IRISH INTEREST RATES IN THE EMS
Were they too high?

by

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Abstract

Was there a risk-premium on Irish pound assets during the EMS period? Yes, if compared with the DM; no, if compared with sterling. These divergent findings are reconciled by appealing to the Dixit-Baldwin transactions cost model of hysteresis. Within this model, the high process variance of expected excess returns experienced against sterling is shown to imply a wide hysteresis band, in contrast to the unpredictability of excess returns against the DM. Therefore the relevant comparison is with the DM. The presence of market makers with common expectations in the foreign exchange market may limit the relevance of the transactions-cost model.

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1 *Introduction and Summary*

Were Irish interest rates relatively high during the narrow-band period of the European Monetary System (EMS), 1979-93?   Curiously, the answer to this question is not obvious, as it depends on whether one compares with sterling or DM interest rates.   Our approach to addressing it draws attention to some hidden implications of transactions costs and hysteresis theory for interest rate determination.   We conclude that the DM is the more relevant comparator, and therefore that Irish interest rates were high, possibly reflecting a "peso premium".

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Interest parity theory continues to underlie theoretical and empirical analysis of international financial interactions. Put simply, uncovered interest parity states that domestic interest rates should exceed foreign rates by just enough to offset the expected exchange rate depreciation. The difficulty of measuring expectations is what makes this hypothesis hard to prove or disprove conclusively. Even if the hypothesis holds, there will be deviations in the *ex post* data, with any gap between actual and expected exchange rate movements translating into a positive or negative *ex post* excess return.

Most of the empirical work has referred to bilateral comparisons involving the US dollar, and early evidence in favour of the hypothesis has subsequently been reversed by more systematic econometric analysis. Most of this negative evidence has to do with forecastibility of excess returns: i.e. the evidence is more that excess returns are forecastible rather than that they are systematically positive or negative over a lengthy interval. No fully satisfactory explanation has commanded universal acceptance, as there are econometric difficulties with the most plausible ideas, such as those based on risk aversion (cf. Cumby, 1988). Nevertheless, as noted by McCallum (1994) in a useful review,[1] uncovered interest parity still appears as a key behavioral relationship in virtually all of the prominent current models of exchange rate determination.

For some countries, excess returns against the US dollar have remained systematically positive

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[1]McCallum suggests that the econometric results are in fact consistent with interest parity if one takes account of a systematic response of monetary policy to interest rate trends.

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for prolonged periods. To explain these observations, the hypothesis of a "peso premium" has been used in the literature. A peso premium makes allowance for a small possibility - not realized within the sample, of a large devaluation, or of more devaluations than actually have occurred in the sample. Thus the peso premium hypothesis allows one to maintain that interest parity prevailed, but that the sample data does not reflect the true distribution of exchange rate changes.

The Irish pound is a member of the exchange rate mechanism (ERM) of the European Monetary System, and is thus part of the Deutsche Mark zone. At the same time, a high proportion of Irish trade and financial links are with the United Kingdom. Accordingly, the relevance of interest parity theory so far as the Irish pound is concerned must be verified with respect to both the DM and sterling at the very least. In fact, systematically large excess returns were recorded *vis-à-vis* the DM, but mostly small and insignificant ones against sterling, which was in the ERM for only two years (and even then with a wider-than-normal band of fluctuation). So the choice of reference currency matters, for example in assessing whether Irish interest rates embodied a peso premium.

While the mean excess return against the DM is significantly positive, variations over time in the excess return are not predictable. In contrast, though the mean excess return against sterling is insignificantly different from zero, variations in the sterling figures are somewhat predictable. According to the model of transactions costs and hysteresis bands discussed by Baldwin (1990), predictability of excess returns will tend to induce a relatively wide hysteresis band around interest parity, reducing the practical relevance of the parity condition in the determination of interest. Baldwin's theory would thus imply that the zero excess return against sterling is not evidence against the presence of a risk premium. But no hysteresis band is predicted for the DM comparison; accordingly the evidence which that comparison gives of a substantial constant risk premium cannot be discarded.

That interest parity (augmented by a risk premium) prevails *vis-à-vis* the DM reminds us that, in a quote-driven market where the market makers have common expectations, price changes can occur even in the absence of transactions, thereby reducing the importance of transactions costs in the determination of prices in such markets.

The paper is organized as follows: Section 2 reviews previous literature on Irish pound interest rates. Section 3 describes the facts that need to be explained. Section 4 outlines the hysteresis literature, and how it can be applied to interest rate parity. This theory is then used in Section 5

to interpret the Irish data   Section 6 contains concluding remarks.

2   *Previous Literature on Irish Pound Excess Returns*

Before the EMS, Irish interest rates tracked those in the UK rather closely (Honohan and Conroy, 1994b).   Since 1979, however, they have assumed a life of their own, buffeted by speculative exchange rate crises, by heavy government borrowing, by domestic inflation and above all, perhaps, by overall confidence considerations.

(i) Unusual character of Irish interest rates

That Irish interest rate behaviour is unusual in the EMS context has been highlighted by Koedijk and Kool (1992). Their principal components analysis of eight EMS interest rates found that two components explain 80 per cent of the total variation: of these the second, accounting for 26 per cent of the total variation was highly correlated with Irish interest differentials and was "clearly an Irish phenomenon".   Other work has shown the remarkable sensitivity of Irish interest differentials to the sterling/DM or sterling/IR£ exchange rate (e.g. Bartolini, 1995, Honohan and Conroy, 1994a, Thom, 1995 and Walsh, 1993).

(ii) Efficiency in the sense of predictability of excess returns

A number of recent papers have discussed the efficiency of the Irish foreign exchange and money markets, using the concept of cointegration. The focus of these papers has been on the question: "Have Irish interest rates been predictable in a way that would allow for profitable speculation?". The basic idea of the approach used in the papers is derived from two facts. First, if exchange rates are linked in a dynamic error-correction model - as they must be - if cointegrated, then it may be possible to exploit the predictability of exchange rates to make profits on average. The hypothesis of market efficiency denies the possibility of such profits on a systematic basis.   Second, market efficiency also implies that the forward exchange rate should be an unbiased predictor of the spot exchange rate; if so, then the spot and forward rates should be cointegrated.

An early example of this kind of work is Lucey (1988). He examined Irish pound exchange rates against the pound sterling and the US dollar on a daily basis.[2]   He found no evidence for cointegration among either (i) the two spot rates (ii) the two forward rates or (iii) either of the

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[2]Both spot rates, and rates for 30-day ahead future delivery were employed. The sample size was 100 and the data was for the period December 1988-April 1989.

forward-future spot pairs. In the first two cases this evidence was adduced as being in favour of the hypothesis of market efficiency (as a cointegrated system might have allowed predictability of the system of exchange rates) but the finding that the spot and forward rates were not cointegrated suggested lack of market efficiency, or at least a time varying non-stationary risk premium.

Leddin (1988, 1989) used non-overlapping[3] quarterly data 1979 to 1988. He focused on the forward-spot pairs and reported that for the Irish pound rates against sterling and the DM cointegration appeared to be present (though not for the US dollar). Leddin's findings were confirmed by Nugent (1990) using non-overlapping monthly data from January 1979 to March 1984. (He also finds no evidence for cointegration between (i) the two spot rates and (ii) the two forward rates).

(iii) Average Excess Returns

In a sense our question is a more primitive one than those related to predictability in that we wish to know whether the average exchange-rate corrected interest differentials (excess returns) are significantly different from zero.[4] Our exploration of this question does, however, take us into the territory of predictability.[5,6]

3 *The Facts to be Explained*

If markets were efficient, and if speculators were risk-neutral, then international interest

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[3]In the sense that the forward rate was for a period not exceeding the sampling frequency; use of non-overlapping data avoids potentially serious estimation problems, cf. Hansen and Hodrick (1980).

[4]Inasmuch as we are thus looking at long-term relationships there is a parallel with the work of Browne and McNelis (1990), who examined the short- and long-term impact of domestic monetary policy on interest rates in the context of assessing the impact of exchange controls on the effectiveness of monetary policy.

[5]McEntee and Downward apply a GARCH approach to modelling excess returns for the Irish pound against the DM. Their conclusion: that a time-varying risk premium was in effect, agrees with the conclusion of this paper.

[6]We ignore the issue of default risk. Alesina et al. (1992) purport to find evidence of default risk on Irish Government securities, but their analysis is fatally flawed for Ireland by their inadvertent use of floating rate private instruments. Comparing the yields on these with those on fixed rate government securities can provide no information at all on default risk.

differentials would be just sufficient to offset expected exchange rate movements. Provided expectations were not systematically biased, excess returns (i.e. actual *ex post* interest rate differentials adjusted for exchange rate movements) would be unpredictable and would average zero. In this section we examine the pattern of Irish excess returns.

The excess return λ on short-term Irish pound securities against foreign short-term securities can be simply expressed as the raw interest differential less the rate of exchange rate change. An appropriate formula for foreign currency *i* is:

$$\lambda_t^i = r_t - r_t^i - \frac{S_{t+1}^i - S_t^i}{S_t^i},\qquad (1)$$

where *S* is the spot exchange rate (Irish pound cost of an unit of foreign exchange), *r* are interest rates.

Cumulative quarterly excess returns for the Irish pound against the DM and sterling are plotted in Figures 1 and 2 (which are drawn from the detailed description in Honohan and Conroy, 1994b). Note the relatively smooth upward sloping curve of cumulative excess returns against the DM, significantly interrupted only by the devaluations of August 1986 and February 1993. The EMS period was thus one of generally positive, though modest, excess returns against the DM. Against sterling, cumulative excess returns display a low frequency oscillation, beginning with a period of negative excess returns until late 1981, followed by mostly positive excess returns until mid-1986, with lesser cumulative fluctuations thereafter.

Table 1 shows that between the beginning of the EMS in 1979 and the abandonment of narrow margins in 1993, mean excess returns on Irish pound securities were positive against the DM, sterling and the US dollar, though only against the DM was the mean excess return significantly different from zero. At about 2½ per cent per annum the mean excess return against the DM was certainly economically significant as well as statistically so (t=2.3), and this was the highest mean excess return of any of the currencies participating in the EMS from the beginning (the Danish krone being the only currency that comes close: cf. Table 2, based on broadly comparable statistics).

On the other hand, at less than ¾ per cent per annum, the mean excess return for the Irish pound against sterling was much smaller and, with a much higher standard deviation, was quite insignificant.

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In short, the Irish holder of DM assets suffered a considerable loss relative to Irish pounds, but experienced relatively low volatility; the Irish investor in sterling suffered little, but experienced high volatility.

Thus there is an apparent paradox in that there was a large and significant mean excess return against the currency against which excess returns were relatively stable, but a much smaller, and insignificant mean excess return against the currency with volatile returns. Should risk aversion not have produced the opposite conclusion? Furthermore, we might (setting aside econometric subtleties for the moment) be tempted by the sterling comparison to entertain the possibility that uncovered interest parity prevailed, whereas this seems clearly false if the comparison is taken with the DM.

In order to resolve the paradox we will provide some evidence that, though volatile, movements in the sterling excess returns were predictable, while deviations from the mean of the DM excess returns were unpredictable. The contrasting results for the two reference currencies will then be interpreted by asserting the applicability of the theory of transactions costs and hysteresis bands to the sterling case, leaving interest parity theory (as modified by risk aversion) to explain the DM case.

4 *Transactions Costs and Hysteresis Bands*

One possible approach to resolving the paradox and to explaining why the effects may differ from currency to currency is to take account of the wedge that transactions costs may place in the interest parity conditions (even as modified by risk aversion). Even small transactions costs may imply substantial deviations from the parity conditions discussed so far.

The discussion in this section leads to the conclusion that observed deviations from the parity conditions are more easily explained away for the Irish pound-sterling comparison than for the DM. The excess returns *vis-à-vis* the DM is thus all the more striking.

The hysteresis literature (Dixit, 1989, 1991; Baldwin, 1990) takes explicit account of the fact that full arbitrage might entail speculators having to shift frequently in and out of different currencies. If such transactions are costly, then they may not be undertaken for small expected values of λ. The higher the switching costs κ and the higher the variance σ^2 of the stochastic process determining the expected value of λ, the wider the possible deviations from the parity conditions discussed above. Investors will only move when the expected excess return is

materially greater or materially less than zero: and the width of band of indifference or "hysteresis" is surprisingly wide.

A very simple model of the foreign exchange market displaying these properties is obtained by assuming that the expected excess return on holding the home currency $x = \_(\lambda)$ follows a Wiener process with variance σ^2. Investors can adjust their portfolios at a transaction cost g, and they will do so if they are in the "wrong" currency (i.e. the home currency if x is negative and *vice versa*), but only if the absolute value of x is large enough to justify payment of the transaction cost. If x reaches this trigger, then sufficient movement of funds will occur to reset the expected excess return to zero.[7]

Under these assumptions, the results of Dixit (1989, 1991) allow us to state that, if the penalty per unit time suffered by the investor as a result of being in the "wrong" currency is proportional to x (with constant of proportionality k), the trigger point for portfolio adjustment will be approximately $\pm h$, where,

$$h = \left(\frac{6\,\sigma^2\,g}{k} \right)^{1/3}$$

(cf. equation 20 in Dixit, 1991). Accordingly, $x = \_(\lambda)$ will move within a hysteresis band of width $2h$. Because of the cube root, even a small value for the terms within brackets can lead to a large hysteresis band.

More realistic micro-models have been proposed, with qualititatively similar conclusions so far as the hysteresis band and its dependence on a fractional power of the process variance.[8] Note that the relevant stochastic process is not that of λ itself, but of its expectation $x = \_(\lambda)$. So far as g and k are concerned, one may follow Baldwin (1990) in using observed percentage transactions costs in the wholesale foreign exchange market as an indication of the order of magnitude of the ratio g/k.

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[7]Alternatively, think of the financial market as being modelled as an optimizing agent who experiences a flow cost kx, and who is able, at cost g, to reset x to zero.

[8]The potential application of this type of approach to the issue of interest parity was noted by Baldwin (1990), who also noted weaknesses of the underlying assumptions: notably the unrestricted variance (even after possible detrending) of the excess returns process and the lack of micro-foundations. Both of these weaknesses have been ameliorated by Baldwin without altering the qualitative conclusions.

Our application of this model is to explore whether the extent of deviations from interest parity could be correlated with the variables that appear in the hysteresis formula. Of course, because of the cube root, it may be difficult to detect such an effect empirically. For example, a doubling of the expected excess return process variance will widen the hysteresis band by only 26 per cent.

But if, for some currency pairs, excess returns are unpredictable, then there is no "wrong currency" for the investor, and no flow penalty. In terms of the model, _(λ) is non-stochastic. Therefore in such circumstances there is no basis for asserting the existence of a large hysteresis band arising from small transactions costs. Currency pairs with unpredictable excess returns should have no hysteresis bands and vice-versa. Note the bootstrap nature of the theory: if excess returns are unpredictable, interest parity theory applies; if interest parity theory fails empirically, then the conditions for a sizeable calculated hysteresis band automatically prevail. Although this means that no obvious test of the hysteresis theory can be obtained by contrasting currency pairs with predictable and unpredictable excess returns, it does offer a plausible interpretation of the kind of empirical puzzle which we have described.

4 *The Paradox Resolved: The Predictability of Irish Pound Excess Returns*

The empirical evidence for the Irish pound suggests that both cases of predictability and lack of same are relevant, the first with respect to excess returns *vis-à-vis* sterling, the second to excess returns *vis-à-vis* the DM. Reference may be made to the regression modelling of time-variation in λ contained in Honohan and Conroy (1994b), and briefly summarized in the Annex. The time-variation of the fitted values of the regressions provides an estimate of the variance σ^2. Of course it is a lower estimate, since the variance of the projection error u is not taken into account, but if this is small, the ratio of the variances for different currencies may give a reasonable indication of the ratios of the standard errors.[9]

This empirical analysis uncovered apparently predictable variations in the excess returns against

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[9]The hysteresis models do hinge essentially on the ability to trade frequently. If trading is only possible once a quarter, then the width of the hysteresis band reduces to just twice the switching cost. Thus it may be strictly inappropriate to base the calculations on three-month interest rates, but in practice the approximation may not be too bad, because daily rates are quite closely correlated with quarterly.

sterling. The preferred regression has a standard deviation of the fitted value of 1.65 per cent per quarter. In contrast, if we employ a similar regression equation for the DM, the standard deviation is only 0.58 per cent, implying a ratio of the variances of 8.05. Taking this to the third power gives a ratio of just two. Thus if the transactions costs are similar, the formula provided for the width of the hysteresis band implies a hysteresis band for sterling that is twice as wide as that for the DM. But the regression equation for the DM is not significant, and it seems preferable to conclude that the excess return against Germany is not predictable at all, in which case we obtain a zero hysteresis band for Germany, whereas for the UK, the hysteresis band derived from the formula, (using Baldwin's figure for *g/k*) comes out at 15 per cent annum.

Whichever approach we use to estimating the hysteresis band, we deduce that allowing for transactions costs implies that expected exchange rate movements against sterling are less likely to influence Irish interest rates than are expected exchange rate movements against the DM. In short, the hysteresis theory swamps the interest parity theory in respect of the Irish-sterling comparison, but may not do so with respect to the DM.

Although we have shown that predictability of excess returns differs considerably as between the two markets, we have not asked why this might be so. One possible explanation lies in the institutional structure of the markets. The Irish pound market is dominated by a small number of market makers, chiefly Irish banks and the Central Bank of Ireland. Price changes in such a market need not require substantial transactions, and therefore the transactions costs which underlie the hysteresis model may not be present. But the Irish market makers must respect no-arbitrage conditions between their quotes against different currencies. If interest parity does not prevail between two other currencies (and predictable excess returns prevail), then the Irish market-makers' pricing can eliminate predictable excess returns against at most one of those currencies. Our empirical findings suggest that they do so *vis-à-vis* the DM, which is not surprising given the limited fluctuation band of the ERM.

5 *Concluding Remarks*

If interest parity theory remains relevant for the Irish-DM comparison, what are we to make of the fact that, though fluctuations have been unpredictable, the mean Irish-DM excess return has been large and significant? Clearly uncovered interest parity does not prevail, and we must appeal to the existence of an additional risk-premium, possibly reflecting the actual volatility of exchange-rate adjusted returns, but more likely reflecting compensation for the unrealized risk

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(peso-problem) of a much larger depreciation.[10]

The source of excess returns on Irish pound short-term interest rates may be found in investor pessimism which might easily be attributed to the level of Government borrowing during the 1980s (Government debt rose to about 130 per cent of GDP). But it seems clear that the exchange rate regime itself has played an important part. The change from an absolutely fixed exchange rate peg to the more flexible and crisis-prone EMS appears to have brought with it a cost in terms of a risk-premium on interest rates relative to the core currency of the system, namely the DM.

Could one conclude that Irish interest rates have been higher as a result of the policy decision to opt for the EMS instead of the previous one-for-one no margins link with sterling in which it had enjoyed essentially no risk premium relative to the core (sterling) interest rates? Probably not: for one thing the two core currencies also differed in their interest rate experience during the 1980s with sterling interest rates much higher on average than the DM and on-average excess returns on sterling assets relative to DM assets. As a result, average Irish interest rates were only modestly higher than sterling rates during the period. Besides, it is not clear that Ireland could have adhered to the sterling link through the 1980s. UK monetary policy, combined with the effects of North Sea oil, caused a sharp real appreciation in sterling in the period 1979-81. When superimposed on the deep recession in Ireland, such an appreciation could have proved intolerable. It is easy to imagine that abandonment of the sterling link without a clear alternative such as the EMS could have resulted in much higher nominal Irish interest rates, especially against the background of the contemporaneous fiscal crisis.

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[10]Kremers (1990) argued that Irish inflation credibility had been achieved relatively early in the EMS period, but subsequent interest rate experience casts doubt on this conclusion.

References

Alesina, A. M. de Broeck, A. Prati and G. Tabellini (1992), "Default Risk", *Economic Policy*, 15, 427-463.

Baldwin, R.E. (1990), "Reinterpreting the Failure of Foreign Exchange Market Efficiency Tests: Small Transactions Costs, Big Hysteresis Bands", CEPR Discussion Paper No. 407.

Bartolini, L. (1995), "Devaluation and Competitiveness in a Small Open Economy: Ireland 1987-1993", *Economic and Social Review*, 26, 239-259.

Browne, F.X. and P. McNelis (1990), "Exchange Controls and Interest Rate Determination with Traded and Non-traded Assets: The Irish-United Kingdom Experience", *Journal of International Money and Finance*, 9, 41-59.

Cumby, R.E. (1988), "Is It Risk?: Explaining Deviations from Uncovered Interest Parity", *Journal of Monetary Economics*, 22, 279-99.

Dixit, A.K. (1989), "Entry and Exit Decisions Under Uncertainty", *Journal of Political Economy*, 97, 620-638.

Dixit, A.K. (1991), "Analytical Approximations in Models of Hysteresis", *Review of Economic Studies*, 58, 141-152.

Hansen, L.P. and R.J. Hodrick (1980), "Forward Exchange Rates as Optimal Predictors of Future Spot Rates: An Econometric Analysis", *Journal of Political Economy*, Vol. 88, pp. 829-53.

Honohan, P. (1993), "The EMS and the Theory of Target Zones", Centre for Economic Policy Research, London, Discussion Paper No. 845.

Honohan, P. and C. Conroy (1994a), "Sterling Movements and Irish Pound Interest Rates", *Economic and Social Review*, 25, 201-220.

Honohan, P. and C. Conroy (1994b), *Irish Interest Rate Fluctuations in the European Monetary System*, (Dublin: Economic and Social Research Institute).

Koedijk, K.G. and C.J.M. Kool (1992), "Dominant Interest and Inflation Differentials Within the EMS", *European Economic Review*, 36, 925-944.

Kremers, J. (1990), "Gaining Policy Credibility for a Disinflation: Ireland's Experience in the EMS", *IMF Staff Papers*, 37, 116-145.

Leddin, A., (1988), "Interest and Price Parity and Foreign Exchange Market Efficiency: The Irish Experience in the European Monetary System", *Economic and Social Review*, 19, 215-231.

Leddin, A., (1989), "Efficiency in the Forward Foreign Exchange Market: An Application of Cointegration: A Comment", *Economic and Social Review*, 20, 281-285

Lucey, B.M. (1988), "Efficiency in the Forward Exchange Market: An Application of Cointegration", *Economic and Social Review*, 20, 27-35.

Lucey, B.M. (1989), "Efficiency in the Forward Exchange Market: An Application of Cointegration: Reply", *Economic and Social Review*, 20, 286-288.

McCallum, B.T. (1994), "A Reconsideration of the Uncovered Interest Parity Relationship", *Journal of Monetary Economics*, 33, 105-133.

McEntee, P. and P. Downward (1994), "Time-varying Risk Premia in the Foreign Exchange Market: A GARCH-M Application", Staffordshire University, mimeo.

Nugent, J. (1990), "Further Evidence of Forward Exchange Market Efficiency: An application of cointegration using German and UK data", *Economic and Social Review*, 22, 35-42.

Thom, R. (1995), "The Influence of Sterling on Irish Interest Rates", *Economic and Social Review*, 26, 403-416.

Walsh, B. (1993), "Credibility, Interest Rates and the ERM: the Irish Experience", *Oxford Bulletin of Economics and Statistics*, 55, 439-452.

Annex: Modelling the Excess Returns

The implementation of the hysteresis model requires knowledge of the process governing excess returns expectations. Some limited econometric evidence on the source of the excess returns may be obtained from the regressions reported in Tables 3 and 4. This is based on the following simple formalisation. The excess return is decomposed into its expected value and an unpredictable disturbance term ε. The expected value (predictable component) of the excess returns is interpreted as a, potentially time-varying, risk premium ρ. Thus we write the excess return against currency j at any time t as:

$$\lambda_t^j = r_t - r_t^j - \,_{-t}\left(\frac{\Delta S_t^j}{S_t^j}\right) + \varepsilon_t^j = \rho_t^j + \,_{-t}^j \tag{2}$$

where $\_$ is the mathematical expectation. By definition, although unobserved by the econometrician, the risk premium is a given quantity at time t, which we may model as a linear combination of some known variables X:

$$\rho_t^j = X_t \alpha_j + u_t^j. \tag{3}$$

We may substitute (3) into (2) for the unobserved ρ to obtain:

$$\lambda_t^j = X_t \alpha_j + u_t^j + \,_{-t}^j \tag{4}$$

This is the basis of the regression equation which were estimated. The two disturbances ε and u are not separately identifiable without further assumptions.

We tested the predictability of the excess returns against sterling and the DM using quarterly data for the whole narrow-band EMS period (some regressions end in mid-1992 before the major EMS crisis). We began with an over-determined regression including raw interest differentials (equivalent to forward premia), other available quarterly variables in Ireland, and seasonal dummies. We also ran some regressions including pre-devaluation dummies.[11] Apart from the percentage change in Irish industrial production (in the German equation) and some of the dummies, only the IR£/sterling exchange rate and (for the German equation) the forward premium ever prove significant.

For the present purpose the regressions which do not include pre-devaluation dummies seem the most relevant, and in this case only for sterling do we find a significant equation (3.4-6). Comparable equations for the DM (4.5-6) are not significant. Even if we take the insignificant German equations as the true model, we arrive at a hysteresis band for sterling twice as wide as that for the DM: the standard deviation of the fitted value of equation 3.6 is 1.65 per cent, and for 4.6 is 0.58 per cent giving a variance ratio of 8.05.

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[11] The three large devaluations of 1983, 1986 and 1993, and the sterling collapse of 1992, produce outlying observations, and the purpose of the pre-devaluation dummies is to remove the effect of these outliers.