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Devaluation and Competitiveness in a Small Open Economy: Ireland 1987-1993

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Abstract: This paper studies market expectations of a devaluation of the Irish pound from 1987 to 1993, and relates them to the evolution of Ireland's competitiveness over the same period. Much of the volatility of expectations of the currency's devaluation can be explained by developments outside Ireland, particularly by past and anticipated movements of sterling. The devaluation of the Irish pound in January 1993 is estimated to have exceeded investors' realignment expectations as well as the loss of Irish competitiveness since the beginning of the ERM crisis. This "excess devaluation" helps to explain subsequent large capital inflows and the pound's smooth transition to the wide ERM band in August 1993.

I INTRODUCTION

Beginning in 1987, a concerted effort was undertaken in Ireland aimed at stabilising monetary and fiscal aggregates, reducing inflation and public debt, increasing competitiveness, and — ultimately — leading to a more stable, growth-oriented economic environment. The ERM link to core European currencies was seen as central to these objectives: only by explicitly committing itself to a stable Irish pound within the ERM was the Irish government successful in securing the consensus on the stabilisation plan underlying the Programme for National Recovery of 1988-90 and its successor, the Programme for Social and Economic Progress of 1991-93.[1]

1. See Kremers (1990) for an empirical analysis of the links between the Irish pound's experience in the ERM and inflation expectations in Ireland.

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Several external developments contributed to the success of Ireland's stabilisation plan from 1987 to 1992. On the real side, economic growth in Ireland's main trading partners proceeded — at least until 1990 — at a relatively fast pace, thus stimulating exports and easing the absorption of Ireland's labour supply. On the monetary side, seemingly unchallenged progress towards EMU and the entry of sterling into the ERM provided the necessary external conditions for exchange rate and price stability. The clearest sign of the success of Ireland's stabilisation strategy was the steady decline of Irish-German interest differentials, from about 10 per cent after the devaluation of January 1987 to less than 1/2 per cent in May 1992. Elements of domestic uncertainty were apparent, however. After declining for about half a decade, unemployment resumed its upward trend in 1991, thus undermining the sustainability of interest rate policies aimed at fending off potential speculation against the Irish pound. Public debt as a share of GDP — despite having declined significantly from its peaks of the mid-1980s — remained one of the highest among industrial countries.

Against this background, the timing and nature of the ERM crisis of 1992-1993 seem to have provided a clear test of Ireland's commitment to exchange rate stability. Weakening expectations of European growth, high German interest rates, and the turbulence of EC currency markets between the Danish and French votes on the Maastricht Treaty in the summer of 1992, led to widespread speculative pressure on European currencies and to the withdrawal of sterling and the lira from the ERM. A possible interpretation of these events is that sterling's exit from the ERM and its sharp depreciation thereafter played a crucial role in the devaluation of the Irish pound in January 1993, through their effects on Ireland's external competitiveness. While this is a simple and appealing interpretation, the substantial diversification of Irish trade since the 1970s — leading to a share by Britain in Irish trade of little more than 25 per cent — suggests that the Irish pound/sterling link should be analysed not in isolation, but rather on the basis of a framework that also allows for the effects of other currencies' fluctuations. Furthermore, the nature of exchange rate policy in Ireland since the inception of the ERM in 1979 (and — arguably — even after the ERM crisis in August 1993) suggests that fluctuations of the Irish pound's exchange rate should be explained by disentangling its short-run movements around a relatively fixed target from occasional movements of the target itself.

This paper's aim is to explore some of these issues. As a first step, a recent technique suggested by Bertola and Svensson (1993) and Rose and Svensson (1991) is used to estimate market-based measures of the expected devaluation of the Irish pound and its ERM partner currencies from January

1987 to July 1993. The co-movements of the resulting series are then examined jointly with the evolution of Ireland's competitiveness over the same period, and anticipated devaluations of the Irish pound are interpreted in light of their forward- and backward-looking links to Irish competitiveness. This methodology allows this study to focus on the determinants of market expectations of *future* shifts of exchange rate targets, rather than on contemporaneous or backward-looking links between recorded changes in exchange rates and competitiveness.

The paper's main findings can be summarised as follows. Much of the variability of investors' expectations of a devaluation of the Irish pound over the sample can be explained by developments outside Ireland, particularly by past and anticipated changes of the sterling/mark exchange rate. This finding resembles those of Walsh (1993) and Honohan and Conroy (1994). Its perspective is rather different, however. In developing an explicitly multi-currency framework, this paper goes beyond the triangular link between the Irish pound, sterling, and mark. In separating movements of the pound within its target band and expected movements of the band itself, the paper also recognises the need to distinguish transitory movements of the pound's exchange rate around its target, and occasional (but persistent) movements of the exchange rate target. The empirical analysis reveals a close link between estimated series of expected rates of devaluation and the recorded and anticipated dynamics of Ireland's real exchange rate. This link is consistent with a broadly "fundamental" behaviour of speculators in the Irish pound market, which — in turn — is consistent with Ireland's nature as a small open economy with sluggish price adjustment. Finally, the analysis is useful to explain developments in Irish capital markets after the devaluation of January 1993: investors' expectations of a realignment in early-1993 are estimated to be roughly of the same magnitude as Ireland's loss of competitiveness since the beginning of the ERM crisis, but smaller than the actual devaluation of January 1993. This "excess" devaluation, combined with the subsequent appreciation of sterling, helps to explain the large inflow of capital after the devaluation, the sharp fall in interest differentials, and the smooth transition of the pound to the wide ERM band in August 1993.

II MARKET-BASED ESTIMATES OF EXPECTED DEVALUATIONS

A simple technique to extract market-based estimates of expected rates of devaluation for currencies moving within an exchange rate band has been suggested by Bertola and Svensson (1993), and implemented empirically by Rose and Svensson (1991), Svensson (1993), and Caramazza (1993), among others. In these studies, rational investors are assumed to form expectations

about future changes in the exchange rate. Anticipated changes of a currency moving within a target band are thought to come from anticipated movements of the exchange rate within the band, and from expected shifts of the band itself. Under the assumption of uncovered interest parity, investors' expectations of ERM realignments can be estimated by subtracting an estimate of the expected depreciation of the currency within its fluctuation band from the interest differential.

Formally, let x_{it} denote the (log) exchange rate of currency i with respect to the reference currency (currency N; the Deutsche mark, in the present case), measured as the domestic price of a unit of foreign currency. Also, let c_{it} denote the midpoint of the bilateral band of fluctuation between currency i and the reference currency, and let $r_{it}^{\Delta t}$ and $r_{Nt}^{\Delta t}$ denote the i-th country's and reference country's interest rates on deposits maturing at time $t+\Delta t$. The exchange rate x_{it} can be written as:

$$\begin{aligned} x_{it} &\equiv [x_{it} - c_{it}] + c_{it} \\ &\equiv \tilde{x}_{it} + c_{it}, \end{aligned} \tag{1}$$

where $\tilde{x}_{it} \equiv x_{it} - c_{it}$ denotes the position of the exchange rate in a band with central rate c_{it}.

Taking first differences of Equation (1), and taking expectations at time t, gives

$$E_t[\Delta x_{i,t+\Delta t}] = E_t[\Delta \tilde{x}_{i,t+\Delta t}] + E_t[\Delta c_{i,t+\Delta t}]. \tag{2}$$

If uncovered interest parity holds,[2] then the interest rate differential with country N measures the expected change of the exchange rate:

$$[r_{it}^{\Delta t} - r_{Nt}^{\Delta t}]\Delta t = E_t[\Delta x_{i,t+\Delta t}]. \tag{3}$$

Using (2), yields

$$E_t[\Delta c_{i,t+\Delta t}] = [r_{it}^{\Delta t} - r_{Nt}^{\Delta t}]\Delta t - E_t[\Delta \tilde{x}_{i,t+\Delta t}].$$

2. Data from free-floating exchange rates traditionally provides evidence against uncovered interest parity (see, for instance, the surveys by Hodrick (1987) and Boughton (1988)). Svensson (1992), however, has shown that risk premia for currencies regulated within a relatively small target zone are likely to be small: even for extreme parameter values and for currencies subject to realignment risk, the premium should be not greater than 1/5 of the whole interest-rate differential. Thus, apparent interest parity failures for ERM currencies are more likely to reflect a "peso problem", i.e., investors' expectation of large realignments that may or may not occur in any given sample. The technique described in the text is aimed precisely at measuring investors' expectations of these infrequent events.

Thus, given an estimate of the expected movement of the exchange rate within its fluctuation band over the period $[t, t+\Delta t]$, $E_t\left[\Delta \tilde{x}_{i,t+\Delta t}\right]$, Equation (4) can be used to obtain market-based estimates of the expected realignment $E_t\left[\Delta c_{i,t+\Delta t}\right]$ from interest differentials.[3] To estimate $E_t\left[\Delta \tilde{x}_{i,t+\Delta t}\right]$, this paper follows Rose and Svensson (1991) and Svensson (1993) in considering a linear regression of the form:

$$\Delta \tilde{x}_{i,t+\Delta t} = \beta_{i0} + \beta_{i1} z_{it} + \varepsilon_{it}, \tag{5}$$

where z_{it} is a set of variables that may explain anticipated changes of the position of the exchange rate in the band, $\Delta \tilde{x}_{i,t+\Delta t}$.

Although previous literature has been concerned mainly with estimating equations such as (5) individually for each currency, this paper's focus on the correlation of the expected devaluation between the Irish pound and its ERM partner currencies makes it necessary to estimate a set of such equations (one for each currency) simultaneously. To this end, this paper uses a generalisation of Zellner's Seemingly Unrelated Regressions method which also allows for serially-correlated and heteroskedastic errors, a common feature of empirical work that uses overlapping data. Details of the estimation are provided in the next section.

III DATA AND ESTIMATION OF EXPECTED REALIGNMENTS

The sample extends from January 12, 1987, to July 30, 1993. Daily exchange rates against the dollar of the Irish pound, Deutsche mark, British pound, French franc, Danish krone, Italian lira, Dutch guilder, Belgian franc, (and Japanese yen, for the second stage of the estimation), and three-month Euro-interest rates for the same currencies, were obtained from the Bank of England and DRI. The rates were sampled at the close of the London market except for Irish domestic interest rates and Euro-interest rates on sterling, which were sampled at the Dublin and Paris close, respectively. Cross-currency rates against the Deutsche mark were obtained from the mid-point of the bid-offer spread of the dollar rates.

Seven equations such as (5) were estimated for the Irish pound and the

3 More precisely, $E_t\left[\Delta c_{i,t+\Delta t}\right]$ gives an estimate of the expected *size* of the realignment multiplied by its *probability rate*. Further restrictions on the behaviour of the exchange rate when realigned would be necessary to disentangle these two components. For the present analysis, as in much of the related literature, only the product of the two matters. Note, furthermore, that the methodology used in this paper does not depend on the specific size of the fluctuation band, nor on choosing the mid-point of the band as the benchmark for measuring the position of the exchange rate. It does depend, however, on the assumption that the benchmark c_{it} changes infrequently.

other six ERM exchange rates (against the Deutsche mark) included in the sample, using the Two-Step-Two-Stage Least Squares (2S2SLS) method of Cumby, Huizinga and Obstfeld (1983). By selecting the instruments in each equation to be the same as the right-hand side variables, the coefficients estimated by 2S2SLS reduce to Zellner's Seemingly Unrelated Regressions estimates. Simultaneous estimation by 2S2SLS, however, allows consistent estimation of the standard errors under heteroskedasticity, autocorrelation,[4] and cross-equation correlation of the regression errors.

Because sterling and the lira did not participate in the ERM during a significant part of the sample, a five-equation system including the other five currencies using data from January 1987 to July 1993, was estimated first. The lira equation was then estimated over the period January 1987-September 1992 using the five "core" currencies and the lira itself. Finally, the sterling equation was estimated over the October 1990-September 1992 period by including all seven currencies in the system.

We follow Svensson (1993) and estimate the expected rate of depreciation inside the band *exclusive* of possible jumps in the band at realignments, by dropping from the estimation of Equation (5) three months of data (65 observations) preceding each realignment. Thus, $t+\Delta t$ runs until the day of the realignment, and t runs until 65 business days prior to a realignment. This implies that $E_t\left[\Delta c_{i,t+\Delta t}\right]$, as computed from (4), is defined as *inclusive* of jumps in the band at realignments. Naturally, since jumps occurring in the data (at time T, say) are not in investors' information set prior to T, $E_t\left[\Delta c_{i,t+\Delta t}\right]$ can still be computed up to the date of the realignment from spot exchange rates and interest differentials, after the coefficients of (5) are estimated. Svensson (1993) provides a thorough discussion of these issues, and the notes to Table 1 provide details on sample choice in the present estimation.

The choice of variables to be included in z_{it} to describe central bank intervention policy is essentially an empirical issue. As in all the related literature, a simple regression including a constant term, a regime-shift dummy, and the position of the exchange rate in the band as independent variables, produced the most satisfactory estimates. Additional variables tested in Equation (5) included quadratic and cubic terms of x_{it} and various lags of interest differentials (with respect to Germany). None of these variables

4. Since the daily regressors in Equation (5) are defined over overlapping intervals of three months (or 65 business days), the regression errors follow a moving average process of order 65 even if the underlying errors are i.i.d., and therefore exhibit high serial correlation. The 2S2SLS estimator corrects for serial correlation and heteroskedasticity by weighing sample covariances at different lags as described in Newey and West (1987). Note that the consistent estimation of the standard error of the estimates is necessary for the selection of the final regression, but is irrelevant for the analysis that follows.

proved statistically significant.[5] Institutional changes occurring during the sample period were accounted for by allowing for a small set of constant shift dummies. One of these variables identified the period of sterling's participation in the ERM and proved statistically significant in the Irish pound and French franc equations. A variable identifying the period when the lira was in the ERM proved significant in the Dutch guilder equation. A variable identifying the period during which the onshore Belgian market was subject to a dual exchange-rate system proved statistically significant in the Belgian franc equation. Finally, dummies identifying the periods following the Irish pound's realignment in January 1993 and the lira's shift to the narrow ERM band in January 1990 proved insignificant in these two currencies' equations after allowing for the other regime shifts described above.[6]

Table 1: *Estimation of the Expected Depreciation in the Band*

Country	*Ireland*	*France*	*Italy*	*The Netherlands*	*Belgium*	*Denmark*	*United Kingdom*
Constant	.0007	.0044	.0105	−.0021	−.0015	.0044	.0142
	(.0010)	(.0015)	(.0026)	(.0006)	(.0004)	(.0013)	(.0055)
$\tilde{x}_{i,t}$	−.667	−.552	−.785	−.589	−.756	−.518	−.877
	(.184)	(.120)	(.142)	(.249)	(.126)	(.106)	(.180)
$dum_{i,t}$	.0036	.0025	−.0090	.0019	.0140	.0023	—
	(.0017)	(.0017)	(.0034)	(.0008)	(.0028)	(.0018)	—
R^2	.38	.35	.31	.36	.24	.30	.35
Std.Err.Reg.	.005	.006	.011	.001	.005	.006	.016
N	1,594	1,594	1,368	1,594	1,594	1,594	429

Notes: The dependent variable is the change in the (log) position of the exchange rate in the bilateral band with the Deutsche mark over the next three months, $\Delta\tilde{x}_{i,t+65}$. N is the number of observations. Estimation is by Two-Step-Two-Stage Least Squares with Newey-West-corrected standard errors (reported in parenthesis). The sample periods are as follows: for Ireland, France, The Netherlands, Denmark, and Belgium from January 12, 1987, to July 30, 1993; for the United Kingdom: from October 8, 1990, to September 15, 1992; for Italy: from January 12, 1987, to September 12, 1992. Data for the three months preceding the end of the sample and the ERM withdrawal of Italy and of the United Kingdom were used to generate $\Delta\tilde{x}_{i,t+65}$, with the index t running through the sample minus 65 observations.

5. Classical statistical analysis is appropriate for diagnostics: the position of the exchange rate in the band is defined over a finite interval, and is therefore stationary (although it will generally be serially correlated). Similarly, interest differentials among industrial countries are well known to be stationary (for Ireland, see Walsh (1993) and Honohan and Conroy (1994)).

6. The shift dummies may capture effects other than the institutional changes they are designed for. The significance of the "lira dummy" in the Dutch guilder model, for instance, is more likely to capture the regime shift induced by the ERM crisis in September 1992 than the effects of the withdrawal of the lira from the system on the guilder.

The results of the estimation are reported in Table 1. To interpret the estimated equations, note that a negative estimate of the coefficient of the exchange rate position in the band $\tilde{x}_{i,t}$ implies that appreciation inside the band should be expected for a weak currency and a depreciation for a strong currency. Thus, all exchange rates in the sample display evidence of a tendency to revert toward the centre of the band during the sample.

Subtracting the estimated series of the rates of depreciation within the band from the interest differential (see Equation (4)), yields estimates of time-varying series of expected devaluation for the seven currencies. These are discussed in the next section.

IV EXPECTED DEVALUATIONS OF THE IRISH POUND

The estimated series of the expected devaluation of the Irish pound are plotted in Figure 1. For reference, Figure 2 plots the sterling/deutsche mark exchange rate.

The expected devaluation series display the expected pattern, their peaks and troughs, respectively, corresponding to well known periods of exchange rate uncertainty and calm.[7] Specifically, the series display spikes in the period surrounding the crisis of the fall of 1992. The expected rate of devaluation of the Irish pound eventually settles at lower values after the devaluation of January 30, 1993.

To begin with, it may be of interest to verify to what extent the estimated series of expected rates of devaluations differ from the original series of interest differentials. For this purpose, Table 2 reports the correlations and the mean absolute deviations (annualised) of the expected rates of devaluation and interest differentials for each ERM currency in the sample. Two features are apparent from Table 2. First, with the exception of sterling, and similarly to related results in the literature, the correlation between estimated rates of devaluation and interest differentials is fairly high, ranging from .46 for the French franc to .93 for the Irish pound. Interestingly, sterling displays a negative correlation between its expected rate of devaluation and its interest differential with the DM, a feature that reflects the relative contribution of the expected rate of depreciation *in the band* and of the expected rate of devaluation *of the band* to the interest differential: when sterling is weak in its band, investors expect an appreciation of the currency *within the band* conditional on successful intervention in defence of

7. To interpret Figure 1, consider for instance the period from October 1992 to January 1993, when investors were expecting a 6-8 per cent devaluation of the Irish pound over the next three months. This can be interpreted as a sure devaluation of 6-8 per cent, or as a 50 per cent probability of a realignment of 12-16 percent and a 50 percent probability of no realignment, etc.

the parity, but also anticipate greater likelihood of a devaluation. If mean-reversion is quantitatively strong (which is more likely to be the case for a currency displaying large swings in a 6 per cent band such as sterling) a currency at the weak margin of its band will display a smaller-than-average interest differential in conjunction with a higher-than-average expected devaluation of the band. The usefulness of distinguishing between expectations of currency movements *within the band* from movements *of the band* could hardly be clearer than in this case.

Second, the mean absolute deviations between devaluation rates and interest differentials for each currency vary significantly, from a low of 0.32 per cent per year for the Dutch guilder, to a high of 4.60 per cent per year for sterling (confirming the previous considerations). The mean absolute deviation for the Irish pound, 1.24 per cent per year, equals more than a quarter of the size of the Irish pound's band, and 40 per cent of the mean absolute interest differential. Thus, even when interest differentials and expected rates of devaluation are as highly correlated as they are in Ireland,

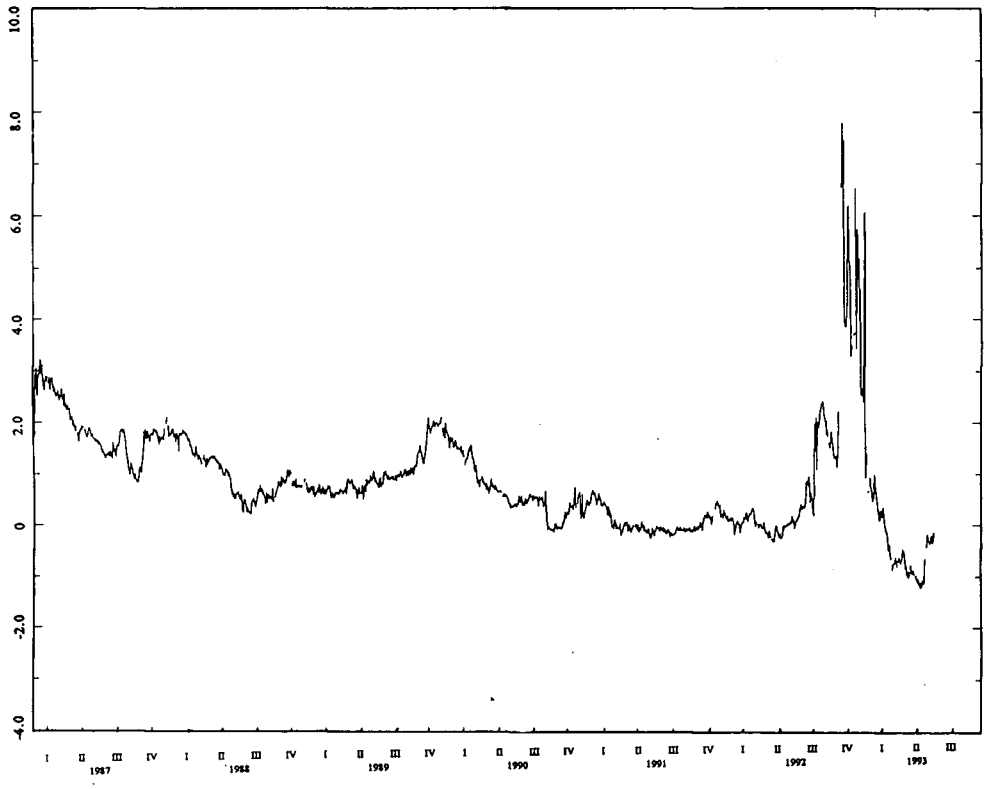

Figure 1: *Irish Pound: Expected Rate of Devaluation (in per cent)*

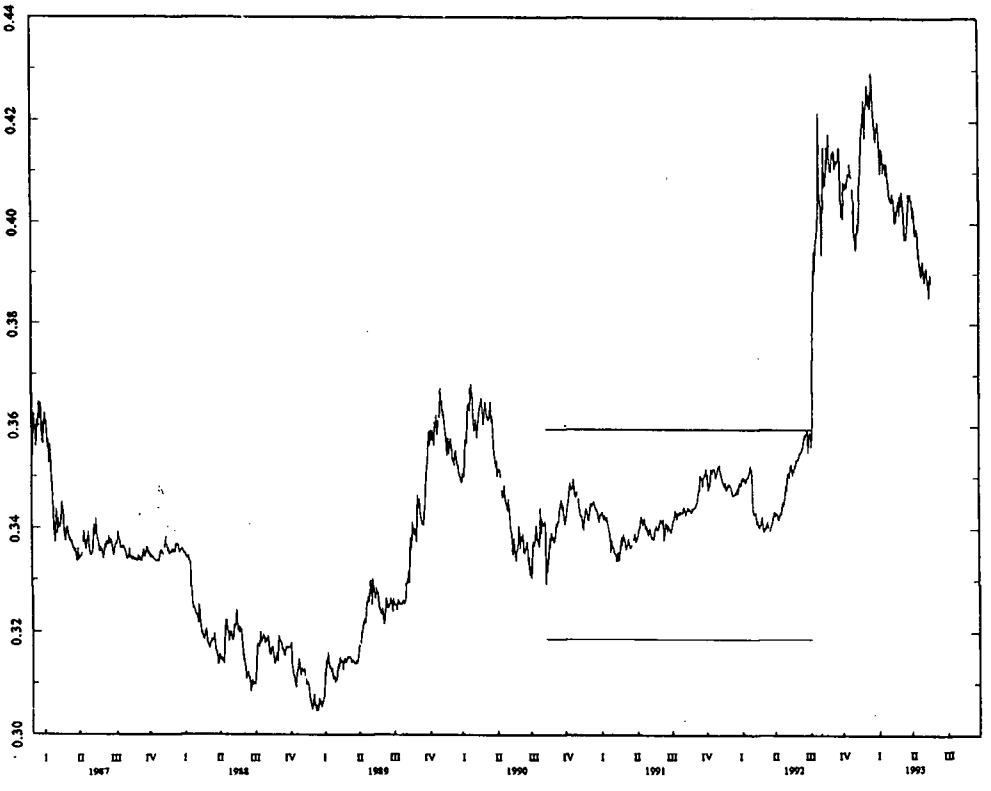

Figure 2: *Sterling/Deutsche Mark Exchange Rate and ERM Band*

Table 2: *Expected Devaluation and Interest Differentials*

	Correlation	*Mean Absolute Deviation (in per cent, annualised)*
Irish pound	.93	1.24
British pound	–.15	4.60
French franc	.46	1.52
Belgian franc	.71	0.88
Dutch guilder	.69	0.32
Italian lira	.71	3.32
Danish krone	.82	1.44

adjusting for the expected rate of depreciation in the band of the currency implies a significant correction to the interest differential.

Next, examination of the series of expected rates of devaluation for different currencies reveals significant cross-currency correlation (charts for currencies other than the Irish pound are available upon request from the

author). This feature is illustrated in Table 3, which reports simple and partial correlation coefficients between the estimated series of expected devaluation on the Irish pound with the estimated series for the other currencies from October 1990 to September 1992 — the period during which sterling participated in the ERM — and over the whole sample (thus excluding the lira and sterling). Table 3 highlights that the estimated series of expected realignments for Ireland is highly correlated with the corresponding sterling series and, to a lesser degree, with the French franc, krone, and lira series. The correlation with the stronger ERM currencies, the guilder and the Belgian franc, is weaker. Overall, an analysis of the co-movements between the estimated series of expected devaluation reveals the contribution given by anticipated movements in other European currencies to the total variance of Irish devaluation risk. In particular, the partial correlation coefficients between the estimated series reported in Table 3 indicate that correlation with sterling explains 12 per cent of the total variance of the Irish expected devaluation even after taking into account the correlation with all the other currencies in the sample.

Two reasons underlie the predominant contribution of sterling to the variability of Irish pound devaluation risk. The first reason is purely statistical: during the period considered, sterling was more volatile around its central ERM parity than the other ERM currencies. (Recall that sterling fluctuated in a wide 6 per cent band during its participation in the ERM.) The second reason is the larger weight of sterling in Irish trade. Anticipating a realignment of sterling in response to its weakness, investors will also anticipate a significant loss of Irish competitiveness. This, in turn, raises expectations of a devaluation of the Irish pound. This specific link between

Table 3: *Correlation of the Expected Devaluation of the Irish Pound with the Expected Devaluation of Other ERM Currencies*

	UK in ERM		*Full Sample*	
	Simple Correlation	*Partial Correlation*	*Simple Correlation*	*Partial Correlation*
British pound	.68	.12	—	—
French franc	.49	.06	.43	.01
Belgian franc	.47	.02	.36	.01
Dutch guilder	.41	.01	.24	.01
Italian lira	.51	.01	—	—
Danish krone	.39	.04	.43	.02
Explained Variance	.62	—	.42	—

sterling and the Irish pound was already explored by Walsh (1993) and Honohan and Conroy (1994). The interaction between changes of a currency's exchange rate and shifts in competitiveness, however, can be expected to hold more generally, since the real exchange rate (measured with respect to a common currency) of countries producing similar output, or trading in more integrated good and factor markets, will tend to be more correlated. If prices adjust sluggishly, the same correlation should be expected among *nominal* exchange rates. The next section explores these linkages as part of a broader dynamic relationship between market-based expectations of Irish pound devaluations and Ireland's competitiveness.

V COMPETITIVENESS AND DEVALUATION EXPECTATIONS SINCE 1987

The standardised real effective exchange rate (REER) of the Irish pound, based on Ireland's and its partners' consumer price indices, is plotted in Figure 3 from February 1987 to July 1993.[8] The country weights used to compute the real exchange rate index are reported in Table 4.[9]

Several features are apparent from Figure 3. First, although the behaviour of Ireland's competitiveness from February 1987 to May 1992 was erratic, the overall increase in competitiveness over that period was only 3 per cent. Figure 3, which also reports the REER series together with the estimated expected devaluation rates (ignore for the moment the series of partner currencies' expected rate of devaluation), also reveals a remarkable similarity between these two series. The role of sterling in the evolution of Irish competitiveness and the Irish pound devaluation series is easy to spot by comparing Figures 2 and 3. More generally, Figure 3 suggests strong concordance between the behaviour of speculators in the Euro-Irish pound market and recorded changes in Ireland's competitiveness.

8. Price data is from the International Financial Statistics of the IMF. When unavailable, as in the case of Ireland, monthly series were obtained as weighted moving averages from the quarterly series. Since most of the within-quarter variability of real exchange rates is caused by changes in exchange rates (rather than by changes in prices), this approximation seemed preferable to moving to quarterly frequency, or using wholesale-price deflators (which are usually of much poorer quality than consumer price deflators).

9. A more comprehensive discussion of the weighing scheme is provided in a longer version of this paper, available upon request from the author. In summary, the reported weights are estimated by updating the total competitiveness system of McGuirk (1987) (based on trade data for 1980) with data for 1991, and are corrected for exchange rate-insensitive trade conducted under the Common Agricultural Policy of the EU. (The competitiveness weights encompass trade relationships in Ireland, in each of Ireland's partners domestic markets, and in third country markets.) Information on Irish agricultural trade under the CAP was derived mainly from a recent Central Bank of Ireland study (McGuire, 1993).

Table 4: *Ireland: Total Competitiveness Weights*

United Kingdom	27.4	The Netherlands	3.7
Austria	1.1	Norway	1.1
Belgium	2.9	Spain	1.9
Denmark	1.2	Sweden	1.8
Finland	0.6	Switzerland	2.4
France	7.1	United States	17.6
Germany	17.1	Canada	1.2
Italy	5.9		
Japan	7.0	Total	100.0

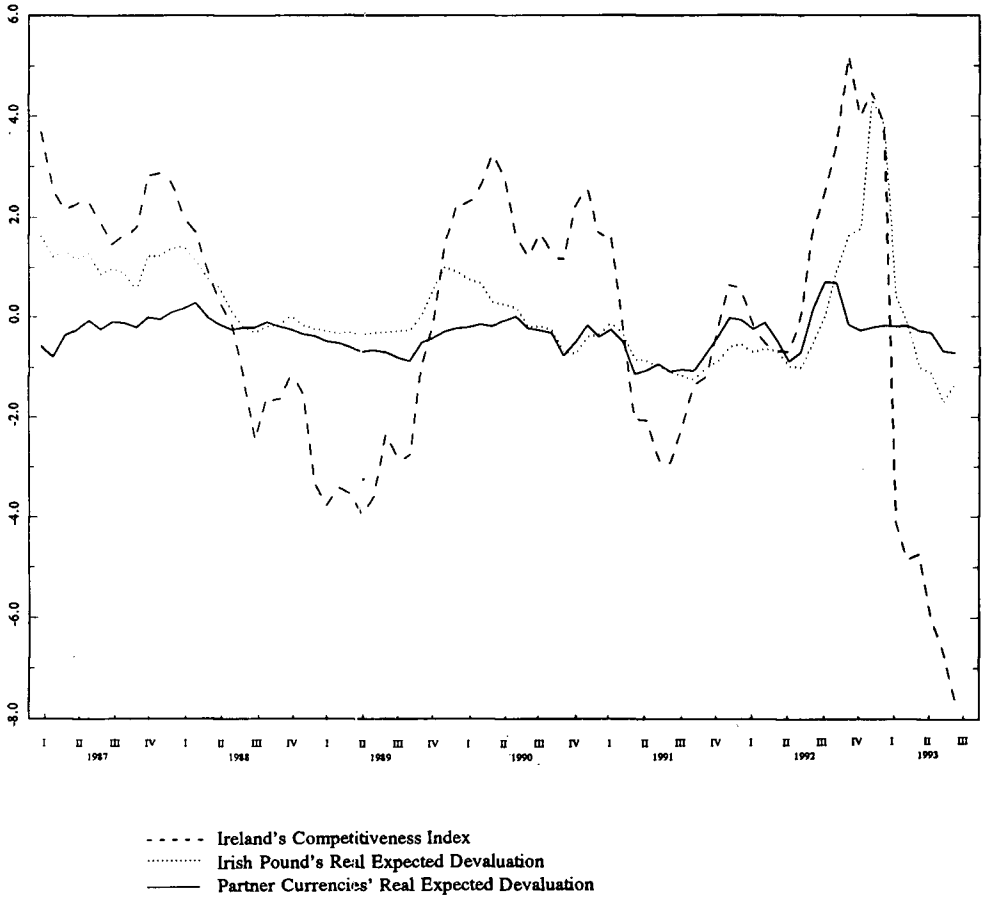

Figure 3: *Irish Pound's and Partner Currencies' Real Expected Devaluation and Ireland's Competitiveness Index (in per cent)*

An examination of the events during the ERM crisis of 1992-93 further highlights the link between anticipated devaluation of the Irish pound and developments in Irish competitiveness, and the crucial role played by sterling. Ireland's effective competitiveness worsened by about 6 per cent from June to October 1992, largely as a result of sterling's slide within its wide ERM band from June to September and its sharp depreciation after its withdrawal from the ERM. (Over the period July-October 1992 alone, sterling depreciated by about 20 per cent, thus leading to a loss of Irish competitiveness of more than 5 per cent.) Ireland's real effective exchange rate then remained broadly stable until mid-January 1993, when a 5½ per cent decline of sterling was triggered by a further cut in the key Minimum Lending Rate in the United Kingdom. On January 30, following another attack on the Irish pound, the Central Bank of Ireland devalued the Irish pound/ECU central parity rate by 10 per cent. Note that in the three months preceding the devaluation, the estimated series of expected devaluation hovered around 4-6 per cent (on a three-month basis), while the loss of Irish competitiveness with respect to the pre-crisis period (end-May 1992) was 5-5½ per cent. In practice, the effect of the realignment was to devalue the Irish pound by about 7½ per cent, as a result of the 10 per cent change in the central parity and a revaluation inside the new band of about 2½ per cent. Thus, the devaluation of the Irish pound in January 1993 appears to have exceeded both investors' expectations at that time, and the loss of competitiveness accumulated since the beginning of the crisis in June 1992.[10] Subsequently, while the Irish pound stabilised within its new band after February 1993, sterling began to recover some of its previous decline. Thus, the link with sterling that had worked against the Irish pound in the fall of 1992, was now working in its favour, in combination with the under-valuation effects of the realignment of January 1993. Expectations of an appreciation of the Irish pound had a wide range of effects: large inflows of private capital, a record accumulation of official reserves, and a rapid decline of interest rate differentials, to the point that the Irish pound-Deutsche mark short-term interest differential became negative in May 1993. In fact, when speculative pressure mounted in the ERM in July 1993, the real exchange rate of the Irish pound was hovering at about 4 per cent lower than its post-devaluation level. In the event, the pound joined the Deutsche mark and the Dutch guilder at the top of the ERM grid, making a smooth, speculation-free transition to the wide ERM band in August, and maintaining a strong

10. June 1992 represents a natural benchmark for the beginning of the Irish pound crisis. That month marks the reversal of the flow of Irish official reserves, the upturn of interest rate differentials, the beginning of sterling's slide within its ERM band, and the consequent beginning of the appreciation of Ireland's real exchange rate.

position in the system afterwards.

Section IV has pointed at the strong correlation between market-based estimates of expected Irish pound devaluations and estimates of *anticipated* devaluations of the pound's partner currencies. We also noted the concordance between expectations of Irish pound devaluations and movements of Ireland's real exchange rate, which measures *past* changes in competitiveness. This informal evidence can be integrated and made more precise by considering an empirical model of the form:

$$E_t\left[\Delta x_{0,t+\Delta t} - \Delta p_{0,t+\Delta t}\right] = \beta_0 + \beta_1 E_t \sum_{i=1}^{N-1} \gamma_i \left[\Delta x_{i,t+\Delta t} - \Delta p_{i,t+\Delta t}\right] + \beta_2 \ln(REER_t). \quad (6)$$

In Equation (6), γ_i is the competitiveness weight of currency i in Irish trade (i=0 for Ireland) and p_i is the (log) price level in country i. Thus, $E_t \sum_{i=1}^{N-1} \gamma_i \left[\Delta x_{i,t+\Delta t} - \Delta p_{i,t+\Delta t}\right]$ is an index of the expected future real devaluation of the Irish pound's partner currencies (with respect to the N-th currency), while the real effective exchange rate (REER) is defined as in the previous section. Thus, Equation (6) captures *backward*-looking links to competitiveness by relating expected devaluations of the Irish pound to previous changes in Ireland's real exchange rate, as well as *forward*-looking links to anticipated changes of the real exchange rates of Ireland's partner currencies.

Although a comprehensive examination of the long-run properties of Ireland's real exchange rate remains beyond the scope of this paper (for this, see Wright (1994)), Equation (6) is suitable to test the consistency of the main predictions of a simple model based on Purchasing Power Parity (PPP) with the behaviour of the Irish pound market from 1987 to 1993, in the form of a test of the hypothesis that the coefficients β_1 and β_2 are positive. Indeed, Equation (6) is consistent with recent research studying the cointegrating properties of real exchange rates in a number of industrial countries,[11] insofar as it can be re-written as a (one-period-ahead) error-correction model of the form:

$$E_t\left[\Delta x_{0,t+\Delta t} - \Delta p_{0,t+\Delta t}\right] = \beta_1 E_t \sum_{i=1}^{N-1} \gamma_i \left[\Delta x_{i,t+\Delta t} - \Delta p_{i,t+\Delta t}\right] + \beta_2 \left[\left(p_{0,t} - p_{N,t} - x_{0,t}\right) - \sum_{i=1}^{N-1} \gamma_i \left(p_{i,t} - p_{N,t} - x_{i,t}\right) - \kappa\right], \quad (7)$$

11. Several recent papers have provided evidence in favour of a long-run tendency of many exchange rates to revert to Purchasing Power Parity (PPP), based on cointegration methods and long series of historical data. See Taylor (1993) for a survey of the literature.

where

$$\kappa \equiv -\beta_0 / \beta_2,\ \ln(\text{REER}) \equiv \sum_{i=1}^{N} \gamma_i \left[x_{i,t} - x_{0,t} + p_{0,t} - p_{i,t} \right],\ \sum_{i=1}^{N} \gamma_i \equiv 1,\ \text{and}\ x_N \equiv 0.$$

Thus, a positive estimated value of β_2 would be consistent with the prediction that (real) anticipated devaluations are driven by a long-run tendency of real exchange rates to revert to PPP in Equations (6) and (7). A positive estimated coefficient β_1 would capture the short-run impact of an expected real devaluation of Ireland's partner currencies.[12]

The competitiveness weights γ reported in Table 4 were used to construct the composite index of the "foreign" expected rate of devaluation, $E_t \sum_{i=1}^{N-1} \gamma_i \left[\Delta x_{i,t+\Delta t} - \Delta p_{i,t+\Delta t} \right]$. To compute this index, the expected rates of devaluations estimated in Section III were used for the six ERM currencies (and for the Irish pound on the left-hand side of (6)). Expected devaluation series for the free-floating US dollar and yen were obtained as the unfiltered series implied by the respective three-month interest-rate differential with Germany.[13] Expected devaluation rates for the lira and sterling, when these two currencies were not participating in the ERM, were also obtained directly from the corresponding interest-rate differential series.

Table 6 reports results of several variants of regression (6), all of which exhibit the same qualitative results. The estimated slope coefficients display the predicted positive sign at relatively high levels of significance, even after adjusting their standard errors to correct for the serial correlation induced by the use of overlapping observations. The regressions also show that a large part of the variance of the expected rate of devaluation of the Irish pound can be explained by the simple empirical model described in Equation (6).

Several specification checks were considered. First, it seemed useful to verify the robustness of the qualitative results with regard to the specification of inflation expectations. One would not expect much sensitivity to this specification: with sluggish price adjustment, anticipated real devaluations over a three-month horizon should reflect mainly the variability of nominal exchange rates, rather than the variability of inflation. Table 6, which reports three different specifications of the inflation forecast method, confirms this conjecture. Model (1) estimates future inflation using the AR(3) process documented in Table 5 (additional lags were insignificant). Model (2) assumes perfect inflation foresight and thus uses *actual* inflation. Model (3) assumes expectations of constant inflation differentials, thus effectively specifying (6)

12. All exchange rates in Equations (6) and (7) are defined in terms of currency N (the Deutsche mark), so that $(x_{0,t} - x_{i,t})$ gives the (log) exchange rate of the Irish pound with currency i.

13. As shown in Table 4, 90 per cent of Ireland's trade is accounted for by including in the sample the six ERM currencies studied in Section III, the dollar and the yen (in addition to the reference Deutsche mark).

Table 5: *Ireland: Domestic and (Weighted) Foreign Inflation*

Model	*Ireland*	*Composite Foreign*
Constant	.0014	.0007
	(.0005)	(.0002)
$p-p_{-1}$	1.485	1.636
	(.085)	(.058)
$p_{-1}-p_{-2}$	−.844	−.788
	(.112)	(.075)
$p_{-2}-p_{-3}$	.169	.050
	(.072)	(.052)
R^2	.84	.94
Std. Err. Reg.	.001	.001
N	79	79

Notes: The dependent variables are the 3-month rate of inflation in Ireland and in its trading partners (aggregated with the set of weights from Table 4). N is the number of observations. Estimation is by OLS with Newey-West-corrected standard errors (reported in parenthesis). The sample includes monthly data from October 1986 to July 1993. When unavailable, monthly observations were obtained as weighted moving averages from quarterly data from the International Financial Statistics.

Table 6: *Ireland: Real Exchange Rate and Expected Devaluation*

Model	(1)	(1)	(2)	(2)	(3)	(3)	(1)(IV)	(1) (IV)
Constant	.0027	.0020	.0037	.0022	.0072	.0029	.0020	.0024
	(.0018)	(.0017)	(.0019)	(.0015)	(.0033)	(.0012)	(.0018)	(.0018)
$E_t \sum_{i=1}^{N-1} \gamma_i \left[\Delta x_{i,t+\Delta t} - \Delta p_{i,t+\Delta t}\right]$	.515	.793	.869	.848	.184	.926	.333	.977
	(.396)	(.290)	(.227)	(.217)	(.622)	(.342)	(.390)	(.297)
$\ln(REER_t)$	.180	.080	.181	.105	.199	.100	.192	.058
	(.072)	(.033)	(.052)	(.030)	(.067)	(.035)	(.073)	(.036)
dummy	—	.025	—	.024	—	.024	—	.026
		(.002)		(.002)		(.002)		(.006)
R^2	.38	.73	.46	.77	.37	.72	.37	.64
Std. Err. Reg.	.008	.005	.008	.005	.008	.005	.008	.006
N	78	78	78	78	78	78	77	77

Notes: The sample includes monthly data from February 1987 to July 1993. The dependent variable is the real expected devaluation of the Irish pound/DM bilateral parity over the next three months, $E_t\left[\Delta c_{0,t+3} - \Delta p_{0,t+3}\right]$. Model (1) estimates expected inflation by the AR(3) model presented in Table 5; model (2) uses actual inflation; model (3) assumes constant inflation differentials, so that the model reduces to 1 with nominal expected devaluations. N is the number of observations. Estimation is by OLS, except as noted. The lagged composite expected devaluation rate was used as an instrument for the corresponding contemporaneous term in the IV estimation. Newey-West-corrected standard errors are reported in parenthesis.

as an error-correction model for *nominal* exchange rates. Table 6 shows that the three models produced very similar results.

Next, a constant shift dummy was allowed for, to capture the large outliers recorded in the October 1992-January 1993 period. This procedure effectively recognises the inability of the simple linear PPP model to capture much of the volatility of the estimated expected devaluation series during these four months. On the other hand, the correction highlights the large proportion of the variance captured by the model during the remaining part of the sample and the robustness of the statistical significance of the slope coefficients.

Finally, the term $E_t \sum_{i=1}^{N-1} \gamma_i \left[\Delta x_{i,t+\Delta t} - \Delta p_{i,t+\Delta t} \right]$ is a generated regressor, and it may in principle be subject to measurement errors. If this is the case, estimation with instrumental variables is necessary to obtain consistent estimates of the coefficients. Estimation of model (1) with instrumental variables using the lagged term $E_t \sum_{i=1}^{N-1} \gamma_i \left[\Delta x_{i,t+\Delta t} - \Delta p_{i,t+\Delta t} \right]$ as an instrument is reported in Table 6, and shows that in one specification of the model the REER term is marginally less significant (the hypothesis that β_2 is equal zero can still be rejected with 89 per cent confidence, however). The results show that the IV estimates are very similar to the OLS estimates, suggesting that measurement errors should not cause particular concern and that more powerful OLS estimation should therefore be used.[14]

In summary, confirming the visual evidence from Figure 3, the results of this section indicate that market-based expectations of Irish pound devaluations display strong evidence of backward linkages to competitiveness as well as forward-looking linkages to anticipated devaluations of other currencies exchange rates with the Deutsche mark. A large fraction of the in-sample variance of the estimated rate of expected devaluation from 1987 to 1993 can be explained by the simple empirical model considered here, although only about half of the large values recorded in the October 1992-January 1993 period can be captured by the model. We also note that while the interpretation of the REER variable in terms of competitiveness is immediate, the interpretation of the term $E_t \sum_{i=1}^{N-1} \gamma_i \left[\Delta x_{i,t+\Delta t} - \Delta p_{i,t+\Delta t} \right]$ is potentially more ambiguous. By definition, this term captures anticipated changes in real exchange rates of Ireland's partner currencies. However, the reduced-form approach of the present paper is not suitable to trace the reasons for such changes, nor the specific channels through which such changes lead to anticipated real devaluations of the Irish pound. Our prior is

14. One reason why one would not expect measurement errors to be a problem here, is that these errors are likely to cancel out when forming the composite indicator of foreign expected devaluation. Note that measurement errors in the dependent variable do not affect the consistency of the estimation, because they are absorbed in the error term.

to interpret the significance of this term in Equation (6) as evidence in favour of forward-looking links to competitiveness, for the estimated linkage correspond exactly to what a simple PPP-based model, or even a model with imperfect substitutes, would predict. Alternative interpretations are possible, however, one possibility being that the estimated devaluation series simply reflect the anticipation of a common speculative attack on European currencies, with little link to competitiveness or other fundamental considerations. Clearly, only a structural model of exchange rate determination would help in discriminating among alternative interpretations of the empirical results presented here. This is a task that goes beyond the scope of the present study, but we hope that the present results may provide motivation for such effort. What we note here is that the behaviour of estimated expected rates of devaluation of the Irish pound from 1987 to 1993 conforms exactly with the predictions of a simple "fundamental" model of real exchange rate dynamics based on the principle of competitiveness.

VI CONCLUDING REMARKS

This paper has provided empirical evidence of a simple notion: a small open economy with sluggish price adjustment — such as that of Ireland — is bound to face speculative pressure on its (nominal) exchange rate target whenever movements in its trading partners' currencies lead to cumulative and anticipated losses of its competitiveness. Using recent techniques designed to extract market-based expectations of exchange rate devaluations, the paper has verified the existence of backward and forward-looking links between market-based estimates of expected devaluation of the Irish pound and changes in Ireland's real exchange rate. Changes in Ireland's "fundamentals" — namely, the evolution of its real effective exchange rate and anticipated changes in its partner currencies' rates — are found to explain most of the speculative activity occurring in the Irish pound market from 1987 to 1993. This finding is consistent with Ireland's nature as a small open economy, with a high vulnerability to competitiveness losses, and more generally with the predictions of standard trade models and recent empirical evidence in support of long-run PPP.

With specific reference to the 1992-1993 crisis, the paper has highlighted how market-based expectations of Irish pound devaluations have been highly correlated with expected devaluations of sterling, a correlation that reflects — more generally — a link prevailing during the whole period of sterling participation in the ERM. Thus, notwithstanding Ireland's significant trade diversification since the mid-1970s, the Irish pound-sterling link remains strong. Also, the actual depreciation of the Irish pound following the

realignment of January 1993 is estimated to have exceeded both investors' expectations and the loss of competitiveness that had occurred since the pre-crisis period. This "excess" devaluation, coupled with the subsequent appreciation of sterling leading to further competitiveness gains, seems to largely explain the prompt market acceptance of the new ERM band. In contrast with the relapse of speculation on Italian lira, Spanish peseta, and Portuguese escudo in 1992-93, exchange rate credibility was quickly restored in Ireland after the devaluation. This favoured the rapid inflow of capital, the fall of interest differentials to below their pre-crisis level, and, eventually a smooth, speculation-free, transition to the wide ERM band in August 1993.

Finally, although this paper has focussed on events in the period from 1987 to 1993, its findings bear implications also for the analysis of exchange rates in the period following the widening of the ERM band. Exchange rate targeting remains an important ingredient of monetary policy in Ireland, as well as in the majority of small open economies around the world. Traditional target zone models used to study the dynamics of exchange rates within relatively narrow bands will have to be refined in order to describe more realistically how investors learn of changes in intervention policies in post-1993 European currency markets. Even under these circumstances, however, the empirical link explored in this paper, between anticipated shifts of exchange rate targets and developments in competitiveness, can be expected to survive. Some analytical work in developing more general models of exchange rate intervention has already been conducted (see, for instance Klein and Lewis (1993)). Empirical research on the relevance of such models for European exchange rates after the 1992-93 crisis will certainly follow.[15]

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15. This article was already in press when this Review's editor brought to my attention the closely related work by O'Donnell (1995). Despite the differences in sample choice, estimation techniques and underlying "fundamental" models, my work and O'Donnell's reach similar conclusions in pointing at the possibility of explaining anticipated ERM devaluations of the Irish pound on the "fundamental" (as opposed to purely speculative) motives.

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