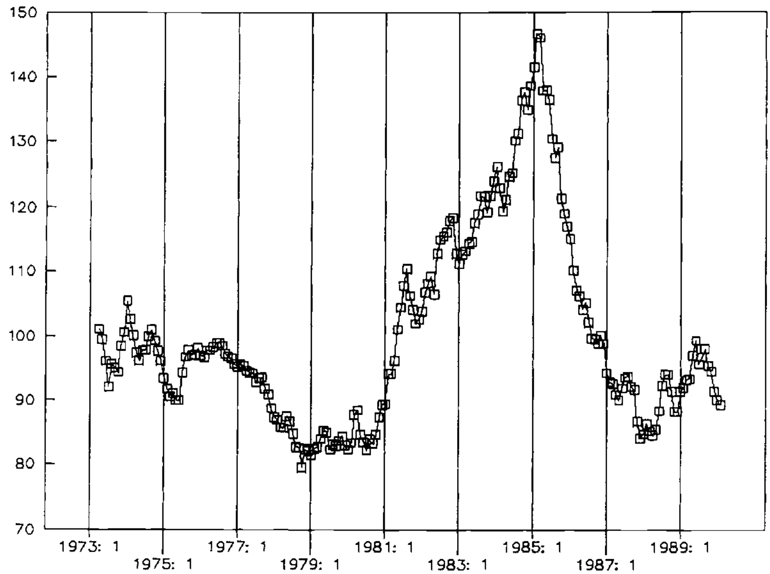

Fig. 11C.1 Real exchange rate, 1973:4–1990:2 (March 1973 = 100)

1986.[5] This looks like the kind of sudden permanent adjustment that might give rise to less than immediate learning and large forecast errors in forward rates.

I have not tested for such errors. However, I have computed the mean and variance of changes in real exchange rates for selected periods of fixed and fluctuating rates. These data differ from the data in Marston in relevant ways. The data in table 11C.1 here are computed from Federal Reserve multilateral real exchange rates. Also, I attempt to control for differences in policy by separating the changes arising from oil shocks and Reagan policies.

Clearly, variability under fluctuating rates is higher. Equally clear, however, is the dominating effect of the Reagan policies. Removing this period changes the picture considerably, but it remains true that periods of fluctuating exchanges have higher variance than the fixed exchange rate period. Even in the most stable period, the variance of changes in real exchange rates is seven times higher than under Bretton Woods. The mean depreciation of the real exchange rate is lower under fluctuating rates, however.

We do not know how much of the increased variability substitutes for variability elsewhere in the economy. Nor do we know whether there is excess burden under fluctuating rates. Marston's paper begins to study the welfare

5. There were also policy changes in other countries, including Britain, Germany, and Japan, in this period.

TABLE 11C.1 Means and Variances of Changes in Monthly Multilateral Real Exchange Rates (selected periods)

Fixed Rates			Fluctuating Rates		
Period	Means	Variance	Period	Means	Variance
1960:1–1971:8	−.12	.31	1973:3–1980:6	−.24	3.20
1960:1–1973:3	−.25	.71	1973:3–1975:4	−.51	5.75
			1975:5–1980:6	−.12	2.09
			1980:7–1987:11	.04	8.22
			1987:12–1990:2	.10	4.58
			1973:3–1990:2	−.07	5.60

issue by showing that there is much more to the comparison of the social costs or excess burden of fixed and fluctuating exchange rates than calculation of time-varying risk premiums. The paper presents some evidence that should broaden the discussion and cast doubt on some premature claims about excess burden and welfare loss.

General Discussion

There was considerable discussion of Marston's use of uncovered interest differentials. *Alan Stockman* took issue with the author's comparison of the average foreign exchange risk premium with the average risk premium on equity. Because equity is a residual claim, it is highly variable. This would tend to make the risk premium based on equity and Treasury bills positive. *Jeffrey Frankel* agreed with Marston that interest differentials can be used to compare different regimes. But he suggested also examining measures of expectations of depreciation such as a comparison of the Eurodollar interest rates with other Euromarket rates. Finding that the exchange risk premium is very small does not mean that it cannot have important effects. A small risk premium says something about whether domestic and foreign assets are imperfect substitutes and whether sterilized intervention has an effect. *Susan Collins* argued that looking at interest differentials over long periods may be misleading. The differentials may cancel out over decades even if large persistent differentials exist for substantial subperiods. She suggested looking at persistence over a number of years governed by different exchange rate regimes. Both Collins and *Charles Wyplosz* suggested that long-term interest rates would be a more appropriate measure because they drive the international allocation of capital.

Alexander Swoboda concurred that Bretton Woods was characterized by significant capital controls. Yet it was also a period in which international capital markets developed rapidly and capital mobility improved considerably. The key reason, he suggested, why capital markets are much more tightly integrated today than in the 1960s is not primarily because of the removal of capital controls but because of closer integration of national capital markets. *Ronald McKinnon* argued that, although capital controls were a way of insulating national monetary policies, the Eurocurrency markets developed as a way of circumventing the controls. He cited a study by Bayoumi that, following the Feldstein-Horioki approach, found that, while aggregate saving and investment were more closely balanced under Bretton Woods than under the classical gold standard, private saving and investment imbalances were similar in the two regimes.[1] The reason for the difference between aggregate and private behavior was that, under Bretton Woods, government used fiscal policy to offset imbalances in the private market. *Susan Collins* said that one lesson of the paper was that capital controls do not work very well—to make them effective, governments have to impose more and more of them. *Charles Wyplosz* viewed capital controls as useful both in maintaining fixed exchange rates and in allowing countries to negotiate occasional realignments. He regarded the substantial interest differential that emerged in 1971–73 as an indication of when capital controls were useful. They allowed conditions in different parts of the system to diverge as necessary. Controls were in large part abandoned in 1973 because the United States and Germany abandoned fixed exchange rates.

1. Tamim Bayoumi, "Saving-Investment Correlations: Immobile Capital, Government Policy or Endogenous Behavior?" *Internation Monetary Fund Staff Papers* 37 (1990): 360–87.