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Working Paper No. C92-005

Financial and Currency Integration in the European Monetary System: The Statistical Record

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December 1992

Department of Economics

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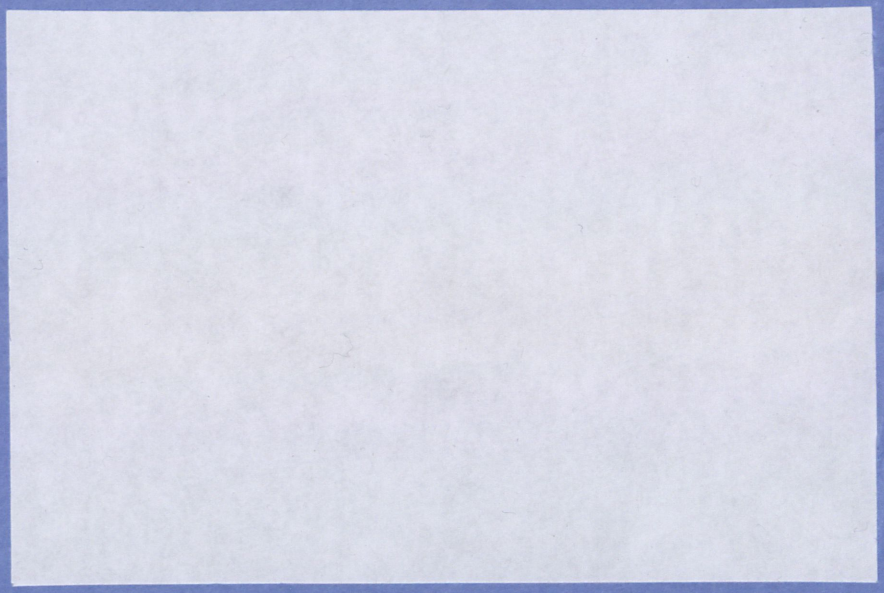

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Abstract

The paper documents econometrically the trend toward financial and monetary integration among the countries of the EMS. The first half of the paper examines return differentials among European countries. Short-term nominal interest differentials have fallen. What is the role of country factors (e.g., capital controls) versus currency factors (e.g., exchange risk premia)? To find out, we look directly at covered interest differentials, measured with the aid of forward rate data, and exchange risk premia, measured with the aid of survey data on exchange rate expectations. The second half of the paper examines the credibility of the EMS, essentially updating the results and condensing the presentation in "The European Monetary System: Credible at Last?" We find evidence that the danger of realignment perceived by investors was lower in 1990-91 than previously. The overall conclusion is that all components of the interest differential fell during the course of the 1980s.

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"Financial and Currency Integration
in the European Monetary System: The Statistical Record"

The Maastricht Agreement sets out convergence of interest rates as one of the key criteria for deciding whether an EC country can join the European Monetary Union when it is established in the late 1990s. Specifically, long-term interest rates should be within two percentage points of the average of the three members with the lowest rates. There is wisdom in such a test criterion. Politicians occasionally declare their support for regional integration without fully realizing the degree of loss of economic independence that is implied. If a country's interest rate is tied closely to that of its neighbors, it cannot independently use monetary policy to stimulate domestic demand. The criterion of interest rate convergence is a clear test of whether a country is in fact prepared to make the sacrifice of monetary sovereignty that joining EMU will require.

Interest rate convergence comprises two distinct kinds of integration. First, it implies the elimination of capital controls, and other barriers to the movement of capital across national boundaries, which we shall below call financial integration or "country integration." Second, it implies the elimination of investor perceptions that the exchange rate is likely to change in the future, which we shall below call "currency integration." The paper tests the recent statistical record on both kinds of integration.

Another of the criteria set out at Maastricht is exchange rate stability: the currency must not have devalued within the preceding two years, and must have remained within the normal $\pm$ 2.25 % margins of the exchange-rate mechanism. Of central concern to investors is the credibility of future exchange rate stability. Though related to historical exchange rate stability, credibility among investors is less immediately observable.

Table 1 reports the absolute magnitude of 3-month interest differentials (vis-a-vis Germany) for 13 European countries.[1] The sample of September 1982 to May 1990 is broken at January 1987, the date of the last major realignment. In every case, the mean absolute interest differential is statistically significant, even when conservative standard errors are used to allow for the likelihood of serial correlation.[2] Every country but two (Denmark and the United Kingdom), however, shows a smaller interest differential during the later period 1987-1990, than during the earlier period 1982-1986.[3] When we fit OLS regressions against a time trend, we confirm that most countries' interest differentials on average narrowed during the course of the EMS period. (Norway showed a widening trend during the period 1982-86, whereafter our data source gives out.) Seven of the time trends have the appearance of being statistically significant. In descending order of the estimated rate of narrowing, they are: Italy, Ireland, France, Spain, Belgium, Switzerland, and Sweden.[4]

Why have interest rates gradually narrowed? And why do

substantial gaps still remain? (Table 1 indicates that only in Austria, the Netherlands and Switzerland were interest differentials smaller than 100 basis points during the 1987-90 sub-period. Only one of these is an EC member.)

There are two distinct factors at play: financial or country integration, and currency integration. They correspond to the two categories of barriers that can create international interest differentials. Country barriers, defined as obstacles to the free movement of capital across national boundaries, include capital controls, different tax treatment of domestic and foreign income, information barriers, default risk, and risk of future capital controls. Currency barriers, defined as those factors that apply to the possibility of changes in the exchange rate in question regardless of the political jurisdiction in which assets are issued or held, include the exchange risk premium and expectations of depreciation.

The two kinds of barriers need not move together. It was argued in the early phase of the EMS that the success at stabilizing European exchange rates had been accomplished entirely by means of country barriers (e.g., Rogoff, 1985). France, for example, strengthened its capital controls in 1981. In other words, exchange rate stability can increase even while financial integration decreases.

The central aim of this paper is to separate out the effects of country barriers and currency barriers, and to see the extent to which country integration and currency integration have contributed

to the recent gradual narrowing of overall interest differentials. We begin by using forward rate data to decompose the total interest differential of Table 1 into a covered interest differential term, which measures country barriers, and other terms, which represent currency factors. We will then proceed to a detailed analysis of the currency factors.

2. How rapidly have country barriers, as measured by the covered interest differential, diminished?

The differential for interest rates of common maturities can be decomposed as follows:

$$(1) \qquad i - i^{GY} = (i - i^{GY} - fd) + (fd - \blacktriangle s^e) + \blacktriangle s^e$$

interest differential	covered interest differential	exchange risk premium	expected depreciation

Where:
GY superscript denotes the German variable
fd is the forward discount for a consistent maturity
$\blacktriangle s^e$ is the expected depreciation over a consistent horizon

This equation merely breaks the nominal interest differential into its constituent parts: a covered interest differential, which reflects the country premium, and the exchange risk premium plus expected rate of depreciation, which together constitute the currency premium.[5]

Covered interest parity has in many episodes proven a useful test of whether or not a country has become integrated into international financial markets. The positive covered interest differential that had existed for Germany in the early 1970s

disappeared when controls on capital inflow were removed in 1974.[6] The negative differential that had existed for the United Kingdom in the 1970s disappeared when Margaret Thatcher removed controls on capital outflow.[7] Negative differentials persisted for France and Italy into the 1980s, reflecting binding capital controls.[8]

Frankel (1989, 1991) reported statistics for absolute covered interest differentials vis-a-vis London eurodollars, for the period September 1982 to April 1988.[9] All countries showed an average trend of narrowing differentials, except for three that already had small differentials at the beginning of the period (Austria, Belgium, and the United Kingdom). Eight had downward trends that appeared to be statistically significant. In descending order they were: Portugal, Spain, France, Denmark, Italy, Germany, Switzerland, and Netherlands.[10]

Table 2 estimates time trends in the magnitude of covered interest differentials for European countries *vis-a-vis German interest rates*. All show a downward trend except two (Belgium and Ireland). Five countries' trends appear statistically significant even if conservative standard errors are used. (In many cases there is little enough evidence of serial correlation that conventional standard errors could as well be used.) In order of estimated speed of integration, they are: Portugal, France, Spain, Denmark, and the Netherlands.

Evidently the country component of European interest differentials has generally diminished, indicating enhanced financial integration. We now turn to the currency component.

3. Has the exchange risk premium diminished?

The risk premium, defined as $(fd - \blacktriangle s^e)$, is the second of the three components of the interest differential in equation (1). It is the difference in the expected rate of return on otherwise-identical assets denominated in different currencies. Such a difference in expected returns would in theory be compensation to risk-averse investors for holding assets in currencies that they view as risky. Much has been written both for and against the existence of a large and variable risk premium.[11]

We cannot directly observe s^e, but we can observe the average response from a survey of market participants ($\blacktriangle \hat{s}^e$). Survey data that include the minor European currencies are collected by Currency Forecasters' Digest. The data consist of "combined consensus" values (harmonic means) from surveys of approximately 45 exchange rate forecasters from major banks, multinationals and forecasting firms.[12]

These survey data were first used in Chinn and Frankel (1991), to test for the presence of a time-varying risk premium of the sort studied in many tests of bias in the forward market. That paper studied 17 countries' exchange rates vis-a-vis the dollar. We regressed expected depreciation, as measured by the survey data, against the forward discount, to see if it was possible to reject the hypothesis of a unit coefficient. When the countries were tested individually, only a few showed statistically significant evidence of a time-varying risk premium. There included two out of the nine EMS currencies tested (Ireland and Belgium). Two more out

of four non-EMS European currencies tested showed evidence of such a time-varying risk premium (Norway and Austria). When all 17 currencies were pooled, there was significant evidence of a time-varying risk premium at the three-month horizon overall.

We now test for the existence of a time trend in the risk premiums of European currencies. We measure the absolute risk premium against the DM, as:

$$(2) \qquad ARP = \left| fd^{(loc/DM)} - \Delta\hat{s}^{e\,(loc/DM)} \right|$$

The results are reported in Table 3 for the 1988:02-91:12 period. Unfortunately, we do not have expectations data going as far back as the covered interest differentials analyzed in the preceding section.[13]

It appears that over this recent four-year period, the risk premium fell for the Danish Krone, French Franc, Irish Punt, Norwegian Krone, Swedish Krone, and the Pound Sterling at statistically significant rates for at least one of the forecast horizons (either 3 or 12 month). Two countries experienced statistically significant declines in the risk premium at <u>both</u> forecast horizons, the Norwegian Krone and the Pound Sterling. On the other hand, the risk premium showed no clear trend for the Belgian Franc, the Italian Lira, or the Dutch Guilder.[14]

It is interesting to note that the most pronounced decline in the risk premium is among countries that entered the EMS during the sample period, either officially (Spain and the United Kingdom) or

de facto and unilaterally (Norway and Sweden). It is further interesting to note that the risk premium appeared to increase for the one European currency in the sample unrelated to the EMS, the Swiss Franc. This correlation with exchange rate regime bolsters a bit one's confidence that the movements in the measured risk premium are genuine.

4. The EMS target zone

The European Monetary System has been in operation since 1979. Realignments were recurrent during the first eight years, eleven altogether. The history is illustrated in Figure 1, which presents plots of central rates around the DM, in normalized log form so that they can be read as percentage deviations. Only the Dutch guilder was able to maintain a nearly fixed rate against the DM, undergoing just two small devaluations.

A period of exchange rate stability dates from January 1987, the month of the twelfth (and possibly final) realignment. Giavazzi and Spaventa (1990) argue that 1987 marked the beginning of a "New EMS." A series of policy steps and institutional reforms was taken during the subsequent five years with the aim of enhancing exchange rate stability. [An appendix B to this paper presents a chronology.] But one cannot tell whether there might not be a future realignment. More relevantly to the determination of interest differentials, one cannot tell whether investors think that there might be a future realignment. In the remainder of the paper we test the recent credibility of the EMS with participants

in the foreign exchange market.

Recent research on the EMS takes off from the theory of the target zone introduced by Krugman (1991). He examined the case where the commitment of the authorities to intervene to defend the target zone was completely credible, showing the effect of investor awareness that the foreign exchange market would become a one-way bet as the exchange rate neared the target zone boundary. Empirical studies, such as Flood, Rose and Mathieson (1990), show that the European data of the 1980s do not fit the standard target zone model. The simplest test of target zone credibility is that proposed by Svensson (1991a): expected future exchange rates were found to lie nearly always outside contemporaneous EMS target zones for the period 1979 through early 1990. This result suggested that the market during this period usually perceived a strong probability of realignment. Expectations were inferred from interest rates using the assumption of uncovered interest parity (requiring that there exist no risk premium).

Our goal here is to update the tests of exchange rate expectations, to see in particular if the credibility of the EMS has been enhanced over the period 1988-1991. Our main methodological innovation is the use of the Currency Forecasters' Digest survey data, supplementing interest differentials as a measure of market expectations.[15] The potentially important advantage of using survey data is immunity to errors introduced by exchange risk premiums. If the existence of a large exchange risk premium meant that the apparent finding of expected rates outside

the band were spurious, this would still be piece of evidence that investors had little faith in exchange rate stability: after all, they would not demand a risk premium if they were confident that the exchange rate would not change. Nevertheless, we wish to distinguish empirically between the exchange risk premium, considered in the preceding section of this paper, and expectations of exchange rate changes.

As noted above, it is a controversial question whether the exchange risk premium is large enough and variable enough to render the forward discount or interest differential deficient measures of the expected future spot rate. Recent tests using the survey data for a number of minor currencies, such as the tests of the European currencies reported in the preceding section, turn up more evidence of a time-varying risk premium than did earlier studies of the major currencies.

In addition to the question of EMS credibility per se, we are also interested in the question whether the empirical failure of the standard target zone model noted above might reflect simply an erroneous assumption of uncovered interest parity. The alternative explanation of the empirical results, advanced by Bertola and Svensson (1990), is based on time-varying credibility. Our analysis suggests particularly good reason to believe that EMS credibility changed over this period. We use the Bertola-Svensson framework to estimate an expected realignment term, and observe how it changes over time.

We begin by reviewing the standard evidence on EMS credibility

based on interest differentials. If there is no risk premium and uncovered interest parity holds, we can use interest rates and contemporaneous spot rates to construct expected future exchange rates and see whether they lie within the bands.[16] Figure 2 plots expected future exchange rates at the one-year horizon, as deviations from then-current central rates. Vertical lines indicate dates of realignment against the DM, while the horizontal lines indicate the target zone boundaries. The period is March 1979 through the January 1987 realignment.

Figure 2 provides striking evidence on the historical credibility of the EMS. Only the Dutch guilder is nearly always expected to remain inside its contemporaneous band. The other five currencies are nearly always expected to violate the limits against the DM. The evidence supports the view that the EMS had low credibility during its first eight years. The many devaluations during this period apparently did not come as a surprise.

5. Have expected future exchange rates fallen inside the bands since 1988?

We now proceed to the period February 1988 to December 1991. We add to the original set of six currencies two recent joiners, the Spanish peseta and British pound. Figure 3 presents actual spot rates of the DM price of each currency, in normalized log form. While the Dutch guilder has remained close to its central rate,[17] the other currencies have shown more variability, and several have come close to their lower DM limits. The strength of

the Spanish peseta within its DM target zone in 1990-91 is atypical.

To assess the credibility of the current EMS target zones, we first in Figure 4 update the interest rate test, presenting the 12-month expectations that would be implied by uncovered interest parity. It may be compared to Figure 2 for the earlier period. All eight currencies show smaller expected deviations from current central rates than pre-1987. Table 4 compares sample means from the two periods; t-statistics indicate a statistically significant increase in credibility for all five currencies tested.

We note an upward trend in the 12-month expectations within the 1988-1991 period. During the second half of the sample, most values were within the target zones, a remarkable finding by earlier EMS standards. However, these results are only valid under the assumption of uncovered interest parity. We therefore turn to our alternative measure of expectations, the survey data.

Figure 5 presents plots of the forecasts at the one-month horizon for the period February 1988 to December 1991.[18] They typically lie within the official limits. Figure 6 shows the forecasts at a 3-month horizon; they too come to lie within the bands by the second quarter of 1988. At both horizons, forecasts (with the exception of the guilder) have often been close to the lower limits of the band, a possible symptom of imperfect credibility.

A more stringent test comes with consideration of longer horizons. Figure 7 shows 12-month expectations, which were often

outside the target zone: prior to 1990, the forecasts for the currencies of France, Denmark, Belgium, and Italy were typically 1 to 3 percentage points below their lower DM limits. In January 1990, however, forecasts for these four currencies began to strengthen, crossing inside the band limits by the second quarter of that year. In 1991, the 12-month forecasts were typically inside the target zone.

Notice that the suvey-based forecasts of Figure 7 are similar to the interest-rate-based forecasts of figure 4 for the same period and horizon. The exception is the Irish pound, where the CFD data show greater credibility: since mid-1988, most of its 12-month forecasts are inside the DM target zone.

Figure 8 presents (quarterly) forecasts at a horizon of five years. Although most have been several percentage points below the lower limits, some show an upward trend. Several draw near to the zone during 1990-91, or cross into it (most clearly the Belgian franc). With credibility apparently greater than before, today's EMS might seem more likely to conform to the basic target zone model developed by Krugman and others. We now re-examine this question using the recent data.

6. Reassessing the performance of target zone models

The standard target zone model is built on an equation that determines the exchange rate as a function of economic fundamentals, such as the money supply and real income, and rationally expected depreciation. The fundamentals are assumed to

evolve exogenously, in accordance with a continuous-time stochastic process (analogous to a random walk), except that discrete changes in the money supply occur when the authorities intervene to defend the band. The solution for the exchange rate has the important property that, near the bands, speculation will help stabilize the exchange rate, lessening the need for actual intervention. This phenomenon has been called the "honeymoon effect." The model is predicated on the assumption that the commitment to defend the band is entirely credible.

The first rigorous empirical evaluation of the target zone model is the study of the EMS through May 1990 by Flood, Rose and Mathieson (1990). It finds negligible evidence in favor of the specification. Phillips (1990) finds similar results for the "Mini-Snake" of the 1970s.

These tests require a number of auxiliary assumptions in addition to the basic assumption of target zone credibility: the absence of a risk premium, flexibility of goods prices, and a reliable estimate of the money demand elasticity with respect to the interest rate. We focus here on a key prediction of the theory that does not depend on these assumptions: a negative relationship between the level of the exchange rate (within the band) and its expected rate of change. This relationship is the basis for the stabilizing honeymoon effect.

Table 5 presents correlations between the exchange rate and its own expected rate of change, using both measures of expectations. For the entire four-year period, there are more

positive coefficients than negative, and none of the latter is statistically significant. Indeed, the Belgian franc is significantly positive. We also report results for the second half of the period. Signs are negative during 1990-91 for Denmark, Netherlands, Italy and France (and significantly so for the interest rate test on the last). These results suggest that credibility increased between the first half of the sample and the second.

7. Estimation of the realignment term

The Krugman model was not designed to deal with time-varying credibility, but the Bertola-Svensson (1990) version was. Bertola and Svensson allow for a probability of realignment. The model can thus explain why investors who observe the exchange rate move close to the boundary might expect a further movement in the same direction rather than a reversal. Rose and Svensson (1991) were the first to implement the Bertola-Svensson model (on the franc/DM rate for the period March 1979 to May 1990). Svensson (1991c) extends the procedure to five other EMS currencies. Weber (1992) pursues the implications of time-varying realignment fears for the relationship between the level of the exchange rate and its expected rate of change. All of these studies measure expectations by interest differentials.

In this section we use the Bertola-Svensson framework to estimate a term showing investor perception of the importance of possible realignments. This measure is based on the overall

expected rate of change of the exchange rate, but differs in that expectations of mean-reversion within the target zone have been filtered out, leaving a more pure measure of realignment perceptions.

The expected change in the exchange rate is a weighted average of (1) the expected magnitude of the realignment conditional on one taking place, and (2) the expected reversion to the centre of the band conditional on there being no realignment. How can we measure expected reversion conditional on no realignment? Since no realignments in fact took place during the period January 1987 to December 1991, we estimate the ex post relationship between the level of the exchange rate and its next-period change during this period, and invoke rational expectations to argue that this was the process perceived by investors.

Table 6 presents results for OLS regressions of the change in the exchange rate against its past level for horizons of 1, 3, 6 and 12 months.[19] The estimates of the autoregressive coefficient β_1 are satisfactory in a number of respects. As would be expected, the absolute magnitude of the coefficient is larger the longer is the horizon considered (with the single exception of the 12-month Irish forecast). The simple linear form appears to be adequate. We test for quadratic and cubic terms β_2 and β_3 in Table 7, and find relatively little evidence to support such non-linearity.

Section VI of Frankel and Phillips (1991) shows how one can subtract this measure of expected reversion conditional on no realignment from overall expected depreciation, to derive a measure

q of the perceived importance of possible future realignment. The realignment term q reflects both the perceived probability of realignment and its expected magnitude. We focus on the 12-month horizon, the longest for which CFD data are available on a monthly basis. We believe this will give the most accurate result.

Figure 9 presents results from applying this procedure to the survey measure of expected depreciation for the period 1988-1991, "filtering out" reversion within the band to arrive at the estimated realignment term q. The estimates tend to be close to zero for the guilder, suggesting a low probability of realignment (or a very small expected magnitude of realignment). For the other currencies, the q estimates are usually negative, indicating some perception of possible devaluation of the central rate against the DM. But there is quite a bit of fluctuation, and the perceived importance of realignments is substantially diminished for all examined currencies during the 1990-91 period.

Figure 10 is analogous to Figure 9, but interest differentials are used to measure expectations instead of survey data. We are thus able to estimate q beginning just after the last EMS realignment in January 1987. Again, we note an improvement in credibility after early 1990.

Table 8 reports summary statistics for the expected rates of mean-reversion. Mean absolute values during the 1987-91 period for those currencies using $\pm$ 2.25 % bands range from 0.2 to 0.9 % per year. Compared to historic levels of EMS interest differentials, such values seem relatively small. [Refer back to section 1.] The

TABLE 1
Average Absolute Interest Differentials

Country	82:09-86:12	87:01-90:05
Austria	0.730	0.410
	(0.204)	(0.150)
Belgium	4.528	2.405
	(0.492)	(0.357)
Denmark	1.059	1.797
	(0.390)	(0.423)
France	5.087	3.200
	(0.588)	(0.501)
Ireland	7.516	4.586
	(0.687)	(1.221)
Italy	10.144	6.280
	(0.804)	(0.606)
Nether-lands	0.673	0.663
	(0.186)	(0.219)
Norway	6.962	not avail.
	(0.348)	
Port.[1/]	14.912	10.884
	(1.581)	(1.179)
Sweden	6.512	5.619
	(0.657)	(0.405)
Spain	9.302	8.751
	(1.395)	(1.170)
Switzer-land	1.069	0.643
	(0.414)	(0.261)
UK	5.229	6.341
	(0.666)	(0.420)

Notes: Standard errors in parentheses, and assume N/3 independent observations.
1/ Regression includes a dummy for data revision.

TABLE 2
Time Trends in Absolute Covered Interest Differentials
1982:09-90:12

Country	Const.	Trend	$\overline{R}^2$	DW	n	Sample
Austria	0.297	-0.010	-.01	1.82	78	1982:09-89:04
	(0.217)	(0.032)				
Belgium	0.163	0.011	.00	2.02	90	1982:09-90:02
	(0.123)	(0.016)				
Denmark	4.859**	-0.330*	.17	0.31	82	1982:09-89:08
	(0.918)	(0.134)				
France	3.300**	-0.869**	.27	0.79	100	1982:09-90:12
	(1.186)	(0.143)				
Ireland	-0.636	0.248	.01	0.85	83	1982:09-89:09
	(2.157)	(0.306)				
Italy	1.680	-0.142	.04	1.43	100	1982:09-90:12
	(0.947)	(0.114)				
Nether-lands	0.236**	-0.039**	.21	1.78	100	1982:09-90:12
	(0.063)	(0.008)				
Norway	1.252*	-0.164	.06	0.47	50	1982:09-86:10
	(0.576)	(0.140)				
Port.[1/]	16.378**	-3.290**	.37	0.33	98	1982:09-90:12
	(4.823)	(0.879)				
Sweden	0.381	-0.012	-.01	1.68	84	1982:09-89:09
	(0.202)	(0.029)				
Spain	3.821**	-0.448*	.14	1.24	100	1982:09-90:12
	(1.523)	(0.184)				
Switzer-land	0.218*	-0.011	.01	1.97	85	1982:09-89:09
	(0.098)	(0.014)				
UK	0.135	-0.018	.06	1.20	100	1982:09-90:12
	(0.099)	(0.012)				

Notes: Trend coefficients are annualized. Standard errors in parentheses, and assume N/3 independent observations. *(**) indicates significance at 5%(1%) level.

[1/] Regression includes a dummy variable for data revision. See data description.

TABLE 3
Time Trends in Absolute Risk Premium
1988:02-91:12

COUNTRY	k	Constant	Trend	$\bar{R}^2$	DW	n	Assumed MA
Belgium	3	2.480** (1.010)	0.259 (0.440)	-.02	1.686	45	
	12	0.960** (0.158)	-0.062 (0.070)	-.00	1.629	45	
Denmark	3	2.145** (0.429)	-0.180 (0.187)	-.00	1.768	47	
	12	1.643** ((0.249)	-0.318** (0.108)	.14	1.531	47	
France	3	3.283** (1.864)	-0.284 (0.781)	-.01	0.927	47	MA(1)
	12	1.041** (0.080)	-0.139** (0.021)	.01	2.254	47	MA(6)
Ireland	3	3.543** (0.602)	-0.460* (0.222)	.09	1.265	47	MA(1)
	12	2.377** (0.411)	-0.326 (0.179)	.04	1.994	47	
Italy	3	4.131** (1.578)	-0.727 (0.618)	.06	1.424	47	MA(1)
	12	1.776** (0.339)	-0.010 (0.148)	-.01	1.659	47	
Nether-lands	3	0.985** (0.335)	0.138 (0.155)	-.00	1.774	47	
	12	0.635** (0.196)	-0.032 (0.085)	-.02	1.602	47	
Norway	3	6.087** (0.817)	-0.883** (0.335)	.10	1.862	47	
	12	6.940** (0.587)	-1.656** (0.256)	.47	1.920	47	

COUNTRY	k	Constant	Trend	$\bar{R}^2$	DW	n	Assumed MA
Sweden	3	6.456**	-1.136	.17	1.276	47	MA(3)
		(1.794)	(0.619)				
	12	6.911**	-1.374**	.23	1.824	47	
		(0.816)	(0.136)				
Spain	3	8.549**	-0.883**	.10	2.032	47	
		(0.835)	(0.036)				
	12	7.470**	-0.898*	.20	1.317	47	MA(3)
		(1.026)	(0.434)				
Switz.	3	0.843	0.593	.07	1.809	47	MA(1)
		(0.564)	(0.377)				
	12	0.591**	0.476**	.22	1.598	47	MA(7)
		(0.279)	(0.136)				
UK	3	6.985**	-1.363**	.19	2.126	47	
		(0.905)	(0.396)				
	12	5.433**	-1.248**	.43	1.401	47	MA(4)
		(0.724)	(0.242)				

Notes: Trend coefficients are annualized.
Standard errors are in parentheses. "Assumed MA" indicates order of moving average process assumed in calculating Hansen-Hodrick robust standard errors.

* (**) indicates significance at 5% (1%) level.

Table 4. Mean 12-Month Expectations (from interest rates) as Deviations from DM Central Rates

currency	Mar. 1979-Dec. 1986	Feb. 1988-Dec. 1991	difference of means	t-test of inequality
France	-5.57%	-2.87%	+2.70	+5.98
Belgium	-4.95	-1.94	+3.01	+11.60
Denmark	-5.17	-3.14	+2.03	+6.27
Netherlands	-0.531	-0.162	+0.369	+2.24
Italy	-8.40	-7.42 -2.13**	+0.98 +6.27	+1.49 +14.46
Ireland	-6.50*	NA	NA	NA

Percentages approximated as log deviations times 100.

* Irish interest rate data available for 1982-1986 only.

** The central rate of the lira shifted with the narrowing of the target zone in January 1990. February 1988 - December 1989 mean was -7.42%; January 1990 - December 1991 mean was -2.13%.

Table 5. Correlation Coefficients: Spot Position in Band and Expected Change over 12-month Horizon

	February 1988 - Dec. 1991		January 1990 - Dec. 1991	
	survey data	interest differential	survey data	interest differential
Belgium	+.716	+.823	+.476	+.760
	(.000)	(.000)	(.025)	(.000)
Denmark	+.106	-.196	-.014	-.392
	(.493)	(.186)	(.954)	(.058)
France	+.067	+.006	-.308	-.519
	(.665)	(.965)	(.163)	(.009)
Ireland	+.105	NA	+.077	NA
	(.498)		(.732)	
Netherlands	-.232	-.262	-.346	-.316
	(.129)	(.075)	(.115)	(.133)
Italy	-.059*	+.491*	-.414	-.360
	(.794)	(.017)	(.056)	(.084)

Marginal significance levels in parentheses.
* Through December 1989 only.

Table 6. Expected Mean Reversion Within the Band: Estimates of β_1

currency of		k=1 mo. (59 obs)	k=3mo. (57 obs)	k=6mo. (54 obs)	k=12 mo. (48 obs)
Belgium	β_1	-.0653	-.167	-.356	-.629
	std. err.	(.0555)	(.112)	(.207)	(.238)
Denmark	β_1	-.123	-.393	-.853	-1.06
	std. err.	(.0631)	(.186)	(.173)	(.219)
France	β_1	-.140	-.424	-.769	-0.977
	std. err.	(.0723)	(.174)	(.200)	(.033)
Ireland	β_1	-.427	-.931	-1.31	-0.768
	std. err.	(.114)	(.131)	(.805)	(.125)
Nether-lands	β_1	-.382	-.746	-1.11	-1.17
	std. err.	(.138)	(.205)	(.111)	(.204)
Italy	β_1	-.154	-.523	-.727	-1.37
	std. err.	(.0775)	(.146)	(.187)	(.122)

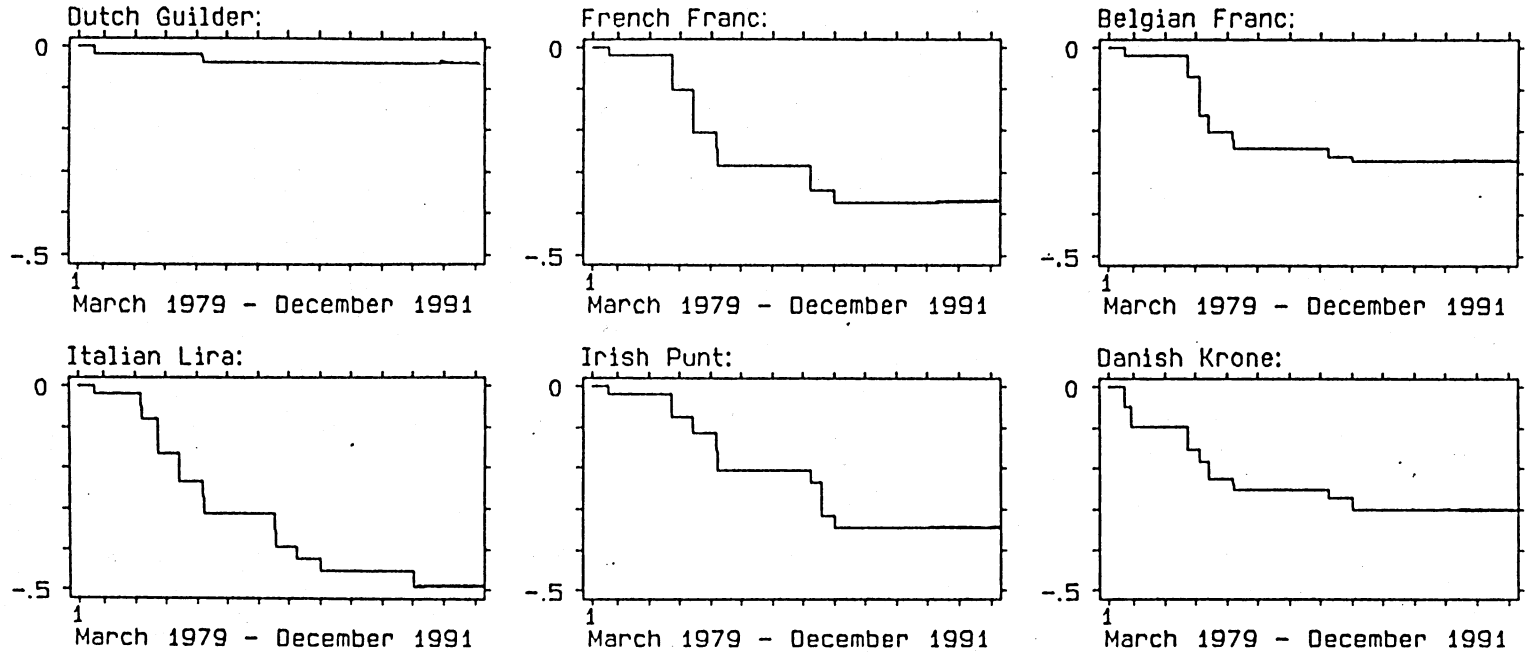
Based on monthly observations, January 1987 through December 1991 (through December 1989 for Italy). Standard errors based on Newey-West covariance estimators.

Table 7. Test of $B_2=B_3=0$: Marginal Significance

currency	k=1 mo.	k=3 mo.	k=6 mo.	k=12 mo.
Belgium	.000**	.000**	.000**	.091
Denmark	.432	.498	.478	.000**
France	.413	.067	NA	.298
Ireland	.447	.182	.435	NA
Netherlands	.000**	.001**	.319	.575
Italy	.954	.919	NA	NA

Chi-square(2) test of $B_2=B_3=0$, based on Newey-West covariance estimators.
** denotes significance at the 5% level; NA denotes computational problems.

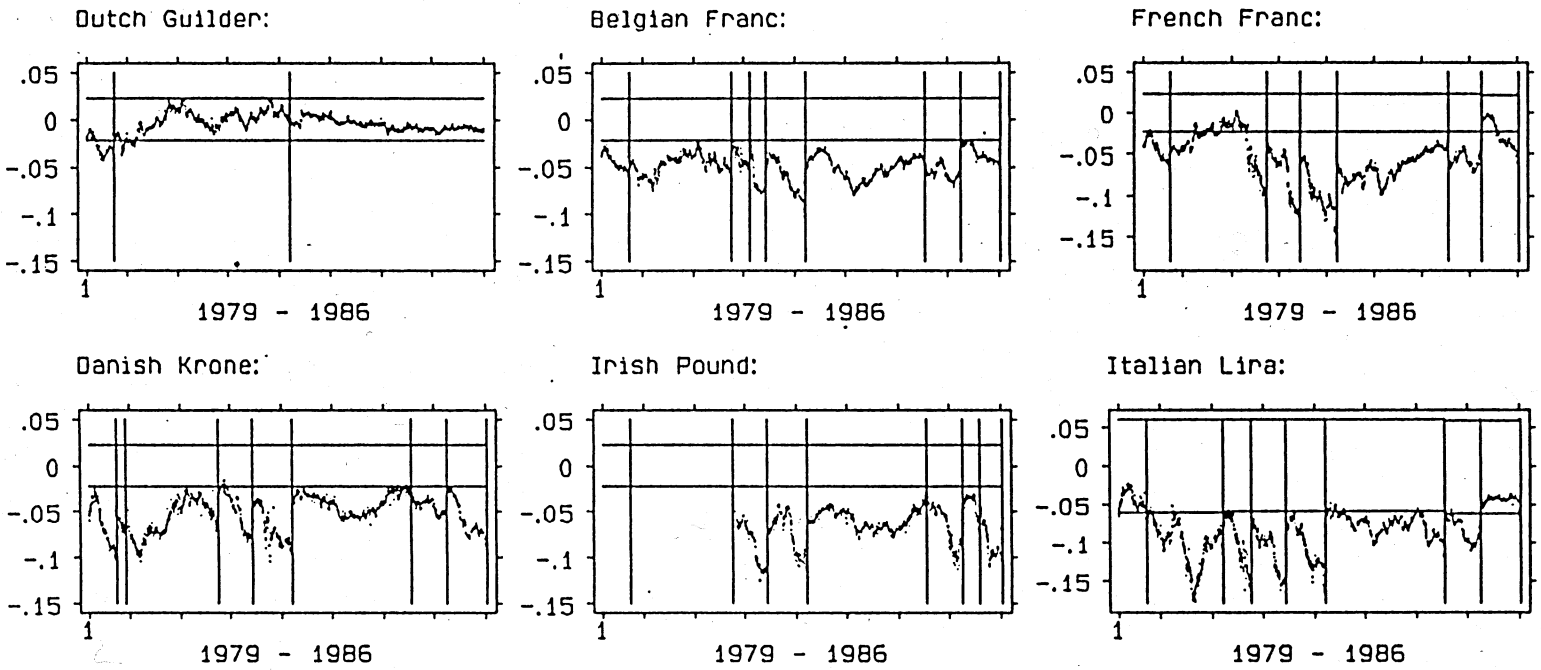
Figure 1



March 1979 - December 1991

EMS Currencies: log of DM Central Rates

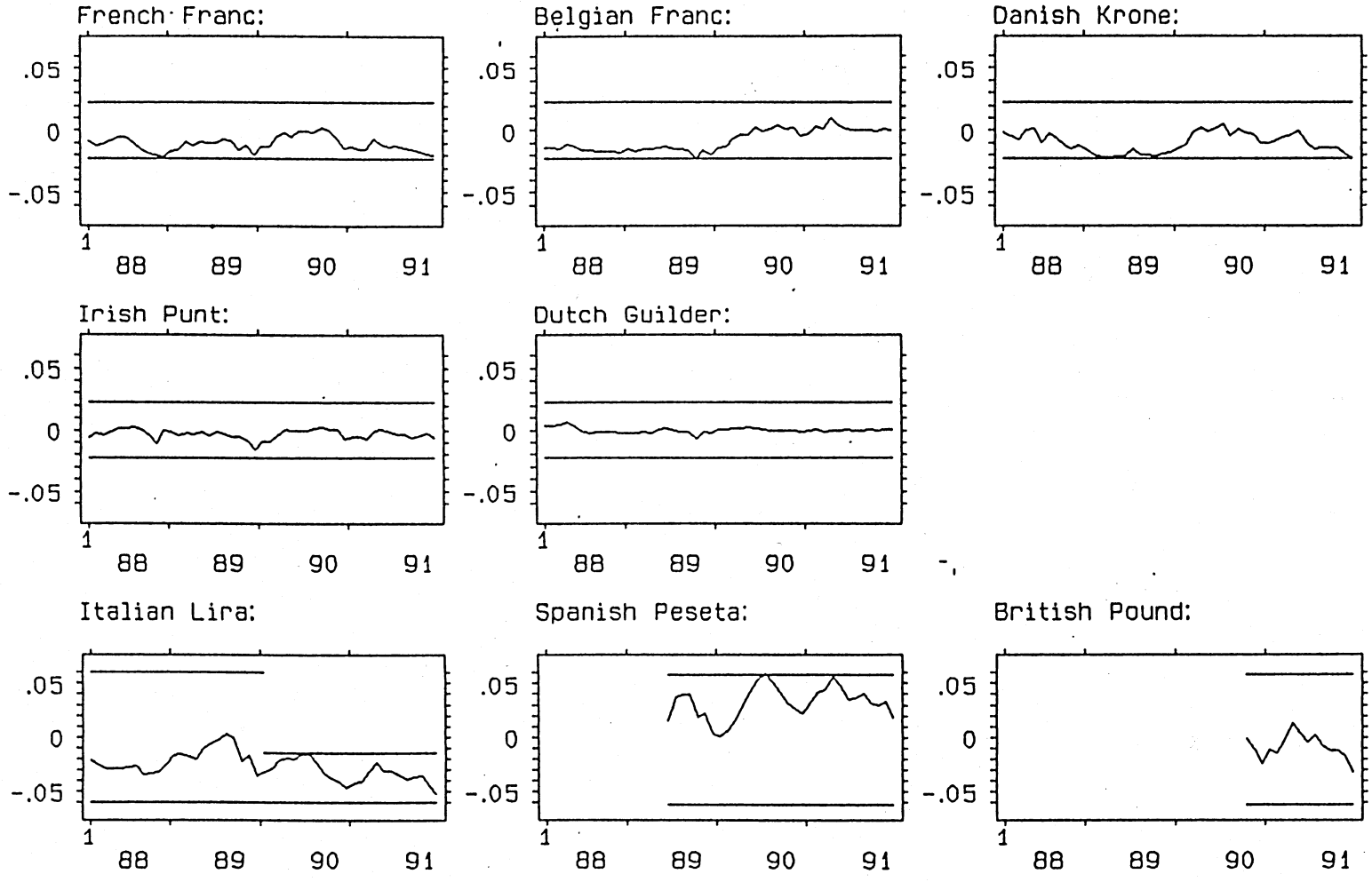
Figure 2



March 1979 - Jan. 1987, as deviations from current DM Central Rate

1-Year Expectations, based on interest differentials

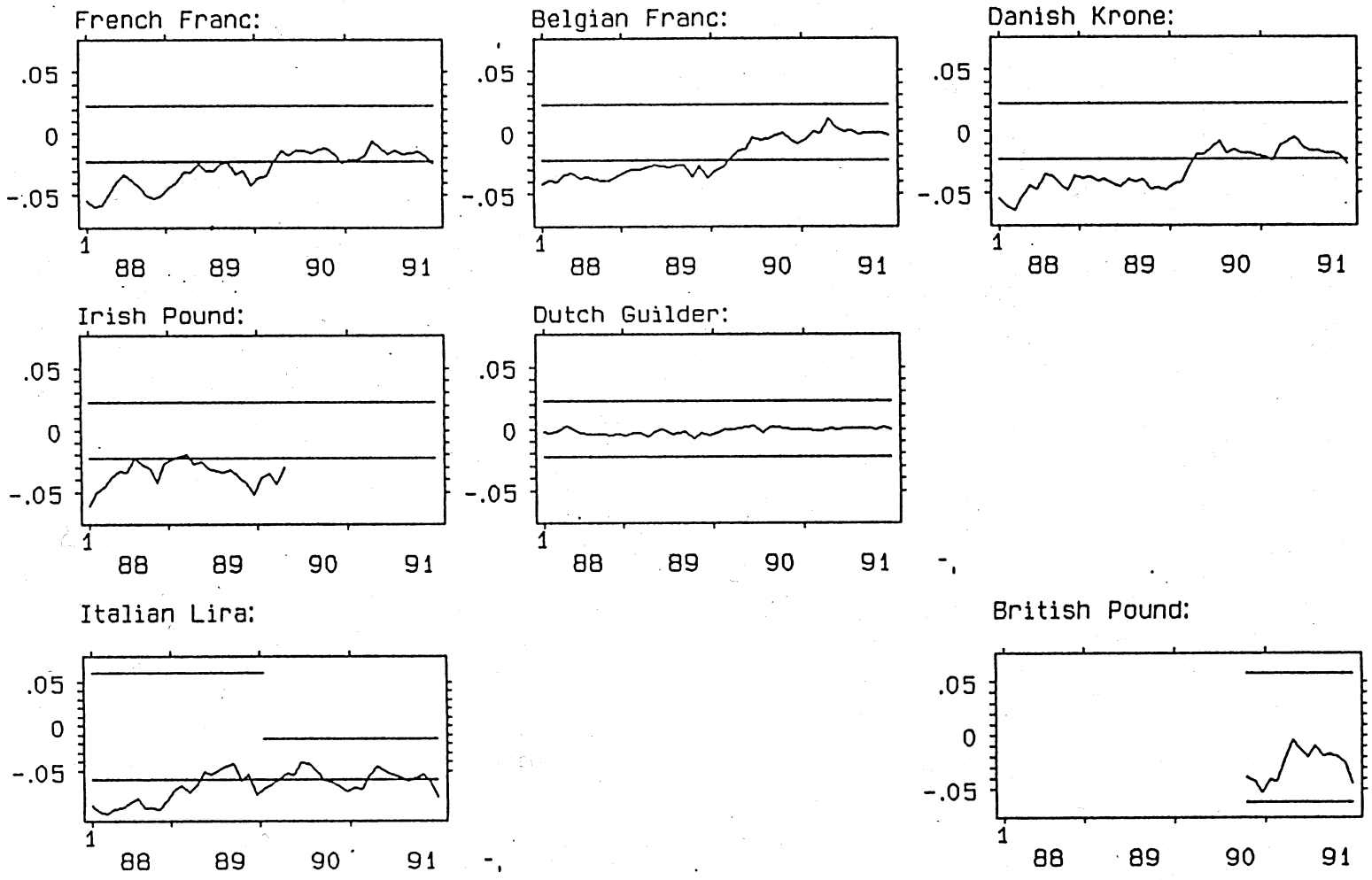
Figure 3



as log deviation from DM central rate

EMS Spot Exchange Rates, Feb. 1988 - Dec. 1991

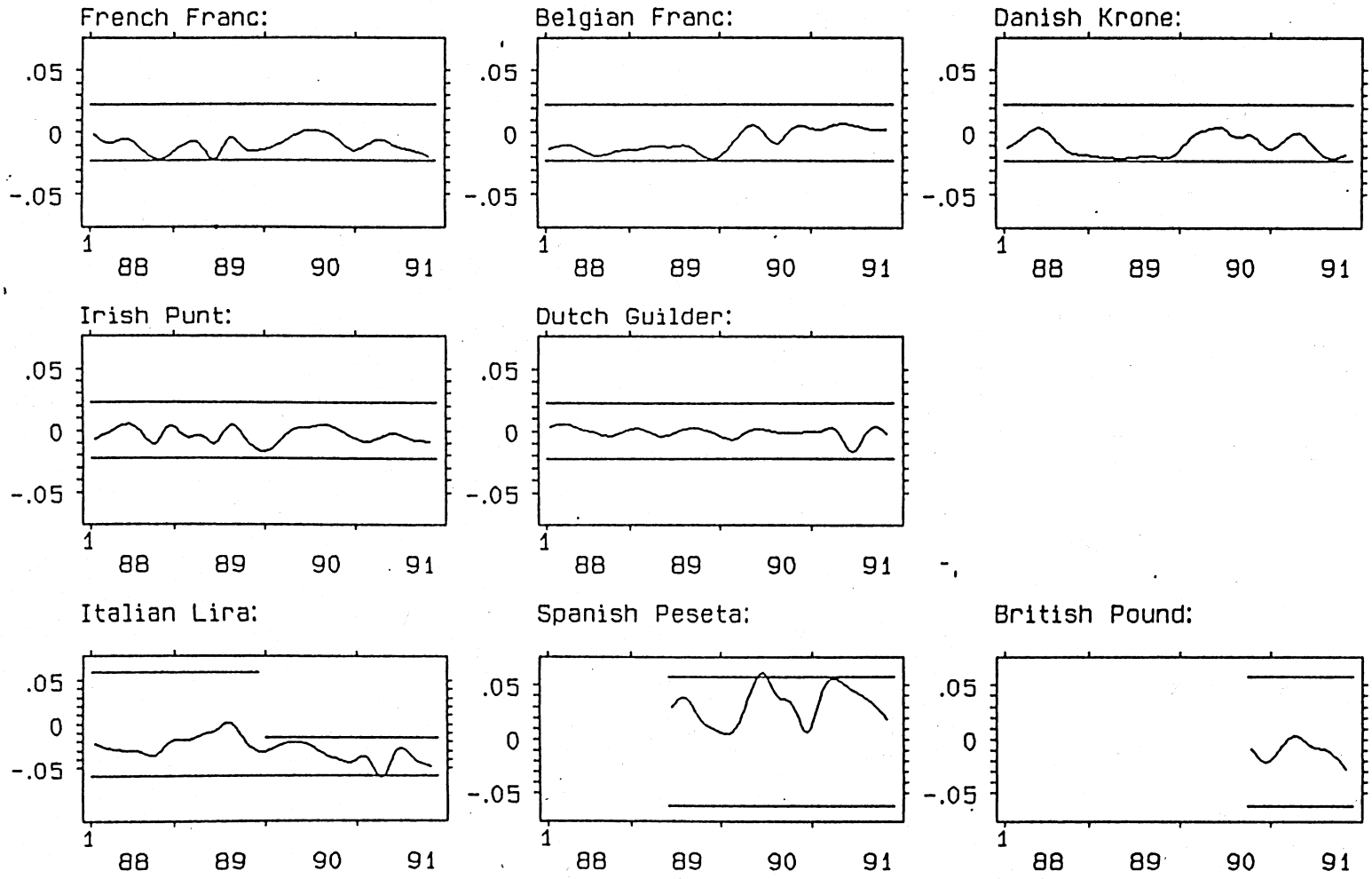
Figure 4



as log deviation from DM central rate, Feb. 1988 - Dec. 1991

12 Month Expectations, using interest differentials

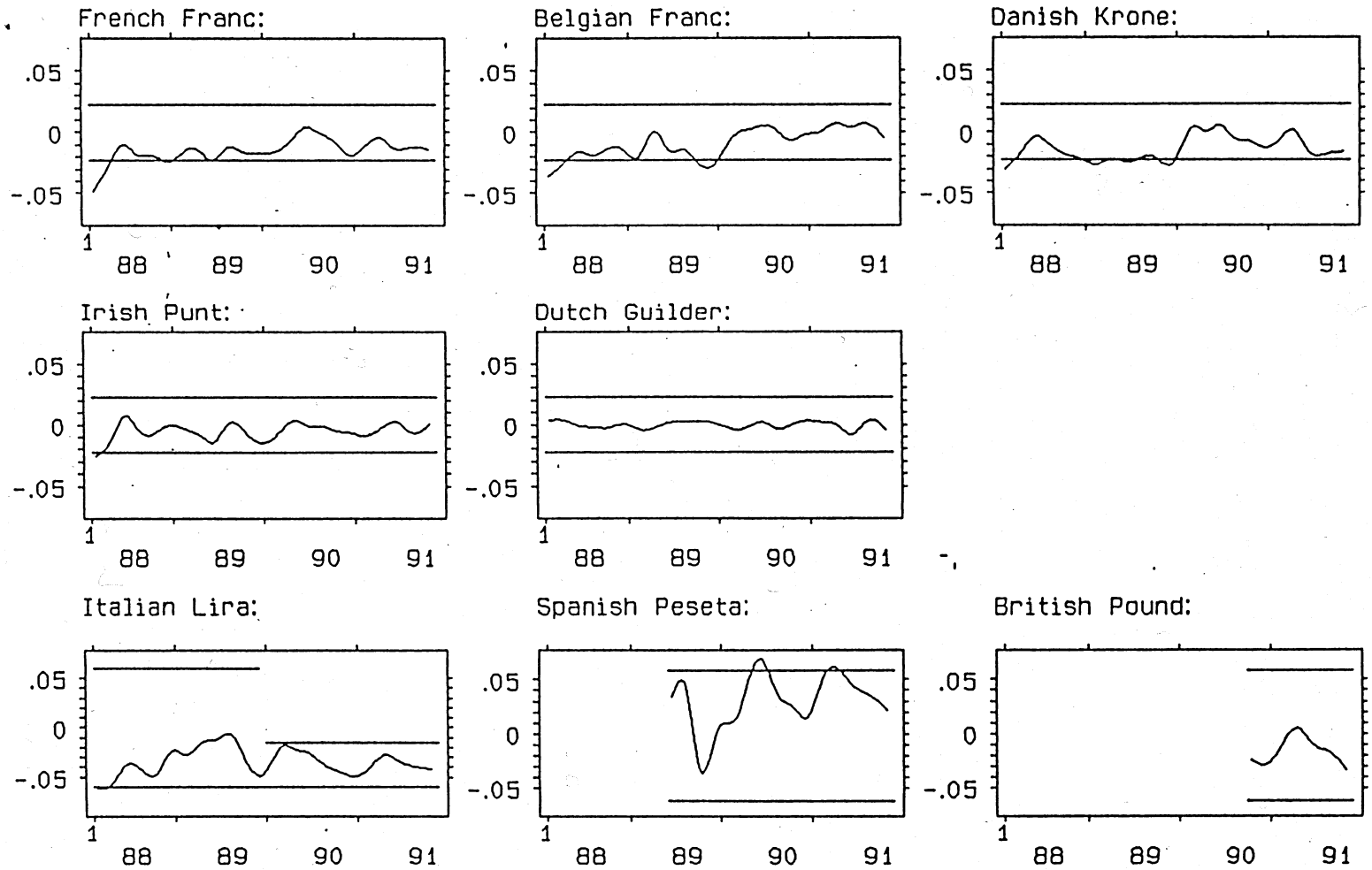
Figure 5



as log deviation from DM central rate, Feb. 1988 - Dec. 1991

1 Month Forecasts, computed from CFD Survey

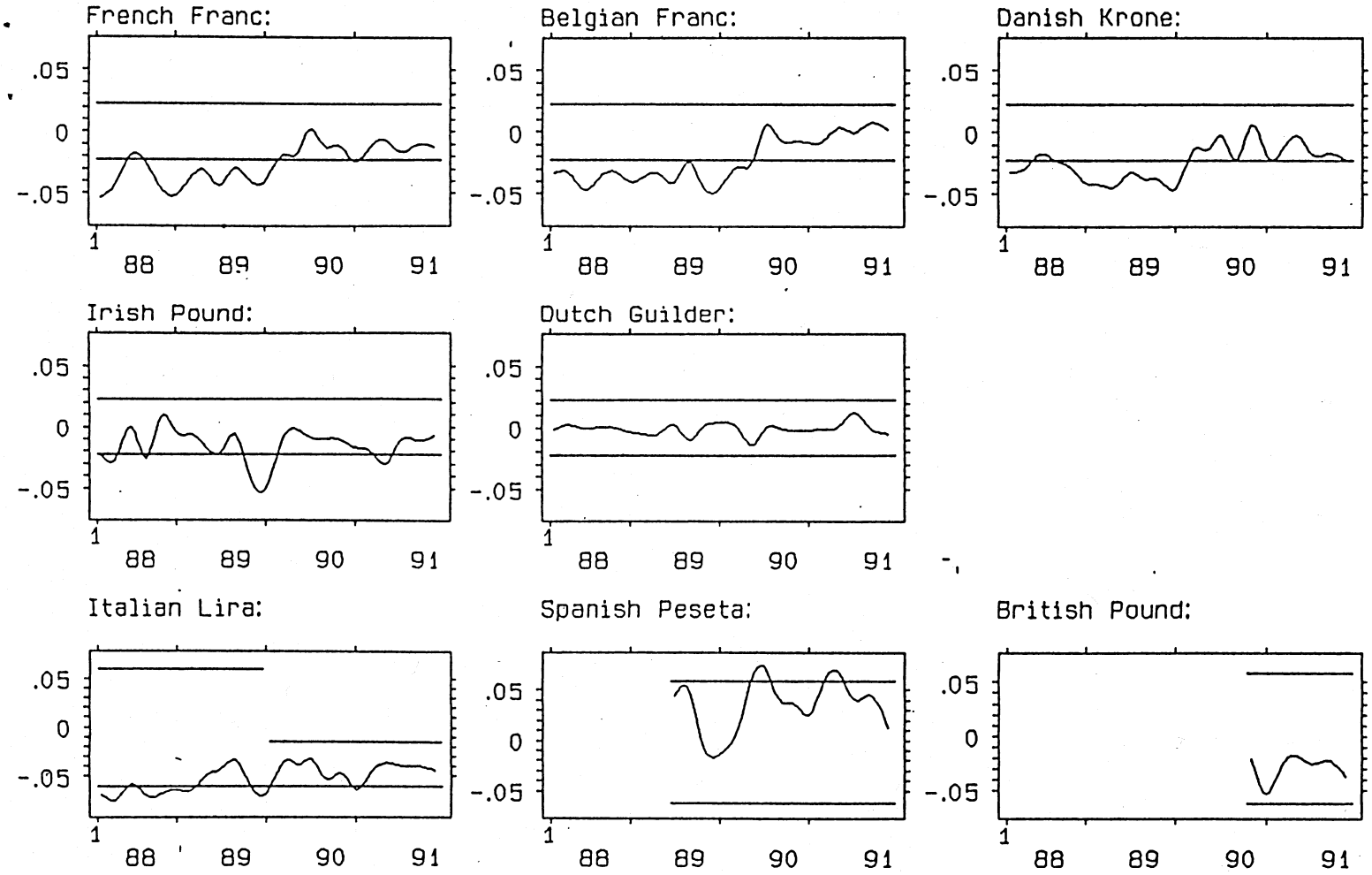
Figure 6



as log deviations from DM central rates, Feb. 1988 - Dec. 1991

3 Month Forecasts, computed from CFD Survey

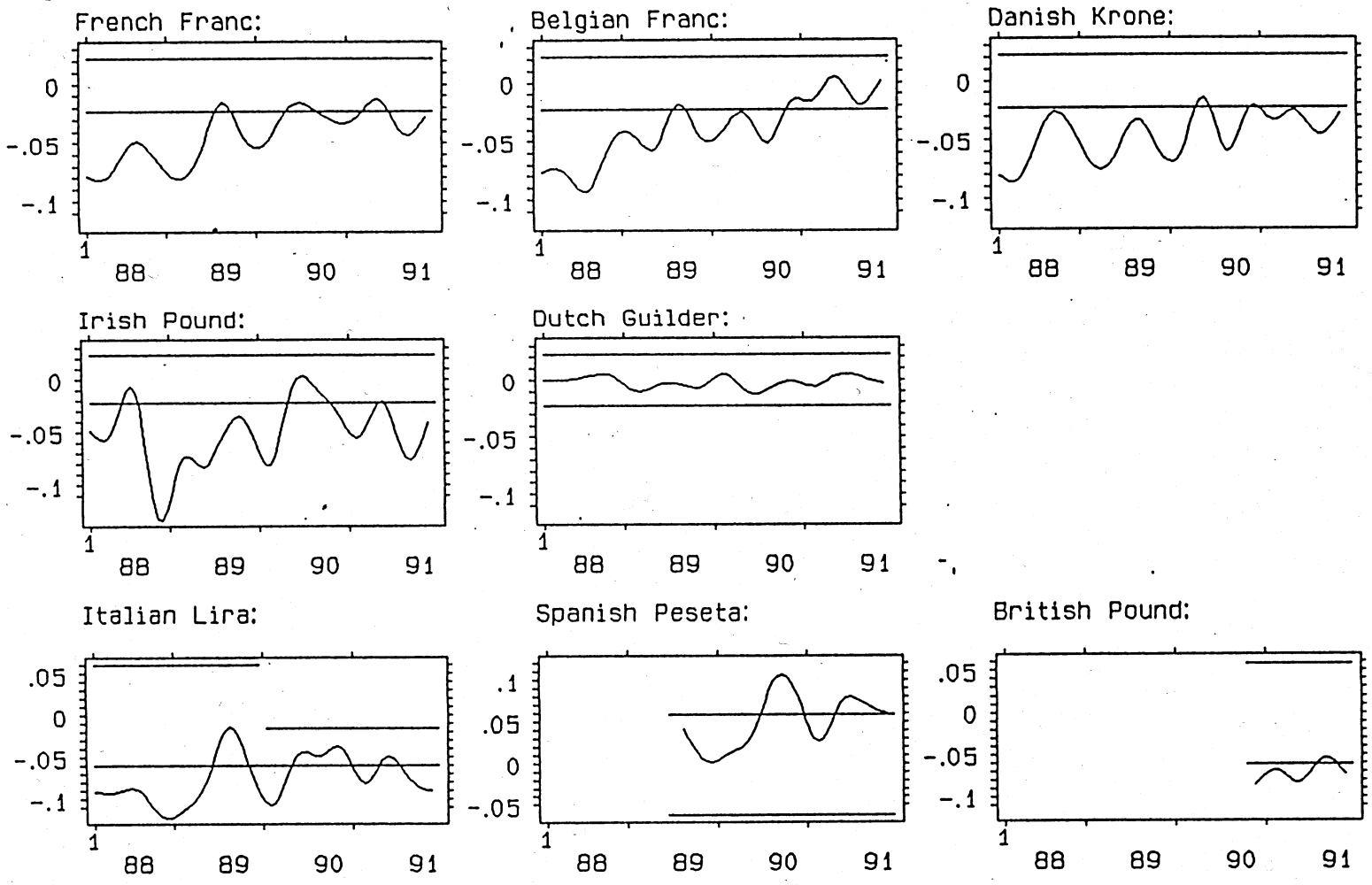
Figure 7



as log deviation from DM central rate, Feb. 1988 - Dec. 1991

12 Month Forecasts, computed from CFD Survey

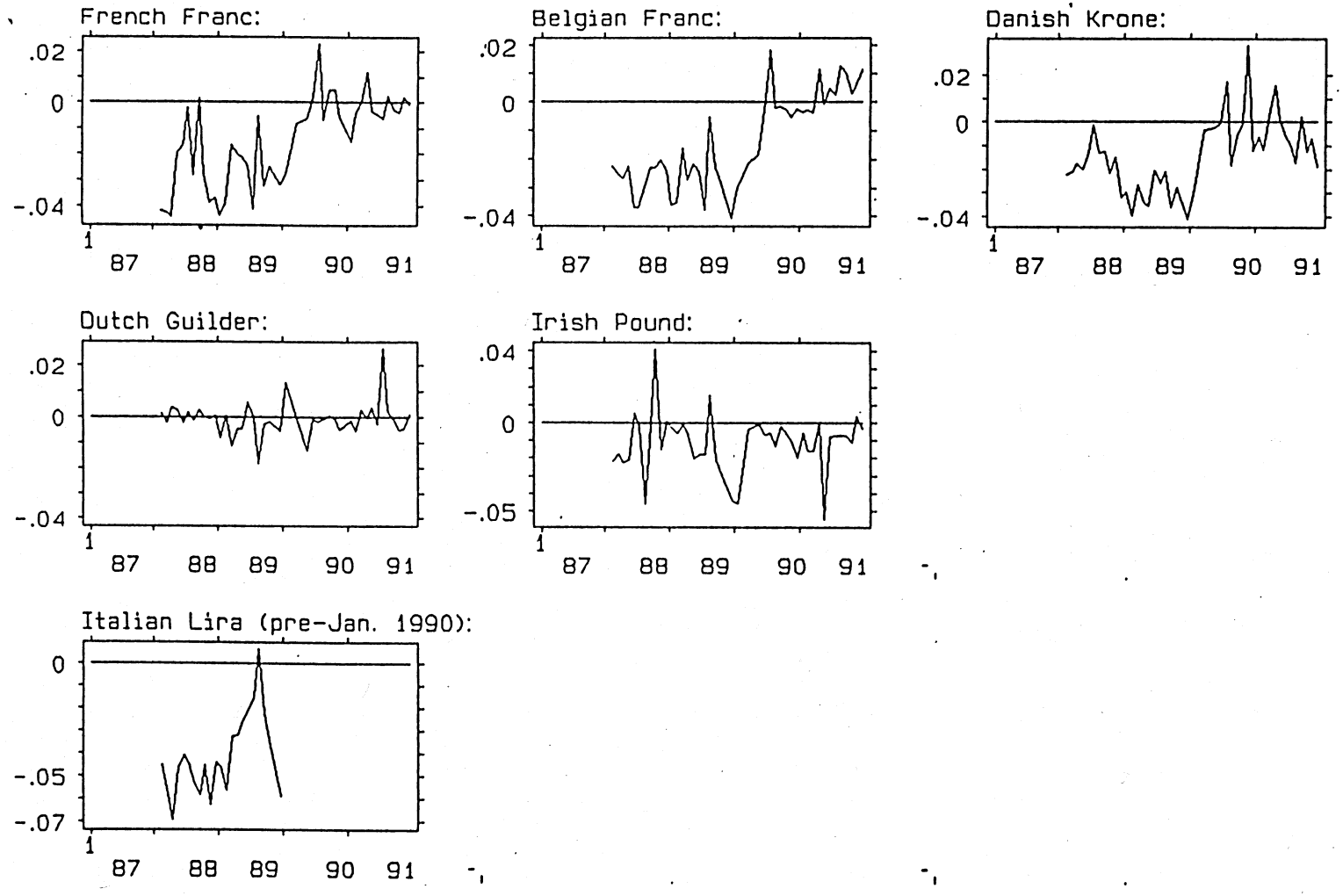
Figure 8



as log deviation from DM central rate

5 Year Forecasts, computed from quarterly CFD Survey

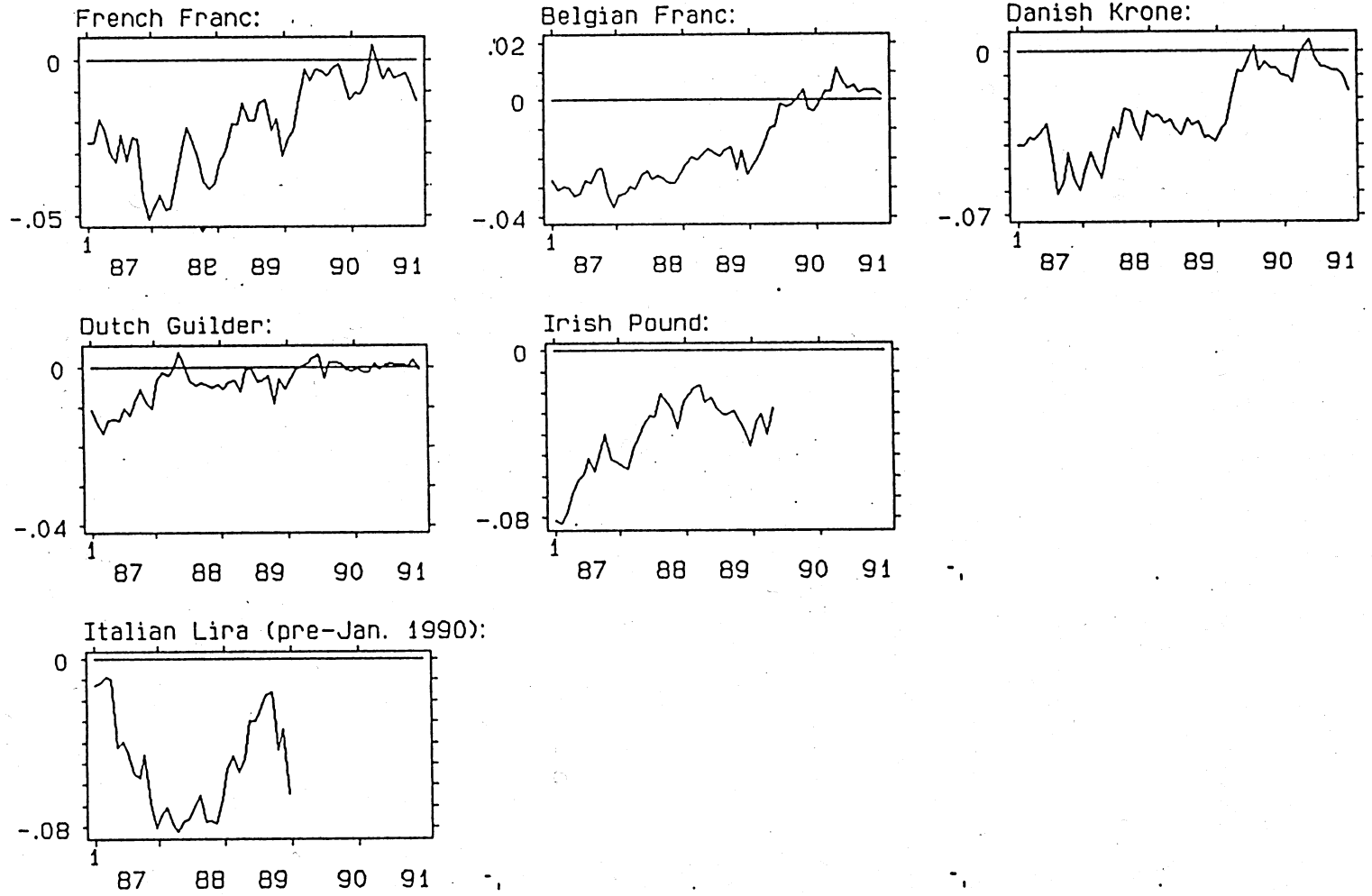
Figure 9



12 Month Horizon, annualized, based on CFD survey

q Estimates: Expected Rate of Realignment against DM

Figure 10



12 Month Horizon, annualized, based on uncovered interest parity

q Estimates: Expected Rate of Realignment against DM

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Endnotes

1. The interest rate data used in the table, and throughout the paper, are end-of-period interbank rates, if available. If interbank rates are not available, 3-month time deposit rates or other substitutes are used. Most of the data are as described in NBER Working Paper 2309. A data appendix to this paper describes the changes, including the updating from World Financial Markets for 88.04-89.09 (and 3-month money market rates from the Economist thereafter, in the absolute interest rate regressions).

2. The standard errors are calculated assuming only 1/3 the number of observations, to allow for the observations' failure to be independent.

3. The Denmark interest rate is a highly regulated 3-month time deposit rate, which may account for the result.

4. It must be noted that high levels of serial correlation mean that the appearance of statistical significance may be illusory, despite the use of conservative standard errors. For this reason the regression results are only reported in an Appendix [Table A1]. Correcting for high serial correlation by taking first differences does not yield trends that are truly significant statistically.

5. Frankel (1991) performs a similar decomposition of the real interest differential, for a sample of 25 countries.

6. See Dooley and Isard (1980); and Giavazzi and Pagano (1985, p.27).

7. The British liberalization of 1979 is explained and analyzed in Artis and Taylor (1989).

8. Giavazzi and Pagano (1985, pp.27-28), and Wyplosz (1986), among others.

9. The forward rate data were mostly from Barclay's Bank, as reported by Data Resources, Inc. The interest rate data for this were primarily from World Financial Markets, which discontinued this series subsequently. The DRI data were used to extend the series for France, GErmany, Italy, the Netherlands and the United Kingdom.

10. It is clear from Figure 5 in Braga de Macedo and Torres (1989) that the magnitude of Portugal's covered interest differential fell sharply in the first half of 1986, and remained relatively small in 1987-89.

11. Studies such as Fama (1984), Hodrick and Srivastava (1986), Cumby and Obstfeld (1984), and Giovannini and Jorion (1988) find what they consider to be evidence of a large and variable risk premium. Studies such as Frankel (1982), Froot and Frankel (1989), and Svensson (1991b), on the other hand, argue that the risk premium may be small in magnitude or variability.

12. These data are proprietary, and were obtained by subscription at the Institute for International Economics, where one author is a Visiting Fellow. We form an estimate of the implied forecast of intra-EMS exchange rates using the ratio of the relevant forecasts against the dollar. Contemporaneously dated forward rates are available from the same source, as described in Frankel and Phillips (1991).

13. The forward rate observations are chosen to match the survey dates, and thus differ from the end-of-period forward rate data used in the test of covered interest parity.

14. There does not appear to be much evidence of serial correlation which might bias downwards the standard errors. GMM standard errors were calculated for those regressions where there appeared to be some evidence of serial correlation (see Table 3).

15. This section in large part replicates the results in Frankel and Phillips (1991). However the sample there only ran through July 1991, whereas we here update the sample period to December 1991, the month of the Maastricht meeting. (The reader is referred to the earlier paper for some of the technical details of the theory and tests.)

16. This basic test of target zone credibility was first performed by Svensson (1991a) for the Swedish krone. Here we replicate the findings of Flood, Rose and Mathieson (1990) for the EMS. We thank these authors for access to their data. Giovannini (1990) conducts an equivalent test for the French franc and Italian lira.

17. The Dutch apparently follow a DM target zone much narrower than the standard EMS bands of ± 2.25 %: about $\pm$ 0.5 % since 1983.

18. For an extra degree of protection to the confidentiality of the original Currency Forecasters Digest data, we have applied a data-smoothing technique to the series plotted in these figures. We do not believe that the qualitative conclusions are materially affected by this procedure.

19. Because estimation of mean-reversion is sensitive to sample length, we do not attempt to estimate the relationship for the EMS newcomers Spain and the United Kingdom. For the Lira, we limit the sample to the period before the narrowing of its target zone in January 1990.

Appendix A

TABLE A1
Trends in Absolute Interest Differentials
1982:09-90:05

Country	Const.	Trend	$\bar{R}^2$	DW	Sample
Austria	0.695*	-0.026	.00	0.47	82:09-89:09
	(0.288)	(0.042)			
Belgium	5.745**	-0.562**	.74	0.48	82:09-90:05
	(0.465)	(0.061)			
Denmark	0.897	0.127	.06	0.23	82:09-89:08
	(0.597)	(0.087)			
France	6.614**	-0.615**	.77	0.30	82:09-90:05
	(0.468)	(0.061)			
Ireland	9.053**	-0.764**	.42	0.3	82:09-89:09
	(1.185)	(0.168)			
Italy	12.440**	-1.043**	.85	0.56	82:09-90:05
	(0.615)	(0.080)			
Nether-lands	0.665*	0.000	-.01	0.35	82:09-90:05
	(0.282)	(0.036)			
Norway	6.049**	0.448**	.43	0.70	82:09-86:10
	(0.516)	(0.126)			
Port.[1/]	15.349**	-0.442	.49	0.08	82:09-90:05
	(2.301)	(0.436)			
Sweden	6.741**	-0.162	.06	0.30	82:09-90:05
	(0.828)	(0.107)			
Spain	11.194**	-0.557*	.17	0.13	82:09-90:05
	(1.692)	(0.220)			
Switzer-land	1.551**	-0.175**	.20	0.31	82:09-90:05
	(0.471)	(0.061)			
UK	4.162**	0.407**	.39	0.41	82:09-90:05
	(0.693)	(0.090)			

Notes: Trend coefficients are annualized.
Standard errors in parentheses, and assume N/3 independent observations.
* (**) indicates significance at 5% (1%) level.
1/ Regression includes a dummy for data revision.

APPENDIX B. EMS DEVELOPMENTS, 1986-1991

1986

Feb. Single European Act sets Dec. 31, 1992 as date for completion of internal market with free movement of goods, services, labor and capital within the EC.

1987

Jan. 12 EMS Realignment (the eleventh, and possibly final)

Jan. France and Italy announce changes in their exchange rate management.

Sept. Basle-Nyborg Agreement. Committee of Central Bank Governors agrees to strengthen the ERM by providing for intra-marginal intervention and more liberal short-term finance of intervention.

1988

June 13 Agreement to free capital movements in the EC. Germany softens previous opposition to EC central bank; France and Italy persuaded to remove major capital controls over next two years.

June 28 Hanover Summit. Britain rejects proposal for European central bank and single currency; Delors Committee is created.

July 14 Bundesbank's president denies opposition to concept of a European currency.

1989

April 17 Delors Committee Report. Proposes a three-stage transition to economic and monetary union (EMU), without specifying a timetable:

Stage 1: Capital movements liberalized, ERM membership enlarged, more powers to EC Committee of Central Bank Governors.
Exchange rate realignments still permitted.

Stage 2: Exchange rate bands narrowed from ±2.25%, realignments permitted only in exceptional circumstances. Economic policy guidelines,

not yet binding, set at the Community level. European System of Central Banks (ESCB) set up, absorbing existing monetary arrangements.

Stage 3: Exchange rates irrevocably locked. ESCB replaces the national central banks. Adoption of single currency completes stage.

June 3 — An editorial in The Economist calls for one last general devaluation against the German mark.

June 19 — Spain joins the ERM.

June 27 — European Council decides to begin Stage 1 of the Delors plan on July 1, 1990. (According to the Delors Report, "a decision to enter upon the first stage should be a decision to embark on the entire process.")

Nov. — Berlin Wall falls.

Dec. — Strasbourg Summit. Agreement that by December 1990 an intergovernmental conference would convene to prepare changes in Treaty of Rome needed for EMU. Having favored a slower pace, West Germany agrees to this schedule as its EC partners give their stamp of approval to German monetary unification.

1990

Jan. 8 — Lira bands narrowed from ±6% to the standard ±2.25%. Lower limit unchanged.

Feb. 6 — Apparently sudden decision of Germany's Kohl in favor of rapid movement toward a German currency union.

March — France: minister announces French franc will never again be devalued in the EMS.

March — European Commission releases its plan for EMU; similar to Delors' report, but drops centrally-set rules for members' budget deficits. Plan to be discussed by EC finance ministers on March 31.

March 31 — Ashford Castle meeting of EC finance ministers. Eleven of 12 ministers agree on main features of a new European Central Bank.

April — German governments agree on terms of monetary conversion and union, to be enacted July 2, 1990.

April 28 Dublin summit. Declaration that changes in Treaty of Rome relating to EMU must be ratified by end of 1992 (thus possible for Stage 2 to begin in January 1993). Dec. 14, 1990 chosen as date for conference on EMU.

May 18 Treaty to unify the two Germanies signed. FRG agrees to set up DM 115 billion fund to support GDR through end of 1994.

June Belgian central bank declares DM exchange rate as its main policy target.

July 1 Stage 1 of EMU begins.

July 1 Complete removal of capital controls, as previously scheduled. Exceptions: Ireland, Spain, Portugal, and Greece (deadline 1992).

July 1 German monetary unification.

August European Commission finalizes its contribution to the upcoming Rome conference on EMU. (See March 1990.) Recommends the ecu replace existing currencies (rather than fixing permanent exchange rates among them). Proposes that Stage 2 should start in January 1993, leading after "a short duration" to full monetary union.

Sept. Meeting of finance ministers in Rome reveals large differences over timing of EMU.
Belgium, France and Italy call for Stage 2 to start January 1993 and Stage 3 soon afterwards.
Germany and the Netherlands are against setting any deadlines, argue economic convergence must come first.

Oct. 8 Britain joins the ERM, using bands of ±6%.

Oct. 22 Norway unilaterally links its currency to EMS.

Oct. 27 Rome Summit. Breakthrough in favor of EMU deadlines. Eleven of 12 agree that Stage 2 of EMU should begin January 1994 (subject only to mild conditions). European central bank to be set up at start of Stage 2, to begin conducting monetary policy in Stage 3. Timing of Stage 3 is vague, but apparently before 2000. Countries will be permitted to stay outside Stages 2 and 3 if they choose.

Nov. 13 EC central bankers unveil their draft statutes for a future European central bank: first objective is to be maintenance of price stability.

Nov. 22	U.K. Prime Minister Thatcher resigns.
Dec. 14	Rome Summit. Intergovernmental conference on EMU begins work on a treaty to be signed by October 1991. Draft treaty published by European Commission to be used as its working base.
1991	
April	Spain removes virtually all capital controls.
April	Speculation that Britain and Spain will narrow their exchange rate bands to ±2.25%.
May 13	Financial Times reports that many EMU negotiators have now accepted that a "two-speed" transition to EMU is inevitable.
May 19	The Economist reports that EMU negotiators, after five months of little progress, now appear likely to accept compromises embodied in draft EMU treaty proposed by Luxembourg.
May 13	Reports that Bundesbank's president will resign; resignation officially announced May 16.
May 17	Sweden unilaterally links its currency to EMS, using bands of ±1.5%.
June 7	Finland unilaterally links its currency to EMS.
June 9	U.K. and German leaders agree they will try to slow the pace of EMU negotiations at upcoming summit.
June 30	Luxembourg Summit takes no significant new steps toward EMU; key remaining decisions are apparently postponed until Maastricht Summit.
Nov. 15	Finland devalues by 12.3 % against the ecu.
Dec.9-10	Maastricht Summit.

Sources: The Economist, The Financial Times of London, Giovannini [1990], Haberler [1990], Weber [1991].

Appendix to "Financial and Currency Integration In the European Monetary System: The Statistical Record"

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April 1992

Appendix to "Financial & Currency Integration" vers. 7.4.1992

1. BRIEF DESCRIPTION OF THE INTEREST RATE RESULTS

1.1. Absolute interest differentials

The absolute interest differential (AID) is defined as:

$$AID \equiv |(i^{local} - i^{GY})|$$

This variable is (i) regressed upon a constant and a linear time trend; and (ii) regressed upon a constant in two subsamples (1982:09-86:12; 1987:01-1990:05) to yield period averages. The results reported in Tables A1 and A2, respectively, are mostly in accord with intuition -- that is there is mostly evidence of decreasing absolute interest differentials over time. The sample period is 1982:09-90:05 for most series.

Inference is complicated by the fact that there is evidence of high serial correlation, evidenced by the very low Durbin-Watson statistics. Inspection of the residuals indicates that the serial correlation is usually of a autoregressive nature, rather than that of a moving average process. Consequently, the significance levels are calculated using very conservative adjusted standard errors, rather than some type of serial-correlation robust standard errors.[1]

The Denmark result obtains from the highly regulated nature

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[1] Hansen robust standard errors are only appropriate for serial correlation of a moving average type. The adjustment indicated involves assuming N/3 <u>independent</u> observations, hence the constant's standard error (SE) is "blown-up" by 3, and the independent variable SE is blown up by square root of 3.

of the rate used -- a 3 month time deposit rate. The Norway result occurs because the sample spans only the first part of the period.

1.2. Absolute covered interest differentials

The absolute covered interest differential (ACID) is defined as:

$$ACID \equiv |(i^{local} - i^{GY} - fd^{(local/DM)})|$$

In Table A3, the absolute covered interest differential against the onshore German rate (rather than the Eurodollar rate used in the Frankel 1991) seems to be decreasing over this period for most currencies. Belgium and Ireland are the only exceptions, and here the increases are not statistically significant. Note that the sample begins in 1982:09, but extends up to 1989:09 for most series, and up to 1990:12 for a few.

1.3. Correlations of local rates with financial center rates

The local interest rates were regressed on a constant, and the money market interest rates prevailing in London and Frankfurt, and those rates interacted with a time trend.

$$i^{local} = \alpha_0 + \alpha_1 i^{UK} + \alpha_2 (i^{UK} \times TIME) + \alpha_3 i^{GY} + \alpha_4 (i^{GY} \times TIME)$$

The results are reported in Table A4. The entries indicate the

sign of the coefficients on the interaction terms (i.e., α_2 and α_4) if and only if the coefficients are significant at the 5% level. These regressions are actually estimated in both with interest rates in levels, and in first differences.

There are not many significant entries. Part of the reason may be that a linear time trend is a rather blunt instrument in trying to isolate time variation in relationships. Another factor may be the relatively short time period covered in the sample -- roughly 6 years. In other tests, using data covering 1973:03-1990:12, the results are much less ambiguous: Frankfurt gains influence as London loses (see Table A4.A). However, these results are not strictly comparable, since they use time averaged data.[2]

An alternate measure of financial center influences can be obtained by regressing the local rate on the (covered) rates in London and Germany, and on those rates interacted with time trends. The interpretation of the results (in Table A5) is analogous to that in Table A4. Frankfurt appears to be gaining influence at London's expense.

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[2] The data used in this alternate analysis is from OECD's Main Economic Indicators. The interest rate data is the month's average of daily figures, and is therefore not comparable to the end-of-month data used in this analysis.

Since the serial correlation appears to be an order 2 moving average, appropriate robust standard errors were used in order to make inferences about significance. The results do not change substantially -- Frankfurt still appears to be gaining.

2. DESCRIPTION OF VARIABLES

2.1. Interest Rates

The interest rate series are the same as those in Frankel and MacArthur, NBER Working Paper #2309. All data are from at or near end-of-month, unless otherwise indicated.

Country	Source	Interest Rate	Comments
Austria	WFM	3 mo.time deposits	
Belgium	WFM	4 mo. CDs	
Denmark	WFM	3 mo.time deposits	
France	DRI	3 mo.interbank dep.	
Germany	DRI	3 mo.interbank dep.	
Ireland	WFM	3 mo.interbank dep.	
Italy	DRI	3 mo.interbank dep.	
Netherl.	DRI	3 mo.interbank dep.	
Norway	WFM	3 mo.time deposits	
Portugal	WFM,MEI	interbank deposits	avg. of 30-90 day until 87:12; avg. 1-7 day
Spain	WFM	3 mo.interbank rate	avg. of daily quotes
Sweden	WFM	3 mo. CD	
Switz.	WFM	3 mo.interbank dep.	
UK	DRI	3 mo.interbank	

Where:

- WFM Morgan Guaranty, World Financial Markets.
- DRI Data Resources, Inc., Financial and Credit Statistics database
- MEI OECD, Main Economic Indicators.

World Financial Markets ceases publication of most European interest rates after September 1989, which defines the sample

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periods for the absolute covered interest differential regressions. For the absolute interest rate regressions where synchronization with forward rates is not critical, 3 month Money Market rates from the Economist are used. These Money Market rates correspond to the WFM rates, and are at or near end-of-month. The DRI rates are the arithmetic average of the bid and ask interest rates.

2.2. Spot and Forward Exchange Rates

All the spot and 3 month forward rates are derived from DRIFACS, with the exception of Portugal's (see below). They are the arithmetic average of the prevailing rates, at or near the end-of-month.

2.3. Calculation of the Forward Discount

The forward discount was calculated thus:

$$[\log(F) - \log(X)] \times 400\%$$

The exception is for Portugal's forward discount, which was recorded directly from The Financial Times.

TABLE A1
Time Trends in the Absolute Interest Differential
1982:09-90:05

Country	Const.	Trend	$\overline{R}^2$	DW	Sample
Austria	0.695*	-0.026	.00	0.47	82:09-89:09
	(0.288)	(0.042)			
Belgium	5.745**	-0.526**	.74	0.48	82:09-90:05
	(0.465)	(0.061)			
Denmark	0.897	0.127	.06	0.23	82:09-89:08
	(0.597)	(0.087)			
France	6.614**	-0.615**	.77	0.30	82:09-90:05
	(0.468)	(0.061)			
Ireland	9.053**	-0.764**	.42	0.3	82:09-89:09
	(1.185)	(0.168)			
Italy	12.440**	-1.043**	.85	0.56	82:09-90:05
	(0.615)	(0.080)			
Nether-lands	0.665*	0.000	-.01	0.35	82:09-90:05
	(0.282)	(0.036)			
Norway	6.094**	0.448**	.43	0.70	82:09-86:10
	(0.516)	(0.126)			
Port.[1/]	15.349**	-0.442	.49	0.08	82:09-90:05
	(2.301)	(0.436)			
Sweden	6.741**	-0.162	.06	0.30	82:09-90:05
	(0.828)	(0.107)			
Spain	11.194**	-0.557*	.17	0.13	82:09-90:05
	(1.692)	(0.220)			
Switzer-land	1.551**	-0.175**	.20	0.31	82:09-90:05
	(0.471)	(0.061)			
UK	4.162**	0.407**	.39	0.41	82:09-90:05
	(0.693)	(0.090)			

Notes: Trend coefficients are annualized. Standard errors in parentheses, and assume N/3 independent observations. *(**) indicates significance at 5%(1%) level.
1/ Regression includes a dummy for data revision.

TABLE A2[a/]
Average Absolute Interest Differential

Country	82:09-86:12	87:01-90:05
Austria	0.730 (0.204)	0.410 (0.150)
Belgium	4.528 (0.492)	2.405 (0.357)
Denmark	1.059 (0.390)	1.797 (0.423)
France	5.087 (0.588)	3.200 (0.501)
Ireland	7.516 (0.687)	4.586 (1.221)
Italy	10.144 (0.804)	6.280 (0.606)
Nether-lands	0.673 (0.186)	0.663 (0.219)
Norway	6.962 (0.348)	not avail.
Port.[1/]	14.912 (1.581)	10.884 (1.179)
Sweden	6.512 (0.657)	5.619 (0.405)
Spain	9.302 (1.395)	8.751 (1.170)
Switzer-land	1.069 (0.414)	0.643 (0.261)
UK	5.229 (0.666)	6.341 (0.420)

Notes: Standard errors in parentheses, and assume N/3 independent observations.
1/ Regression includes a dummy for data revision.
a/ Corresponds to Table 1 in the paper.

TABLE A3[a/]

Time Trends in Absolute Covered Interest Differentials
1982:09-90:12

Country	Const.	Trend	$\overline{R}^2$	DW	n	Sample
Austria	0.297	-0.010	-.01	1.82	78	1982:09-89:04
	(0.217)	(0.032)				
Belgium	0.163	0.011	.00	2.02	90	1982:09-90:02
	(0.123)	(0.016)				
Denmark	4.859**	-0.330*	.17	0.31	82	1982:09-89:08
	(0.918)	(0.134)				
France	3.300**	-0.869**	.27	0.79	100	1982:09-90:12
	(1.186)	(0.143)				
Ireland	-0.636	0.248	.01	0.85	83	1982:09-89:09
	(2.157)	(0.306)				
Italy	1.680	-0.142	.04	1.43	100	1982:09-90:12
	(0.947)	(0.114)				
Nether-lands	0.236**	-0.039**	.21	1.78	100	1982:09-90:12
	(0.063)	(0.008)				
Norway	1.252*	-0.164	.06	0.47	50	1982:09-86:10
	(0.576)	(0.140)				
Port.[1/]	16.378**	-3.290**	.37	0.33	98	1982:09-90:12
	(4.823)	(0.879)				
Sweden	0.381	-0.012	-.01	1.68	84	1982:09-89:09
	(0.202)	(0.029)				
Spain	3.821**	-0.448*	.14	1.24	100	1982:09-90:12
	(1.523)	(0.184)				
Switzer-land	0.218*	-0.011	.01	1.97	85	1982:09-89:09
	(0.098)	(0.014)				
UK	0.135	-0.018	.06	1.20	100	1982:09-90:12
	(0.099)	(0.012)				

Notes: Trend coefficients are annualized. SEs in parentheses assume N/3 independent observations. *(**) indicates sig. 5%(1%).
[1/] Regression includes a dummy variable for data revision. See data description.
a/ Corresponds to Table 2 in the paper.

TABLE A4
Regressions of Local Rates on Interest Rates
in London and Frankfurt
1982:09-90:05

	===== IN LEVELS =====		== IN DIFFERENCES ==	
Country	London	Frankfurt	London	Frankfurt
Austria				
Belgium				
Denmark	+	-		
France				
Ireland	-			
Italy				
Nether-lands				
Norway				+
Port.	-	+		
Sweden				
Spain				
Switzer-land	-	+		

Notes: Sample periods match those indicated in Table A1. An entry indicates a statistically significant coefficient (at 5% level) on the interaction term, of the indicated sign.

TABLE A4.A
Regressions of Local Rates on Interest Rates in London and Frankfurt Using MEI Data
1973:03-91:12

		=LEVELS==		DIFFERENCES	
COUNTRY	Description	UK	GY	UK	GY
Belgium	call money		-	+	
	3 mo. treasury	-	+		+
Denmark	long-term treasury	-	+		+
France	call money	-	+		
	3 mo treas., ungtd.	-	+		+
Ireland	call money	-	+		
	3 mo. treasury	-	+		
Italy	6 mo. treasury	-	+		
Nether-	call money	-	+		
lands	3 mo. treasury	-	+		
Norway[1/]	call money	+			
Portugal	interbank deposit	-	+		
Sweden	3 mo. disc. notes	-		-	
Spain	3 mo. interbank	-			
	call money		+		
Switz.	call money	+	+		

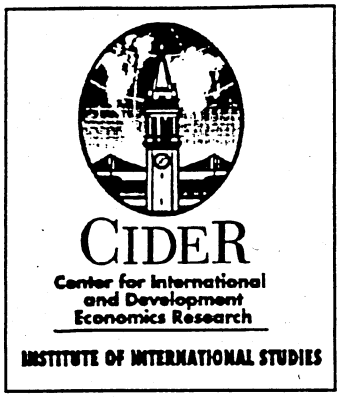
Notes: Entries refer to positive or negative coefficients on interaction terms (see text). Entries indicate significant at 5% level.

1/ Series breaks for two years, from 1979 to 1980.

TABLE A5
Regressions of Local Rates on Covered Interest Rates in London and Frankfurt
1982:09-90:05

	===== IN LEVELS =====		== GMM ROBUST SEs ==	
Country	London	Frankfurt	London	Frankfurt
Austria				
Belgium	-	+	-	+
Denmark	-	+	-	+
France	-	+	-	+
Ireland	-	+	-	+
Italy	-	+	-	+
Nether-lands	-	+		+
Norway				
Port.	-	+	-	
Sweden	-	+		+
Spain	+		+	
Switzer-land	-	+	-	+

Notes: Sample periods match those indicated in Table A3. GMM Robust SEs indicates use of Hansen serial correlation robust standard errors, with MA lag order of 2. An entry indicates a statistically significant coefficient (at 5% level) on the interaction term, of the indicated sign.



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