

## **Sterling Movements and Irish Pound Interest Rates\***

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*Abstract:* Despite convergence of inflation to below the system's average, Ireland experienced volatile short-term interest rates in the EMS. Much of the volatility comes from periods of Sterling weakness being associated with higher Irish interest rates, presumably reflecting realignment expectations.

### I INTRODUCTION

**T**he Irish pound joined the European Monetary System (EMS) from its initiation in 1979. This broke the century-old one-for-one link with the UK pound (Sterling). Although there were relatively frequent realignments in the EMS in the period 1979-1987, these did not prevent wide swings in the Irish pound/Sterling exchange rate which has been as low as 25 per cent below and as high as 10 per cent above the old parity. Persistently high inflation and government borrowing delayed the hoped-for convergence of nominal Irish interest rates to German levels, but near convergence was eventually achieved after almost a decade of EMS membership.

From 1987, the authorities, benefitting from a more stable environment with lower inflation and a considerable fiscal consolidation, announced a policy of no further devaluations, and argued that this policy would generate

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a credibility that would help keep nominal interest rates low. This policy came under stress in late 1992 following the sharp fall in the value of Sterling, and after four months of record interest rates, the Irish pound was devalued on February 1, 1993 by 10 per cent. Interest rates fell rapidly after the devaluation and within weeks were close to German levels.

The purpose of this paper is to highlight a significant factor in interest rates which was important for relatively frequent and protracted periods, namely a perceived risk of realignment correlated with movements in Sterling. We find that Sterling weakness was rather consistently associated with high domestic interest rates. This Sterling factor in Irish interest rates has been noted in the past (Honohan, 1989), and probably underlies the fact that principal component analysis shows Ireland to have had a distinctive interest rate pattern (Koedijk and Kool, 1992). However, its persistence and consistency undermine the suggestion that realignment risk had been eliminated in recent years or that this perceived risk has been influenced by the unilateral devaluations of 1986 and 1993.

In the regressions presented in this paper we show that the link between Irish interest rates and the value of Sterling has been sufficiently regular to be modelled by a very simple regression model.<sup>1</sup> The model allows us to identify periods in which Irish interest rate movements cannot be explained by the Sterling effect, and it also allows us to assess whether the responsiveness of Irish interest rates to Sterling was increased by the devaluation of August 1986.

The paper is organised as follows, Section II briefly reviews Ireland's experience with realignments and expectations of realignments. Section III provides some background to the modelling strategy to be employed. Section IV presents regression results. Section V concludes with some observations about policy implications.

## II IRISH REALIGNMENTS IN THE EMS

In this section we briefly review the experience of the Irish pound in the EMS, focusing in particular on the question of realignments and of the link, perceived or otherwise, with Sterling.<sup>2</sup>

### 2.1 *The Early Months: Breaking the Sterling Link*

In the immediate run-up to the start of the EMS (in early 1979) and after it had become clear that Sterling would not participate in the Exchange Rate

1. Similar relationships have been explored independently by O'Leary and Mangan (1993) and Walsh (1993). Bartolini's (1993) sophisticated econometric treatment of devaluation expectations is in the same spirit. None of those papers looks at the period before 1986.

2. Gros and Thygesen (1992) provide a more detailed analysis of this period.

Mechanism (ERM) of the System, some consideration was given to the possibility of maintaining both the Sterling link while still participating in the ERM. But analysis of the extent of currency fluctuations in previous years quickly revealed that, even had the permissible wider margins of plus-or-minus 6 per cent been adopted, the likelihood was that such a policy would have led to realignments on a regular basis — every few months in practice. It was clear that this would be unacceptable to other members of the EMS and was not seriously pursued.

For the first two-and-a-half weeks of the System's operation, the one-for-one link with Sterling was maintained, but when Sterling's strength brought the Irish pound to the top of its permissible fluctuation band on 30 March 1979, the Sterling link was abandoned. Over the next few months the Central Bank, which was actively intervening in the foreign exchange market, allowed the Irish pound to slip gradually towards the middle of the allowable band of fluctuation. Thereafter, the Irish pound's value depended mainly on the movements of the pound Sterling *vis-à-vis* the DM, and to a secondary extent on the movements of the Irish pound *vis-à-vis* the DM both within the fluctuation band, and as a result of realignments. The combination of these movements has been a rather volatile, but overall trend-less, evolution of the relative value of the two pounds (Figure 1).

This decisive break in exchange rate policy — the Sterling link had been in effect for a century and a half — was accepted at face value by market participants and (at least at first) there was no sentiment that the authorities' realignment policy would be strongly influenced by movements in the pound Sterling. Indeed in the early months there was little talk of realignments at all in what had, after all, been established as "a zone of monetary stability". Even when the first realignment, in late September 1979, involved a devaluation against the DM by all other members,<sup>3</sup> the general understanding was that the DM had been revalued and that there had, in some sense, been no change for the Irish pound.<sup>4</sup> Besides, since the Irish pound had only recently moved to a discount on Sterling, there were no

3. Five per cent for Denmark; 2 per cent for the others. This was the first of only two occasions on which The Netherlands guilder was devalued against the DM in the EMS.

4. Actually, since the formal parities or central rates are defined in terms of the ECU, every realignment involves a change in all countries' bilateral parities. For cosmetic purposes each realignment has been announced in terms of some currencies appreciating and others depreciating, but such a classification is at best arbitrary. We prefer to use the depreciation against the DM as the most relevant measure of currency movements at realignments. For one thing the DM has always been the strongest (most appreciated) currency at each realignment. Furthermore, the market exchange rates of the DM against the US dollar and other non-member countries have tended to move relatively little around realignments, suggesting that the DM is the anchor against which devaluations of other currencies should be measured.

evident competitiveness arguments for a devaluation.<sup>5</sup>

Nor were there significant private capital outflows in 1979 as a whole: indeed measured non-bank private capital flows showed a modest inward movement of 0.8 per cent of GNP, with the balance of payments residual outflow (possibly capturing unmeasured private capital movements) just under 1 per cent of GNP. Nevertheless, even at this early stage, there may have been Sterling-sensitive capital movements.

### *2.2 Sterling Weakness and Capital Outflows from Ireland*

Already in the early months of the new regime, an interesting pattern emerged whereby Irish corporate treasurers began to take advantage of any periods of Sterling weakness to settle Sterling payables. Thus when, in September and October 1979, Sterling began to fall back from its highest mid-year values (and even touched parity briefly in November) there was reportedly a surge of repayments of private Sterling debt. As this (like subsequent periods of Sterling weakness) was a time when Sterling was experiencing speculative selling pressure, this behaviour of Irish corporate treasurers was seen by outsiders as somewhat perverse. However, it is unlikely that Irish non-banks were taking a different view to the rest of the market regarding the prospects for Sterling; instead their behaviour can best be rationalised by their desire to close out at an acceptable loss (measured in Irish pounds) a net debtor position in Sterling established before the break in the Sterling link. Thus stop-loss or safety-first theories could be advanced to explain the fact that Irish companies were buyers of Sterling in periods of Sterling weakness.

Another reason for capital outflows when Sterling became weak was, of course, the increased risk of a downward adjustment of the Irish pound in the next realignment, as the Irish authorities would be likely to try to recover competitiveness losses. This reason probably became relatively more important over time as the inherited corporate debt position was unwound.

Whatever the reason, a pattern of short-term capital outflows from Ireland associated with Sterling weakness became established. These flows tended to cause the Irish pound to drift lower in the EMS fluctuation band, to tighten liquidity in the Dublin money market, and to put upward pressure on domestic interest rates.

### *2.3 The Realignments*

Realignments were indeed sufficiently frequent to validate the market's fears. Apart from one involving a Lira depreciation against all others, there

5. Although there was a huge current account balance of payments deficit in 1979 — about 13.4 per cent of GNP — this was primarily due to fiscal expansion (the Exchequer Borrowing Requirement (EBR) was 13.2 per cent of GNP) and to the increase in oil prices.

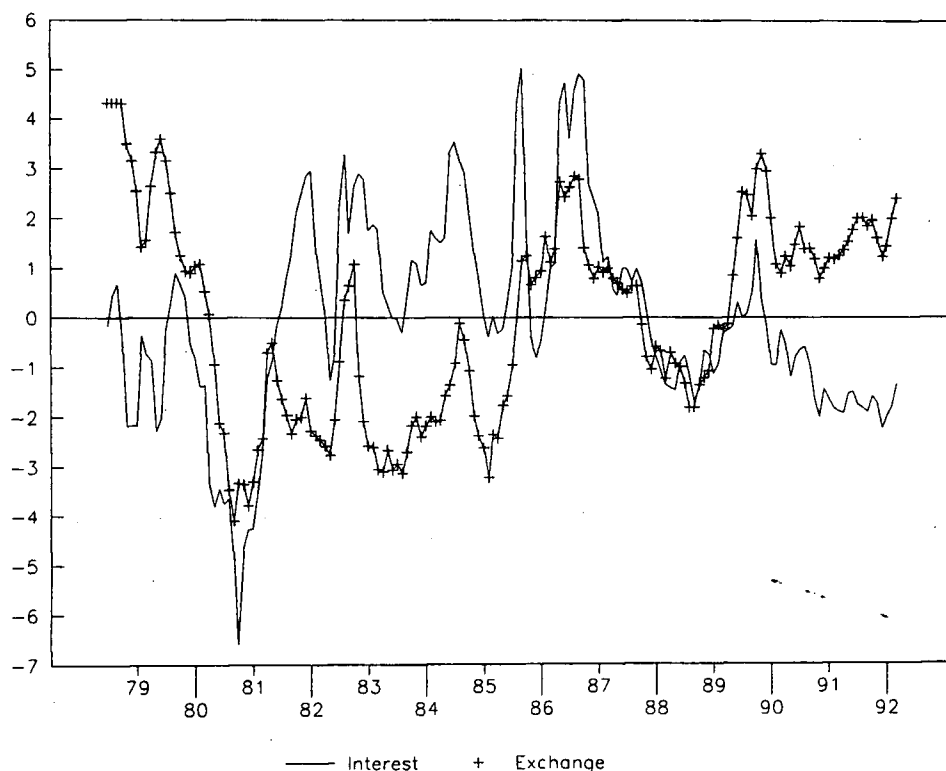
IR£/Sterling Exchange Rate and Detrended Interest Differential *vis-à-vis* DM

Figure 1: *Exchange Rates and Interest Rates*

were no realignments between December 1979 and September 1981. But the following 18 months saw four, culminating in that of March 1983 where the Irish pound was devalued by 9 per cent against the DM, the largest single devaluation of any currency before that of February 1993<sup>6</sup> (Table 1). Despite attempts to cloak devaluations against the key currency as upward adjustments of the latter, it became increasingly evident during this period just how adjustable the peg of the EMS could be; this was news to some Irish participants in the financial markets, accustomed as they were to a truly fixed regime, especially those who had not experienced or studied the frequency of realignments in the “snake”, predecessor to the EMS.

6. This was only the second occasion on which all currencies devalued against the DM.

Table 1: *EMS Realignments 1979-1993*

<i>(a) Percentage Change Against Notional Mid-point</i>										
<i>Date</i>	<i>BF</i>	<i>DK</i>	<i>DM</i>	<i>FF</i>	<i>IR£</i>	<i>LIT</i>	<i>DG</i>	<i>PTA</i>	<i>ESC</i>	<i>UK£</i>
24.9.79		-2.9	2.0							
30.11.79		-4.8								
22.3.81						-6.0				
5.10.81			5.5	-3.0		-3.0	5.5			
22.2.82	-8.5	-3.0								
14.6.82			4.25	-5.75		-2.75	4.25			
21.3.83	1.5	2.5	5.5	-2.5	-3.5	-2.5	3.5			
21.7.85	2.0	2.0	2.0	2.0	2.0	-6.0	2.0			
7.4.86	1.0	1.0	3.0	-3.0			3.0			
4.8.86					-8.0					
12.1.87	2.0		3.0				3.0			
8.1.90						-3.7				
14.9.92						-6.8				
17.9.92						**		-5.0		**
22.11.92								-6.0	-6.0	
1.2.93					-10.0					
14.5.93								-8.5	-6.8	

<i>(b) Percentage Change Against DM</i>										
<i>Date</i>	<i>BF</i>	<i>DK</i>	<i>DM</i>	<i>FF</i>	<i>IR£</i>	<i>LIT</i>	<i>DG</i>	<i>PTA</i>	<i>ESC</i>	<i>UK£</i>
24.9.79	-2.0	-4.9		-2.0	-2.0	-2.0	-2.0			
30.11.79		-4.8								
22.3.81						-6.0				
5.10.81	-5.5	-5.5		-8.5	-5.5	-8.5				
22.2.82	-8.5	-3.0								
14.6.82	-4.3	-4.3		-10.0	-4.3	-7.0				
21.3.83	-4.0	-3.0		-8.0	-9.0	-8.0	-2.0			
21.7.85						-8.0				
7.4.86	-2.0	-2.0		-6.0	-3.0	-3.0				
4.8.86					-8.0					
12.1.87	-1.0	-3.0		-3.0	-3.0	-3.0				
8.1.90						-3.7				
14.9.92						-6.8				
17.9.92						**		-5.0		**
22.11.92								-6.0	-6.0	
1.2.93					-10.0					
14.5.93								-8.5	-6.8	

\*\*Abandoned EMS membership.

After March 1983 there were no further realignments for 3 years.<sup>7</sup> Inflation rates across Europe fell during this period, reducing the degree to which losses of competitiveness were building up, and providing some rationale for the persistence of existing parities. However, there were several episodes in which realignment speculation emerged against the French franc and other currencies, and the risk of realignment generally had an impact on the Irish money market too. Eventually, in the realignment of April 1986, the pressure on the French franc was relieved by a 6 per cent devaluation, partly followed by all the other participants.

The relatively small adjustment in the Irish pound at the April 1986 realignment (down 3 per cent against the DM) can be explained by a brief period of strength shown by Sterling in the days before the realignment, this made a larger depreciation in the realignment seem unnecessary on competitiveness grounds. Unfortunately, the strength of Sterling proved short-lived, and Sterling resumed a downward trend that had begun in mid-1985 and which continued until early 1987. By end-July of 1986 this trend, combined with the weakness of the US dollar, had resulted in an appreciation of the effective index (trade-weighted average value) of the Irish pound by as much as 11 per cent over the previous 12 months. This was by far the largest and fastest appreciation ever to have been experienced by the currency. Acting quickly to head-off the threat to competitiveness (which could otherwise be achieved only by cuts in nominal wages, so low was the rate of inflation) and in the knowledge that even after the devaluation price inflation would be so low as to make a wage response unlikely, the Government obtained agreement to an unilateral devaluation of 8 per cent, taking effect in early August 1986. This was the first unilateral devaluation of the Irish pound in the EMS, though unilateral devaluations had also been employed for the lira and the krone.<sup>8</sup>

Before the Autumn of 1992, there was only one other realignment<sup>9</sup> and this took place in January 1987. It involved a 3 per cent devaluation by 4 participants including the Irish pound.<sup>10</sup> Subsequently, the low inflation rates being experienced by all participants, combined with the large capital inflows into what would otherwise, on inflation grounds, tend to be seen as a potentially weak new participant, the Peseta, ushered in a period of calm known as the "New-EMS" period.<sup>11</sup>

7. Again ignoring one unilateral Lira devaluation.

8. The Peseta has more recently joined the group of unilateral devaluers.

9. Ignoring a technical Lira devaluation.

10. This devaluation occurred at the time of maximum Sterling weakness with the Irish pound standing at £Stg0.955.

11. Hughes and Hurley (1993) observe that, during this period, inflation and interest differentials both predicted that the Irish pound need not realign.

For the Irish pound, however, the period was not uniformly calm. While the effective exchange rate index remained well below its mid-1986 peak until late 1989, facilitating a vigorous supply response to the demand boom in the UK and elsewhere, a renewed weakness of Sterling in late 1989 put some upward pressure on interest rates once again. The effective exchange rate index of the Irish pound appreciated sharply — though not by as much as in 1985-1986 — but there was no devaluation. A factor here is that wage rates in the UK had moved sharply ahead in the intervening years, so that the higher nominal effective rate index did not imply as severe an overall loss of competitiveness. In fact, despite the higher interest rates, this episode was not seen as a major crisis at the time.

The disturbances of September 1992-July 1993 are still sufficiently fresh to require no detailed commentary. The departure of Sterling from the ERM — under acute speculative pressure and in mid-week — did not at first place severe pressure on the Irish pound, but the magnitude of Sterling's subsequent fall meant that Ireland soon became subject — like many other member and associated currencies — to waves of speculation. The authorities' initial response was to raise short-term interest rates to emergency levels and to undertake foreign currency borrowing. The persistence of high interest rates without any clear indication of an end in sight led the authorities to devalue by 10 per cent with effect from 1 February.

The French franc and the Danish krone were also the object of severe speculative pressure during these months (as were the Iberian currencies, which were devalued more than once — see Table 1) and eventually the whole system succumbed at the end of July 1993, to be replaced by one with extremely wide 15 per cent margins.

#### *2.4 Interest Rate Movements Around the 1986 Devaluation*

Interest rate movements around the time of the early August 1986 devaluation, and at the time of the 1989-1990 Sterling weakness will be analysed in more detail in a separate paper. The question is important in the present context because of subsequent assertions by observers that devaluation had led to high interest rates. Our interpretation is different, namely that the high interest rates in late 1986 and early 1987, though influenced by renewed Sterling weakness, were induced more by increased market worries about fiscal policy. The main points worth noting about the pattern and timing of interest rate movements for 1986 are as follows:

- (i) there was little movement in Irish interest rates in the immediate run-up to the devaluation;
- (ii) there was little further movement in Irish interest rates in the weeks immediately following devaluation — even during September,



- short-term rates (one-month interbank) were only 50 basis points higher than they had been in July;
- (iii) there was a sharp increase in interest rates thereafter: October short-term interest rates averaged 429 basis points higher than those of June;
  - (iv) long-term interest yields also jumped: the June-October change averaged 434 basis points. Accordingly the yield curve remained flat. Previous periods of realignment speculation had been associated with sharp increases in the slope of the yield curve;<sup>12</sup>
  - (v) there was no sharp fall in interest rates after the January 1987 realignment; the decisive fall only occurred in April.

This pattern of interest rate movement suggests that other factors than exchange rate speculation were chiefly at work. Uncertainty about future fiscal policy, with the deteriorating fiscal position becoming evident with the publication in early October 1986 of the third quarter fiscal returns, combined with the imminent collapse of the government<sup>13</sup> are the most plausible explanations, especially bearing in mind the rise in long-term as well as short-term rates, and the fact that rates began to come down soon after the Budget of 31 March 1987 was introduced.

### III MODELLING THE DEPENDENCE OF SHORT-TERM INTEREST RATES ON STERLING

When Sterling is weak, the market fears a realignment and demands a higher short-term interest rate to compensate. This is the effect which we model. Our approach is a direct one; we do not, for instance, provide any evidence that Sterling movements are a good predictor of realignments (actually they do not appear to be) nor that interest rate differentials are justified by subsequent exchange rate movements (they are not, see Honohan and Conroy, 1993). Nor do we explicitly examine implications of the fact that the EMS has fluctuation margins.<sup>14</sup> Still, in the regressions presented in this paper we show that the link between Irish interest rates and the value of Sterling has been sufficiently regular to be modelled by a simple regression model. The model allows us to identify periods in which Irish interest rate movements cannot be explained by the Sterling effect, and it also allows us to

12. For instance in the 4 months running up to the April 1986 realignment short-term rates jumped by 500 basis points whereas long-term yields actually fell by 149 basis points on average.

13. In the event, the new government that took office in February 1987 implemented a tighter fiscal policy than the outgoing government, but when in opposition they had not espoused fiscal contraction.

14. Some empirical evidence suggests that this neglect may not be too serious; see for example, Flood, Rose and Mathieson (1991), Rose and Svensson (1991).

assess whether the responsiveness of Irish interest rates to Sterling was increased by the devaluation of August 1986.

Of course other factors, additional to those being considered, also influenced Irish interest rates in the EMS period. Indeed, it would be more conventional to estimate a model of interest rates which began with these other factors, both domestic and international. On the domestic side, for one thing, there was a substantial change in the inflation differential between Ireland and Germany as the EMS progressed. For another, the Irish EBR was at extremely high levels in the early 1980s, sufficient perhaps to increase domestic interest rates, whereas the EBR was at an acceptably low level by the end of the decade.

On the international side, the US fiscal deficit, combined with a tight monetary policy in the early 1980s drove up real interest rates worldwide. Late in the decade and into the 1990s, a similar pattern in Germany provided a further surge in worldwide interest rates and especially those in Germany.

In modelling the impact on domestic interest rates of international influences of foreign factors affecting worldwide interest rates it seems reasonable to assume that this is essentially the same as the impact on German interest rates. If so, then it can be netted out by subtracting German interest rates from Irish ones, i.e., by using the Irish-German interest differential as the variable to be explained by the remainder of the model.

The domestic influences — such as inflation and Government borrowing — are not quite so easily modelled, essentially because it is not the current quarter's borrowing or inflation that is likely to be the dominant influence, but the financial market's expectations about future inflation and borrowing. Quarterly movements in inflation and Government borrowing are very volatile, and their correlation with changes in expectations about future borrowing are likely to be small. Simple attempts to take account of this, such as the use of seasonal adjustment and mathematical smoothing, can help, but we must not assume that they fully capture the expectations we would like to model. In practice, despite attempts to incorporate such variables, they rarely appeared significant and are not included among the reported equations.

In these circumstances it seems prudent to include a time trend in the equation as a first approximation to slow movements in those missing expectations factors. But there is another reason for including a time trend, namely that the impact on interest rates of a given Sterling exchange rate may drift over time. Thus, for instance, after 6 years of much lower rates, a value of £0.95 may have had a larger effect on the financial markets in 1986 (after 5 years in which the average rate had been £0.81) than it had at the end of 1989 after 4 years in which the average rate had been almost £0.89.

There are short-term factors too which we would like to model but are not

included in the present exercise, notably the policy actions of the Central Bank (McGowan, 1992). By supplying liquidity to the market, the Central Bank can dampen upward movements in interest rates and vice-versa. Central Bank support to the market is thus a potentially important factor. Certain types of Central Bank support do not show up in published statistics, and these types may have been used particularly vigorously at times of crisis. This limits the usefulness of published data for evaluating the rôle of the Central Bank's activities.

Most models of the link between interest rates and exchange rates stress that it is the expected change in exchange rates — and not simply the levels — that can be expected to be linked to interest rates. The strong performance of the nominal level of the Sterling exchange rate in our equations reflects the broadly mean-reverting character of the Sterling exchange rate. This mean-reversion implies that a high value is expected to be reversed. That is the key to our results. In the next subsection we present a model which links this mean reversion to a mechanism whereby devaluation expectations in the EMS are triggered by loss of competitiveness. Alternatively, or in addition, arbitrarily determined regressive expectations on the nominal Sterling exchange rate might be a driving force.

### *3.1 A Formal Model of the Relationship Between Interest Rates and Exchange Rates*

While one can proceed to examine the regression results on the basis of the above informal discussion, we now present a formal model which can underpin and justify the regressions, and link them to standard theory.

Actually, there is a large literature on the stochastic relationship between interest rates and exchange rates. A good recent example summarising the state of play is Edison and Pauls (1993), which contains many other references. As is standard, they begin with the assumption of uncovered interest parity (apart from a risk premium):

$$i_t - i^*_t = y_t - E(y_{t+1}) + \rho_t \quad (1)$$

where  $y$  is the log of the spot exchange rate (DM per IR£1),  $i$  and  $i^*$  are the nominal one-period rates of interest denominated in Irish £ and DM,  $\rho$  is the exchange risk premium and  $E$  denotes an expectation formed at time  $t$ .

The key to our estimating equation, which relates the interest differential to an exchange rate, is essentially an assumption of mean reversion in the trend-adjusted exchange rate. To see this, we need to develop an algebraic treatment of the various components of expected exchange rate change.

In the case of the Irish pound, we are interested in the divergent move-

ments *vis-à-vis* ERM and non-ERM partner currencies. In particular, it will be relevant to model the overall (log-)spot exchange rate of the Irish pound ( $s$ ) as a weighted average of the rate against the DM ( $y$ ) and that against Sterling ( $z$ ). Recent work on the EMS (e.g. Bartolini, 1993, Chen and Giovannini, 1993, Svensson, 1993) has distinguished between movements of the currency within the band and realignments. Thus, the rate against the DM is made up of a central rate ( $c$ ), which remains unchanged between realignments, and the spot position within the band ( $x$ ). Thus:

$$s_t = \alpha z_t + (1 - \alpha)y_t = \alpha z_t + (1 - \alpha)(c_t + x_t) \quad (2)$$

The weight  $\alpha$  may not represent a simple trade-weighted average as the relative importance of Sterling may be higher than the simple trade-weight in the eyes of the authorities, or the market, or both.

Realignment policy in the EMS was, we argue, for the most part defensive and driven by a need to prevent losses of competitiveness of Irish labour. Realignments were more likely, the further competitiveness had slipped. This can be modelled using a conventional real exchange rate measure (as with Edison and Pauls):

$$q = s + p - p^* = s + p - \alpha p^z - (1 - \alpha)p^y \quad (3)$$

where  $p$ ,  $p^z$  and  $p^y$  are the log of domestic, UK and German price levels respectively.

The probability of a realignment  $\theta$  is assumed to depend on the deviation of  $q$  from a target level.<sup>15</sup> Thus  $c_{t+1} = c_t$  with probability  $1 - \theta$ , and  $c_{t+1} = c_t - \delta_{t+1}$  with probability  $\theta$ , where  $\delta_{t+1}$  is the size of the devaluation and

$$\theta = \theta_1 + \theta_2(q_t - \bar{q}_t). \quad (4)$$

In addition, the future position in the band  $x_t$  is likely to depend on the current competitiveness position, whether or not a devaluation occurs:<sup>16</sup>

$$Ex_{t+1} - x_t = \phi^1 + \phi^2(q_t - \bar{q}_t). \quad (5)$$

15. Proximity of the DM rate to the lower intervention limit could also be a predictor of realignment.

16. For a monthly horizon we have found at most a weak tendency for mean reversion in the band position for the Irish pound between realignments. This contrasts with the results of Svensson, 1993, for a quarterly horizon. The within band dynamics of the Irish pound needs further analysis.

Substituting (2), (3), (4) and (5) into (1), and rearranging, we obtain:

$$i_t - i^*_t = \beta_t^1 + \beta_t^2 [\alpha z_t + (1 - \alpha)y_t + (p_t - p^*_t - \bar{q}_t)] + \rho_t, \quad (6)$$

where:

$$\begin{aligned} \beta_t^1 &= \theta_1 \delta_{t+1} - \phi^1 \\ \beta_t^2 &= \theta_2 \delta_{t+1} - \phi^2 \end{aligned}$$

Although (6) suggests a time-varying parameter set-up, we simplify in the reported regressions by assuming constant risk premium  $\rho$  and size of devaluation  $\delta$ .

Provided the relevant variables satisfy the requirements for a valid regression — notably requirements of stationarity — Equation (6) motivates regressions linking interest differentials with exchange rate levels. Thus we assume that the target real exchange rate  $\bar{q}$  and, where data on prices is not available at the desired frequency, the log-price difference  $p - p^*$ , can be modelled as a time trend plus an autoregressive component.

Note the importance of the stationarity assumption on the price difference. If, in contrast, the nominal exchange rate and the price difference were non-stationary but cointegrated, the exchange rate should not be included on its own in the equation. That point can be made for each currency separately: thus Equation (6) may be rewritten:

$$i_t - i^*_t = \beta_t^1 + \beta_t^2 [\alpha(z_t + p_t - p_t^z) + (1 - \alpha)(y_t + p_t - p_t^y) - \bar{q}_t] + \rho_t. \quad (7)$$

This formulation could prove helpful in interpreting the lack of significance of the DM exchange rate  $y$  which we find in the regressions. If  $y$  is non-stationary though  $(y + p - p^y)$  is trend stationary, then  $y$  could prove to be insignificant in the regression. In fact, as we show below, while the Sterling rate  $z$  appears to be stationary, non-stationarity of  $y$  cannot be rejected.

### 3.2 Time Series Properties of the Data

As will be seen, the best-fitting regressions involve the interest differential and the log-Sterling exchange rate. As is well-known, the use of standard inferential procedures in such regressions relies on the variables being stationary. A standard test for stationarity is that of Dickey and Fuller (1981) and is implemented in Table 2. The low power of this test in small samples tends to result in the null hypothesis of non-stationarity being accepted too often. Nevertheless, including the time trend, the results of the test on both

Table 2: *Stationarity Tests: Dickey-Fuller and Augmented Dickey-Fuller Tests**Variables: Irish-German Short-term Interest Differential, IR£ / stg£ and IR£ / DM Exchange Rates*

	DF	(DW)	ADF(2)	(DW)	95% Crit
Int. Differential (with trend)	4.50	(2.07)	4.35	(2.08)	3.45
Log IR£/stg Exchange Rate (with trend)	2.35	(1.35)	3.43	(2.00)	3.45
Log IR£/DM Exchange Rate (with trend)	5.18	(2.46)	2.43	(2.08)	3.45
Int. Differential (without trend)	1.90	(2.26)	1.62	(2.02)	2.88
Log IR£/stg Exchange Rate (without trend)	1.63	(1.37)	2.33	(1.99)	2.88
Log IR£/DM Exchange Rate (without trend)	2.98	(2.80)	2.08	(2.11)	2.88
No. of observations	126				
Sample Period	1982m1 — 1992m6				
Irish Interest Rate	1-month Interbank Rate (IFS60b)				
German Interest Rate	Call Money Rate (IFS60b)				

the Sterling exchange rate and the interest differential reject the null at close to or better than the 5 per cent level. We therefore propose to proceed on the basis that these variables are stationary.<sup>17</sup>

Trend-stationarity of the Sterling exchange rate in particular is a key feature of the Irish data which should be stressed. In a sense, this is the central message of the data: the Sterling-Irish pound relationship is mean-reverting and it is thus not surprising that a weakening of Sterling foreshadows a weaker Irish pound and hence prompts higher interest rates. Stationarity of the DM exchange rate is not given much support by these tests: this alerts us to the relevance of the possibility mentioned after Equation (7) above, essentially that inclusion of the DM separately in the regression may not prove to be appropriate.

#### IV THE RESULTS

The theoretical development of the previous section proposed that, essentially because of devaluation risk, the Irish-German short-term interest differential would be positively related to the Sterling and DM values of the Irish pound, and also to price and other variables influencing the long-run equilibrium real exchange rate and deviations from it. The attempt to estimate a regression equation consistent with this hypothesis was quite successful, at least so far as the rôle of the Sterling exchange rate is concerned. Tables 3 and 4 illustrate the type of results obtained.<sup>18</sup> Because the Irish pound — Sterling exchange rate is trend stationary (i.e., loosely speaking, it is mean reverting around a trend) a weakening of Sterling

17. In contrast, for example, Edison and Pauls found that bilateral US real exchange and interest rates appeared non-stationary over the period 1974-1990. See also Wright (1993).

18. A more complete set of results was provided in the working paper version.

Table 3: *Regression Results: Irish-German Short-term Interest Differential*

Equation No: Monthly data	Dependent Variable: Irish-German Short-term Interest Differential					
	3.1		3.2		3.3	
	Coeff	t-stat	Coeff	t-stat	Coeff	t-stat
Intercept	21.3	(18.6)	30.2	(5.9)	30.3	(4.7)
Log IR£/stg£ Exchange Rate	31.7	(8.7)	28.9	(8.6)	28.9	(7.1)
Same*Dummy from 86M8	-4.8	(1.3)			0.1	(0.0)
Log IR£/DM Exchange Rate			-7.7	(1.9)	-7.8	(1.4)
Time	-0.12	(13.7)	-0.12	(12.1)	-0.10	(12.1)
Autoregression coefficient	0.55	(7.5)	0.54	(7.2)	0.50	(7.2)
RSQ/DW	0.922	2.12	0.923	2.12	0.923	2.12
Method/No. of obs.	AR(1)	126	AR(1)	126	AR(1)	126
Sample Period	82 M2-92 M7		82 M2-92M7		82 M2-92 M7	

Interbank rates, IFS 60b.

generates a precautionary interest premium.

One issue should be highlighted, and that is the potential importance of using on-shore interest rates, i.e., those traded behind the exchange control barriers which were in effect until the beginning of 1993. To the extent that the exchange controls were a binding constraint on short-term speculative flows, the expectations effects which we seek to model would not be apparent. Wide gaps between on-shore and offshore differentials have been noted for other EMS currencies such as the French franc. That we find effects on onshore rates tends to reinforce the validity of the underlying theory.

The most striking finding is the impact of the Sterling exchange rate. This has a very significant semi-elasticity indicating a response approaching 300 basis points in the interest rate to a 10p change in the price of Sterling. This finding is robust over a variety of time periods and with a variety of estimation methods and equation specifications.<sup>19</sup> Because movements of the Irish pound between realignments were constrained by the EMS band, we take it that fluctuations in the Sterling rate can be taken as essentially exogenous (and this is checked in regression 4.2 mentioned below).

The second interesting point is that there is no evidence of an increase in the responsiveness of the interest rate to the Sterling exchange rate after the unilateral 1986 devaluation, contrary to the fears of some market commentators at the time of that devaluation and thereafter. A slope dummy taking the value unity after the devaluation is never significant.

Although the DM rate also approaches significance in some equations, it

19. Earlier versions of the paper reported regressions at quarterly frequency which also included some other variables such as Exchequer borrowing, inflation differentials and cumulative current account deficit. The coefficient for the Sterling exchange rate remained robust (though slightly smaller than in the monthly data). Other coefficients seemed sensitive to specification, and to the use of instrumental variables for the DM exchange rate.

has the “wrong” sign. This rate is a strongly trending series which is nearly collinear with other low-frequency variables potentially in the model.<sup>20</sup> There are several possible sources of this problem from an econometric point of view. First, one of the main problems with this variable is the fact that its variation (between realignments) is too low.<sup>21</sup> A second consideration, already mentioned after Equation (7) above, is that non-stationarity of this variable will tend to invalidate its separate inclusion in the regression. A further issue is that the variable could be endogenous: instrumental variables estimators also tend to make it insignificant. Finally, it is possible that the weight of the DM in the competitiveness index implicitly used is very small.

Table 4 shows regressions using alternative exchange rate variables as a variation on the main model. Regression 4.1 uses the real (i.e., price-adjusted<sup>22</sup>) Sterling exchange rate: the effect is as strong as with the unadjusted series.<sup>23</sup> Regression 4.2 addresses the potential endogeneity of exchange rate variables by employing the exchange rate for Sterling against the DM (rather than against the Irish pound). While this is not exactly the specification proposed by the model, it provides an alternative summary of the impact of Sterling strength on Irish interest rates; Bartolini (1993) has also used this variable in his study of devaluation expectations.

Finally Equations (4.3) and (4.4) employ daily data which have become available to us.<sup>24</sup> There is considerable autocorrelation in the residuals here which we remove with long lags on the dependent variable (coefficients not shown).<sup>25</sup> Even on the daily data the Sterling exchange rate has a clear effect with an instantaneous semi-elasticity of about 0.02, estimated with a standard error of less than 0.004. The point estimate of the long-term interest semi-elasticity is 0.37 — rather higher than obtained for the monthly and quarterly data. Here the DM exchange rate is insignificant, as is the post-1986 dummy.

20. In the quarterly regressions (not reported here) inclusion of such other variables as inflation differentials, government borrowing or the cumulative current account balance of payments deficit, or of a quadratic in time, tends to make it insignificant, although inclusion of dummies for the outlier observations in March 1983 and January 1986 have the opposite effect.

21. The “wrong” sign could also reflect the fact that a DM-value close to the intervention limit could predict a realignment, a complication of the band-type system that does not affect the sterling rate.

22. The consumer price series is interpolated from quarterly data.

23. Use of the Effective Exchange Rate index in lieu of the sterling rate did not result in significant coefficients.

24. The daily data is that used by Flood, Rose and Mathieson, 1991, and fully documented by them. We are very grateful to Donald J. Mathieson for making these data available to us. The exchange rates are cross-rates based on US dollar quotes; the interest rates are Bank of International Settlement quotes — presumably therefore off-shore — for two-day maturity. There is a significant number of missing observations in the daily data series.

25. Non-stationarity can easily be rejected for each of the variables in the daily regression.



Table 4: Regression Results: Alternative Exchange Rates

Equation No.	Dependent Variable: Irish-German Short-term Interest Differential							
	4.1		4.2		4.3		4.4	
	Log Real IR£/stg£		Log DM/stg£		Log IR£/stg£		Log IR£/stg£	
Main exchange rate variable:	Coeff	t-stat	Coeff	t-stat	Coeff	t-stat	Coeff	t-stat.
Intercept	21.30	(9.9)	54.30	(10.6)	0.93	(7.0)	0.98	(7.2)
Exchange Rate Variable	30.00	(6.6)	26.90	(8.2)	1.75	(5.8)	2.05	(5.6)
Same*Dummy from 86M8	-10.60	(1.6)			-0.31	(1.1)	-0.53	(1.4)
Log IR£/DM Exchange Rate							-0.07	(1.1)
Time	-0.11	(5.3)	-0.16	(11.3)	-0.33	(6.0)	-0.35	(6.2)
Autoregression coefficients:								
AR(1)	0.63	(7.2)	0.56	(6.5)	*		*	
AR(2)	0.20	(2.3)	0.23	(2.7)				
RSQ/DW	0.913	1.97	0.92	1.96	0.958	1.99	0.958	1.98
Method/No. of obs.	AR(2)	126	AR(2)	126	AR(1)	1730	AR(1)	1708
Sample Period	82 m2-92 m7		82 m2-92 m7		2 Feb 82-5 May 90		2 Feb 82-5 May 90	

Interest rate data for 4.1-4.2 is one-month interbank rate (IFS 60b); for daily data see text.

\*In addition to AR(1), this equation on daily data included a long lag on the dependent variable (coefficients not reported).

Overall, the results support a remarkably simple specification, with the nominal Sterling exchange rate as the key variable. Unusual in the wider international context (where nominal exchange rates are typically non-stationary) the role of the nominal Sterling exchange rate in these equations is undoubtedly linked to its mean-reverting character. After all, the level of a mean-reverting exchange rate is negatively correlated with its expected future rate of change.

## V CONCLUSION: CREDIBILITY AND INTEREST RATES

A large theoretical literature has emerged in recent years on credibility in macroeconomic policy.<sup>26</sup> It is clear that, without credibility, policy can be inefficient, but that acquiring credibility can be costly. In important respects Irish macroeconomic policy has acquired credibility over the past few years notably so far as inflation and Government borrowing are concerned. (Kremers, 1990, Dornbusch, 1989, 1990). This is evident in the sharp decline in long-term yield differentials *vis-à-vis* Germany, a decline that was scarcely reversed by recent turbulence in the foreign exchange market.

Nevertheless, anxious not to dissipate a credibility which they believed had been achieved, the Irish authorities held out for four months in the face of a record high value of the Irish pound against Sterling and record high interest rates. Indeed, full credibility in the oft-declared policy of no realignments had not been achieved, and (as we have shown) the high interest rates reflected an enduring sensitivity of Irish interest rates to the exchange value of the Irish pound, particularly against Sterling. Following the 10 per cent devaluation of the Irish pound in February 1993, Irish interest rates fell back close to German rates (as had been predicted in the version of this paper presented at a Seminar in Dublin on 28 January 1993).

It is hard to say whether or to what extent the subsequent fall in interest rates was greater because the authorities waited so long to devalue. The delay surely signalled an aversion to devaluationist or inflationary slippage. On the whole, credibility is most easily achieved for policies that are coherent and sustainable. A policy of no devaluation regardless of the value of Sterling was never sustainable.

Since the paper was first prepared, the EMS narrow band has been suspended and the question of how much flexibility to apply in matters of devaluation has become moot. But the question of sustainable and credible policies remain, and in particular the desirability of maintaining an exchange

26. There is a good review in Blackburn and Christensen (1989). Giavazzi and Pagano (1988) is an interesting application to the EMS.

rate regime which acknowledges the continuing relevance of movements in Sterling for the competitiveness of Irish workers and enterprises.<sup>27</sup>

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