
IRISH INTEREST RATE FLUCTUATIONS: IN THE EUROPEAN MONETARY SYSTEM

Patrick Honohan and Charles Conroy



THE ECONOMIC & SOCIAL RESEARCH INSTITUTE

No. 165
IRISH INTEREST RATE FLUCTUATIONS
Honohan and Conroy
December, 1994

THE ECONOMIC AND SOCIAL RESEARCH INSTITUTE

COUNCIL

- * TOMÁS F. Ó COFAIGH, *President of the Institute.*
- * EUGENE McCARTHY, *Chairman of the Council.*
KEVIN BONNER, *Secretary, Department of Enterprise & Employment.*
JAMES CAWLEY, *Managing Partner, Cawley & Company, Solicitors.*
LIAM CONNELLAN, *Vice-President, Royal Dublin Society.*
- * SEAN CROMIEN, *Former Secretary, Department of Finance.*
WILLIAM B. DILLON, *Chief Executive, Amdahl Ireland Limited.*
- * MARGARET DOWNES, *Deputy Governor, Bank of Ireland.*
- * MAURICE F. DOYLE, *Former Governor, Central Bank of Ireland.*
- * CONNELL FANNING, *Professor, Department of Economics, University College, Cork.*
IAN GRAHAM, *Consultant Cardiologist, The Charlemont Clinic, Dublin.*
GRAHAM GUDGIN, *Director, Northern Ireland Economic Research Centre.*
JOSEPH HARFORD, *Chief Executive, Yamanouchi Ireland Company Limited.*
JOHN HURLEY, *Secretary, Public Service Management Development, Department of Finance.*
KEVIN J. KELLY, *Group Financial Director, AIB Group plc.*
- * KIERAN A. KENNEDY, *Director of the Institute.*
PATRICK LYNCH, *Chairman of the Institute, 1983-1988.*
EDWARD F. McCUMISKEY, *Secretary, Department of Social Welfare.*
FERGUS McGOVERN, *Former Chief Executive, Telecom Eireann.*
ALAN MATTHEWS, *Department of Economics, Trinity College Dublin.*
JOSEPH MORAN, *Chief Executive, Electricity Supply Board.*
- * PATRICK MULLARKEY, *Secretary, Department of Finance*
DONAL MURPHY, *Director General, Central Statistics Office.*
- * DONAL NEVIN, *Former General Secretary, Irish Congress of Trade Unions.*
MAURICE O'CONNELL, *Governor, Central Bank of Ireland.*
JOYCE O'CONNOR, *President, The National College of Industrial Relations.*
PATRICK O'REILLY, *Chief Executive, EBS Building Society.*
- * W.G.H. QUIGLEY, *Chairman, Ulster Bank Limited.*
- * NOEL SHEEHY, *Professor, Department of Psychology, Queen's University of Belfast.*
MICHAEL J. SOMERS, *Chief Executive, National Treasury Management Agency.*
T.K. WHITAKER, *President of the Institute 1971-1987.*
- * PADRAIC A. WHITE, *Director, Dresdner International Finance plc.*

* Members of Executive Committee

IRISH INTEREST RATE FLUCTUATIONS IN THE EUROPEAN MONETARY SYSTEM

*Copies of this paper may be obtained from The Economic and Social Research Institute
(Limited Company No. 18269). Registered Office: 4 Burlington Road, Dublin 4.*

Price IR£12.00

(Special rate for students IR£6.00)

Patrick Honohan is a Research Professor with The Economic and Social Research Institute. Charles Conroy was a Research Assistant with the Institute and is now with Fidelity Management and Research in Boston. The paper has been accepted for publication by the Institute which is not responsible for either the content or the views expressed therein.

*IRISH INTEREST RATE FLUCTUATIONS:
IN THE EUROPEAN MONETARY SYSTEM*

**Patrick Honohan
and
Charles Conroy**

© THE ECONOMIC AND SOCIAL RESEARCH INSTITUTE
DUBLIN, 1994

ISBN 0 7070 0154 4

Acknowledgements

The authors are grateful to AIB, Bank of Ireland, Ulster Bank and Woodchester-Credit Lyonnais for their financial support for this work through their funding of the Banking Research Centre in the ESRI.

Without implicating them, we would like to acknowledge our indebtedness to the following for useful discussions and comments: Terry Baker, Lorcan Blake, Frank Browne, Patrick Carey, Peter Charleton, Eoin Fahy, John FitzGerald, John Frain, Pat McArdle, Colm McCarthy, Michael Moore, Peter Neary, Cormac Ó Gráda, Thomas O'Connell, Jim O'Leary, John O'Mahony, Maurice Roche, Diarmuid Sugrue, and Brendan Walsh; to the Central Bank of Ireland and the Department of Finance, to participants at Seminars at the ESRI and at the Dublin Economic Workshop; to an anonymous referee; and to Mary McElhone and Dee Whitaker for editorial assistance.

Date of Final Revision: 14 November 1994

CONTENTS

	<i>Page</i>
<i>Acknowledgements</i>	iv
<i>General Summary</i>	ix
<i>Chapter</i>	
1 The Evolution of Irish Interest Rates	1
2 Excess Returns on Irish Pound Assets in the EMS	19
3 Liquidity and Irish Interest Rates	40
4 The Effect of Realignment Crises on Interest Rates	56
5 Expectations and Risk Premia in the Determination of Long-Term Rates	75
6 Concluding Remarks	97
<i>Bibliography</i>	100

LIST OF TABLES

<i>Table</i>	<i>Page</i>
1.1 Mean Interest Differentials: Ireland vs. London, 1820-1949	6
1.2 Summary Statistics of Long and Short-term Interest Rates, Ireland and Other Countries	12
2.1 Cointegration Tests	21
2.2 Excess Returns: International Comparison	23
2.3 Regression Results: Irish-UK Short-term Excess Returns	31
2.4 Regression Results: Irish-German Short-term Excess Returns	32
3.1 Elements of Central Bank Balance Sheet	44
3.2 Regression Results: Central Bank Support	54
4.1 Regression Results: Role of Sterling (Daily Data)	68
5.1 Excess Returns: Long vs. Short	83
5.2 Regression Results: Using the Yield Gap to Explain the Short Rate	84
5.3 Regression Results: Modelling the Risk Premium	90
5.4 Regression Results: The Yield Gap	92

LIST OF FIGURES

<i>Figure</i>	<i>Page</i>
1.1 Irish Interest Rates and Differential over London, 1820-1994	4
1.2 Long-term Bond Yield 1927-93	9
1.3 Real Short-term Rates 1927-93	10
1.4 Daily 1-month Interest Rates During the EMS	14
1.5 Long-term Interest Rates and Possible Causes	16
1.6 International Interest Differentials 1979-93	18
2.1 Excess Returns: International Comparison	24
2.2 Cumulative Excess Returns	25
3.1 Central Bank Support	46
3.2 Net Bank Liquidity	47
3.3 Bank Liquidity and Interest Rates	52
4.1 Interest Rate Differentials Near Realignments	58
4.2 1983 Realignment	59
4.3 1986-87 Realignments	62
4.4 Interest Rate and Exchange Rate in 1989-90	63

<i>Figure</i>		<i>Page</i>
4.5	Daily Interest Rates 1992-93	64
4.6	1993 Realignment	67
4.7	Band Position	69
4.8	Band Position and Sterling Exchange Rate	70
5.1	Long-term Interest Rates and Subsequent Inflation: Ireland	78
5.2	Long-term Interest Rates and Subsequent Inflation: Germany	79
5.3	Long-term Interest Rates and Subsequent Inflation: UK	79
5.4	Long-term Real Interest Rates: Ireland, Germany and UK	81
5.5	Cumulative Excess Returns: Long vs. Short	88
5.6	Excess Returns: Long vs. Short (Actual and Fitted)	91
5.7	Yield Gap: Ireland and Germany	93
5.8	Yield Gap: Ireland and UK	93
5.9	Irish and World Long-term Interest Rates	94

GENERAL SUMMARY

After many years during which they remained close to those in the UK, Irish interest rates assumed an independent existence in 1979 following the establishment of the European Monetary System (EMS) and the break-up of the long-standing exchange rate link with the pound sterling. The following fifteen years have been turbulent ones for Irish money markets, with real interest rates at heights not even approached since the 1930s and nominal interest rates also reaching record levels. This paper examines the factors that have influenced movements in Irish interest rates in the past decade and a half. Several of the factors that contributed to the turbulence have been removed with the abandonment of the narrow margins.

An Overview

A glance at the historical record might suggest that the major breakpoint in Irish interest rates came in the early 1970s, when nominal wholesale rates soared well into double digits for the first time ever. But the interest rate fluctuations of the 1970s, along with the surge in inflation, were imported. Home-grown economic problems, including the rapid growth in unemployment and the slide into fiscal deficit, had scarcely any influence on financial markets during that time.

A more decisive break is that which occurred soon after the EMS began, when sustained deviations of Irish interest rates from those in the UK began to occur. Henceforth, Irish interest rate developments would lack the traditional anchor and would follow new tides and currents.

Over the subsequent 15 years Ireland experienced unprecedented interest rate volatility and far higher average interest rates than ever before. Both short-term and long-term yields have been affected. Of course this has been a period of unusually high and volatile interest rates worldwide, but Ireland's experience has been extreme. By embarking on an independent course just at the start of a deep world recession, with a large and growing fiscal deficit and rapidly rising inflation, it was inevitable that Irish financial markets would experience turbulence.

We stress the key role which market expectations of future developments play in determining the price and interest yield of financial

assets. It would be hard to find a period of greater uncertainty about the immediate and the more remote prospects for the Irish macroeconomy than the early months of the EMS. The markets responded with growing pessimism and allowed a large risk-premium to emerge in Irish interest rates, both short and long-term, during the early 1980s.

The markets feared currency depreciation, high inflation and high interest rates; all of these potential consequences, among other things, of fiscal instability. As a result, short-term interest rates were driven systematically higher than necessary to compensate for subsequent depreciation against the DM. In addition short-term rates surged when sterling was weak, once again exaggerating the implied risks.

When long-term yields peaked at over 19 per cent in early 1982 the allowance for future inflation and falling bond prices implicitly built-in to those yields was far too high in the light of subsequent events.

That the markets were subsequently proved wrong does not nullify the importance of market expectations. On the contrary, the threat then posed to medium-term financial stability by the fiscal imbalance, by high levels of inflation and by growing unemployment was high and hard to evaluate. The complexity of the process of expectations formation is confirmed by the difficulty of uncovering any simple relationship between measured economic variables and market expectations.

The underlying worry of the markets throughout the period, and the factor that was subject to repeated re-evaluation, was surely the fear that the fiscal deficit would not come under control. This introduced a new and destabilising element in budgetary planning. The difficulty of controlling budgetary deficits in the early 1980s was compounded by the high interest rates at which borrowing was being carried out. Conversely, when the deficit was at last demonstrably under control, the much lower interest rates which ensued helped speed the improvement in the budgetary accounts.

Outline of the Paper

We begin in Chapter 1 with an overview of the main historical trends in Irish interest rates. The era of relatively stable interest rates ended several years before the EMS began, reflecting the higher and more volatile inflation rate in the UK. After the EMS began the potential role of domestic factors was greater, because it is a more flexible exchange rate regime. Irish interest rates (and their differential above foreign rates) increased sharply in the first

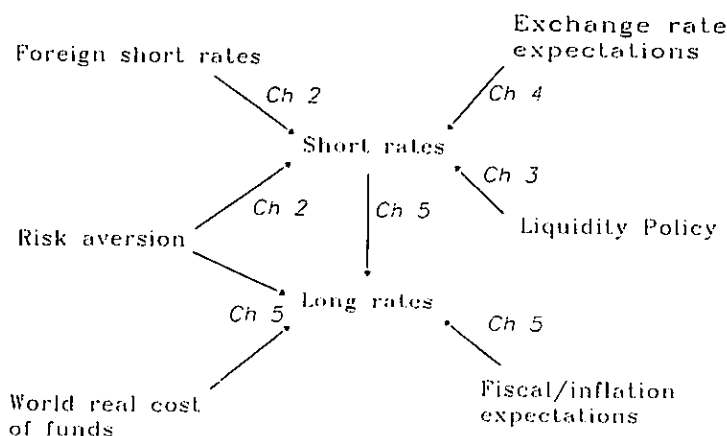
years of the EMS, but began to decline after 1982, slowly at first, and then quite sharply during 1987-88. This corresponds roughly to the time-path both of inflation and of public borrowing, particularly the latter, suggesting a causal link.

The remainder of the paper adopts a more analytical approach, examining aspects of Irish interest rate movements during the narrow-band EMS period in more detail. We focus on wholesale interest rates and therefore do not directly consider variations in banking spreads or in retail interest rates. Bearing in mind the potential for both foreign and domestic influences on interest rates, we work within a framework which assumes that

short-term money market rates are driven chiefly by (i) foreign money market rates and (ii) the market's expectations of imminent exchange rate changes, the latter being the channel through which domestic factors have their effect;

nominal yields on long-term bonds are driven by both nominal and real factors. The former are especially expectations regarding future inflation and exchange rate trends and thus the future development of short-term rates. The latter is the real cost of loanable funds, traditionally seen as balancing the forces of thrift and productivity.

The accompanying diagram displays the schematic framework of the paper and indicates the chapters in which each link is explicated.



Expectations play a major role in this framework, though it has to be acknowledged that they are hard to measure, and the proxies which we use for expectations are necessarily imperfect. The same applies when it comes to including an allowance for risk aversion in the modelling.

Chapter 2 introduces the concept of excess returns and examines the degree to which, by comparison with foreign rates, Irish short-term interest rates have displayed excess returns in the EMS period. When compared with the DM, Irish interest rates have been far higher than necessary to offset the actual exchange rate changes that occurred. Our interpretation is that investors required an additional risk-premium, possibly reflecting the actual volatility of exchange-rate adjusted returns, but more likely reflecting compensation for the unrealised risk of a much larger depreciation.

An apparent paradox arises when the same comparison is made with sterling. Over the whole period excess returns have averaged out at zero *vis-à-vis* sterling. We prefer to interpret this not as an absence of risk-premium, but rather as reflecting the much higher volatility of the exchange rate between the Irish pound and sterling during the period: the actual outcome was more likely to be the result of chance.

Although Irish interest rates were higher than UK rates during the EMS, and although membership entailed a new risk-premium above German rates, it is hard to be sure that the EMS actually made Irish interest rates higher than they would otherwise have been. The real appreciation of sterling from 1979 and the associated recession, combined with the grave fiscal problems at home would have made maintenance of the sterling link difficult in the early 1980s. Therefore a continuation of the long-established close relationship between Irish and UK interest rates might not have been an attainable option.

Central Bank policy responds to, and influences interest rates. It may do this through its influence on market expectations, or by a more direct liquidity effect influencing the balance of supply and demand of liquid Irish pound funds on the market. Chapter 3 describes the methods adopted by the Central Bank for influencing liquidity conditions and hence interest rates, and assesses the degree of responsiveness of policy to incipient interest pressures.

Intervention has been very heavy at times of pressure during the EMS, particularly towards the latter part of the period. By plotting the scale of intervention against the level of interest rates we display what is apparently a

very marked increase from mid-1988 in the degree to which monetary policy attempted to smooth interest rates. The contrast between the stance of monetary policy before and since that date has not hitherto been remarked upon, but emerges quite clearly from the data.

It is debatable whether monetary policy measures could have been very effective in lowering the volatility of short-term interest rates. At any rate, there is little indication before 1988 that monetary policy attached much weight to interest smoothing. Even afterwards, the degree to which short-run stabilisation of interest rates was achieved appears to have been modest. Interest rate policy was clearly subordinated to exchange rate policy throughout.

In Chapter 4 we return to the question of short-term expectations, and explore the devaluation experience building on previous work which has emphasised the role of sterling movements. Day-by-day developments around the time of each of four episodes of speculative pressure are plotted. Statistical analysis of the correlation between daily interest rate and exchange rate movements confirms earlier work that identified a strong link between sterling weakness and higher Irish pound interest rates.

Currency movements within the EMS band have often been neglected in analysis of the link between interest rates and devaluation expectations. Because of the widening of the margins, these within-band movements can certainly no longer be ignored - indeed it is the role of realignments which may now be down-played. We explore the dynamic characteristics of daily movements within the narrow band and find that they were close to being a random walk.

Chapter 5 turns to the yields on long-term securities. These yields can be looked at from a long-term or a short-term point of view. In the first case, for example, comparison may be made with inflation. In the second, the issue is how the holding-yield over a short-period (including capital gains) compares with short-term rates. In both cases expectations of future developments should be important, and we explore the degree to which such expectations can be associated with independent measurable factors.

Although it performs poorly as a predictor of interest rates or inflation rates over the longer horizon, the yield gap is consistently significant when included in equations for current or imminent short-term interest rates. The lagged *long-term* interest rate is a better predictor of the short-term rate than its own lagged value. This finding fits well the transitory nature of many

short-term interest rate surges, and shows that information about the term structure provides a very useful additional degree of explanatory power in short-term interest rate forecasting. Adding this variable also tends to strengthen the case for including government borrowing as an explanatory factor, though this is not conclusively shown.

The holder of long-term paper over the entire EMS period came out better than an investor who rolled-over short-term paper. However, there were many fluctuations in the excess return, so no systematic pattern of a positive risk premium is evident from these figures, and there is no strong evidence of what exogenous factors might have been driving a time-varying risk premium.

The most successful equations explaining Irish long-term yields are those which include not only the Irish short-term rate, but also foreign long rates. The short-rate has only a modest impact. But the size and significance of the foreign long rate is noteworthy. The best results were obtained with an equally-weighted average of UK, US and German long rates, which we call the "world interest rate". There is also a correlation (albeit not very robust to model specification) with the government borrowing a reduction of £100 million in the EBR being estimated to reduce long-term rates (and the yield gap) by 0.2 percentage points.

Chapter 6 contains concluding comments and draws some lessons for the future. The suspension of the narrow band intervention limits and the healthier fiscal position offer the prospect of a less volatile evolution of interest rates in the years ahead. In future, financial market disturbances are likely to be felt more in exchange rates than in interest rates. The narrow band and the fiscal difficulties are also among the factors that have made for a high average differential over German rates, and their removal justifies the lower differential now prevailing and augurs well for the future.

Chapter 1

THE EVOLUTION OF IRISH INTEREST RATES

The violent interest rate fluctuations which have been seen in recent years, not only in Ireland, but in a majority of countries, advanced and less developed, represents a striking contrast with historical experience.

During the century before independence, close banking ties with London were the dominant influence on Irish credit market conditions and, although local disturbances occurred from time to time, interest rate movements in Ireland for the most part mirrored those in London. In most respects, the new State continued to operate with the British financial system in the early years following independence. Indeed, although an Irish pound was introduced in 1928, following the establishment of a Currency Commission by the new State two years earlier, and although the Central Bank of Ireland began operations in 1943, it was not until 1979 that the Irish monetary system really took on a life of its own. It is a curious fact that the introduction of the European Monetary system as "a zone of monetary stability in Europe" and as a stepping stone to increasing financial integration should have been the occasion of this singular monetary disintegration.

This chapter begins with a look at the evolution of Irish interest rates before the EMS began. We show that the era of stable interest rates in Ireland had already ended before the EMS began, a casualty (like fixed exchange rates) mainly of the tendency to higher and more volatile inflation. The EMS period coincided with an episode of record high interest rates in most of the industrial countries. Although no longer tied to UK rates, Ireland was far from being immune to this trend and indeed Irish interest rates during the EMS period, whether measured in real or nominal terms, were far higher than those in the UK or Germany. We end the chapter with a brief review of salient macroeconomic trends in Ireland that might have contributed to the pattern of deviation of Irish interest rates from those abroad. This will serve as a prelude to the more detailed analysis of subsequent chapters.

1 *Interest Rates Before Independence*

Because of the sketchy nature of early Irish data, the general European experience may be as good a guide as any to the likely long-term historical trend in credit conditions and interest rates in Ireland, and that suggests that interest rates were on a declining trend until the end of the 18th Century. On the assumption that this gradual decline in interest rates did not reflect any diminution in investment opportunities, it may have been partly attributable to an increasing propensity to save. But arguably more important were improvements in the security of lenders' property rights, and in the technology of financial intermediation, which could have contributed to the declining trend by reducing the risk premium and intermediation cost components of lending rates (Homer, and Sylla, 1992, Clark, 1991). From an early date, financial intermediation was an international business (de Roover, 1963) and, while substantial local differences certainly existed in credit terms, these differences became less important over time as financial integration increased during the Gold Standard.

Systematic statistical information about Irish interest rates begins in 1783 with the establishment of the Bank of Ireland as the only joint-stock bank in Ireland.¹ By this stage London had passed out Amsterdam as the

In providing a quantified description of the historical experience, we immediately encounter what is a pervasive difficulty with the discussion of interest rate trends, namely the wide variety of interest rate series that can be used. Many different interest rates co-exist in all financial markets, reflecting differences in the maturity, perceived default risk and other characteristics of the contract which they represent. In addition, data can be analyzed at different frequencies - daily, monthly, annual, or with time-averaging. It is not always easy to decide which interest rate series best represents the general level of rates. Fortunately, the data we will be looking at is drawn from markets which have normally been relatively free of directly distorting government controls on rates, and therefore most rates represent market-clearing values. Accordingly, for any given currency and maturity, most interest rates move in step with each other. Nevertheless it is not possible to eliminate problems of comparability altogether. Our main objective is to look at rates of interest which are free of default risk and traded in liquid markets - what may be termed wholesale rates, and, when comparing different interest rates for the same time period, we try to focus on differences that can be attributed to currency and maturity of the contract only.

¹ McGowan (1990) and O'Gráda (1994) provide accounts of the origins of the modern Irish banking system.

leading international financial centre (Kindleberger, 1993), and it was inevitable that credit conditions in London would have a decisive influence over those offered by the Bank of Ireland and the smaller private Irish banks. The Bank's statute placed a ceiling of 5 per cent on its lending rate, and this was in fact the rate it posted continuously from its establishment until 1824. That period encompasses the lengthy suspension of convertibility of bank notes into gold (1797-1821). The absence of any interest rate movements, despite the considerable fluctuations of the purchasing power of Bank of Ireland notes (a relatively rapid but volatile price inflation was recorded during this period) and in international exchange, suggests that the statutory interest rate ceiling was a binding one for at least part of the time.

The removal of the interest ceiling on Bank of Ireland lending and the liberalisation of usury laws in the 1820s was actually followed by a lengthy period of generally declining interest rates punctuated by relatively frequent bursts of volatility, as is shown by the Bank of Ireland's lending rate² (Figure 1.1).³ This rate moves fairly closely in line with the Bank of England's rate, with the correspondence improving as the century progresses. However, the correspondence is not exact: especially before mid-decade, the Dublin rate lags movements in the London rate sometimes by weeks, and there are autonomous fluctuations in the Irish rate, though the gap never exceeds 2 per cent. The sharp interest rate movements of the major London panics are closely transmitted to Dublin. Improvements in communications may explain the fact that all but one of the 1866 rate movements shows up in Dublin the same day, whereas those of 1857 had a one-day delay. In each of these crises, rates in both centres reached 10 per cent, a rate which seems modest by the standards of recent financial crises.

On average the Bank of Ireland rates in the 19th Century⁴ are rather more than a half a percentage point higher than the Bank of England's rate. The

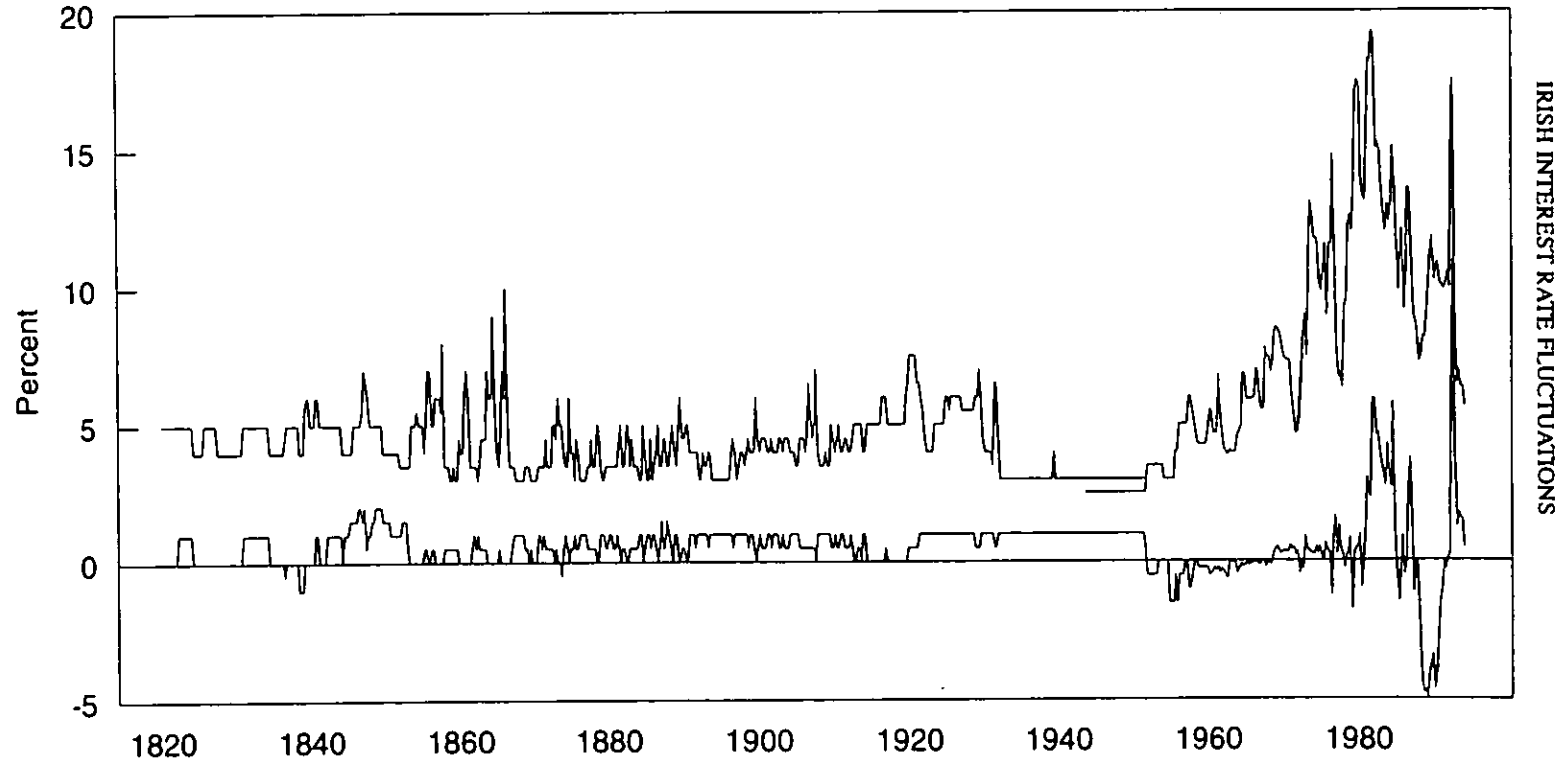
² This is the rate for discounting Irish bills. Overdraft rates were typically one per cent higher than this bill rate, though the differential was not absolutely fixed.

³ As with all of the figures in this paper, the dates are printed directly below the observations to which they refer. Where sub-annual data is shown, the year is printed below the data for June or for the second quarter. Figure 1.1 provides an overview of short-term interest rate movements since 1820. It follows the Bank of Ireland rate (after 1920 the Irish Banks' Rate) until 1951 (*Source*: Hall, 1949 and Moynihan, 1975). The Central Bank of Ireland's minimum rediscount rate for bills is shown for 1943-1972 (Moynihan, 1975). Thereafter the new issue market yield on Exchequer Bills is given from 1973-June 1992. The last few observations refer to the three-month interbank rate. (*Source*: Central Bank of Ireland Bulletins). Observations are at end-quarter. The differential with Britain refers to Bank Rate until it was discontinued in 1972 and to Treasury bill rates thereafter. British data used in this chapter is sourced from Homer and Sylla (1992) and Mitchell (1988).

⁴ 1830-1899.

Figure 1.1

Irish Interest Rates, 1820-1994 and Differential over London



highest differential is in the late 1840s, reflecting financial pressures indirectly associated with the Great Famine, and the average differential for the whole decade of the 1840s is over 1 per cent. Otherwise there is a tendency for the gap to widen as the Century progresses (Table 1.1), although the correlation between the two series improves, suggesting improved tracking of fluctuations at a higher average gap. Bearing in mind that the Bank of England's rate itself exceeded the London open market discount rate by an average of almost one percentage point in the same period this would suggest a materially higher cost of credit in Ireland. However, the London rates are for the finest trade bills, whereas the Bank of Ireland rates applied to a wider category of risk.

There is no comparable series for yields on Irish long-term securities in the 19th Century. Long-term British government securities were relevant for the asset portfolios of wealthy Irish families. Having risen during the last decades of the 18th Century, the market yield on these declined gently from about 5 per cent at the end of the Napoleonic wars through the decades until they were running below $2\frac{1}{2}$ per cent in the 1890s. Long-term yields were unaffected by the high-frequency fluctuations in short-term rates (Homer and Sylla, 1992, Siegel, 1992).

Price fluctuations influence the *real* yield on financial assets, but during the 19th Century there were lengthy periods of general price decline as well as periods of inflation. On average in the century before independence general price inflation ran at about $\frac{1}{4}$ per cent per annum; representing a modest modification to the average nominal short-term interest rate of about $4\frac{1}{2}$ per cent during that period.

2 *After Independence: The Sterling Link Period*

After the turn of the century both long and short rates began to climb. This began even before the suspension of gold-convertibility during the First World War. After the war, as Britain struggled to return to the pre-war parity high interest rates persisted. The Bank of Ireland Rate (renamed the Irish Banks' Rate in 1920 following the establishment of the Irish Banks' Standing Committee)⁵ continued to track the Bank of England's rate, though it is noteworthy that, on the eve of independence, the margin jumped to a steady⁶ one per cent after November 1921.

⁵ Cf. Banking Commission, 1938, p. 194.

⁶ Over the following three decades the gap was exactly one per cent except for two brief periods of a $\frac{1}{2}$ per cent gap, namely when London went above $5\frac{1}{2}$ per cent in the Autumn of 1929 and again in the Winter of 1931-32. That this was the formula being used is implied by the Banking Commission report. However, had such a formula been in effect during the 19th Century the Bank of Ireland rate would have been about 0.3 percentage points higher on average than it actually was.

Table 1.1: *Mean Interest Differentials and Correlation:
Ireland vs. London*

	percentage points	correlation
1822-1922	0.55	0.93
1820-29	0.24	0.68
1830-39	0.25	0.46
1840-49	1.03	0.71
1850-59	0.53	0.96
1860-69	0.33	0.99
1870-79	0.56	0.97
1880-89	0.64	0.98
1890-99	0.81	0.98
1900-09	0.70	0.98
1910-19	0.27	0.95
1920-29	0.89	0.99
1930-39	1.00	1.00
1940-49	1.00	1.00
1950-59	-0.18	0.92
1960-69	-0.14	0.99
1970-79	0.28	0.98
1980-89	0.91	0.77
1990-94	0.64	0.37

Based on the same rates as shown in Figure 1.1. The data for 1820-1950 is monthly. The series used for 1950-69 and for 1970-94 are not comparable with the earlier figures; also they are based on quarterly data.

The Irish pound was established as the standard unit of account in 1927. The first notes were brought into circulation the following year. They enjoyed a statutory one-for-one link with the pound sterling together with institutional safeguards designed to ensure full confidence in this link. These included a guarantee written on the notes that they would be redeemable at par in London, and a 100 per cent backing of the currency notes by Gold or British Government securities.⁷ Confidence in the indefinite duration of the link was surprisingly high at least until the 1970s. Accordingly, though as noted elsewhere (Honohan, 1982b) the point can be overstated, all authorities agree that, during this period, Irish interest rates were driven by those in London.⁸ After all, for most of the period, the wholesale money market available to the banks was that of London. This situation was not at first affected by the establishment of the Central Bank of Ireland, as the banks continued to hold large liquid reserves in London. Even after the first tentative steps towards the creation of a domestic money market in the late 1960s, the banks' close financial links with London, combined with the apparent solidity of the one-for-one parity, ensured that interest rates normally moved in step.

The result was that Ireland shared in the two decade-long interval of low and stable nominal short-term interest rates after the abandonment of the Gold Standard. Of course, far from being a golden age, this period included the Great Depression, the Anglo-Irish "Economic War", and the Second World War. Indeed, the low interest rates engineered in London were at best a mixed blessing to an economy which appears to have been a net creditor in fixed interest securities.

In the 1950s and 1960s an upward drift in UK inflation and a sequence of balance of payments crises placed upward pressure on London interest rates. Figure 1.1 shows that Irish wholesale rates generally tracked these developments. From 1952, the Irish interest rate shown in the Figure is the Central Bank Minimum Rediscount Rate. Although it is the only Irish wholesale rate for which continuous quotations are available through the 1950s and 1960s, it must be treated with caution, especially because the London money market continued to be the main source and outlet for Irish bank liquidity; the Central Bank carried out no rediscounting at all until

⁷ Irish Government securities were not admitted as backing for the currency until 1957, and then only on a restrictive basis.

⁸ As a simple indication, the quarterly correlation between London and Dublin rates was 0.92 in the 1950s and 0.99 in the 1960s and 1970s. For a sophisticated econometric analysis, see Browne and O'Connell (1978).

1956. Furthermore, the Central Bank Rate did not maintain any fixed relationship with the Irish banks' rates for customers. At first, it was pitched at $\frac{1}{2}$ per cent below Irish Banks' Rate, but (from 1956) it tended to reflect London money market rates or the rate in the primary issue market for Irish Exchequer bills rather than the Irish banks' lending or deposit rates.⁹ The Figure reveals a tendency for the Central Bank Rate to trail slightly below London, and the 1955 policy experiment, where the Irish banks were prevailed upon by political pressure not to follow an upward movement of $1\frac{1}{2}$ percentage points in London rates is also evident. This is the largest negative gap shown before the EMS period.¹⁰ It is no surprise that 1955-56 also saw the first use of the Central Bank's rediscount facility, with bills both of a state-sponsored body and of the Exchequer being refinanced at rates considerably more favourable than obtainable in London. To what extent the unprecedented opening-up of this interest gap contributed to the balance of payments and fiscal crisis which immediately ensued is an unresolved question.¹¹

Turning to long-term yields, some series for Irish Government Securities from 1927 are plotted in Figure 1.2.¹² These shows the same general upward trend as in the short-term rates. A positive yield-gap is apparent, with long yields on average about 1 per cent higher than short.

After 1972 UK nominal interest rates (like others) soared to unprecedented levels. At first this both reflected an attempt to dampen down an overheated economy, and a defensive response to the first oil crisis. The world had recently lost the anchor of fixed exchange rates, and this opened the way to a British policy response to the crisis that was to result in an accelerating inflation which quickly validated the higher nominal interest rates. Indeed, although nominal interest rates were high, in real *ex post*

⁹ From 1960 the Central Bank's Rate was automatically adjusted in line with market rates, the initial formula being that it would be set at one-sixteenth of a percentage point above the highest rate accepted at the most recent public tender for Exchequer bills.

¹⁰ But it should be noted that the Central Bank Rate tracks the London rates more closely after 1956 than do the banks' deposit and lending rates, which tended to be relatively lower thereafter.

¹¹ A more detailed review of Irish macroeconomic experience during the sterling link period is contained in Honohan (1994b).

¹² From 1952-1993 the series used is that printed in *International Financial Statistics* and discussed in Chapter 5 below. Nevin (1962) provides alternative data series for the periods 1927-44 and 1944-61: these are simply the average of the annual maximum and minimum for a set of representative securities; where there is an overlap, the Nevin yields are somewhat lower than the IFS yields. Ó Gráda (1994) shows that the yield differential on long-term Irish Government securities jumped by about 50 basis points in 1933 following the change of Government.

terms, interest rates in the mid-1970s were actually negative. An understanding of interest rate movements in these years thus requires an awareness of trends in price inflation.

Figure 1.2
Long-Term Bond Yield, 1927-93
and Yield Gap

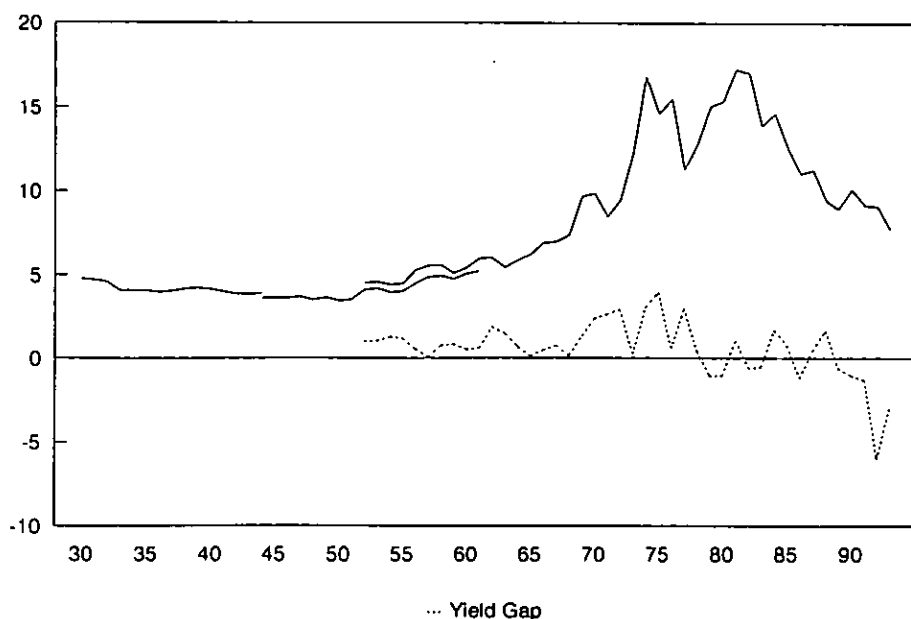
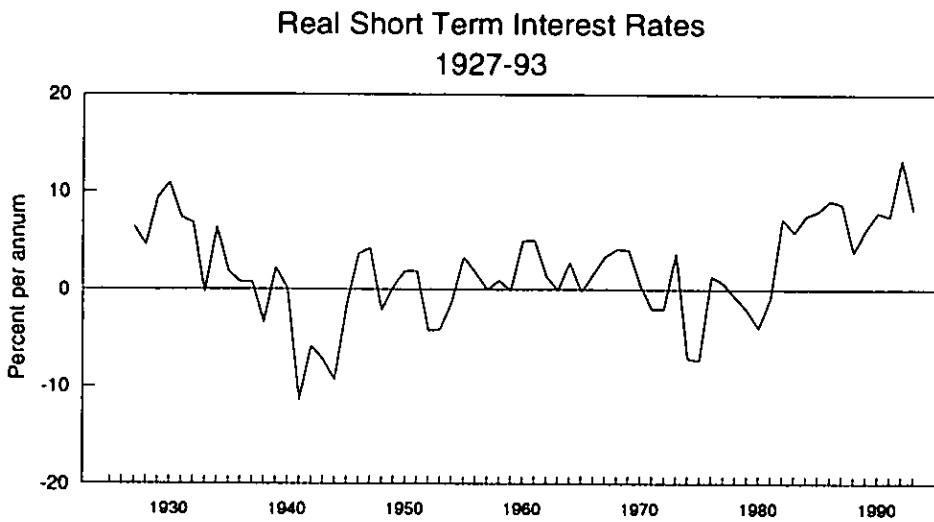


Figure 1.3 presents a long series of short-term real interest rates adjusted to take account of general price inflation.¹³ As well as displaying the low real rates in the mid-1970s, this figure demonstrates how exceptionally high real interest rates have been more recently. The average value of 1.8 per cent for the whole period 1927-93 conceals considerable fluctuations. Some of the highest values are for the early years (an average of 6.4 per cent for 1927-35, partly reflecting falling prices for most of the 1930s) and there are sharply

¹³ The interest rates used are the Irish Banks' Rate up to 1951, the Central Bank minimum rediscount rate from 1951 to 1972 (average of four quarters), and the one-month interbank rate (average of twelve months) from 1973; the deflator is the average of the following four quarters' change in the Consumer Price Index, thereby generating *ex post* real interest rates. Source for the earlier interest rates is Moynihan (1975), for the later ones, *International Financial Statistics*.

negative real interest rates during the Second World War.¹⁴ For the following quarter century, the real interest rate oscillates between about plus or minus 4 per cent. There is a sharp dip to more than minus 7 per cent in 1974-75, giving an average of -0.5 per cent in 1935-81. After 1982 the average real rate jumps to 7.8 per cent. Real interest rates in 1994 were still higher than the annual average for the whole 60 years.

Figure 1.3



3 Irish interest rates in the EMS

The 1970s and 1980s were a period of unprecedented volatility in international capital markets. The impact of the two oil crises and the policy responses to them included deep recessions and very high inflation in most of the industrial countries. At the same time, increased international financial market integration ensured rapid transmission of financial market disturbances from one country to another. As banks looked for international lending opportunities in order to place the funds deposited with them as a

¹⁴ The higher measured inflation of Ireland *vis-à-vis* the UK during the war is the one big deviation from UK-Irish purchasing power parity in the sterling-link period as discussed, for example by Leddin and Walsh (1993).

result of the huge balance of payments surpluses of the oil exporting countries, many countries, including Ireland, began to have ready access to foreign borrowing on a scale which had not been experienced since the 1920s. Ireland took advantage of these borrowing opportunities, and began a process of foreign debt accumulation which began to moderate only in the mid-1980s and has still not been decisively reversed.

It was against this turbulent background that the EMS was established and promised to be a zone of monetary stability. But for Irish interest rates this promise has not been fulfilled.¹⁵ High and volatile interest rates have compromised economic growth not least through their effect on the cost of servicing the National Debt and the consequences of that for taxation.

Summary statistics of Irish and foreign interest rates during the EMS are shown in Table 1.2 (which may be compared with the table provided by Hardouvelis, 1994). Of the currencies for which rates are shown, the Irish pound rates, whether short- or long-term, are the highest - by a modest margin against sterling and by a large margin against the DM and the US dollar. On quarterly data, the volatility of Irish short-term rates is much higher than that of the DM or the pound sterling rates, but not higher than the US dollar short-term rates. Long-term government bond yields were more volatile in Ireland than for the other currencies.

Using quarterly data to measure volatility tends to neglect high frequency fluctuations over a period of days. A daily plot of short-term nominal interest rates (one-month maturity) is provided in Figure 1.4a. It covers only the period beginning in November 1981, and thus does not show the sharp increases in rates during the first three years of the EMS.¹⁶ The five essential features of short-term interest rate movements during the EMS are evident from the Figure:

¹⁵ The correlation with London interest rates fell to 0.77 in the 1980s, and to 0.27 in the most recent ten year period.

¹⁶ This data was kindly provided by the Bank for International Settlements. The interest rates are for off-shore or Euro-Irish pound contracts. The plot ends at July 1993, when the EMS narrow-bands were suspended.

following a sharp increase during 1979-81, the generally declining trend from 1982 until 1987-88;

a number of surges superimposed on the trend, some of them lasting for several months (at least five different episodes can be observed);

the prolonged period of fairly high rates from 1989-92;

the crisis of 1992-93; and

the sharp decline following the devaluation of January 1993.

Table 1.2: *Summary Statistics of Long and Short-term Interest Rates Ireland, UK, Germany, US*
1979: Q1 - 1993:Q2 (% per quarter)

	IR£	£ stg	DM	US \$
<i>Short-term</i>				
Mean	12.33	11.60	6.94	8.93
St. Dev.	3.17	2.65	2.33	3.65
St. Dev. of Chg	2.03	1.28	0.81	2.07
<i>Long-term</i>				
Mean	12.31	10.95	7.69	9.78
St. Dev.	3.12	1.87	1.32	2.33
St. Dev. of Chg	1.00	0.72	0.57	0.96
<i>Yield Gap</i>				
Mean	-0.02	-0.64	0.75	0.85
St. Dev.	2.00	1.89	1.40	2.14

It is possible to decompose the data into low and high frequency movements, and Figure 1.4b shows a series from which the high frequency

components have been filtered out.¹⁷ Foreign and domestic factors will have contributed to both low-frequency movements and high-frequency components of interest rate change. So far as domestic factors are concerned, such factors as the medium-term evolution of non-speculative demand and supply of funds, trends in inflation and in macroeconomic performance, would tend to contribute to the low-frequency changes. The high-frequency movements would presumably correspond to sporadic events such as realignment speculation and other informational disturbances, and perhaps the occasional lumpy but non-speculative transaction which the market was unable to absorb without prices changing.

The relative importance of foreign and domestic influences is one of the major questions to be explored in this paper. Although foreign influences on interest rates remain clearly important, they do not tell the whole story: there is an important domestic component. This is evident from examination of Figure 1.6 which shows the differential of Irish short- and long-term rates with respect to broadly comparable UK and German assets.¹⁸ The differentials are not small, and their time-path displays much the same features as we have noted for the Irish rates themselves.

Sterling-denominated rates of interest are no longer uniquely relevant as an international comparator for Irish rates once we enter the EMS. The UK remains important because of the financial market links, but the new currency arrangement involving a degree of stability with the DM makes it equally, or perhaps more relevant. Indeed, the importance of currency movements, actual and expected, forms an important part of the analysis which follows. Some strong patterns are evident.

Looking first at the German comparison we see a pattern of gradual decline until 1992 (faster after 1986). This is interrupted by three peaks (mid-1982; end-1984 and end-1986) that are shared by both short- and long-term differentials. These three sharp movements in

¹⁷ Essentially this is being done by a procedure which approximates the original series by a weighted average of hundreds of sine-curves each of which repeats with a different frequency. The low-frequency filtered series is obtained by replacing the original weighted average by one which ignores all of the high-frequency sine-curves. Specifically, we remove the higher frequencies from the Fourier transform of the original series and transform back into the time domain. Figure 1.4b is drawn for a filter which removes all frequencies above 25.

¹⁸ The data are for the last month in each quarter. For Ireland the Exchequer bill rate is used, for UK the Treasury bill rate and for Germany the call money rate (*sources*: Central Bank Bulletin, Bank of England Bulletin and OECD Main Economic Indicators). The long-term rates are for Government bonds, line 61 in *IFS*.

Figure 1.4a

Daily Irish 1 month Interest Rates during the EMS

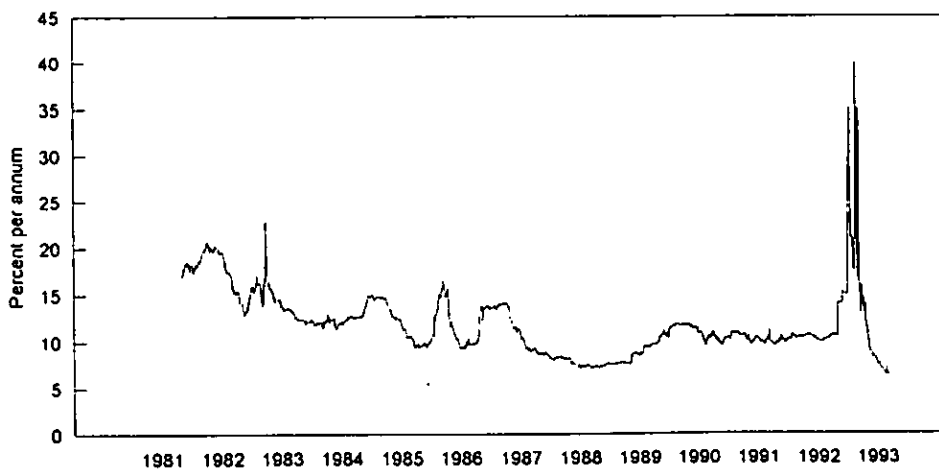
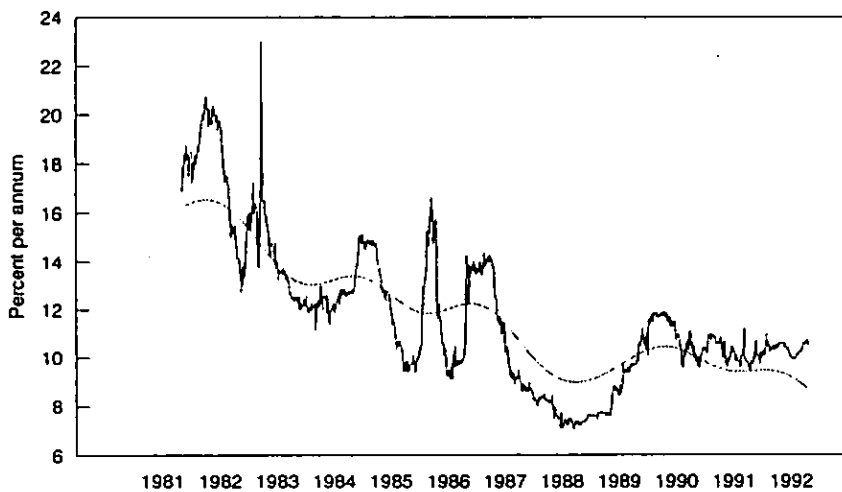


Figure 1.4b

Daily 1 month Interest Rates 1981 - 1992
Actual and Smooth series



long-term rates probably reflect a sequence of substantial and sudden market reassessments of the medium-term prospects of the Irish economy. Two of them coincide with General Elections.¹⁹

Apart from a handful of transitory deviations, the short- and long-term differentials move closely in line. Of the deviations between short- and long-term differentials, one involves a much lower differential at short-term.²⁰ The rest can be attributed to periods of realignment speculation.

For the UK there are clear differences in the early years, 1979-81, but between 1982 and 1988 the short- and long-term differentials also move closely in line. After 1988 the very high short-term UK interest rates and reverse yield curve have the effect of pushing the short-term differential far below zero.

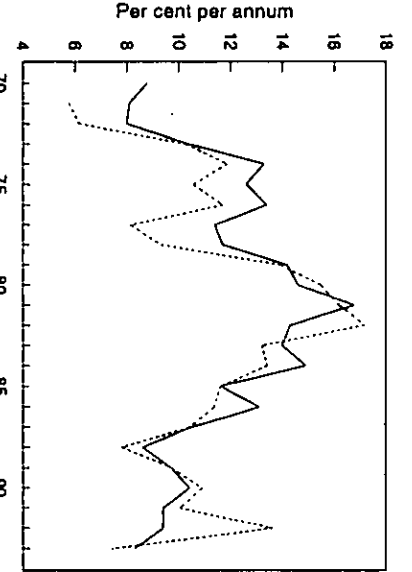
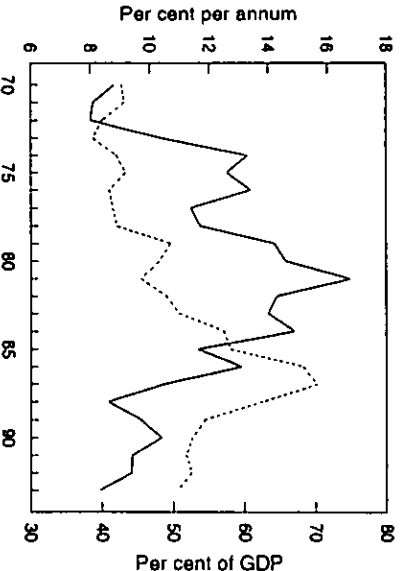
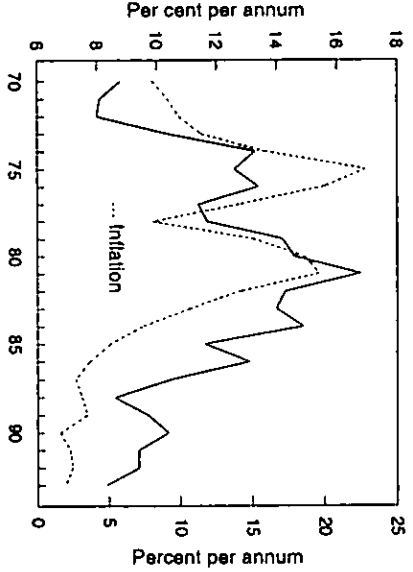
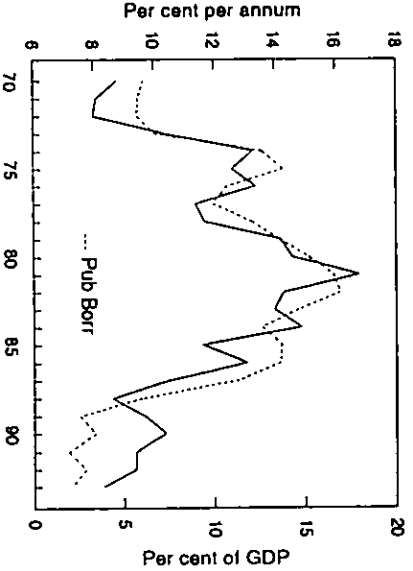
Turning to domestic factors likely to have influenced Irish interest rates and their differential above foreign rates, among the most frequently mentioned are public borrowing, the stock of Government debt and the inflation rate. A high rate of public borrowing was already established before the EMS began. Tax increases from 1981 helped to stabilise the rate of *borrowing* but were not enough to stop a cumulative growth in the ratio of government *debt* to GNP. An attempt to limit reliance on foreign debt resulted in much of the increase in the debt ratio during the mid-1980s falling on domestic debt. Hampered as they were by a deep recession in the UK (which added to unemployment and slowed growth), and by rising world interest rates (which added to the servicing cost of government debt), this early fiscal retrenchment did not command the market's confidence in the medium-term fiscal prospects. After 1987 a second wave of fiscal consolidation, this time concentrating on expenditure cuts, was successful. Helped by a world boom which lowered unemployment and stimulated

¹⁹ It is harder to relate the end-1984 jump in long-term interest rates to an identifiable medium-term expectations factor. This episode is sometimes linked to the announced decision of the authorities to adopt a self-imposed ceiling on foreign borrowing in that year despite an increase in overall Exchequer borrowing. It has been suggested that, because of a departure from market efficiency, this placed the authorities in a weak "bargaining position" for a short period.

²⁰ According to the Central Bank's analysis of this puzzling event in early 1981, when Irish short-term rates failed at first to track a sharp upward movement in German and other interest rates, it was the plentiful liquidity in the Irish market attributable to Government spending (financed by foreign borrowing) which precluded, or at least delayed, an interest rate increase on this occasion.

Figure 1.5

Long-term interest rates and possible causes



export growth, this second wave succeeded in reversing the trend in the ratio of debt to GNP and by 1988 there was a palpable recovery in market confidence. On this reading, market confidence in the medium-term prospects was correlated more with the rate of borrowing (worsening until 1982, steady through the mid-1980s, much improved after 1988) than with the level of debt.

So far as inflation is concerned, fuelled by the second oil price rise, and by generous public sector wage settlements at home (partly validated by the weakness of the Irish pound in the EMS by comparison with sterling), CPI inflation increased sharply in the first years of the EMS to peak in early 1982 at almost 20 per cent per annum. Thereafter, a much improved evolution of import prices, combined with the weak domestic economy, helped bring inflation down to 5 per cent by 1985 and lower thereafter.

Figure 1.5 compares the annual movements in these variables with the annual average of long-term yields.²¹ The fourth panel of Figure 1.5 reveals an important correlation between long and short-term interest rates. Temporary surges aside, the big trends in these two have been surprisingly closely correlated; a factor to which we return below. This correlation allows us to concentrate on just the long-term yields.

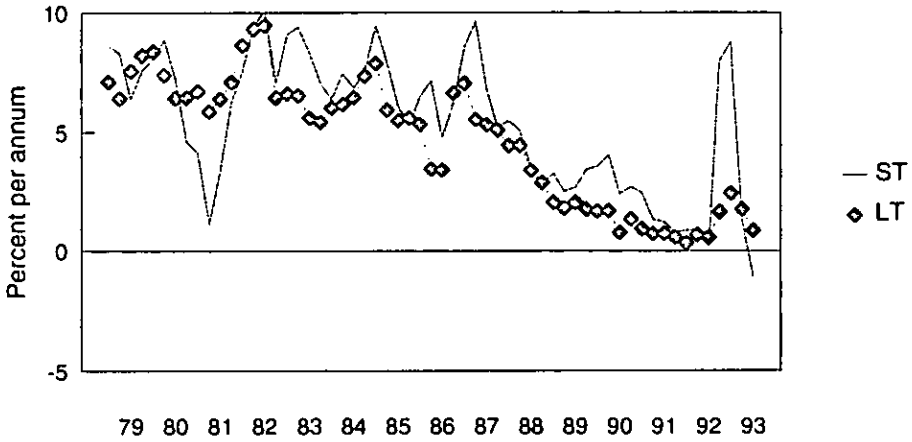
Each of the candidate variables in Figure 1.5 show a decline towards the end of the period, but the timing of the movements in public borrowing seem closest to those in long-term yields, although the fit is not perfect, and the fall in interest rates after 1987 is much less than that in public borrowing. Admittedly, inflation and yields both peak in 1982, but the subsequent decline in inflation is much more rapid than in interest rates. For its part, the stock of debt does not peak until long after interest rates have begun to decline.

On the whole, these simple timing relationships suggest that market confidence in the fiscal position could have been the decisive domestic factor in influencing interest rates. If so, note the feed-back effect through the impact of higher interest rates on debt servicing costs which impeded the effectiveness of a less-than-decisive first wave of fiscal contraction, but assisted the second, more convincing wave. Any future severe deterioration in the fiscal position anticipated by the market can be expected to make itself felt through a sharp increase in interest rates.

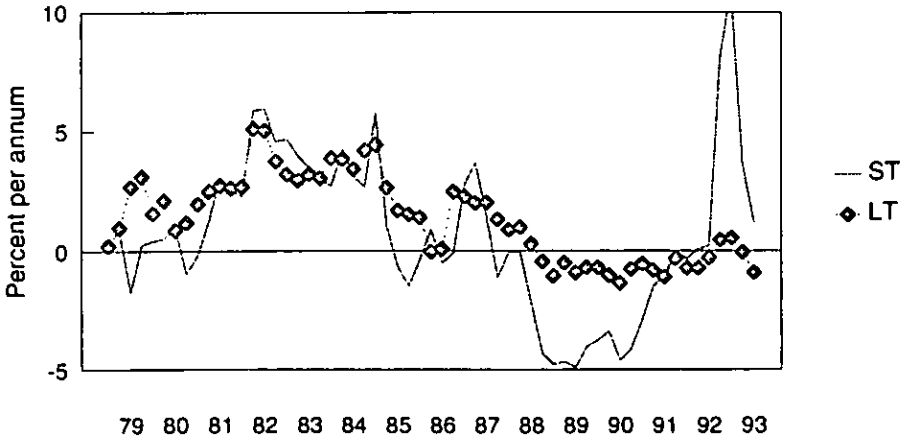
²¹ The yield is that on 8 year Government bonds; consumer price inflation, Public Authorities' borrowing, and the domestic Government debt as a share of GDP are the explanatory candidates.

Figure 1.6

Irish and German Interest Differential Short and long-term



Irish and UK Interest Differential Short and long-term



Chapter 2

EXCESS RETURNS ON IRISH POUND ASSETS IN THE EMS

1 Introduction and Summary

From the end of March 1979 the exchange value of the Irish pound began to fluctuate. Henceforth, comparisons of interest rates at home and abroad had to take account of the reality of these fluctuations. Rational market participants formed expectations of future exchange rate developments and adjusted their portfolios accordingly. This chapter analyses international interest differentials adjusted for exchange rate change, and focuses in particular on the extent to which a realistic allowance for future exchange rate movements was built-in to Irish interest rates.²²

The role of expectations has taken centre stage in the analysis of interest rates, and more generally of the determination of asset prices. The demand for an interest-bearing asset will depend not only on the promised interest rate, but also on an assessment of the future price of that asset in comparison with alternatives. For short-term Irish interest rates, the obvious alternative assets against which comparison may be made are the short-term interest rates denominated in alternative currencies such as the Deutsche Mark or sterling. For long-term Irish securities, an obvious comparison is between the return (interest plus capital gain) on holding such securities for a short period with the interest on a short-term security maturing in the same period. Analysis of such asset return differentials or "excess returns" allows us to infer the links between foreign and domestic interest rates, and between short- and long-term rates.

This chapter presents a conceptual framework for exploring what the data on these excess returns can tell us about interest rate determination. We begin in Section 2 by defining excess returns and presenting summary statistics. Section 3 outlines the benchmark expectations hypotheses regarding excess returns against which the actual data can be assessed. Section 4 presents econometric results. Section 5 discusses the implications of transactions costs for interpreting the econometric findings. Section 6 presents some concluding remarks.

²² International yield differentials have also been discussed recently in respect of Ireland by Browne and McNelis (1990), Leddin (1988, 89), Lucey (1989) and Nugent (1990).

When compared with the DM, Irish interest rates have been far higher than necessary to offset the actual exchange rate changes that occurred. Our interpretation is that investors required an additional risk-premium, possibly reflecting the actual volatility of exchange-rate adjusted returns, but more likely reflecting compensation for the unrealized risk of a much larger depreciation. It is noteworthy that the risk premium is correlated with movements in the sterling exchange rate: periods of sterling weakness are associated with higher excess returns.

An apparent paradox arises when the same comparison is made with sterling interest rates instead of DM rates. Over the whole period excess returns have averaged out at zero *vis-à-vis* sterling. We prefer to interpret this not as an absence of risk-premium, but rather as reflecting the much higher volatility of the exchange rate between the Irish pound and Sterling during the period: the actual outcome was more likely to be the result of chance.

Although Irish interest rates were higher than UK rates during the EMS, and although membership entailed a new risk-premium above German rates, it is hard to be sure that the EMS actually made Irish interest rates higher than they would otherwise have been. The real appreciation of sterling from 1979 and the associated recession, combined with the grave fiscal problems at home would have made maintenance of the sterling link difficult in the early 1980s. Therefore a continuation of the long-established close relationship between Irish and UK interest rates might not have been an attainable option.

2 Measuring Excess Returns

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

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

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

Table 2.2a shows the mean value and other summary statistics of λ for the Irish pound against sterling, the Deutsche mark and the US dollar during

Stationarity of Excess Returns

An important statistical characteristic of any time series is whether it is stationary or not. A stationary series has the characteristic that any disturbance to the series will eventually tend to be reversed. Furthermore, the variance of the difference between the value of a stationary series at two points in time will not tend to diverge as the time-gap increases. Non-stationary series have no tendency to revert to a mean value or trend. The validity of many econometric inference procedures depends on whether the relevant series are stationary or not.

Among the standard methods of assessing stationarity is the Dickey-Fuller test. Table 2.1 shows the values of this test in its normal and augmented forms for the raw interest rates and for the excess returns. (It also shows results for the excess returns on long-term securities relative to short to be discussed in Chapter 5). Even adopting the rigorous 1 per cent significance level, we can reject the hypotheses that the excess returns are non-stationary. The evidence is not so conclusive for the raw interest rates: if no trend is included, they appear to be non-stationary. Inclusion of a trend allows non-stationarity can be rejected at the 5 per cent level for the short rate, but the test statistics for the long rate does not quite reach the 5 per cent significance level. (Taken literally, stationarity around a linear trend would eventually imply negative interest rates, but this need not be taken as a decisive argument against a trended model as an approximation). Because of the known low power of these tests, we should not jump to the conclusion that the long interest rate was non-stationary.

Table 2.1: *Cointegration Tests*

1978 Q4 - 1993 Q1	DF	(DW)	ADF(3)	(DW)
long interest r^l	-0.88	1.65	-0.98	1.94
- with trend	-3.10	1.61	-3.39†	2.01
short interest r^s	-2.60	1.44	-2.43	1.73
- with trend	3.58*	1.47	-3.64*	1.84
excess return μ	-6.58**	1.92	-3.95*	2.01
- with trend	-6.58**	1.93	-3.99*	2.02
excess return λ^{aw}	-8.01**	1.79	-3.30*	1.83
- with trend	-8.27**	1.80	-3.57*	1.83
excess return λ^c	-6.78**	1.95	-4.13*	1.98
- with trend	-6.79**	1.94	-4.27**	1.98

† The 5% significance level is 3.49; * (**) implies significant at 5% (1%).

the EMS period. The table indicates positive average excess returns over the whole period for each of the comparisons shown, with the holder of Irish short-term assets coming out ahead of those holding other currencies. For the DM the excess return, equivalent to 2½ per cent per annum, is larger than that recorded for any other EMS country - the Danish krone being the only currency that comes close (cf. Table 2.2b, which is based on broadly comparable data for the other currencies). Taking account of the quarterly standard deviation of these excess returns, the mean excess return is not only large, but is clearly statistically significant (t-statistic of 2.3).

Against the pound sterling and the US dollar the mean excess return is a good deal smaller, and the standard deviation much higher, reflecting the high volatility of these excess returns by comparison with the mean returns - the sterling figures indicate a coefficient of variation of about 2500 per cent. Neither of these other two mean excess returns figures are significantly different from zero in the statistical sense.

Figure 2.1 shows quarterly excess returns for Irish pound securities against Sterling, DM and US\$ securities respectively for the period 1971-93. Beginning with Sterling (panel 1), it is clear that excess returns become important only after the break in the sterling link (early 1979). This reflects the universal fact that short-term movements in excess returns are driven by exchange rate movements much more than by interest rate movements. The fact, already commented upon, that volatility in excess returns is much more important than any trend, is clearly evident from this figure (as from the others). The maximum excess return was 14 per cent in mid-1992, whereas the minimum was minus 9 per cent in late 1980.

Turning to panel 2 and the excess returns against the DM, there is an un-surprising contrast in that excess return volatility pre-EMS appears much higher than later. Indeed the standard deviation in the EMS period is only 2.0 per cent per quarter - less than a half of what it was pre-EMS. Furthermore, in the EMS there was - before 1993 - only one really big outlier, minus 8 per cent in the third quarter of 1986 (the unexpected August devaluation). But the mean excess return in the EMS period was about 0.5 per cent per quarter.

Excess return volatility against the US dollar (panel 3) is somewhat higher in the EMS than it had been before: a standard deviation of over 6 per cent compared with 4 per cent before. The mean also jumps, from 0.2 per cent before to about 0.4 per cent in the EMS.

Table 2.2a: *Summary Statistics of Excess Returns on Irish Pound Assets - Irish pound versus other currencies 1978:Q4 - 1993:Q1 (% per quarter)*

	<i>UK£</i>	<i>DM</i>	<i>US \$</i>
Mean	0.17	0.59	0.39
Standard Deviation	4.22	1.94	6.50
Variance	0.18	0.04	0.42
Sharpe Ratio	0.04	0.30	0.06
Maximum Return	13.96	5.47	15.28
Minimum Return	-8.62	-8.26	-12.44

Ireland - Average Yield 3-mth Exchequer bills, *Central Bank Quarterly Bulletin*
 UK - 3-mth Treasury bills, *Bank of England Quarterly Report*
 US - Federal funds rate, *International Financial Statistics (IFS)*, line 60b
 Germany - Call money Rate; *IFS* line 60b

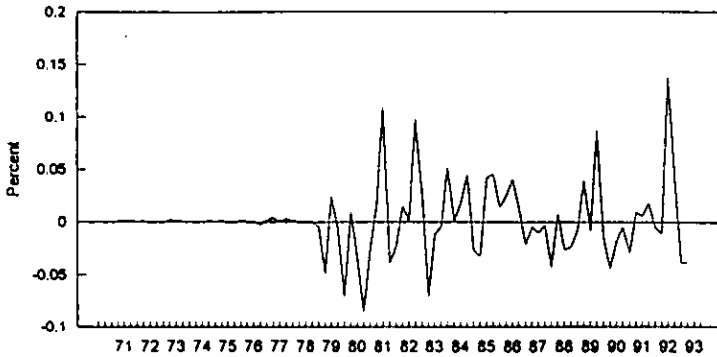
Table 2.2b: *Mean excess returns versus DM EMS currencies 1979-93*

	<i>% per quarter</i>
Ireland	0.65
Denmark	0.60
Italy	0.42
France	0.19
Belgium	0.14
Netherlands	0.11

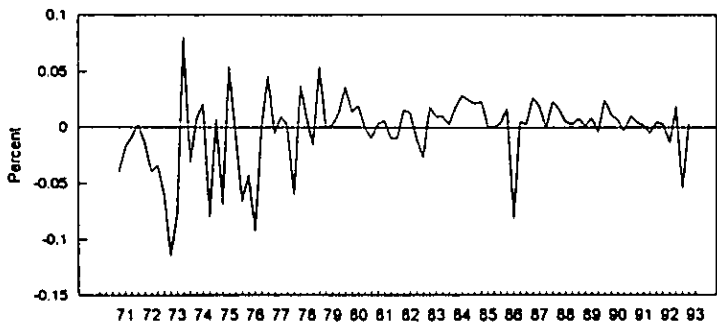
Based on annual average data from
International Financial Statistics

IRISH INTEREST RATE FLUCTUATIONS

Figure 2.1 Excess Returns on Short-Term Irish Assets Against £ sterling



Against the DM



Against the US\$

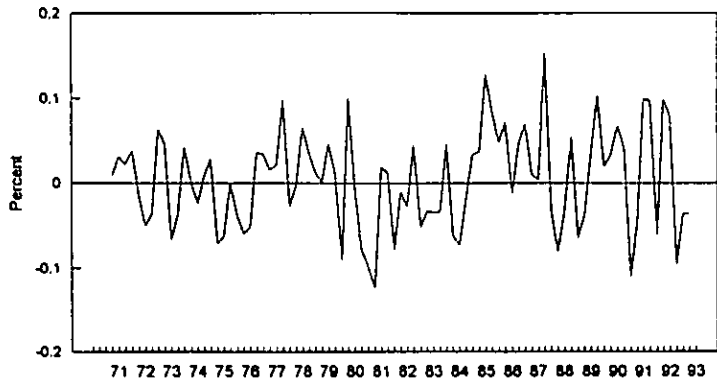
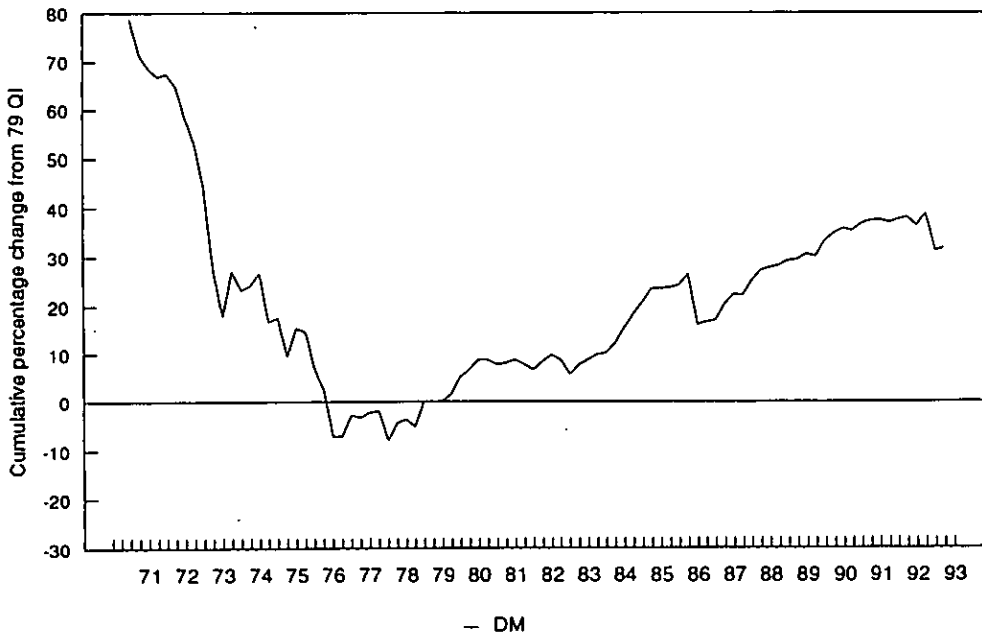
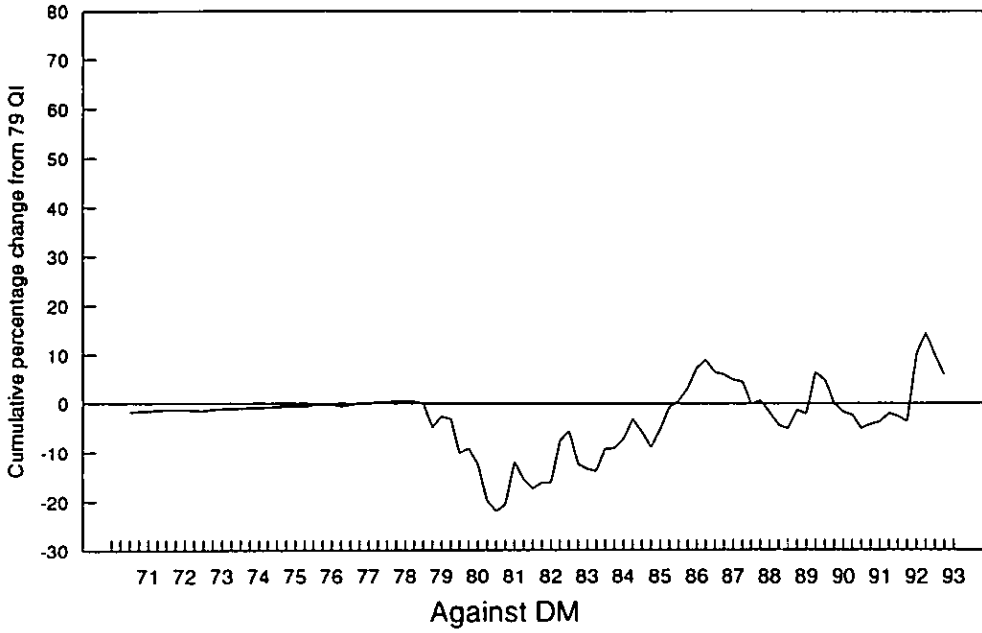


Figure 2.2

Cumulative Excess Returns on Short-Term Irish Assets
Against £ Sterling



The correlation between the excess returns on the different currencies depends only on developments in those currencies, and has nothing to do with Irish pound interest rates or the exchange rate of the Irish pound. Still it is interesting to note that the correlations are rather low: the highest in the EMS period being that between the dollar and sterling at less than 0.3.

The high volatility of excess returns tends to mask the cumulative trends in the quarterly plots. These trends are seen more clearly in Figure 2.2, which plots the cumulative excess returns, measured as a percentage deviation from the start of the EMS. (Thus, for example the 80 per cent for the DM at the beginning of the sample indicates that a holder of German marks from 1971 would have been 80 per cent better off by the start of EMS than the holder of Irish pounds over that period). The main patterns evident from this figure are:

- the large negative excess returns vis-a-vis DM until late 1976, reflecting the low real sterling interest rates during this period and the rapid depreciation of sterling against the DM;
- a long period of generally positive, though modest, excess returns against the DM in the EMS period, significantly interrupted only by the mid-1986 devaluation, giving a cumulative excess return of almost 40 per cent by 1992;
- a low frequency oscillation against sterling during the EMS, beginning with a sustained period of negative excess returns until late 1981, followed by mostly positive excess returns until mid-1986, with lesser cumulative fluctuations thereafter;
- the pronounced V-shape against the US dollar in the 1980s: reflecting the sustained appreciation of the dollar against most currencies in the first half of the decade, and its reversal thereafter.

Which of these phenomena need to be explained in terms of Irish developments? After all, we could focus on the sterling relationship and point out that, though volatile, excess returns averaged out at close to zero in the EMS. On the other hand, we could decide to focus on the DM relationship which is less volatile, but shows a cumulative excess return at the rate of over 2.5 per cent per annum.²³

²³ Note that short-term sterling assets also experienced excess returns against the DM - the mean is 0.42 per cent per quarter - but (unlike the Irish excess return against the DM) this was not significantly different from zero as it was accompanied by a high variance of 0.25 per cent per quarter.

Thus we find that 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.

Put another way, although holders of Irish pound deposits received a relatively steady return in DM terms (thanks to the DM-link inherent in the EMS), their return was materially higher than that available on DM-denominated assets. In contrast, the volatility of the sterling rate meant that (after adjusting for changes in expected exchange rate) there was no close link between Irish pound returns and those in the UK. We return below to the interpretation of this striking phenomenon.

3 *Benchmark Hypotheses on Excess Returns*

International interest rate movements have been extensively analysed by economists over the years with somewhat disappointing results. At this stage there is no point in pretending that a simple theory can reliably explain the evolution of excess returns. The current status of traditional theories is as benchmarks. Examining the deviations of actual interest rates from these benchmarks helps us interpret the data.

The main benchmark hypothesis concerning these excess returns is that of uncovered interest parity or *Fisher Open Parity*. This hypothesis states that the expected value of λ is zero, i.e., that there is no expected arbitrage profit to be made by borrowing in one currency and lending in another. This hypothesis is based on the idea that well-financed and risk-neutral speculators who agree on the prospects for exchange rates would seize any opportunity offered by non-zero expected λ and thereby drive interest rates and exchange rates back to the position where λ was zero. (An analogous hypothesis, the *pure expectations* hypothesis about long-term interest yields, is discussed in Chapter 5.)

As indicated, many studies for different countries have shown that it is not strictly true.²⁴ Specifically, although λ for most major currencies (*vis-à-vis* each other) has tended to be approximately zero on average, and not significantly autocorrelated, nevertheless, many recent studies have adduced evidence that λ is predictable - indeed that it is predictable simply by the raw interest differential uncorrected for expected exchange rate change.

Most explanations of the divergence from open parity (and pure expectations) are based on the idea that there are not sufficient risk-neutral

²⁴ A useful review of empirical research in this area is contained in MacDonald and Taylor (1992).

speculators. Thus there is thought to be a *risk-premium* attached to interest rates. The variation over time of this risk premium could depend on varying degrees of uncertainty, i.e., variations in perceptions of the magnitude of the risk. Another explanation for such variations could be varying capacity of speculators to bear risk.²⁵ Furthermore, exogenous factors may influence the degree of risk being absorbed by speculators at any given level of λ . Thus in particular, a current account balance of payments deficit may result in a higher expected value of λ emerging, as speculators will have to absorb more domestic assets to achieve the same expected value of λ . Official intervention in the domestic money market or the foreign exchange market can have the same effect.

Even if international investors have unlimited resources, they may differ systematically from domestic investors in regard either to their perception of the riskiness of Irish securities (in which case they cannot both have rational expectations), or in the information and transactions costs which they face in dealing with Irish securities. If the Government is not borrowing much, domestic investors will dominate in the market for Irish securities in such circumstances, but with higher levels of domestic borrowing, the higher risk premium demanded by domestic lenders will drive interest rates sufficiently high for the foreign borrowers to become interested (cf. FitzGerald, 1986).

When lenders have the alternative of placing their funds abroad, the comparative thinness of the Irish market (with its implication that by liquidating one's holdings one could drive the market against one) may also imply a premium on Irish interest rates.

A particular factor in Irish circumstances is the role of exchange controls in restricting the activities of speculators. Before the EMS, capital movements between Ireland and the UK were completely free (though restrictions existed with respect to other countries). In preparation for the EMS, exchange controls were tightened in December 1978 to cover transactions with the UK. Although these controls began to be relaxed in the mid-1980s they were not eliminated altogether until the beginning of 1993. While these certainly constrained domestic private and institutional portfolios, as witness the large adjustments in portfolios in response to liberalisation (Honohan, 1992), it is not clear how effective they were at the margin (Browne and McNelis, 1990, Mathieson and Rojas Suarez, 1993). As they were designed mainly to limit capital outflows, and as foreigners

²⁵ For instance, exchange controls might limit the degree to which speculators are able to exercise their role.

were never restricted from repatriating capital or earnings, it may be supposed that any effect of exchange controls on interest rates would have been in the direction of lowering them. Nevertheless one cannot rule out the possibility that, through an adverse effect on confidence, the very existence of exchange controls reduced portfolio inflows thereby actually increasing interest rates.

Another possibility, sometimes also loosely referred to as risk aversion but more properly termed the "peso effect" (from experience in Latin American monetary systems) occurs when speculators fear a major exchange rate event which does not actually occur in the sample. More precisely, a peso effect is present if a small, but not negligible, perceived risk of a large devaluation affects interest rates even though the frequency of large devaluations in the sample is lower than predicted. For example, speculators might make provision for the possibility, albeit slight, of a sharp weakening of the Irish pound resulting from a switch in Government monetary and fiscal policy towards laxity.

Such a very large devaluation would be a rare event, so that even a long time series might not contain any examples of the eventuality against which investors are hedging. If so, longer time series would be needed to falsify the hypothesis of a peso factor. These issues are reviewed in Agenor, Bhandari and Flood (1992).

Quasi-peso effects might be said to prevail over sub-periods if positive excess returns were correlated with a risk-inducing exogenous factor. The interpretation would be that the exogenous factor was removed before it had time to generate the feared big devaluation.

If there is a peso effect, the analyst's identification of the sample mean excess return with the market's expectation of excess return may be wrong. A peso effect (named for the very high excess returns computed in respect of Latin American currencies) will also induce errors in measuring subjective variance of returns. The peso effect can thus help explain systematically large or surprisingly predictable excess returns even if the degree of risk aversion is not very high.

4 Testing International Interest Parity on Irish Data

To summarise, the pure expectations theory implies that excess returns should be randomly distributed around zero. The simplest form of risk-aversion model would allow a non-zero mean, but without any predictable

variation in the excess returns. Within this overall expectations modelling framework, predictable variation in excess returns might be attributable to systematic and predictable variation in the risk premium.

(a) Fitting an equation to the excess returns

Econometric evidence on these issues in the Irish context is presented in Tables 2.3 and 2.4. These are based on the following simple formalisation of the above discussion. We decompose the excess return into its expected value and an unpredictable disturbance term ϵ . We interpret the expected value (predictable component) of the excess returns as a, potentially time-varying, risk premium ρ . Thus we write the excess return against currency j at any time t as:

$$\lambda_t^j = r_t - r_t^j - \mathcal{E}_t \left(\frac{\Delta S_t^j}{S_t^j} \right) + e_t^j = \rho_t^j + \epsilon_t^j \quad (2)$$

where \mathcal{E} 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 :

$$\rho_t^j = X_t \alpha_j + u_t^j. \quad (3)$$

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

$$\lambda_t^j = X_t \alpha_j + u_t^j + \epsilon_t^j \quad (4)$$

This is the regression equation we can estimate. The two disturbances ϵ and u are not separately identifiable, though in some circumstances, for example where we have monthly data on assets with a three-month maturity, a particular pattern of autocorrelations is expected for ϵ (a second order moving average in the case mentioned).

By including a plausible list of regressors X , the hypothesis of an unchanging risk premium can be tested by seeing if there are any non-zero coefficients in regressions of Equation (4). We did so for Irish pound returns against the pound 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).

Table 2.3: *Regression Results: Irish-UK Short-term Excess Returns*

<i>Regression No:</i>	<i>2.3.1</i>		<i>2.3.2</i>		<i>2.3.3</i>		<i>2.3.4</i>		<i>2.3.5</i>		<i>2.3.6</i>	
	<i>Coeff</i>	<i>t-stat</i>	<i>Coeff</i>	<i>t-stat</i>	<i>Coeff</i>	<i>t-stat</i>	<i>Coeff</i>	<i>t-stat</i>	<i>Coeff</i>	<i>t-stat</i>	<i>Coeff</i>	<i>t-stat</i>
Intercept	0.24	(2.8)	0.22	(3.4)	0.26	(3.5)	0.23	(3.2)	0.16	(2.3)	0.17	(2.8)
IR£/£stg Exchange Rate	-0.27	(2.8)	-0.25	(3.4)	-0.29	(3.5)	-0.26	(3.2)	-0.18	(2.3)	-0.20	(2.9)
Short-term interest diff - UK	-0.32	(1.2)										
Short-term interest diff - DM	0.20	(0.6)										
Inflation diff - UK	0.11	(0.7)										
Inflation diff - DM	0.11	(0.8)										
Yield Gap (Ireland)	-0.10	(0.2)	0.16	(1.9)	0.16	(1.9)						
Exchequer Borrowing	0.03	(0.1)										
Industrial production	-0.75	(0.2)										
Quarter 1	0.003	(0.2)										
Quarter 2	0.02	(1.0)										
Quarter 3	0.02	(0.8)	0.02	(1.9)	0.01	(1.3)						
Dummy 92 qtr2	0.12	(2.9)	0.15	(4.1)							0.15	(4.0)
RSQ / DW	0.43	1.68	0.37	1.80	0.24	1.73	0.16	1.8	0.09	1.7	0.29	1.87
F / d.f.	2.84	12,45	7.72	4,53	5.16	3,50	9.99	1,52	5.31	1,56	11.38	2,55
Method / No. of obs	OLS	58	OLS	58	OLS	54	OLS	54	OLS	58	OLS	58
Sample period	78 Q4 - 93 Q1		78 Q4 - 93 Q1		78 Q4 - 92 Q1		78 Q4 - 92 Q1		78 Q4 - 93 Q1		78 Q4 - 93 Q1	

Table 2.4 *Regression Results: Irish-German Short-term Excess Returns*

Regression No:	2.4.1		2.4.2		2.4.3		2.4.4		2.4.5		2.4.6	
	Coeff	t-stat	Coeff	t-stat	Coeff	t-stat	Coeff	t-stat	Coeff	t-stat	Coeff	t-stat
Intercept	-0.04	(1.6)	-0.05	(2.6)	-0.05	(2.4)	-0.05	(2.5)	-0.05	(1.3)	0.003	(0.1)
IR£/£stg Exchange Rate	0.04	(1.4)	0.05	(2.5)	0.06	(2.4)	0.05	(2.4)	0.05	(1.3)	-0.01	(0.2)
Short-term interest diff - DM	-0.25	(2.8)	-0.23	(4.7)	-0.21	(3.8)	-0.23	(4.4)	-0.19	(2.1)	-0.14	(1.6)
Short-term interest diff - UK	0.01	(0.2)										
Inflation diff - UK	0.03	(0.7)										
Inflation diff - DM	0.002	(0.1)										
Yield Gap (Ireland)	-0.01	(0.1)										
Exchequer Borrowing	-0.01	(0.1)										
Industrial production	1.29	(1.1)	0.01	(2.5)								
Quarter 1	0.004	(0.7)										
Quarter 2	-0.00	(0.4)										
Quarter 3	0.001	(0.1)										
Dummy 82 qtr4	-0.04	(3.8)	-0.05	(4.4)	-0.04	(4.0)	-0.04	(4.0)				
Dummy 86 qtr2	-0.09	(7.9)	-0.09	(9.0)	-0.09	(8.4)	-0.09	(8.4)				
Dummy 92 qtr4	-0.08	(5.9)	-0.09	(7.6)			-0.08	(6.9)				
RSQ / DW	0.773	1.96	0.758	1.84	0.672	1.80	0.727	1.79	0.102	1.84	0.04	1.97
F / d.f.	10.47	14,43	26.57	6,51	25.08	4,49	27.69	5,52	2.88	2,51	1.28	2,55
F / d.f. (excluding dummies)			10.61	3,51	9.35	2,49	11.48	2,52				
Method / No. of obs	OLS	58	OLS	58	OLS	54	OLS	58	OLS	54	OLS	58
Sample period	78 Q4	- 93 Q1	78 Q4	- 93 Q1	78 Q4	- 92 Q1	78 Q4	- 93 Q1	78 Q4	- 92 Q1	78 Q4	- 93 Q1

Our strategy in implementing Equation (4) was to begin with an over-determined regression (the first columns in Tables 2.3 and 2.4) including raw interest differentials (equivalent to forward premia), other available quarterly variables in Ireland, and seasonal and pre-devaluation dummies.²⁶ 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 are significant.²⁷ The insignificance of so many variables shows how hard it is to detect the influence of such variables as the pressure of Irish Government borrowing or inflation on the pure risk premium. Still, the explanatory variables in each of the equations that include pre-realignment dummies are jointly significant and this would be consistent with the existence of a predictable excess return risk premium or peso effect.²⁸

What about the variables that remain significant after deletion of those which are not?

In the German case, we may distinguish between regressions which include pre-devaluation dummies and those which do not. Taking the latter first, the only significant variable is the raw interest differential (forward premium). That raw interest differentials actually help forecast excess returns is a common finding, and is often interpreted as a time-varying risk premium; but that does not reveal the underlying cause of the premium.

Turning to the regressions which include the pre-devaluation dummies, (thereby effectively preventing the three large devaluation observations from influencing the data), the sterling exchange rate emerges as significant, with a positive sign implying that the Irish-German interest differential has adjusted by more than enough to compensate for the implied risk of future movements against the DM. We might wish to

²⁶ 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.

²⁷ One theoretically attractive idea is that the risk premium may evolve in accordance with the volatility of the excess returns themselves. Such a hypothesis can be estimated using what is known as a GARCH-m model. We were unable to detect any stable relationship of this kind on the data set used in this chapter. Recently McEntee and Downward (1994) report some evidence of a GARCH-m effect on Irish pound-DM data in the period 1991-1993.

²⁸ Though if pre-devaluation realignment dummies are excluded from the German equation, the explanatory variables are no longer jointly significant, preventing us from identifying a predictable risk premium.

interpret this as a quasi-peso factor: sterling weakness generates a genuine risk of devaluation greater than that which has actually ensued in the sample period.

For the UK, the sterling exchange rate is also significant, but this time with the opposite sign. Thus, although we know (from work discussed in Chapter 4) that sterling weakness is associated with higher Irish interest rates, the sign on the exchange rate implies that the response of the Irish-UK interest differential to sterling weakness was *not* on average enough to compensate for subsequent exchange rate movements between the two currencies.²⁹ It is not easy to provide a risk-premium interpretation of this correlation.

(b) Are the risk premia consistent across currencies?

But we cannot be sure that the predictable variations in excess returns are really due to time-varying risk premia. One obvious question is whether the putative risk premia estimated for different currencies are consistent with one another. Put simply, if weakness in sterling *increases* the risk premium in the German equation, how could such weakness *reduce* the risk premium in the UK equation?

We can test a version of this hypothesis if we are prepared to assume that the most important sources of the time variation in the risk premium are not dependent on currency-specific factors. If so, then the equation determining the time-variation itself should be the same irrespective of whether we are dealing with the excess return against the DM, the \$ or the £ sterling.

This is the idea underlying the multi-currency approach of Cumby (1988). He points out that many standard models of international capital asset pricing (see box) predict that the vector α_j in Equation (4) should be the same for each currency j (up to a constant of proportionality).

We tested these restrictions of proportionality on three currencies (£, DM, \$). A Wald test for proportionality of the coefficients yielded a χ^2 of 180.3 with 32 degrees of freedom, easily rejecting the hypothesis at the one per cent level. This reflects, for example, the opposite signs obtained on the Irish pound/sterling exchange rate in the German and UK regressions. Thus the findings do not support the simple theory: the risk premia vary in ways that are not consistent with a common factor theory with constant coefficients.

²⁹ In effect, a low value of sterling was often also associated with high sterling interest rates.

International Asset Pricing Model

Among the models which predicts proportionality of the coefficients in Equation (4) is the international asset-pricing model, an analogue of the well-known CAPM. In order to derive the predictions of that model one makes a variety of assumptions (especially assumptions on either the distribution of asset returns or on continuous trading to ensure that mean-variance portfolio selection applies) to obtain the familiar CAPM-type equation for the expected returns on a given asset:

$$\rho_i^j = \beta_i^j \mathcal{E}[\lambda^p - \lambda^0]$$

Where b is a function of the covariances of the various asset returns, \mathcal{E} is the mathematical expectation, and the two λ 's are the excess returns on specific portfolios, namely the total market portfolio p and a special portfolio (the "zero-beta" portfolio) whose returns are uncorrelated with the market portfolio. The point of this derivation is that, while the expected values of the two λ 's may vary over time, it may not be unrealistic to assume that their covariances are stable, implying that the β , though different for different currencies, is not time-varying. If so (or if the β 's for different currencies move proportionately), this equation implies that the ratios of expected returns:

$$\rho_i^j / \rho_i^k$$

must also be constant. That in turn implies proportionality of the vectors α of Equation (4).

More generally, if the expected returns follow any common factor model such as the Arbitrage Pricing Theory, with constant coefficients, the vectors α should be proportional.

The general conclusion from the econometric analysis is that the variation over time in excess returns is partly predictable. However, the pattern of predicted variations differs across countries in ways which cannot be accounted for by a simple model of risk aversion.

5 Transactions Costs and Hysteresis Bands

One possible approach to interpreting the empirical results and in particular 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 is necessarily somewhat involved, but it 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.

Recent theoretical research 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 (assumed to be proportional to the size of transaction)³⁰ 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. In one specific model (Baldwin, 1990), where the $\mathcal{E}(\lambda)$ process is a Wiener process, the width of the hysteresis band is given as approximately:³¹

$$2 \left(\frac{3 \sigma^2 \kappa}{2 r} \right)^{1/3}$$

Because of the cube root, even a small value for the terms within brackets can lead to a large hysteresis band. (Conversely, a doubling of the variance will widen the band by a factor of only 60 per cent.) Note, however, that the relevant process is not that of λ itself, but of its expectation.³²

The underlying mathematics of these models of sunk costs (introduced by Dixit, 1989) need not concern us here, but some intuitive account of why

³⁰ A referee points out that, in addition to transactions costs, asset holders who wish to liquidate their holdings may drive the price against themselves in a small and relatively illiquid market. Thus they would be faced with an effective cost of liquidation which would increase more than in proportion to the size of the transaction. It seems likely that such an effect would tend to increase the width of the hysteresis band.

³¹ This argument is based on exogeneity of the expected return process, but Baldwin (1990) has also developed a general equilibrium model.

³² Thus even if the standard deviation of sterling excess returns is only twice that of DM returns, still the variance of the predicted sterling excess returns could be many times higher than the variance of the DM predictions.

the bands are so wide may be in order. The essential idea is that switching the currency of investment can be done at any time to take advantage of an expected flow excess return. But the decision to switch now (and to incur fixed switching costs) must be weighed against the possibility that one may wish to switch back later.³³ If expected returns are volatile, this possibility is a real one, and while it is of no significance if there are no fixed switching costs, it becomes materially important as soon as they enter. Even a tiny switching cost³⁴ will be larger than the expected excess return over the next day or so, why not wait to see if the expected rate of return gets bigger before committing myself? The optimal decision rule is to switch only when the expected excess return is bigger than a trigger value which depends on the variance of the expected return and the switching cost.

In order to assess the quantitative relevance of the hysteresis model, we need estimates of the variance of the expected return. We have already presented estimates above of a model³⁵ of the time-variation in the expectation of λ . The time-variation of the fitted values 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.

Ignoring over-fitted equations and those with dummies for realignment quarters, leaves us with regressions such as (2.3.6) for the UK and (2.4.6) for Germany in Tables 2.3 and 2.4. The standard deviation of the fitted values in these two regressions is 1.65 per cent and 0.58 per cent respectively, 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.

Alternatively, we may note that the F-statistic in regression (2.4.6) is not significantly different from zero: if we reasonably draw the conclusion that the excess return against Germany is not predictable at all, we obtain a

³³ Another way of looking at this is that, if I am holding Irish pounds now, I have the option to buy DM's: this option is valuable, but could become more so, I will only exercise it when it is very valuable.

³⁴ The derivative of the trigger value of excess return (see below) with respect to switching cost at a value of zero is infinite.

³⁵ 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 our 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.

zero hysteresis band for Germany, whereas for the UK, the hysteresis band derived from the formula, (assuming that the transactions cost is five basis points and the domestic interest is seven per cent per annum) comes out at 19 per cent per 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.

This provides the answer to the question posed above as to whether the relevant comparator for calculating excess returns is sterling or the DM. Because the band of indifference proposed by the new theory discussed above is so much smaller for the DM, it is it that should be used as the reference. Expected exchange rate change against the DM was likely a more powerful force in influencing Irish interest rates than expectations about sterling. Accordingly, since the DM is the relevant comparator, we should conclude that systematic positive excess returns have been earned on Irish pounds over the EMS period, suggesting a long-term peso factor or a substantial risk premium.³⁶

Was the risk premium too large, reflecting a pricing error on the part of the market? If one allows the possibility of a peso factor of unknown magnitude one can never prove that a risk premium was too high. But even ignoring the peso factor the literature does not provide any guidance allowing us to apply a reliable "market-price-of-risk" formula to decide this consideration. Indeed, the gap between equity and bond returns in the US and other industrial countries, usually thought of in theoretical models as explicable in terms of risk aversion (given the higher volatility of equity returns), is too high by a large factor to match with experimental evidence on individuals' risk preferences. The persistence of this "equity premium puzzle" inhibits us from saying that the risk premium on Irish pound assets was too high.

6 *Concluding Remarks*

Participation in the EMS has allowed a certain flexibility in Irish interest rates.³⁷ But this flexibility has not resulted in low interest rates. In this chapter we have shown that Irish pound short-term interest rates have been higher than necessary to compensate investors for actual exchange rate changes. While this may also have been influenced by the level of

³⁶ And the excessive response of the Irish-DM interest differential to sterling weakness, noted above, can be thought of as a kind of short-term quasi-peso effect.

³⁷ Indeed, Svensson (1992b) argues that preserving this flexibility may be the main advantage of having a margin of fluctuation.

Government borrowing during the 1980s, or by monetary policy actions at home (see Chapter 3), it seems clear that the exchange rate regime itself has played an important part in generating these excess returns. 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. There had been no risk premium relative to the core (sterling) in Ireland's previous exchange rate regime. However, 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 (Honohan, 1994b). 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.

We have explored why these persistent excess returns may have emerged in the EMS period. The methodology of this chapter does not inform us very precisely on this point. If there was a deviation from the rationality assumed in the models we have been dealing with it may have been associated with a lag in expectations formation: having consistently underestimated the propensity of sterling (and the Irish pound) to depreciate during the 1980s, the markets may have failed to adjust to the lower depreciation propensity of the 1970s. Another possible illusion relates to the one-way nature of realignments: the virtual certainty that realignments would always involve a depreciation against the DM may have led to an exaggerated perception of the downside risk. We look more closely at the realignments in Chapter 4.

More generally, this Chapter has not looked explicitly at the determinants of exchange rate expectations, Chapters 4 and 5 throw some further light on this matter, and go further in modelling short-term interest rate movements.

Chapter 3

LIQUIDITY AND IRISH INTEREST RATES

1 Introduction

The previous chapter focused on the role of expectations in influencing Irish interest rates during the EMS period. Of course monetary policy affects expectations, and so has already been partly taken into account. Here we examine the role of monetary policy actions more directly, and explore the relation between interest rates, on the one hand, and actions of the monetary authorities in supplying liquidity to, and withdrawing it from, the market on the other. In short, we examine whether there are links between official liquidity and interest rates.

The causal relationships here are bound to be bi-directional. Rising interest rates will induce official action to increase liquidity, and a flow of liquidity to the market will tend to dampen the incipient rise in rates. This presents well-known econometric difficulties which we will not altogether be able to overcome. Nevertheless, the patterns are sufficiently clear for some striking conclusions to be drawn.

It is universally believed that the monetary authorities, especially the Central Bank, can influence short-term interest rates on a day-to-day basis. While the important role of expectations here is not disputed, market participants often emphasise that, by directly influencing the balance of supply and demand for liquid assets in the market, the Central Bank can drive down interest rates relative to where they would otherwise be, even if the action has no effect on expectations about the future.

Whether it is related to expectations or not, the role of the Central Bank in influencing liquidity is potentially important. In this chapter we describe how this influence is effected and assess its quantitative importance. There are six sections. The next section provides a brief account of the liquidity instruments used by the Central Bank of Ireland. Section 3 quantifies the use of these instruments during the EMS period. Section 4 discusses the role of liquidity effects in theory of interest rates, with particular reference to Irish conditions. Section 5 assesses the empirical importance of liquidity effects in Ireland, and provides evidence of an apparently significant shift in

Central Bank policy during 1988. Conclusions are in Section 6.

2 *Liquidity Instruments in Ireland*

As the ultimate issuer of Irish pound liabilities, the Central Bank, like monetary authorities all over the world, is in a strong position to influence the composition of the national portfolio, and thereby potentially affect asset prices and yields.³⁸ The Central Bank also has the power to vary reserve requirements which may have a similar effect. The Central Bank deals primarily with commercial banks, and the effects of its actions depend largely on the response of the banks, which in turn is based on considerations of profitability.

The commercial banks themselves allocate their assets among relatively illiquid loans, and more liquid marketable securities, as well as holding very liquid reserves. The reserves of the banking system are chiefly liabilities of the Central Bank. In aggregate, the banks can increase the stock of reserves by borrowing from abroad and converting the proceeds into Irish pounds, or by borrowing from the Central Bank. If the Central Bank alters the aggregate availability of reserves, or the cost of borrowing from it the knock-on effect from competitive pressures and the need to maintain profitability will tend to transmit interest rate pressures throughout the economy. The availability, to the banks as to their customers, of foreign borrowing is the chief factor acting to dilute such transmission.

There has been a very active short-term monetary policy in Ireland in recent years. Even before the 1992 currency crisis, discretionary interventions made by the Central Bank have frequently amounted to hundreds of millions of pounds (up to 3 per cent of GNP) over periods as short as a few weeks.

As reported by the monetary authorities themselves, there have been two main aspects of policy action: efforts to smooth interest rates by establishing an upper and lower bound for interest rates in the short-run and efforts to influence the trend in rates. In an authoritative description of the mechanisms used to manage monetary policy in Ireland, McGowan (1992) refers to these as overnight balancing and discretionary support respectively.

³⁸ Current practices in interest rate policy in industrial countries are reviewed in Honohan (1993b).

Discretionary support, i.e., money market intervention at the Central Bank's initiative, (which is by far the most important quantitatively) has the objective of avoiding "unwarranted changes in domestic interest rates". By systematically undersupplying or oversupplying the market with discretionary liquidity, the Central Bank can put pressure on market interest rates. Discretionary support is normally influenced through sale and repurchase agreements (repos) of Irish government bonds, term deposits solicited from the banks and forex swaps. In each case, the Central Bank typically sets the maturity and calls for bids as to price and quantity.

In contrast, overnight balancing is done at the initiative of a commercial bank and at off-market interest rates, i.e., rates that are fixed for some time and are normally a little away from market-clearing rates. They effectively provide the short-term floor and ceiling to money market interest rates. The major instrument, establishing the ceiling, is the short-term facility (STF), a standing loan facility offering banks funds at a posted interest rate normally a little above market rates. The size and timing of changes in the STF rate are sometimes used as a signal of Central Bank intent, though it normally moves with the market. Though the STF thus normally provides the upper bound to market interest rates, it has been suspended at times of crisis. The Central Bank also normally posts a rate at which it will accept overnight deposits: this normally provides the lower bound on market interest rates.

The effectiveness of Central Bank interventions in influencing money market conditions generally is enhanced by the degree to which the money market itself is an active allocator of funds in the system, and to the degree to which the Central Bank deals with the market on an impersonal basis.

There has been a very marked shift to the use of market-based instruments of monetary policy over the past decade. Bank-by-bank credit ceilings are gone, as is the interest rate cartel. The so-called primary liquidity ratios (reserve requirements yielding below market rates) have been lowered, thereby reducing an implicit tax which has in recent years been equivalent to about £30 million annually. The restrictions on the banks' open foreign exchange positions and their "spot against forward" positions have

been liberalised. Yet implementation of monetary policy is not wholly indifferent to the identity of the counterparty banks. Thus, for example McGowan observes that "the Central Bank's views about the distribution of liquidity among the banks and its views about the influence of dominant players in the market" may influence the allocation by the Central Bank of swaps between the banks.

Exchange controls (already discussed in the previous chapter) may influence the effectiveness of liquidity policy. However, the domestic banks, whose activities dominate the money market, have not been much constrained by exchange controls over the years. Indeed, even such regulatory restrictions on their open foreign exchange position and on their spot against forward position as have been imposed for reasons of microeconomic prudence were probably little more constraining than the banks own internal prudential controls. Although one dramatic episode involving foreign institutions during the currency crisis of 1992-93 has led to frequent references to the relevance of Irish exchange controls to the money market, this is probably an exception which proves the rule.

On the whole, the Irish money market may be regarded as quite efficient in transmitting interest rate pressures throughout the economy, even where policy interventions have a bilateral character.

3 *The Scale of Liquidity Interventions in Ireland*

Table 3.1 provides a summary of the main elements in the Central Bank's balance sheet. Currency outstanding and the official external reserves are normally the largest elements, but the Central Bank's position *vis-à-vis* the government and the banking system is also important.³⁹

The main elements relevant to the question of bank liquidity are as follows: Banks' primary liquidity is a mandatory percentage of deposit liabilities; its decline in the last few years reflects reductions in the required percentage. The other deposits, usually small, include both overnight and term deposits. Published figures do not allow these to be fully distinguished. Banks may borrow through the STF or through advances secured by Government securities. A sale and repurchase agreement is similar to a loan in its effects on liquidity. Foreign exchange swaps also have the effect of increasing banks' Irish pound liquidity at the expense of their foreign exchange liquidity. The banks' Irish pound liquidity yielded by a swap appears in the Central Bank's balance sheet (and the swap also tends to

³⁹ Recently the gross position of other credit institutions has been growing.

Table 3.1 *Elements of Central Bank Balance Sheet
and their contribution to liquidity support*

		<i>End-year, £ million</i>														
		1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
<i>Liabilities</i>																
A	Currency	634	721	797	879	985	1035	1073	1130	1215	1347	1302	1350	1368	1604	1776
B	Government deposits	180	138	130	186	222	198	193	273	647	882	1132	979	1248	639	1425
C	Banks' primary liquidity	421	584	447	513	560	560	723	715	839	768	759	903	669	446	544
D	Banks' other deposits	85	16	34	0	0	0	0	12	0	2	2	2	2	1	27
<i>Assets</i>																
E	Official (External Reserves	975	1346	1473	1594	2015	2101	2272	2205	2821	3161	2521	2892	3256	2113	4278
F	STF drawings and secured advances	281	46	28	103	69	122	32	59	65	69	161	94	18	95	9
G	Sale and repurchase agreements	0	0	0	0	0	0	54	310	273	171	1141	790	799	1979	588
H	Irish Government bonds	287	333	326	444	403	501	338	320	319	362	356	365	229	230	183
	Other items (net)				-563	-720	-931	-707	-764	-777	-764	-984	-707	-815	-1727	-1286
J	Forex swaps (liquidity provided)	63	-86	60	195	50	50	105	577	40	0	0	0	0	800	NA
C+D	Bank deposits	505	600	481	513	560	560	723	727	839	770	761	905	671	447	571
F+G	Bank borrowings	281	46	28	103	69	122	86	369	338	240	1302	884	817	2074	597
C+D-(F+G)	Net banks' posn (ignoring swaps)	224	554	453	410	491	438	637	358	501	530	-541	21	-146	-1627	-26
C+D-(F+G+J)	Net banks' posn (taking a/c of swaps)	161	640	393	215	441	388	532	-219	461	530	-541	21	-146	-2427	NA
F+G+J-D	CB support net of voluntary deposits	260	-56	54	298	119	172	191	934	378	238	1300	882	815	2873	NA
B-H	Net Government position	-107	-195	-196	-258	-181	-303	-145	-47	328	520	776	614	1019	409	1242

Source: Central Bank Reports; Kelly (1993).

increase official external reserves), but the corresponding future obligation of the banks does not show up as an asset in the Central Bank's balance sheet. Before 1992, swaps data is available only for end-year dates.

Figure 3.1 provides a broad indication of the scale of fluctuations in Central Bank liquidity intervention on an annual basis 1980-93. The variable chosen to summarise Central Bank support here is the change in the net position of the banks at the Central Bank, taking account of forex swaps.⁴⁰ Thus, in order to obtain our variable, we begin with the net asset-liability position of the banks *vis-à-vis* the Central Bank, thus including both their primary liquidity holdings and voluntary deposits on the assets side, while subtracting borrowing, whether from the STF, in the form of sale and repurchase arrangements, or secured advances. It is this net banks' position with the Central Bank which the latter can manipulate to influence banks' liquidity. The end-year interest differential (Irish pound minus DM) is also included for reference in the upper panel of the figure, and its annual change in the lower panel. Three main features stand out.⁴¹

First, the scale of intervention has been very large, with net change in support in excess of £1 billion in three of the fourteen years, and in excess of £0.5 billion in six years. For comparison, the narrow money supply M1 increased from about £1.3 billion in 1979 to about £3.9 billion at the end of 1992.

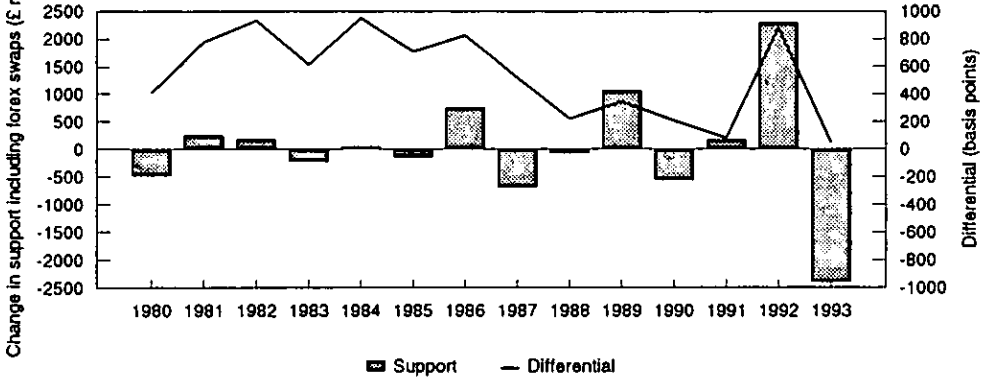
Second, there is a clear indication of negative autocorrelation: almost each year of positive support has been followed by a year of draining support. There is no large net trend in the stock of support.

⁴⁰ An alternative definition - cf. McGowan (1992), Kelly (1993) - ignores the primary liquidity of the banks, but it may be preferable to include it in order to take some account of the net liquidity effect of the changes in primary liquidity requirements. A more sophisticated method again would be to calculate primary liquidity at a standard liquidity ratio and use the difference between this and the actual primary liquidity. Our approach can be regarded in that light as using zero as the standard liquidity ratio.

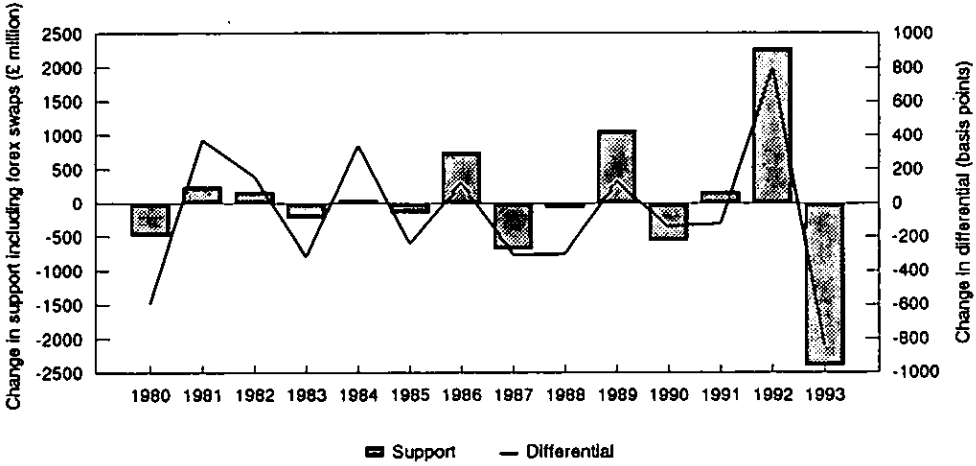
⁴¹ An additional element of liquidity policy is the degree to which the Government has recourse to the Central Bank for funding its borrowing requirement. Table 3.1 includes a row for this where the Central Banks' holdings of Government securities (other than the Certificates of Indebtedness issued mainly in connection with the Insurance Corporation of Ireland administration in 1985) are netted from Government deposits. As the Government's banker the Central Bank always holds large deposits for the Government, and these have generally grown over the years. Even apart from the sizeable 1992 dip, it will be seen that fluctuations in the Government's net position with the Central Bank have also contributed to liquidity conditions. However, this would be a very partial view of the role of Exchequer in liquidity fluctuations, as fluctuations here have been dominated over the years by the Exchequer's recourse to foreign borrowing. Anyway the role of Exchequer financing in interest rate management is not further discussed in this chapter.

Figure 3.1

Change in Central Bank Support and IR£/DM Interest Differential



Change in Central Bank Support and in IR£/DM Interest Differential

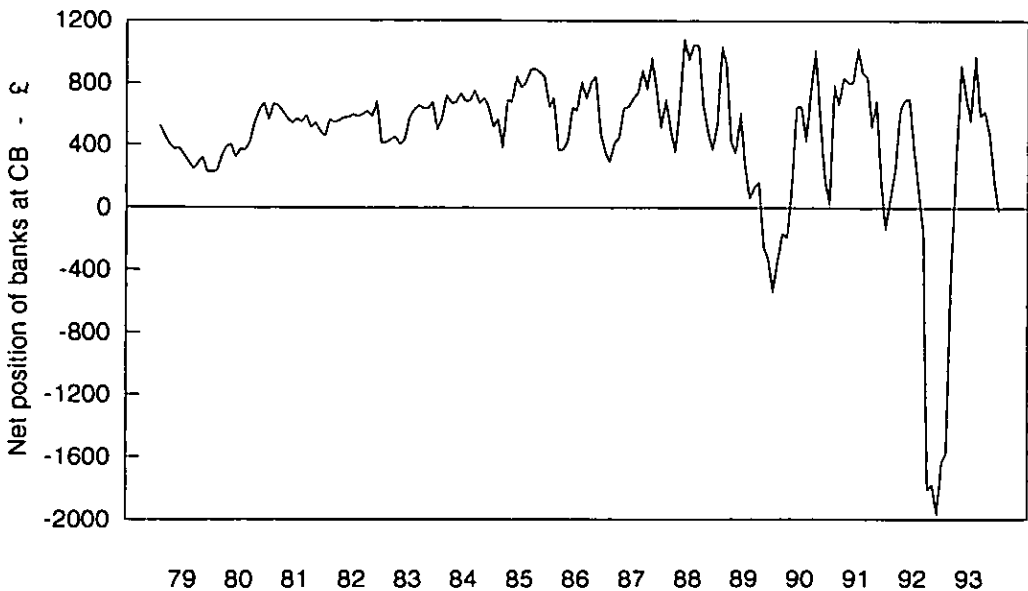


Third, there is strong evidence of a positive relation with the change in interest differentials, i.e., support has tended to be high when Irish pound interest rates have been increasing (the correlation coefficient is 0.86).

Figure 3.2 presents monthly data on the banks' net position *vis-à-vis* the Central Bank. This time the level, rather than the change, is shown. The monthly data are incomplete in so far as they do not include support to the market which came in the form of swaps. Such swaps have been important, especially at times of turbulence, but, as mentioned data on a monthly basis have only been published in respect of very recent months. Monthly fluctuations in support are very large and there is evidence of a seasonal pattern, with support to the market being low during December and January, high in June. The negative autocorrelation remains evident and non-stationarity of the time series can easily be rejected. (We examine the relationship between the monthly liquidity data and interest rates below.)

Figure 3.2

Net bank liquidity
1979-93



4 *Liquidity Effects in Theory*

In the international empirical literature, the liquidity effect has normally been modelled by reference to the demand for money. Several authors derive this demand from a formal model which assumes that economic agents must have cash-in-hand before making their purchases of goods or bonds, and that adjusting one's portfolio takes time.⁴² Alternatively, we can simply assume a stable demand relationship between real money balances (on the one hand) and interest rates and some scale variable such as nominal income (on the other). On either basis, it is easily deduced that an increase in the supply of money must, in equilibrium, result in changes in prices, income and interest rates. The most rapidly adjusting of these variables in an uncontrolled market economy is likely to be interest rates.

In models where the monetary aggregate whose supply is increased is a broad one containing interest-bearing assets, care must be taken in interpreting interest rate movements, as some interest rates will represent the yield on elements of the monetary aggregate, while others represent an opportunity cost of holding the monetary aggregate.

But in models dealing with currency, or the monetary base, or a component of the money stock which is interest-free or on which the interest rate is controlled at below-market rates, then market interest rates do unambiguously indicate the opportunity cost. In that case an exogenous expansion of the money stock should result in a lowering of interest rates.

Three important qualifications must be made to this simple demand-side story.

First, changes in the money stock may result from policy actions which are themselves influenced by interest rates. For instance the authorities may expand liquidity to offset an increase in interest rates: that would make the relationship between money and interest rates ambiguous. (This point thus brings in supply-side effects).

Second, there could be expectational effects: a liquidity expansion might generate expectations of further inflationary policy, thereby tending to increase interest rates rather than lowering them. (This

⁴² If the time taken to adjust portfolios is significant, the short-run impact of liquidity intervention can be greatly magnified, causing sharp - though transitory - deviations of interest rates from what would be predicted by expectations-based models. Furthermore, a consistent correlation pattern between monetary policy interventions and other economic shocks could induce a permanent liquidity premium. Among the main theoretical contributions to the recent literature on liquidity are Lucas (1990), Christiano and Eichenbaum (1992), Coleman *et al.* (1992), and Engel (1992a and b).

second effect implies that the demand for money function is more complex than described in the previous paragraph).

Third, there may be a difference in the response between anticipated and unanticipated liquidity expansions. Thus, for example, if all prices and monetary aggregates have been increasing steadily by ten per cent per annum, then a ten per cent increase in liquidity this year should not cause any change in interest rates, but will instead be absorbed by the continuing increase in other nominal magnitudes.

It is probably because of these qualifications that, though the importance of the liquidity effect is almost universally acknowledged, it is extremely difficult to document using econometric methods (cf. Leeper and Gordon, 1992).

Although we need not force the analysis of liquidity into the expectations straitjacket, it is instructive to realise that the underlying theoretical approach developed in the previous chapter to rationalise the role of expectations can be extended to take account of liquidity. We used the expectations approach above to calculate the interest rate at which a speculator would expect to break-even, by comparison with investing in the core foreign currency j , i.e., r^* , where:

$$r_t^* = r_t^j + \mathcal{E}_t \left(\frac{\Delta S_t^j}{S_t^j} \right) \quad (1)$$

We also discussed the possible existence of a risk-premium. Now suppose the risk-premium depends on the size of the exposure or net position taken by the speculators. Then, if z_t represents the net position we may describe the speculators' influence on interest rates as satisfying, at time t , as:

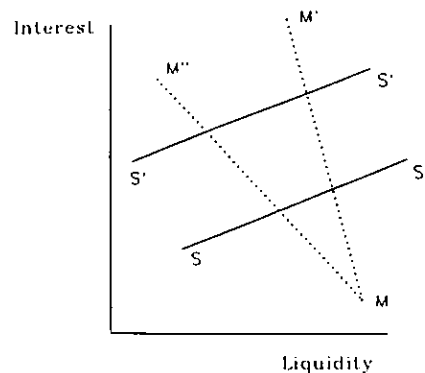
$$r_t = r_t^* + \rho_t(z_t) \quad (2)$$

The risk aversion function r can be assumed to take on a minimum at $z = 0$, and to increase with the absolute value of z . When $r > r^*$, speculators will want to sell foreign exchange to buy Irish pounds; when $r < r^*$, speculators will take up a negative position (i.e., borrow) Irish pounds in order to invest them abroad. Accordingly, we can solve (2) to obtain an upward sloping

relationship between interest rates r_t and the net holding of Irish pound liquid assets z_t by speculators.⁴³ At any given level of exchange rate expectations, the higher the interest rate in the market, the more the speculators will divert funds to it. The monetary authority is also a participant in this market and can be pictured as having a net supply function, or reaction function, of its own. It will supply more Irish pound liquid assets, the higher the interest rate. Thus it provides a downward sloping relationship between liquid asset holdings and the interest rate. However, the monetary authority's function will not necessarily depend on the market's exchange rate expectations. The intersection of these two functions will then determine the equilibrium interest rate.⁴⁴

The relative importance of expectations and of the monetary authority's liquidity actions depends on the elasticity of speculative supply, and thus on the degree of risk aversion and the wealth of the speculators. If the market's expectation of depreciation increases then, short of any monetary policy action, the interest rate will rise by the same amount.⁴⁵ But by lending Irish pound funds to the market, the authorities can reduce the scale of the interest rate increase. Conversely, by withdrawing liquidity the authorities can drive interest rates higher by affecting the size of the net position adopted by speculators.

The position of the speculators' demand function for liquid assets ($SS, S'S'$) will fluctuate up and down with changes in expectations concerning exchange rates. The equilibrium interest rate that emerges will be at the intersection of the speculators' demand function with the monetary authorities' policy reaction function MM (which as mentioned is negatively sloped). The shallower the monetary policy reaction function line, the more liquidity support the authorities are



⁴³ Technically, since p is a U-shaped function of the net position, there are multiple solutions, but the downward sloping solution can be ruled out on stability grounds.

⁴⁴ More generally, we could also envisage the existence of another class of private agents, namely liquidity driven agents whose net supply or demand of funds for non-speculative purposes may also be somewhat interest sensitive. If the monetary authority were not present, then when non-speculative demand was very high, the emergence of high interest rates at home - so high that expected excess returns are above normal - could be closed by speculative flows only if speculators were prepared to increase their exposure to exchange risk involving the Irish pound.

⁴⁵ Apart from the possible role of non-speculative private demand.

prepared to provide to limit interest rate movements. An activist interest rate policy (standing ready to accommodate shifts in private sector money demand to reduce their impact on interest rates) will have a shallow slope as with MM" in the diagram. A passive interest rate policy, intervening little to provide or withdraw liquidity support in response to interest rates pressures, will have a steep slope, as has MM'

5 Liquidity Management and Interest Rates During the 1980s

In order to investigate to what extent systematic patterns of liquidity management are evident in Ireland during the EMS period, we have plotted net bank liquidity⁴⁶ against the Irish-German interest differential (left hand side of Figure 3.3). The upper panel covers the whole period to 1993, the lower one stops in August 1992 before the currency crisis. As we have argued that both policy and speculative factors are relevant, our ability to identify the source of the patterns depends on the relative degree of stability in the policy reaction function and in the speculators' behaviour. Since realignment expectations are very variable over time, our prior belief is that the speculators' demand curve would be more variable and that the plot would therefore map out different points on the more stable (negatively sloped) policy reaction curve.

Indeed, the plot shows not one but two distinct negatively sloped curves, one applying before mid-1988, and one thereafter. Guided by Leamer's (1981) discussion, we are encouraged to identify these negatively sloped curves as policy reaction functions.⁴⁷ As is clear from the labelling of the monthly observations, the earlier period, running up to mid-1988, displays a steep reaction function indicating a passive interest rate policy. After mid-1988 the reaction function becomes much flatter. The two data clouds merge during the Summer of 1988, so that it is hard to say exactly when one regime begins and the other ends. The new regime might begin as early as May 1988, or as late as October 1988.

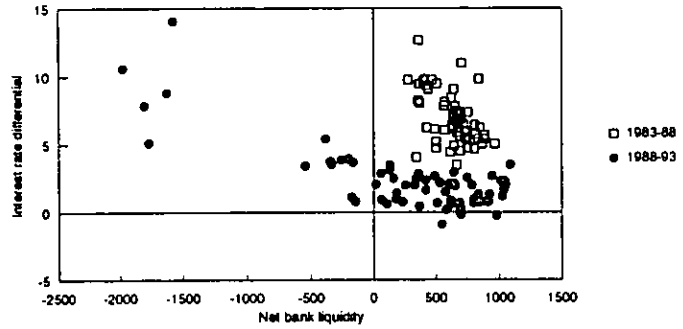
The right hand side of Figure 3.3 plots monthly changes in the interest differential against monthly changes in net bank liquidity (the upper panel shows the full sample, the lower panel excludes the outliers). Here too there is evidence of a firmer intent to smooth interest rate movements in the later period, as evidenced by the clustering of the later observations around the "no change" horizontal axis.

⁴⁶ As previously defined. Note that this does not take account of liquidity provided through forex swaps.

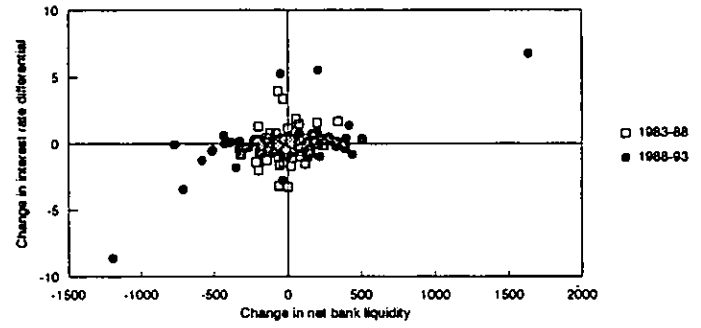
⁴⁷ There is no monthly data available for plausible instruments.

Figure 3.3

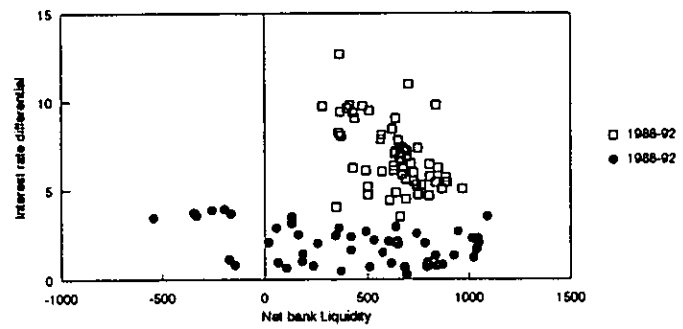
Net bank liquidity and interest rates
1983-93



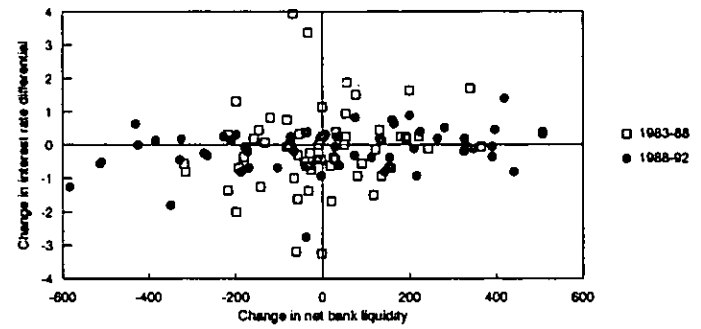
Changes in net bank liquidity and in interest rates
1983-93



Net bank liquidity and interest rates
1983-92 (August)



Changes in net bank liquidity and in interest rates
1983-92 (August)



Of course some of the earlier observations relate to a period of relatively frequent devaluations, and the trend-change in the interest differential in these years may mask the true reaction function. We attempted to address this possibility by regression analysis. The results (summarised in Table 3.2) confirm the visual impression of Figure 3.3.

Regression 3.2.1 shows that for 1979 to mid-1988 there is a small but significant negative relationship between net bank liquidity⁴⁸ and the interest differential (after taking account of a trend decline in net bank liquidity). In this period a 100 basis point increase in the interest rate differential elicits additional liquidity support from the Central Bank, but only of the order of about £20 million.

After mid-1988 the response of liquidity support to a 100 basis point increase in the differential is of the order of £200 million.

These results refer to the period before September 1992. Thereafter, the same equation fits quite well, except for two observations from the exchange rate crisis, November 1992 and January 1993.

There thus appears to be a clear monetary policy regime shift at mid-1988. This coincides with a number of other events. Most macroeconomic indicators begin to turn around close to that period. These include the volume of retail sales (May 1988 is the last month until January 1991 which showed a twelve-month seasonally adjusted fall), employment in building and construction (trough in April 1988), employment in industry and unemployment (peaked in May 1987). Non-resident holdings of Government stock were also increasing rapidly at around this time, growing from £1.1 billion at end-1986 to £1.8 billion at end-1987 and £2.7 billion at end-1988). Above all, fiscal indicators improved sharply in 1988 (Honohan, 1992).

It appears that monetary policy was enabled by these positive trends to adopt a more confident line. The growing belief in the stability of the EMS at that time (Giavazzi and Spaventa, 1990) also helped cement the relevance of German interest rates as a reference point and the authorities acted to insulate Irish interest rates around German reference levels. Even when sterling weakened in late 1989, the Irish interest rate response was

⁴⁸ Note that these monthly data does exclude the effects of forex swaps. This exclusion will not qualitatively affect the results if use of such swaps did not vary systematically over time.

Table 3.2: *Regression Results: Central Bank Support*

<i>Regression No:</i>	3.1.1		3.1.2	
	<i>Coeff</i>	<i>t-stat</i>	<i>Coeff</i>	<i>t-stat</i>
Intercept	580.8	(7.7)	3748.3	(2.4)
Interest differential	-20.7	(3.1)	-259.7	(2.6)
Time	2.4	(3.3)	-19.8	(2.0)
AR(1)	0.58	(7.3)	0.74	(6.2)
RSQ / DW	0.636	2.13	0.663	1.72
F / d.f.	61.6	3,106	31.4	3,48
Method / No. of obs.	OLS	110	OLS	52
Sample period	Mar 79 - Apr 88		May 88 - Aug 92	

moderated by liquidity support at unprecedented levels. As fiscal policy contracted, monetary policy adopted a more relaxed and confident tone. The stability and lower interest rates that this encouraged undoubtedly helped underpin the vigorous recovery in economic activity that was maintained in the following years, and even survived the world recession.

Our methodology does not provide enough information to allow us to estimate the degree to which interest rates in the post 1988 period would have been higher had the new policy regime not been in place. That would require the estimation of the slope of the private sector net demand for liquidity schedule.

6 *Concluding Remarks*

Though it is not clear just how effective recent Central Bank liquidity interventions have been in influencing interest rates, there is evidence of a change in policy towards a more aggressive attempt to smooth rates after mid-

1988. Of course this did not represent the main target of policy, and remained within the limitations imposed by the overall policy target couched in terms of the exchange rate and geared to achieving price stability as the primary objective. But interest rate smoothing, to avoid unnecessary volatility in interest rates, is not inconsistent with exchange rate targeting.

If interest rate policy involved preserving a balance (Doyle, 1990), then the balance appears to have shifted around mid-1988. Before then, the reaction of Central Bank intervention to interest rate pressures was very modest (£20 million per one per cent movement in interest rates) and the impact cannot have been great.

As already mentioned the management of the Government's cash balances and its foreign borrowing are another factor which needs to be kept in mind in this context. It is not known how far these activities (latterly conducted by the National Treasury Management Agency) have been coordinated with the Central Bank's policy, or if it is better to think of them as exogenous disturbance to which the Central Bank responds. This matter deserves further analysis.

With a weaker expectational anchor resulting from the wider margins brought into the EMS since August 1993, it is quite possible that the effectiveness of Central Bank liquidity intervention has increased. Certainly the relative stability of interest differentials *vis-à-vis* the DM since then provide no reason to doubt this hypothesis. If so, the role of official liquidity policy, more aggressive since 1988, will now have become much more important.

Chapter 4

THE EFFECT OF REALIGNMENT CRISES ON INTEREST RATES

1 Introduction

In this chapter we look more closely at the the role of realignment expectations in influencing short-term Irish interest rates. Our discussion of Chapter 2 examined the degree to which interest rates were "too high" relative to subsequent exchange rate movements against the DM. We explored the possible role of a risk premium in this regard, and examined the correlation between such a risk premium and observable variables, notably the sterling exchange rate. Casual observation suggests that weakness in sterling tended to increase the likelihood of a devaluation; what we showed was that it also increased the risk premium. Here we look at the total effect: how much did episodes of sterling weakness increase Irish interest rates during the EMS?

This matter has already been widely explored (cf. Honohan and Conroy, 1994, O'Leary and Mangan, 1993, Thom, 1994, Walsh, 1993). From this analysis it is widely accepted that sterling weakness was fairly consistently associated with high domestic interest rates (Frain, 1993 is a dissenting voice). We add to the evidence here with some new daily regressions and also by tracking the day-by-day movements in interest rates and sterling exchange rates during a few of the most important crises.

Even if they are driven by expectations of relative currency movements, interest rate differentials need not reflect expectations of realignment because of the degree to which currencies can move within the fluctuation band. This is clearly relevant with the wide +/- 15 per cent band, but it may also have been a factor in the narrow band. We therefore explore the movements of the Irish pound within the band.

The chapter is arranged as follows. In Section 2 we describe three of the major currency crises and look at the daily evolution of interest and exchange rates. Section 3 presents our simple model linking short-term interest rates with the sterling movements. Section 4 discusses the pattern of movements within the band. Section 5 contains some concluding remarks.

2 *Three Big Devaluations in the EMS*

From the point of view of their impact on market conditions, a distinction may be made between unilateral⁴⁹ devaluations in the EMS and multilateral realignments. The former were sometimes achieved with the kind of surgical precision of which central bankers dream, in that they were not preceded by speculative outflows or interest rate pressures. However, this was only possible when the devaluing currency was not one of the three large ones, and sometimes not even then. The multilateral realignments were generally heralded by much advance speculation, and by generally higher interest rates for most currencies. That was because the devaluation of a major currency nearly always involved adjustments to the DM parity of most of the other currencies too. There were also episodes where - judging from newspaper reports as well as interest rate movements - realignments were expected but did not occur.

When the EMS began operating on 13 March 1979, the Irish pound remained linked with sterling, but within two and a half weeks, sterling's strength brought the Irish pound to the top of its permissible fluctuation band and, 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. Subsequently the Irish pound was devalued eight times against the DM (about one in every two realignments).⁵⁰ The Irish pound was devalued against the DM in all of the multilateral realignments.

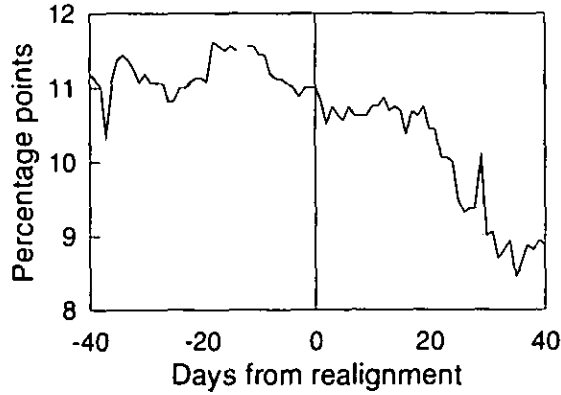
Our daily data series runs from November 1981 and therefore covers, in addition to unilateral realignments, four multilateral realignments, those of June 1982, April 1983 and April 1986, as well as the smaller adjustment of January 1987. In all but one of these, the Irish pound went with the plurality of currencies, but in March 1983 it was the most depreciated. Interest rate movements near the time of these realignments are shown in Figure 4.1. Taking the average of the twenty daily observations before and after the realignment it is striking that in only two of the episodes (June 1982 and April 1986) did Irish interest differentials over the DM fall following the realignment. The March 1983 realignment was followed by a couple of weeks of turbulence, before interest rates subsided, while the January 1987 realignment failed to interrupt a general upward movement in the Irish rates.

⁴⁹ Including under this heading three quasi-unilateral realignments with two devaluers.

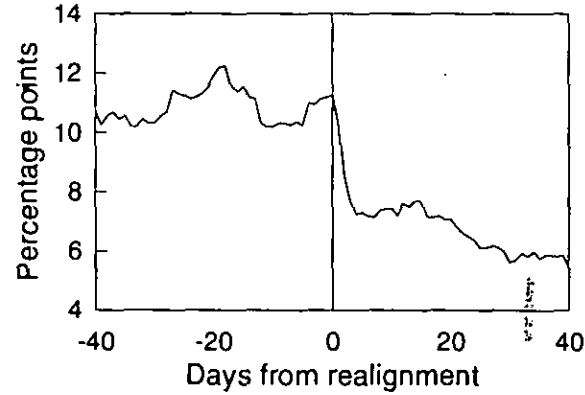
⁵⁰ Ignoring the technical realignments involving only movements of currencies not participating in the ERM.

Figure 4.1

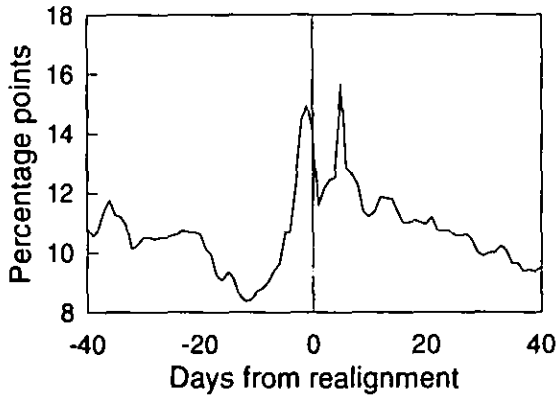
Interest rate differentials near realignments



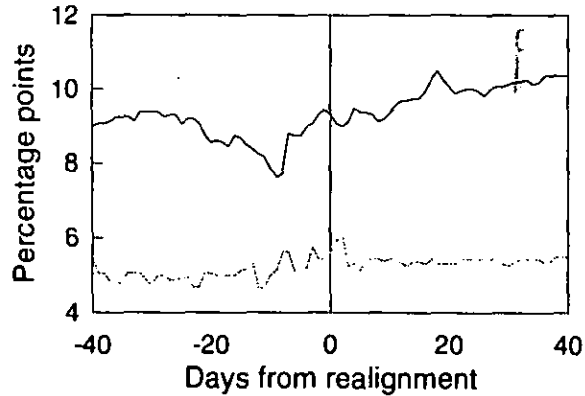
— 820614



— 860407



— 830321



— 860804
- - - 870112

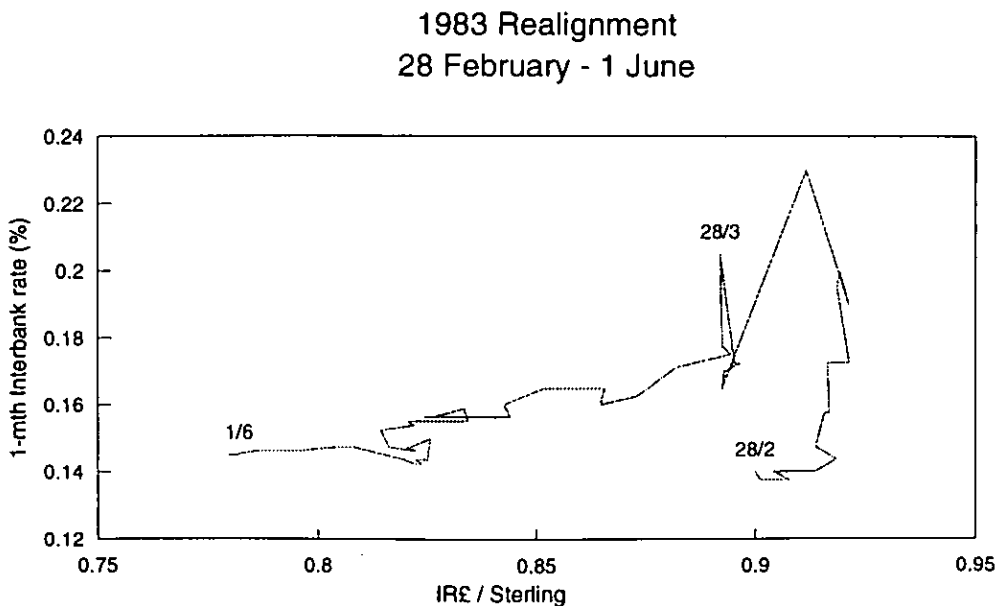
The figure also shows interest rates around the August 1986 unilateral devaluation of the Irish pound, and displays the absence of any significant pre-devaluation increase in interest rates. Post devaluation there is a slight increase in the differential of about 30 basis points (0.3 per cent).

Focusing more closely on the three devaluations in which Ireland was the most depreciated currency, namely the multilateral realignments of March 1983, and the two unilateral realignments of August 1986 and February 1993 we examine the time path of interest rates and the relationship with sterling.

March 1983

This realignment took place in turbulent circumstances with the main pressure on the French franc, barely nine months since it had been devalued by 10 per cent against the DM. This realignment was well forecast by the markets and there was a huge surge in Irish short-term interest rates which rose from about 14 per cent to about 23 per cent during March. At the realignment the Irish pound was devalued by 9 per cent, compared with 8 per cent for both the French franc and the lira, with the three participants devaluing by between 2 and 4 per cent against the DM. Immediately

Figure 4.2



following the realignment Irish interest rates fell, but surged again within a week before falling below 17 per cent and declining gradually thereafter. The role of sterling in this devaluation and in the interest rate increases was not a short-term one, as can be seen from Figure 4.2 which displays the fact that neither of the two surges, pre- and immediately post-devaluation, were associated with a weakening of sterling. On a longer-term basis, however, the steady decline in sterling evident in Figure 4.8 (the Irish pound went from less than £stg 0.80 in November 1982 to £stg 0.92 in March 1983) certainly contributed to the need for such a large devaluation.⁵¹

August 1986

It is important to track the evolution of interest rates around the August 1986 unilateral devaluation carefully and using daily data since the movements were rather abrupt. The role of sterling movements is clearly of relevance here. Figure 4.3a divides the period from 18 July to 31 December into four main sub-periods. The period from 18 July until the realignment (5 August - observation no. 12) is shown as boxes: interest rates hover around 10 per cent. They remain just below ten per cent for the rest of August and most of September (shown with triangles) while the exchange rate remains below about £stg 0.915. After the middle of September sterling again begins to weaken sharply, bringing the Irish pound above £stg 0.935. Still interest rates are well below 11 per cent. On 5 October (observation no. 54) the interest rate jumps by almost 100 basis points, and three days later it is in excess of 13.5 per cent. Sterling is still very weak, but the jump is more plausibly attributed to the market's reaction to the publication of unfavourable Exchequer returns. Although the sterling rate moves below £stg 0.93 towards the beginning of November, interest rates remain in the vicinity of 14 per cent for the remainder of the year (shown by diamonds and numbers).

Figure 4.3b carries forward the story into the first four months of 1987. The realignment of 14 January has no apparent effect on interest rates or the sterling exchange rate. A sharp decline in the sterling value of the Irish

⁵¹ Another episode worth mentioning is that of February-March 1984. There was no realignment, but the Irish pound fell sharply within the EMS band. At the beginning of February, the Belgian Franc was close to its limit against all the other narrow-band currencies which were thus clustered at the top of the band. Then sterling fell by over five per cent against the DM, bringing the Irish pound from £0.78 to £0.82. At the same time the Irish pound dropped sharply by about one per cent against the DM to the middle of the band. The three-month interbank rate in Dublin rose from 12 to 13.5 percent.

pound to the vicinity of £stg 0.91 during March has no immediate effect on interest rates, and it is not until 9 April (just over a week after the budget) that interest rates begin to fall back sharply to dip below 12 per cent on 24 April. Favourable market reception of the budget is probably the major trigger for the decline, which is also helped by a further gentle strengthening of sterling.

Looking at the counter-clockwise loop which, between them, Figures 4.2 and 4.3 describe suggests an important role for the sterling exchange rate, but not one which can be tracked on a day-to-day basis. Other factors were also important: the significant budgetary overrun revealed at the beginning of October was the trigger for a winter of high interest rates to which the political crisis contributed materially (the Government coalition collapsed during December and the minority Government fell at the end of January). The introduction of an unexpectedly tight budget by the incoming Government eased financial market worries and heralded a lengthy period of interest rate stability.

Whether the August 1986 devaluation contributed anything to the winter of high interest rates is doubtful. The need for a realignment was clearly suggested on competitiveness grounds: the effective exchange rate index had appreciated by 12 per cent during the fourteen months before the devaluation. Had it not been for the devaluation, the continued weakness of sterling would have pushed the Irish pound above £stg 1.04 by October: surely an unsustainable level at that time. Besides, as shown in the regression analysis, the average responsiveness of interest rates to sterling movements does not appear to have been any greater after August 1986 than it had been before.

The Devaluation That Didn't Happen

A further period of sterling weakness occurred at the end of 1989. Indeed, the sharp appreciation of the effective exchange rate index of the Irish pound - 8 per cent in seven months - could have suggested the need for a devaluation, but the sharp increase in British wages around that time, and the strength of the economic recovery pointed to the contrary. The positive slope in the plot of interest rates against exchange rates during this period (Figure 4.4) does, however, suggest that the markets were somewhat nervous about the possible impact of sterling appreciation on the likelihood of a devaluation. In the event, sterling strengthened again and interest rates eased back.⁵²

⁵² This episode is also discussed by Doyle (1990) and Menton (1990).

Figure 4.3a

1986 Realignment
18 July to 30 December

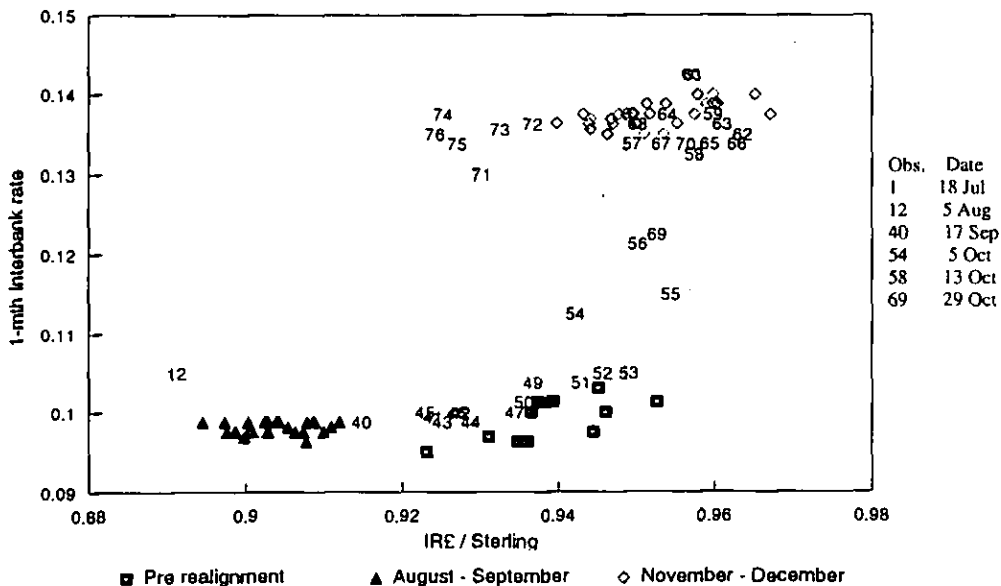


Figure 4.3b

1987 Realignment
1 January - 30 April

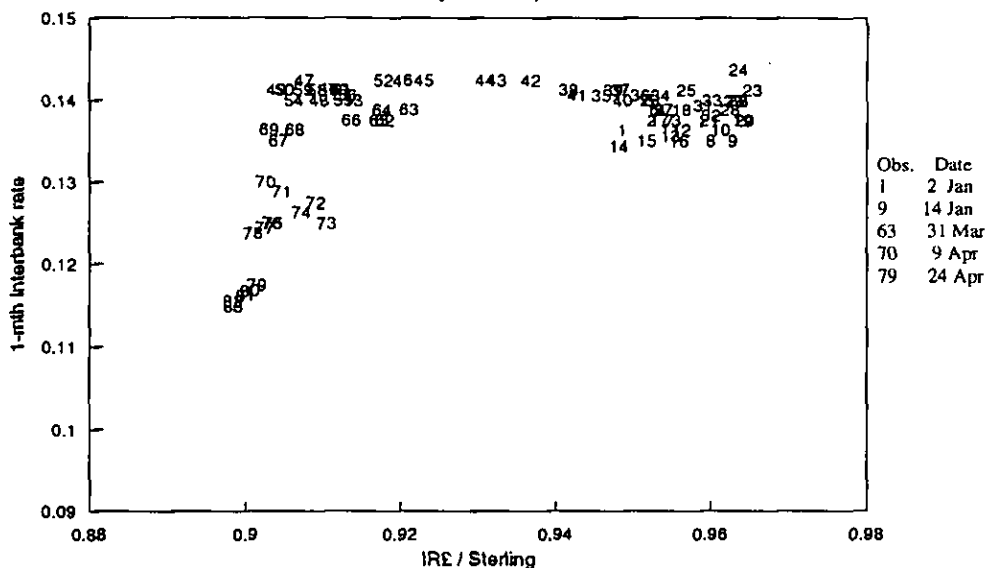
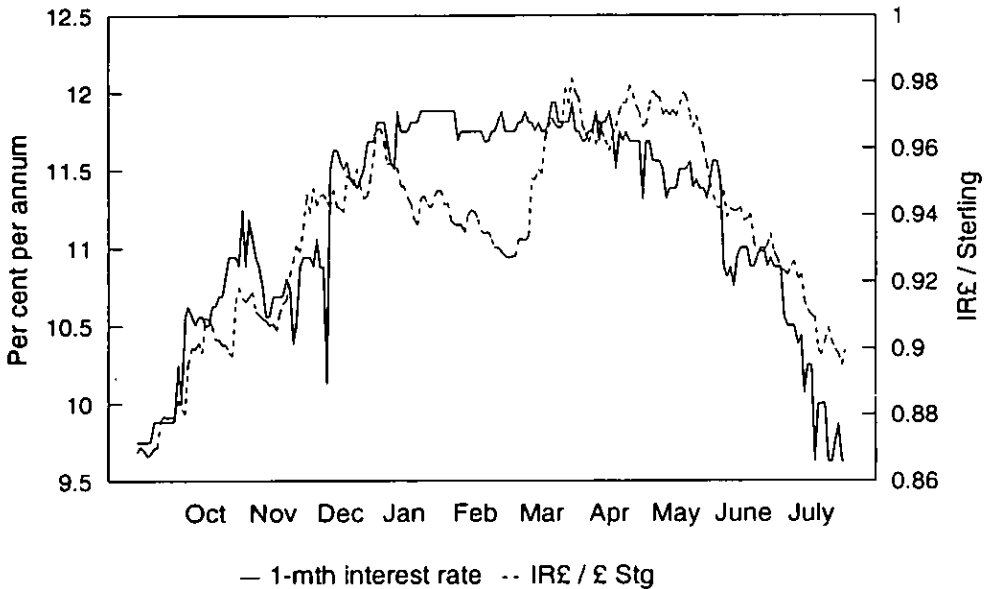


Figure 4.4 Interest rate and exchange rate
October 1989 - July 1990



February 1993

The disturbances of September 1992-July 1993 are still sufficiently fresh to require no detailed commentary.⁵³ Figure 4.5 shows the (on-shore) one-month interest rates on a daily basis and demonstrates the four main peaks. These are also analysed in a plot against the sterling exchange rate (Figure 4.6). The turbulence of market developments in this period produces quite wide differences between the interest rates quoted by different sources. Figure 4.5 uses the BIS data, while Figure 4.6 uses daily newspaper reports of Dublin interbank dealing.

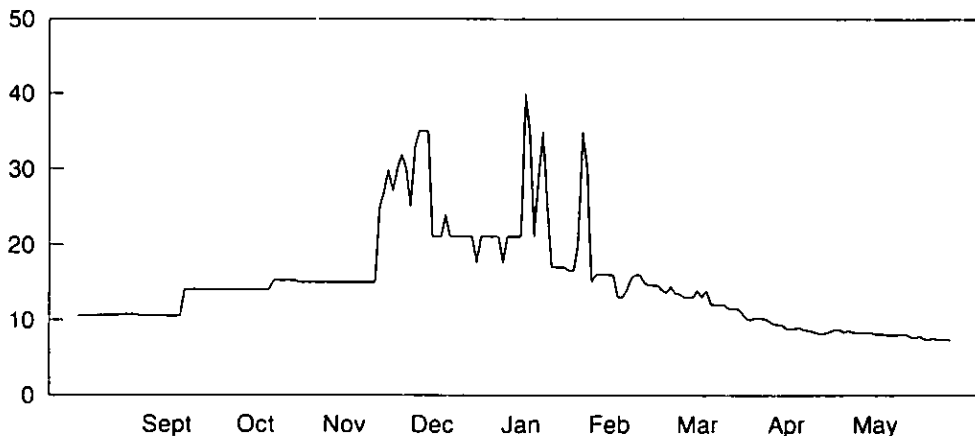
The period from 17 September 1992 to 29 January 1993 falls into six phases (which are indicated in Figure 4.6).

1 The first phase covers the first six working days of the crisis, following the collapse of sterling. The sterling exchange rate and the interest rates are almost linearly related in this phase - exceeding 20 per cent as the exchange rate approaches £stg 1.05.

⁵³ Honohan (1994) provides an account and some references.

Figure 4.5

Daily 1 month Interest rates
September 1992 - May 1993



II For the next two months interest rates remain fairly stable in the upper teens as the exchange rate fluctuates as high as £stg 1.10.

III The third phase sees a surge of interest rates beginning on 23 November (immediately after the devaluation of the Peseta and the Escudo). Between then and early January, interest rates and exchange rate are again positively correlated.

IV A fourth phase is initiated by a huge jump in interest rates not apparently related to sterling strength.

V On 21 January a short-lived fifth phase begins, with interest rates back close to or below 20 per cent despite sterling's renewed weakness to the vicinity of £stg 1.09.

VI There are three final pre-realignment observations with very high interest rates.

It is not altogether possible to disentangle the role of policy from autonomous expectations in influencing these phases. Phases I, III and VI

suggest a strong interest rate-exchange rate correlation. Phase IV can be treated as a speculative aberration.⁵⁴ It is somewhat surprising that phases II and V seem to have interest rates below 20 per cent prevailing at very high values of the exchange rate. These periods of little sensitivity of interest rates to exchange rate movements may suggest a role for Central Bank liquidity policy, though it is hard to be sure of this since we only have end-month data for liquidity support (which was indeed very high - exceeding 10 per cent of GNP at end November).

3 *Modelling the Dependence of Short-term Interest Rates on Sterling.*

When sterling was weak, the market feared a realignment and demanded a higher short-term interest rate to compensate. This effect is generally consistent with standard models of the link between exchange rate movements and interest rate determination (cf. Edison and Pauls, 1993, which contains many other references). Thus⁵⁵ we can rewrite the key equation of the risk premium theory presented in Chapter 2 as:

$$r_t - r_t^{DM} = \mathcal{E}(s_{t+1}^{DM}) - s_t^{DM} + \rho_t + \varepsilon_t \quad (3)$$

where s is the log of the spot exchange rate (DM per IR£1), r and r^{DM} are the nominal one-period rates of interest denominated in Irish £ and DM, r is the exchange risk premium, ε is a modelling disturbance and \mathcal{E} denotes an expectation formed at time t .

The future value of the spot exchange rate against the DM will depend especially on whether a devaluation occurs (though movements within the EMS band could also play a part as discussed in the next section). The market's expectation of a devaluation will depend on current competitiveness trends and on whether a multilateral realignment is on the cards. We have already found this theory to be quite successful in tracking short-run interest rate movements (Honohan and Conroy, 1994) especially at the monthly and quarterly frequencies.

Focusing on daily data, the most relevant indicator of competitiveness available on a daily basis is the sterling exchange rate. Except for an interval of less than two years 1990-1992, sterling was not maintained within the EMS bands and so could and did fluctuate quite widely, thereby influencing

⁵⁴ This has been attributed to the market's interpretation of a ministerial statement.

⁵⁵ Using the approximation:

$$\log\left(\frac{s_{t+1}}{s_t}\right) \approx \frac{s_{t+1}}{s_t} - 1$$

Credibility

In our earlier paper (Honohan and Conroy, 1994) we emphasise the issue of credibility of exchange rate policy and show that the impact of sterling movements on the market's expectation of an Irish pound devaluation - as reflected in the Irish interest differential over German rates - was not any higher after the unilateral devaluation of 1986 than it was before. Our regressions implied that a 10 per cent weakening of sterling lifted Irish interest rates by between 2.5 and 3 percentage points (Thom, 1994 suggests a decline in sterling's impact after 1986). On monthly or quarterly data, a regression of the Irish short-term interest rate on the DM interest rate, the sterling exchange rate and a time trend provides a good fit in the EMS period, especially after 1981. Adding sterling interest rates to the regression tends not to help the fit. In Chapter 5 below we offer some new regressions on quarterly data which seem to improve on those reported earlier, notably by including Irish long yields.

Irish competitiveness significantly (because of the importance of Irish trade with the United Kingdom). Movements of other major currencies could also influence competitiveness, notably the US dollar, but to a much smaller extent; because of the EMS constraints, sudden large movements against the DM did not occur except at realignments. As an exogenous predictor of multilateral realignments, one could consider the offshore interest rates on the French franc: these became very high when realignments were expected.

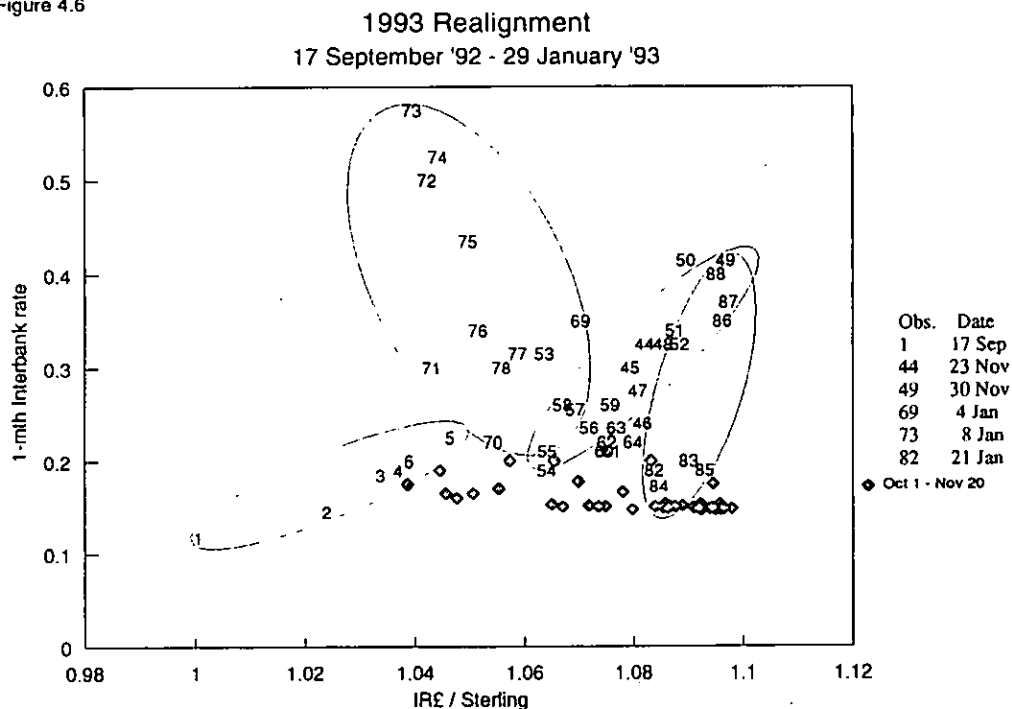
The daily data available to us relate to interest rates for a one-month maturity. The fact that the maturity is longer than the observation interval induces the econometric problem of intertemporal dependence in the residuals (Hansen and Hodrick, 1980) which requires correction if the results are not to be biased.

As is well-known, the use of standard inferential procedures in such regressions relies on the variables being stationary. With the daily data available to us, both the Irish pound/sterling exchange rate and the interest differential appear stationary according to the standard test for stationarity, namely that of Dickey and Fuller (1981).⁵⁶

Although we have daily data on (off-shore) interest and exchange rates (kindly made available by the Bank for International Settlements), we do not have daily data

⁵⁶ This agrees with results reported for Ireland by ourselves and by Bartolini (1993). Over some shorter periods, and for less frequent sampling of the data, the results are less conclusive. In contrast, Edison and Pauls (1993) found that bilateral US real exchange and interest rates appeared non-stationary over the period 1974-90. See also Wright (1993).

Figure 4.6



on other potentially relevant variables such as prices. Accordingly, daily evidence on the theory must be confined to a regression of interest differentials on exchange rate. In Table 4.1 we present regression results of this kind. They illustrate the highly significant role for the Irish pound/sterling exchange rate. The Irish pound/DM exchange rate is not significant, nor is a dummy for the period since the major unilateral devaluation of August 1986. The dynamics of the relationship are captured with an ARMA process estimated by maximum likelihood.⁵⁷

The point estimate of the sum of the autoregressive coefficients in both equations is about 0.91, implying a long-run impact of about 40 basis points on the interest differential for every one per cent move in the Irish pound/sterling exchange rate. These results do not differ much from the monthly regressions reported in our earlier paper (see box).

⁵⁶ This agrees with results reported for Ireland by ourselves and by Bartolini (1993). Over some shorter periods, and for less frequent sampling of the data, the results are less conclusive. In contrast, Edison and Pauls (1993) found that bilateral US real exchange and interest rates appeared non-stationary over the period 1974-90. See also Wright (1993).

⁵⁷ Bearing in mind the presence of autoregressive terms, the Durbin-Watson statistic is included as a memo item only.

Table 4.1: *Regression Results: Role of Sterling*
Daily data

<i>Regression No:</i>	<i>4.1.1</i>	<i>4.1.2</i>
	<i>Coeff t-stat</i>	<i>Coeff t-stat</i>
Intercept	1.63 (5.0)	1.29 (1.5)
Irish £ / Sterling	3.62 (4.7)	3.4 (4.3)
Same*Dum post Aug 1986		0.55 (0.9)
Irish £ / DM		0.27 (0.4)
Time trend	-0.05 (4.9)	-0.04 (3.9)
Autoregression coefficients:		
MA(1)	0.55 (4.7)	0.54 (4.7)
MA(2)	0.41 (6.5)	0.41 (6.5)
MA(3)	-0.47 (7.7)	-0.47 (7.7)
MA(4)	-0.15 (3.6)	-0.15 (3.6)
AR(1)	0.21 (1.8)	0.21 (1.8)
AR(2)	-0.11 (3.5)	-0.11 (3.5)
AR(3)	0.88 (33.4)	0.88 (32.8)
AR(4)	-0.06 (0.6)	-0.06 (0.7)
RSQ / DW	0.982 2.00	0.982 2.00
SEE	0.864	0.864
Method / No. of obs	ML 2951	ML 2951
Sample Period	2/11/82-30/7/93	2/11/82-30/7/93

Dependent variable: Interest differential between Irish and German short-term assets

4 *Movements of the Currency Within the Band*

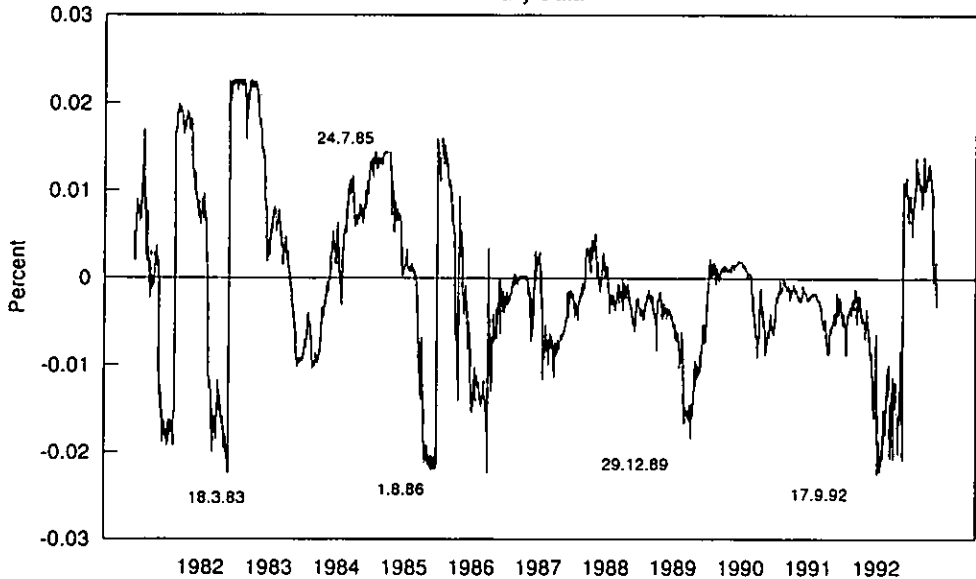
In the previous section we have loosely identified expected exchange rate change with realignment expectations. However, as has been noted in the literature (Bertola and Svensson, 1993, Chen and Giovannini, 1993, Bartolini, 1993, Honohan and Conroy, 1994, Hurley, 1994, O'Donnell, 1993) the potential for within-band fluctuations of the currency may also play a part in influencing interest rate differentials.

Figure 4.7 displays the time-path of the deviation of the Irish pound from its DM parity. This is not the same as its distance from the edge of the band (cf. Honohan, 1993c), which depends on the movements of all other participant currencies in the EMS, but it does provide a broad indication of the relative position of the Irish pound in the system. The figure displays a characteristic roller-coaster shape in the early years, corresponding to four

multilateral realignments. Immediately after each of these realignments, the Irish pound is found at the top of the band, but after staying there for some short period, it moves quite sharply lower.

Figure 4.7

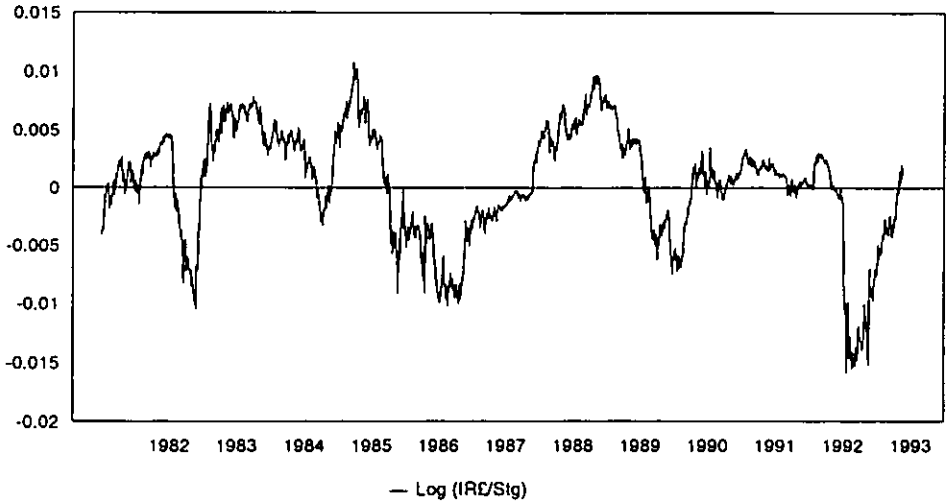
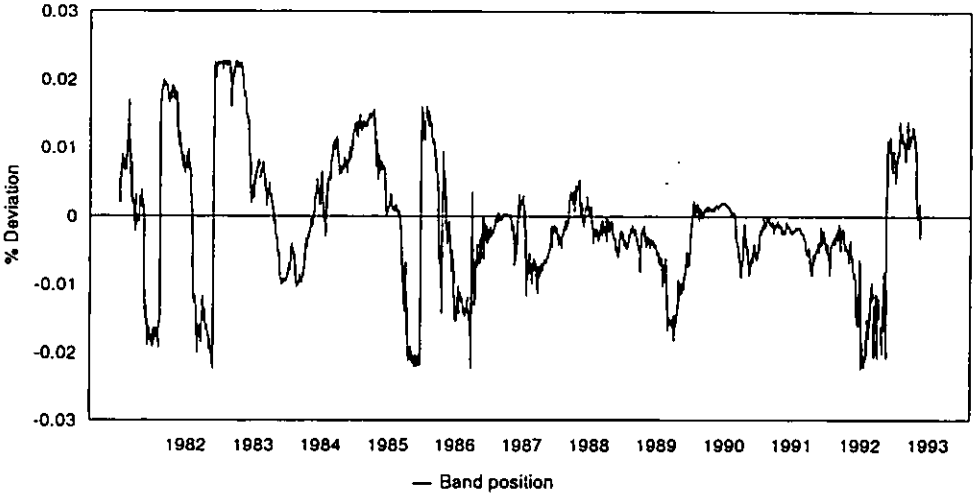
Deviation of IR£ from DM parity
Daily Data



The realignments of August 1986 and January 1987 are not preceded by an interval during which the currency is at or close to the lower intervention limit against the DM (in the first case it spends just one day at the bottom). Every occasion on which the currency dips more than 1.8 per cent below the DM parity is followed by a realignment within a matter of weeks. Indeed there is only one occasion on which the currency goes much further than 1 per cent below and recovers without a realignment. That is the Winter 1989-90 period of sterling weakness. Indeed, the tendency for position in the band to be correlated with sterling weakness is illustrated by Figure 4.8 which displays a detrended logarithmic series of the Irish pound/sterling rate.

What of expected movements within the band? Attempts have been made to model the change in position by means of a regression approach. This is of relevance in assessing expectations of realignments. A simple algebraic formulation will illustrate the relationships involved.

Figure 4.8
Daily Deviation of IR£ from DM parity
and Daily IR£ / Sterling exchange rate



In the case of the Irish pound, we need to take account of the divergent movements *vis-à-vis* ERM and non-ERM partner currencies, especially sterling. 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 and that against sterling. The former is made up of a central rate (c), which remains unchanged between realignments, and the spot position within the band (x). Thus:

$$s^*_t = \alpha s_t^\pounds + (1 - \alpha) s_t^{DM} = \alpha s_t^\pounds + (1 - \alpha)(c_t + x_t) \quad (4)$$

The weight α 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.

Chen and Giovannini (1993) observed that, if uncovered interest parity held, the expected realignment could be deduced by subtracting the expected change within the band from the interest differential:

$$\mathcal{E}[c_{t+j} - c_t | I_t] = i_t - i_t^{DM} - \mathcal{E}[x_{t+j} - x_t | I_t]$$

and they proceeded to project the realised value (i.e., omitting the expectation operator) of the variables on the RHS of this equation onto a set of explanatory variables taken to be the relevant information set at time t . The most significant explanatory variables in their regressions (for the franc and the lira) are x_t , and a variable, which we may call τ , measuring the time elapsed since the last realignment. They also include dummy variables shifting the intercept for each particular inter-realignment period.

Unlike Chen and Giovannini (1993), we prefer to include the raw interest differential in the information set, as it is obviously known at time t . Therefore, we focus on the evolution of the movement within the band, projecting it on an information set to assess the degree to which its dynamics can be modelled. By omitting observations where a realignment⁵⁸ occurs between time t and $t+j$, we can compute a conditional expectation: $\mathcal{E}[x_{t+j} - x_t | I_t; \text{no realignment}]$

⁵⁸ Note that for the observations immediately before a realignment the dependent variable, as computed, does not represent the interest differential less the movement within the band, but includes the effect of the devaluation. Chen and Giovannini seem to argue that it is not possible to estimate the conditional expectation, but it is not clear why this should be so. In fact, by excluding realignment observations, we obtain a coherent time series of such within-band movements. The fact that the risk of realignment will have been priced into interest rates does not influence this consideration.

Bartolini (1993) adopts a similar approach, but his focus of attention is in the unconditional expectation, so he includes observations whose changes straddle realignments.

We explored the regressions of the change in $x_{i,t}$ on its lagged level and a number of other information variables. These are (i) time since realignment; (ii) the sterling/DM and IRE/sterling exchange rates; (iii) the one-month offshore interest rate on French francs, acting as an indicator of expectations of a multilateral realignment; (iv) the one-month interest rate on Irish pounds, representing opportunity cost of speculation against the currency; (v) an intercept shift dummy for the period when sterling was in the ERM. The square and cube of the lagged value of x , and interactive terms between it and the interest rates, and between the two interest rates were also included in the set of explanatory variables, as were intercept shift dummies for each particular inter-realignment period.

The mean daily change in the position within the band was 0.006 per cent, equivalent to about 0.1 per cent per month: a rather small number. It would be surprising if much of the daily fluctuations could be explained by a simple equation, and the low R-squared values obtained (in the region 0.03-0.04) are therefore no disappointment, and are indeed highly statistically significant. The detailed results are available from the authors. Here we draw some tentative conclusions.

First, the position in the band x is fairly close to a random walk. There is some evidence of mean reversion, and the point estimate of the coefficient of mean reversion is about 0.1. There is evidence of non-linearity in the relationship, with the cubed values entering, but there is no evidence of any tendency to asymmetry (e.g. mean reversion weaker at the lower end of the band).

A higher Irish interest rate tends to be associated with a positive subsequent movement within the band, but a higher French interest rate is associated with a negative subsequent movement, perhaps confirming these variables roles as signalling a strengthening and a weakening position respectively.

According to the regressions, a long time since realignment predicts a relatively high position in the band. This particular estimate is undoubtedly influenced by the long period of stability during 1987-92. It contrasts sharply with the experience of Italy, whose position within the band generally declined as the time since realignment grew.

The only exchange rate that is significant is the Irish pound/DM rate, and this becomes insignificant when inter-realignment dummies are included.

5 Concluding Remarks

Short-term realignment expectations have certainly influenced interest rate movements. In this chapter we have illustrated the turbulence of interest rate movements around the time of realignments. Though it is not possible to make reliable predictions about the movements of the exchange rate within the EMS band, certain regularities are evident, notably a tendency for weakness in the band and high interest rates to be associated with a weak sterling.

We also find that, while the currency did display some tendency to converge back to the centre of the band in normal times, this was not the case when realignment pressure was present.

The widening of exchange rate bands from August 1993 represents a key change in the monetary policy and interest rate environment, especially in the context of realignment crises. It does seem that such crises can be avoided altogether in the future (especially with the help of the more active interest rate management policy which has been noted in Chapter 3), thereby removing these periods of turbulence from the Irish interest rate experience.

In addition, the absence of realignment crises may tend to reduce or even eliminate the tendency to excess returns on Irish short-term assets analysed in Chapter 2. While our analysis there does not pin down the exact mechanism for Irish interest rates to be too high in this sense there is a definite suggestion that the crisis-prone nature of the narrow-band EMS may have been an important factor.

For the future, the much wider margins remove the threat of major speculative surges, and the market's perception of the relevance of

sterling to the Irish pound may manifest itself in exchange rate, rather than interest rate movements. In turn this may allow the Irish monetary authorities more freedom in influencing domestic interest rates through liquidity policy.

Chapter 5

EXPECTATIONS AND RISK PREMIA IN THE DETERMINATION OF LONG-TERM YIELDS

1 Introduction

The focus of the previous chapters has been almost entirely on short-term interest rates, with maturities of a few months at most, and in particular on the role of exchange rate expectations in influencing the international interest differentials. In this chapter we turn to longer term securities, especially the yields on Irish Government securities with many years to run. Because such bonds are traded on secondary markets, we are concerned with fluctuations in their market price. These price movements correspond to changes in the yield to maturity of the bonds. The holding yield on long bonds over a short-period such as a quarter is thus the sum of the interest accrued and the capital gain or loss.

In attempting to uncover the main causes of movements in long yields, our main focus is still on expectations, but in this case anticipation of more distant events cast a stronger shadow on current prices. Expected future movements in Irish short-term rates should be important influences, and these in turn will be influenced by expectations of fiscal pressures and of inflationary trends.

We still need to explore the impact of international trends in long-term rates but, whereas the previous chapter emphasised the role of international linkages, (especially with Germany for short-term rates) in the case of long-term securities the risk of interest rate changes is added to the risk of exchange rate changes as a barrier to arbitrage between yields at home and abroad. Independent of the short-term risks of particular financial instruments, underlying shifts in the worldwide real cost of credit make themselves felt and they are likely to be more evident in long yields than in short.

The next section reviews the market for long-term securities in Ireland. Then in Section 3 we examine the pattern of returns over long horizons. Section 4 explores the potential use of long-term yields or the yield gap in predicting short-term interest rate movements over a short horizon. Sections 5 and 6 attempt to analyse the data from the point of view of excess returns

(long versus short) and the possibility of an interpretable risk premium being built in to the yield gap. In fact there is little evidence of systematic patterns here. We turn to the fundamental issue of bond price expectations and hence to the overall determination of long-term yields in Section 7, which offers some firm regression results. Concluding remarks are contained in Section 8.

2 Long-term securities in Ireland

Most long-term securities in Ireland are the bonds issued by the Government and other public bodies; their maturity ranges up to about 20 years.⁵⁹ We could look at a whole range of interest maturities, but we choose to examine just the long end of the market. Bonds with a maturity of less than five years are called short-term. (We will not bother much here with the distinction that is sometimes drawn between medium and long-term maturities, with the dividing line at 10 or 12 years). At end 1993, over £7.7 billion of fixed interest gilts⁶⁰ with more than five years to run was outstanding, an amount equivalent to 28 per cent of GNP. About £3.6 billion of these (13 per cent of GNP) had maturity greater than ten years. The data used in this Chapter relates to the 15-year maturity. In practice the yield does not vary much with maturity beyond five years.

Apart from the Government, there have been comparatively few borrowers of Irish pounds at fixed interest with terms of greater than five years. Most bank lending is on a floating rate basis, and indeed has lesser maturity. Discouraged by stamp duties that were in effect until 1993, non-government borrowers in the fixed interest bond market have been scarce. However, quite recently there has been a growing interest in medium and long-term funds, with the banks and building societies joining the European Investment Bank as borrowers.

Lenders of long-term Irish pound resources have included life assurance and pension funds, and recently long-term fixed interest residential mortgages have been offered by banks and building societies.

A long-term borrower or lender at fixed interest is assured of the cash flows required to service the debt until it matures. It is often stated that this eliminates interest risk, and that can be a very relevant consideration for a financial intermediary whose obligations are expressed in nominal cash terms. However, a fixed money sum is not the same as a fixed real sum, and the non-financial

⁵⁹ Cf. Honohan (1992), Power (1993).

⁶⁰ We are not concerned here with floating rate securities, i.e., those which pay the current short-term rate of interest throughout their life.

borrower or lender is less likely to find the long-term fixed interest contract suitable to hedge other obligations unless inflation is low or predictable.

Indeed, in times of high and volatile inflation, the long-term fixed interest bond is a highly speculative instrument for most non-financial investors or borrowers even if held to maturity, in that the real value of the future cash flows that are committed is highly uncertain. Furthermore, if the bond is sold before maturity the price obtained is very volatile.

There is an active secondary market in Irish Government bonds. Annual turnover has been of the order of 125 per cent of GNP in recent years. The average long bond⁶¹ has been turned over once every 5 months or so. Fluctuations in short-term holding yields are thus also relevant to an important class of holders of long bonds.

The price of long bonds, and thus their calculated yield to maturity, is determined by the market in order to reconcile the portfolio decisions of a variety of different classes of holder. Some plan to hold the assets to maturity, and they have a view to the likely real return over a lengthy period of time, and take account of the comparison with other long-term assets, including inflation hedges such as property and equities. Others are choosing between short- and long-term investments on the basis of a view as to likely holding yields. The Government (or other issuer) can also choose to issue at long or short maturity. Despite the point made about exchange risk, foreign bonds may also be a competing asset. The yield on long bonds can thus be evaluated using a number of different comparators or reference points.

3 *Returns over the Long-term - Ireland, UK, Germany.*

(a) Measuring long-term real yields

But what about the yield to maturity on long bonds relative to price inflation of goods and services? How has the *real* rate of return on long-term bonds moved? There are, of course, two fundamentally different real rates of return that one might examine here, the *ex ante*, or expected and the *ex post* or realised.⁶² Both present measurement difficulties. The expected rate of inflation is not directly measurable;⁶³ the realised inflation rate is measurable, but we have to wait until the maturity of the security before measuring the return - and that can involve a long wait when we are examining long bonds.

⁶¹ Over five years; short bonds have turned-over on average every 3½ months.

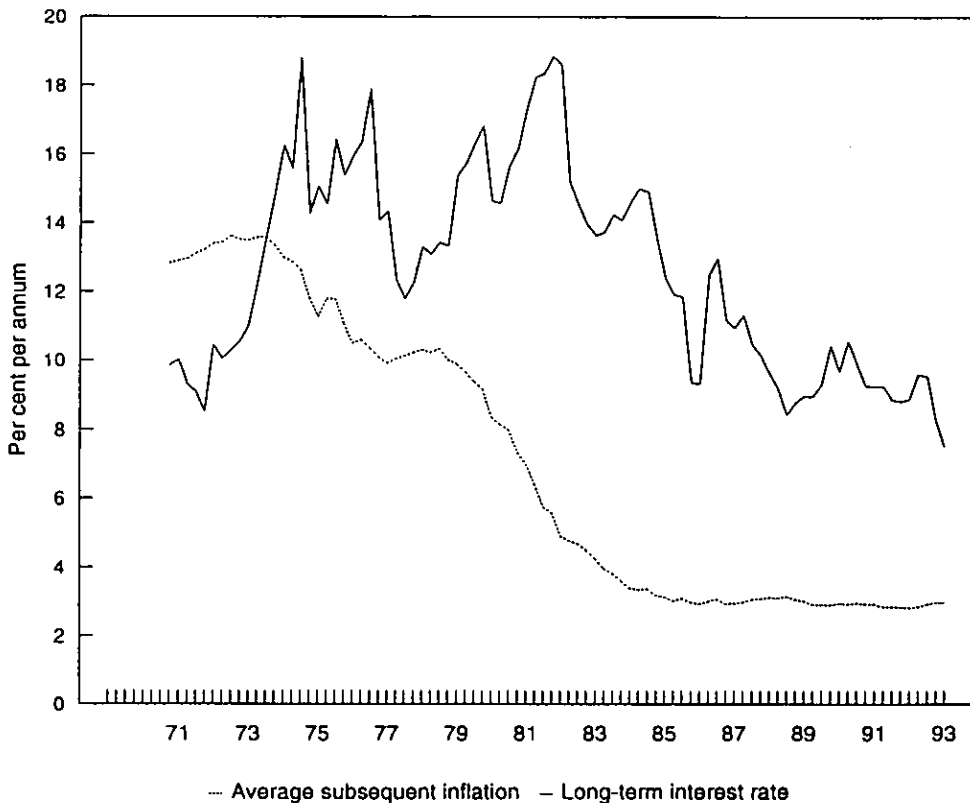
⁶² Note that we are here examining the real yield to maturity and not the real short-term holding yield on long-term bonds.

⁶³ And indeed is often inferred from the long-term nominal interest yield, a procedure which requires assumptions we would like to probe.

To get as close to realised real rates as possible, one approach is illustrated for Ireland, Germany and the UK in Figures 5.1 to 5.3. These figures plot the nominal long-term interest yield and a measure of estimated realised average consumer price⁶⁴ inflation during the subsequent maturity

Figure 5.1

Long-term Interest Rates and Subsequent Inflation Ireland



⁶⁴ We use the consumer price index throughout. Theoretical models of the determination of interest rates begin with intertemporal consumer preferences, which tends to imply that it is consumer price inflation that is relevant. The deviation between consumer and producer price inflation only enters in more complex models, taking account of imperfections in capital markets.

Figure 5.2

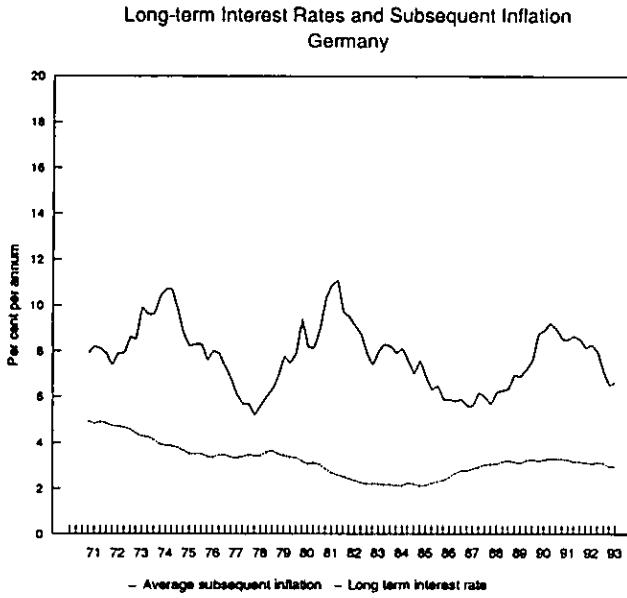
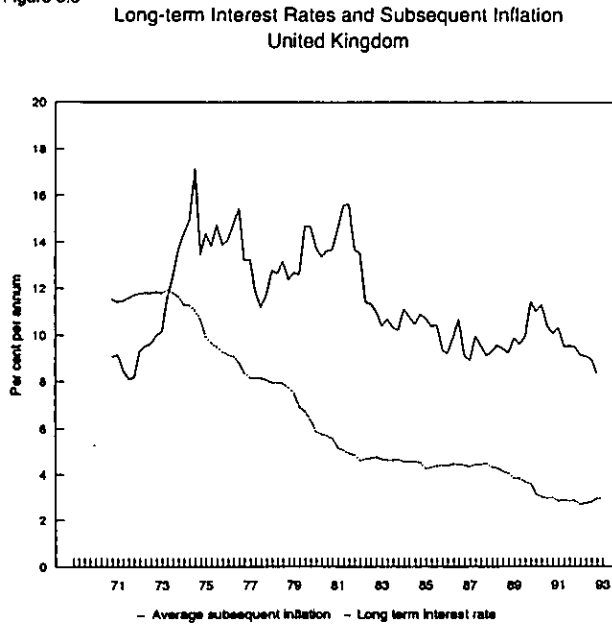


Figure 5.3



of the bond. Thus, for example, at the first quarter of 1982, we show a nominal long-term interest yield⁶⁵ to maturity of 18.8 per cent (the yield went over 19 per cent during that quarter - the highest ever observed). The first inflation curve at the same date shows about 5.6 per cent, which is the appropriately weighted⁶⁶ annual average inflation from the first quarter of 1982 to 1997, with a forecast of 3 per cent per annum used from 1993 on. The difference of over 13 per cent may be taken as the real realised long-term yield at the first quarter of 1982.

A note of caution needs to be mentioned here in that, to the extent that forecast inflation rates are being used, a considerable margin of error is built into these estimates. The resulting real interest rates may be thought of as a combination of true realised rates for earlier periods and latest projections of the realisations for later dates.

For Ireland a clear pattern emerges from Figure 5.1. Those who bought long-term bonds in the early 1970s and held them to maturity experienced real yields that were close to zero and even negative. Since then, a four-peaked surge in nominal long-term interest rates combined with a gradual decline in subsequent average inflation made for extremely high realised real yields, peaking in the second quarter of 1982 at almost 14 per cent per annum real. Thereafter, nominal interest rates have been on a generally downward trend, but there has also been a decline in average inflation, so that "realised" long-term yields have remained high - at about 5-8 per cent per annum.

(b) Comparison with international experience

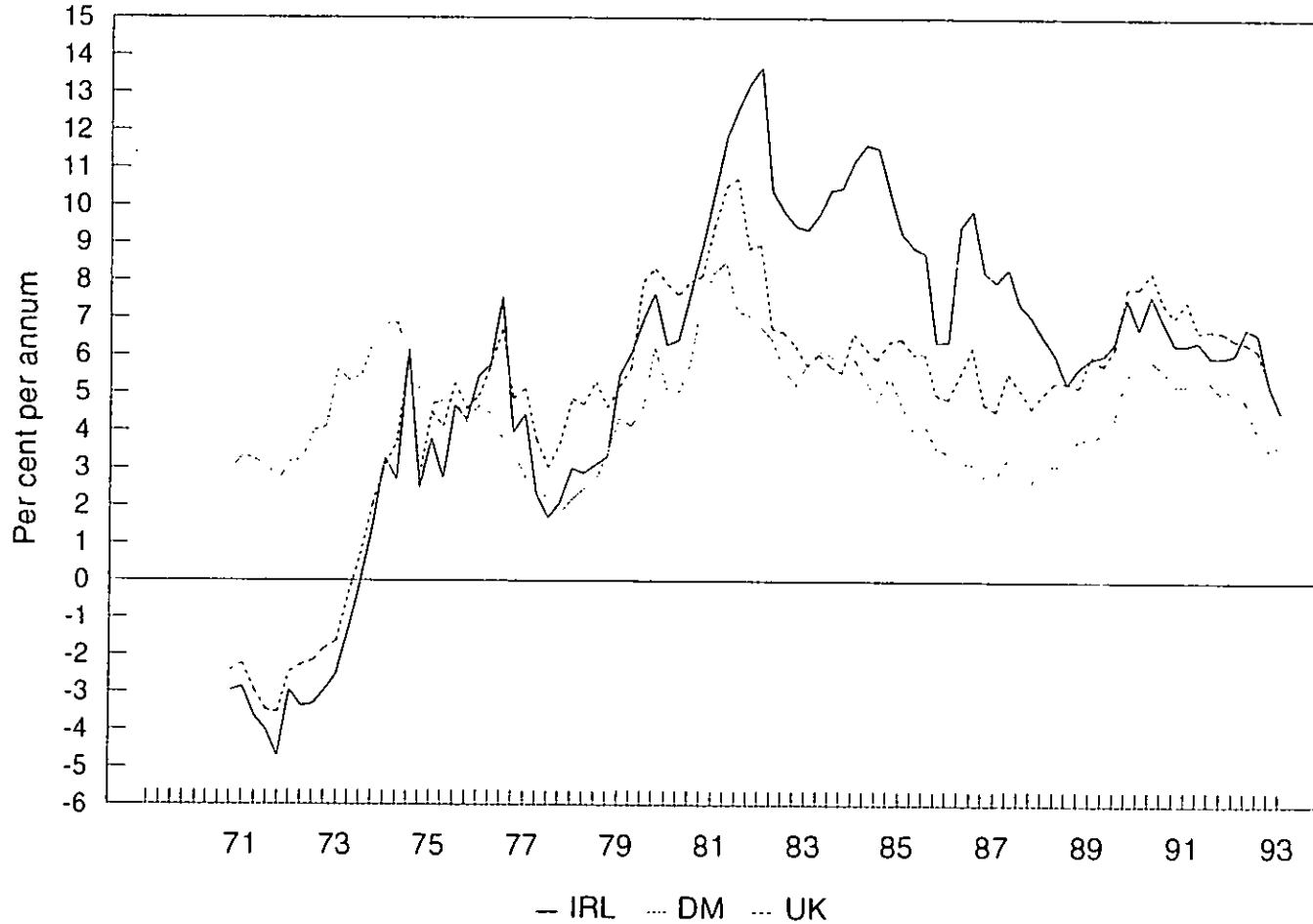
The Irish data can be compared with that for other countries (Figure 5.4). The closest similarity is with the UK. Though interest rates diverged between the two countries from 1979 on, the general pattern is similar. Higher inflation during the late 1980s does appear to have given the UK somewhat lower real yields during the 1980s, though future (post sample) inflation experience in the two countries may reduce the difference here.

⁶⁵ Taken from *International Financial Statistics*. For Ireland, the interest yield is at first a "representative" long-term rate; since 1980 it refers to a constant 15-year maturity and is based on a par yield curve calculated by the Central Bank of Ireland. Bond yields vary with the coupon (i.e. interest as a percentage of face value) as well as with maturity. The par yield for a given maturity is the estimated yield for a security trading at par (cf. Honohan, 1982b).

⁶⁶ The weighting here takes account of the consideration that the cash flow to service the bond occurs throughout the life of the bond, and not just at the end. Accordingly, inflation in early years of the maturity of the bond is weighted more highly than inflation in the later years. Taking account of this involves quite a complex formula. We apply the approximation used by Blanchard (1993).

Figure 5.4

Long-term Real Interest Rates Ireland, Germany and United Kingdom



German experience is quite different. Germany has seen three surges in nominal long rates. The first was in 1973-74 (before that in Ireland and the UK), the second in 1981-82 and the third in 1990-91. None brought yields far into double digits, or for long. The average inflation has been low; declining until 1985 and then gently increasing since. Once again the post-sample experience may reduce the rise at the end. Overall, realised real long-term yields in Germany have been much lower than in Ireland after 1973, though the differential appears to have narrowed towards the end of the period.

Interpreting the very high realised real interest rates in Ireland and the UK (by comparison with Germany and the US) is a controversial business indeed. For Ireland, the discussion earlier in this paper about risk premia related to Government borrowing is obviously relevant. Indeed, it may be taken as the conventional wisdom that fiscal and macroeconomic imbalance contributed markedly to a risk premium on Irish Government Securities during the period. In addition, and applicable to both the UK and Ireland (and to some extent the US) is the question of a risk premium related to more generalised fears of inflation resurgence. Did markets systematically overestimate the 1980s inflation, or underestimate the determination of Governments in the UK, US and elsewhere to squeeze out inflation? This is a discussion that will not be resolved by analysis of the Irish situation alone.

(c) Long yields as predictors of inflation and interest rates.

Can movements in long-term yields be used to forecast general trend of interest or inflation over the years ahead? For example, if bond prices fall, implying a rise in nominal yields, does that mean that inflation, or short-term interest rates, are likely to be higher, and *vice versa*? After all, if market participants anticipated higher interest or inflation in the future, they would surely tend to bid down the price of bonds. In order to examine this,⁶⁷ we regressed the average short-term interest rate and inflation rate over the life of the 15-year bond⁶⁸ on the long yield.⁶⁹ The results are fairly conclusive.

The long yield is a poor forecaster of long-horizon inflation, the point estimate implies that a 10 percentage point jump in long-term yields would predict only a 0.1 percentage point increase in inflation.

⁶⁷ This approach is a simplification relative to the rigorous studies of Mishkin (1990a,b); cf. Hurley (1990) for analysis of earlier Irish data.

⁶⁸ Including estimates from 1993 on at the rates of 7 per cent per annum for interest and 3 per cent for inflation. The weighted average refinement (see footnote 8 above) was not employed here.

⁶⁹ As spelled out in the working paper version of this chapter, the regressions include a correction for autoregressive and moving average errors, since errors in forecasting the inflation rate will tend to have such a structure.

Table 5.1: *Summary Statistics of Excess Returns on Irish Pound Assets - Long-term assets vis-à-vis short-term 1978:Q4 - 1993:Q1 (% per quarter)*

Mean	0.58
Standard Deviation	6.23
Variance	0.39
Sharpe Ratio	0.09
Maximum Return	16.6
Minimum Return	-23.6

The same tiny magnitude of effect was found in the equation forecasting average short-term interest rates over a long horizon. This finding is in line with international studies of "excess sensitivity" of long-term yields to the volatility of short interest rates (LeRoy and Porter, 1981, Shiller, 1981, Cochrane 1991).

4 *Using the Yield Gap for Short-horizon Interest Rate Forecasts*

Although it performs poorly over the longer horizon, the yield gap is consistently significant when included in equations for current or imminent short-term interest rates. When added to the type of equation discussed in Chapter 4, the lagged yield gap is significantly positive, without removing the significance of the exchange rate term. Results are shown in Table 5.2.⁷⁰ Note that the equations also include the lagged short-term interest rate, with a coefficient which is always close to that on the yield gap. Essentially what these equations are saying is that the lagged *long-term* interest rate is a better predictor of the short-term rate - than its own lagged value. This finding fits well the transitory nature of many short-term interest rate surges. The standard error of Regression 5.2.3 at 0.99 per cent is a good deal lower than the 1.09 per cent achieved without the

⁷⁰ The table shows results beginning at end 1981. As discussed in Honohan and Conroy (1994) there appears to be some structural instability in interest rate regressions run over a longer period, though qualitatively the same findings are obtained.

Table 5.2: *Regression Results: Using the Yield Gap to Explain the Short Rate*

Regression No:	5.2.1		5.2.2		5.2.3		5.2.4	
	Coeff	t-stat	Coeff	t-stat	Coeff	t-stat	Coeff	t-stat
Intercept	-27.0	(6.8)	27.9	(3.7)	-16.4	(3.7)	10.3	(1.5)
German short rate			0.79	(4.5)	0.52	(4.9)	0.13	(0.5)
Irish £ / Sterling	30.7	(6.9)	29.1	(6.9)	28.6	(7.3)	31.1	(6.9)
Irish yield gap	0.95	(6.5)	0.69	(3.7)				
Irish long rate					0.66	(4.3)	0.71	(4.0)
Exchequer borrowing (smoothed)							7.00	(2.0)
Time			-0.13	(3.1)	-0.12	(3.1)	-0.18	(3.2)
Lagged dependent	1.0	fixed	0.65	(4.1)			14.3	(3.3)
Autoregressive coefficient AR(1)	0.64	(4.8)					0.40	(2.3)
RSQ / DW	0.634	2.07	0.899	1.47	0.898	1.48	0.911	1.63
F / d.f.	23.1	3.40	67.4	5.38	86.2	4.39	63.8	6.37
SEE / Log-likelihood	1.06	-62.9	1.00	-59.1	1.06	-59.2	0.94	-56.1
Method / No. of obs	AR(1)44		OLS 44		OLS 44		AR(1)44	
Sample Period	81 Q4 - 92 Q3		81 Q4 - 92 Q3		81 Q4 - 92 Q3		81 Q4 - 92 Q3	

Dependent variable: Irish short rate

long-term rate, but including two autoregressive terms. Thus these equations show that information about the term structure provides a very useful additional degree of explanatory power in short-term interest rate forecasting.⁷¹ These may be about the best equations so far for Irish short-term rates.

In addition, the inclusion of the long yield seems to strengthen the case for including government borrowing as an explanatory factor in short-term interest rates (presumably an indicator of expectations of realignment). Regression 5.2.4, implying a large effect (£100 million reduction in EBR giving an 0.7 per cent impact on the short-term rate) illustrates this, but the effect is not robust to varying specifications (for instance it vanishes if the dependent variable is the international interest differential) and cannot be regarded as having been conclusively shown.

5 Excess Returns on Long Gilts

Turning now to the short-term holding yield on long bonds, the natural comparison is with short-term interest rates. The standard benchmark hypothesis here is the *pure expectations theory* of the term structure of interest rates. This is a direct counterpart to the uncovered interest parity assumption for international comparison of short-term rates. Like uncovered interest parity, it has repeatedly been rejected in rigorous analyses, but remains a fair approximation and an important benchmark.

⁷¹ The yield gap does not help predict long-term interest rate changes, in contrast to the experience in the US and some other countries (Hardouvelis, 1994).

The reasoning underlying the expectations hypothesis is as follows. If investors are to be induced to hold long bonds rather than short-term, the short-term expected return on holding these securities (interest plus expected capital gain) must at least match the available return on short-term securities. Competition between well-financed risk-neutral speculators, if they existed in sufficient numbers, would ensure that the expected return would be no higher. Working out what this would mean for future long-term bond prices allows us to compute the long-term yield consistent with any given pattern of future short-term yields. This is the expectations hypothesis yield. In practice, researchers have found that yield data in most countries is hard to reconcile with the expectations hypothesis. Some interpret the systematic deviation as a risk premium. For example, there may not be enough well-financed speculators, combined with a tendency for fully hedged positions to have a net deficiency at long-term - a "constitutional weakness at the long end of the market". But it could be due to systematic expectation errors, so that the actual path of short-term interest rates does not at all correspond to expectations.

The risk premium attaching to long-term yields, by comparison with those available on short-term paper, may not be constant. Changes in the degree of risk aversion, or in the maturity of hedged portfolios, or in the perceived degree of uncertainty concerning future interest rate volatility, may all influence the risk premium.

While short-term returns on bonds are uncertain, it may be possible to measure the risk premium and its systematic variations, by using regression analysis. This will help us to judge the determinants of long-term interest rates in Ireland, conditional on short-term rates.

The difference between the realised return (interest plus capital gain) on holding a long-term bond, and holding short-term paper is known as the "excess return" on the long bond. If the price of the bond is denoted P , its current yield to maturity R , and the short-term interest rate r , we can write the excess return as:

$$\mu_t = R_t - r_t + \frac{\Delta P_{t+1}}{P_t} \quad (7)$$

As an example, for perpetuities yielding R , whose market price is $1/R$, the formula for the excess return along the yield curve is:

$$\mu_t = R_t - r_t + \frac{R_t - R_{t+1}}{R_{t+1}}. \quad (8)$$

A more complicated formula applies to long-dated maturities which are not perpetuities. An approximation to this formula, for n -period bonds, proposed by Shiller (1979) is:

$$\mu_t = R_t - r_t + \frac{\gamma_n}{1 - \gamma_n} (R_t - R_{t+1}), \quad (9)$$

where,

$$\gamma_n = \left(1 + R \left[1 - \frac{1}{(1+R)^{n-1}} \right]^{-1} \right)^{-1}$$

According to the pure expectations hypothesis, this excess return μ should have expected value zero, so any systematic pattern in excess returns could be evidence of a time-varying risk premium, or of systematic forecasting errors. As with the uncovered interest parity theory, empirical evidence in many countries tends to reject its strict implications. Indeed, it has long been held that there is a tendency for long-term yields to be persistently higher than short-term yields, and that μ is on average positive. Furthermore, the yield gap can help to predict the excess yield μ .

Our task here is to examine these issues for recent Irish data. Of course, excess returns can be computed for a variety of maturities, but yield curves tend to be very smooth, and rather flat for long bonds, so that there will not be much difference between results computed with slightly different maturities. We have chosen to concentrate on the fifteen year maturity, and to compare it with a three-month short investment.

Summary statistics of these excess returns are shown in Table 5.1. The quarterly cumulative excess returns are plotted in Figure 5.5. Over the whole of the EMS period, excess returns have been positive, implying that the holder of long-term paper came out better than an investor who rolled-over

short-term paper. However, the mean quarterly excess return of just 0.6 per cent was insignificantly different from zero given the large standard deviation: the t-statistic is only 0.7. The maximum quarterly return was 16.6 per cent, the minimum a loss of 23.6 per cent. So we see that no systematic pattern of a positive risk premium is evident from these figures. The standard deviation may be compared with those obtained for short-term international excess returns. For Ireland vs. Germany, the standard deviation was only 1.9 per cent, for the UK 4.2 per cent and for the US 6.5 per cent. So the riskiness of short-term returns on holding long bonds is very considerable.

So far as the trends over time in these excess returns are concerned, generally rising long yields have been associated with a tendency towards negative excess returns in the first three years of the EMS.⁷² After that, gains have outweighed losses and there have been cumulatively positive excess returns over most sub-periods since 1982 until 1988. Thereafter no significant trend has been seen.

A further implication of the expectations theory is that the yield gap (long minus short interest yield) should be the best predictor of percentage change in long-term bond prices. We ran some regressions to assess this and found that, though as a predictor of bond price changes the yield gap is not biased, there is no significant correlation between the two.

6 Does the Yield Gap Incorporate an Explainable Risk Premium?

As we did in Chapter 2, we now assess the predictability of excess returns for holding-yields on long bonds. Perhaps some of the excess returns are attributable to risk premiums. If so, the movement in excess returns may be correlated with the factors influencing perceived risk. Just as with the excess returns on international investment in short-term assets, such risk factors could possibly be detected using regression analysis of the excess returns. The candidate variables which we employ are inflation and interest rates at home and abroad, and a measure of government borrowing.⁷³

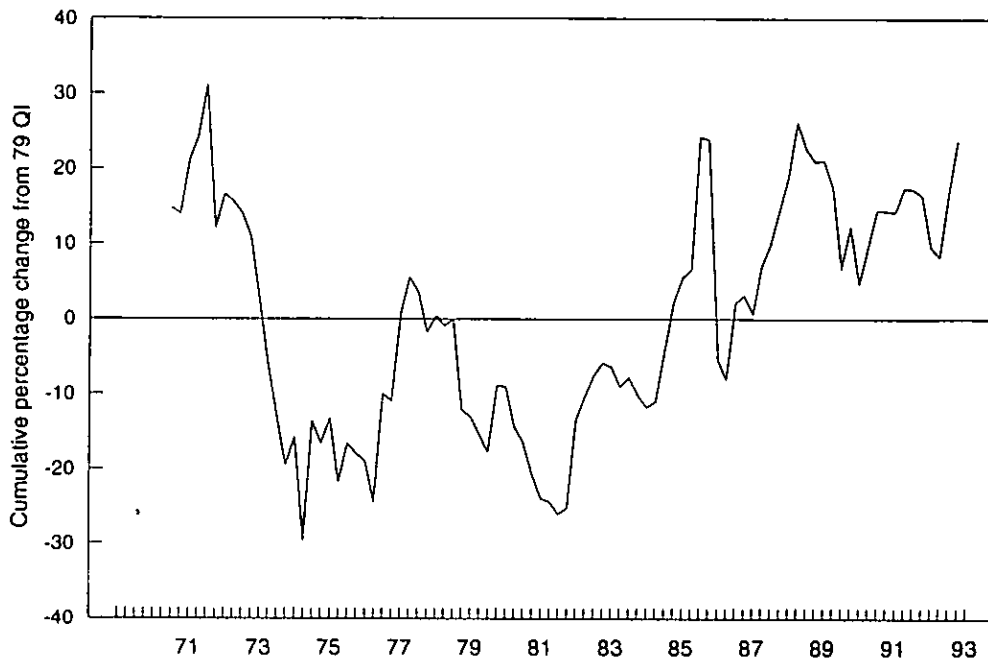
These variables are in line with previous work on Irish long-term interest rates by the OECD (1992). That work was based on the idea that Irish long rates will differ from those in Germany (as the core country in the EMS) by the difference in inflation rates plus a risk premium related to the

⁷² Tests for stationarity of these series are presented in Table 2.1 above.

⁷³ Though much work has been done in recent years on a sophisticated model, based on optimisation of expected utility, of the determination of term premia, it does not seem useful to elaborate that model here, as we are not concerned with testing its restrictions. Cf. Shiller (1990), Singleton (1990).

Figure 5.5

**Cumulative Excess Returns on Irish Assets
Long-term against short-term**



size of the Irish Exchequer Borrowing Requirement as a share of GDP. Inclusion of the latter variable is implicitly justified by the view that financial markets will demand a higher premium when borrowing is high, either as an assurance against outright default, or in case the governments debt problems should result in a rise in inflation (which would lower the real value of outstanding domestic currency debt), thereby increasing short-term nominal interest rates and also resulting in a depreciation of the currency. The OECD model works reasonably well on annual data, but of course the number of observations available limits the confidence with which conclusions can be drawn from annual data, especially since the pre-EMS data refers to an era (the sterling link) when an inflationary solution to debt problems would have seemed much less likely than under the more flexible EMS arrangement.

Two caveats are in order at this point:

First, note that these variables may influence interest rates both through their effect on *expected future bond prices* and through their effect on *risk premia*. Our analysis of excess returns in this section refers to the latter effect. The following section deals with the impact on expected future developments.

Second, note that the current measured values of these variables are but imperfect measures of what really influences perceptions of risk, namely future trends in them.

We turn first to examine the possible impact of the EBR and inflation differentials on excess returns. Just as in Chapter 2 above, we decompose the excess return μ into its expected value and an unanticipated return shock ϵ . We again interpret the expected value as a risk premium ρ . Thus, recalling equation (1), we write:

$$\mu_t = R_t - r_t + \mathcal{E}_t \left(\frac{\Delta P_{t+1}}{P_t} \right) + \epsilon_t = \rho_t + \epsilon_t \quad (4)$$

The unobserved risk premium (at time t) ρ_t is in turn modelled as a linear function of some variables observed at t and a modelling disturbance u_t :

$$\rho_t = X_t \alpha + u_t \quad (5)$$

And substituting, we obtain a regression equation:

$$\mu_t = X_t \alpha + \epsilon_t + u_t \quad (6)$$

This was estimated on quarterly data over the EMS period and the results are shown in Table 5.3.⁷⁴ We find an apparently significant role for the international inflation differential (Irish minus German) and the

⁷⁴ On the grounds that large outliers are likely attributable to ϵ rather than u , it seems wise to estimate with a robust method, or to omit outliers. We adopt the latter approach as indicated by the dummies listed in Table 3.2.

Table 5.3: *Regression Results: Modelling the Risk Premium*

<i>Regression No:</i>	<i>5.3.1</i>		<i>5.3.2</i>		<i>5.3.3</i>		<i>5.3.4</i>	
	<i>Coeff</i>	<i>t-stat</i>	<i>Coeff</i>	<i>t-stat</i>	<i>Coeff</i>	<i>t-stat</i>	<i>Coeff</i>	<i>t-stat</i>
Intercept	-26.6	(2.9)	-25.1	(1.3)	-43.0	(3.6)	-23.6	(2.8)
Irish long rate	1.49	(3.3)	1.49	(0.1)	0.85	(2.2)		
Exchequer borrowing (smoothed)	-7.75	(2.5)	8.59	(0.2)				
Inflation diff - DM	-0.79	(2.1)	-0.79	(1.1)				
Time	0.15	(1.7)	0.08	(1.6)	0.90	(3.2)	0.75	(2.6)
Time ² (*1000)			0.64	(0.1)	5.64	(2.5)	5.51	(2.4)
Dum 80q1	11.8	(2.9)	11.8	(1.4)	13.8	(3.3)	14.3	(3.3)
Dum 82q2	15.5	(3.7)	15.5	(0.4)	13.4	(3.1)	16.6	(4.0)
Dum 85q4	14.9	(3.9)	14.9	(1.9)	15.5	(3.8)	15.0	(3.6)
Dum 86q2	-21.3	(5.2)	-21.3	(5.2)	-23.0	(5.5)	-25.4	(6.1)
RSQ / DW	0.695	1.99	0.695	2.00	0.653	1.77	0.619	1.84
F / d.f.	13.6	8.48	11.9	9.47	13.2	7.49	13.6	6.50
SEE / Log-likelihood	3.75	-151.3	3.79	-151.3	3.96	-155	4.10	-157.6
Method / No. of obs	OLS 57		OLS 57		OLS 57		OLS 57	
Sample Period	79 Q1 - 93 Q1		79 Q1 - 93 Q1		79 Q1 - 93 Q1		79 Q1 - 93 Q1	

Dependent variable: Excess return on long bond

smoothed EBR, as well as for the long-yield in explaining the risk premium (Regression 5.3.1).⁷⁵ The regression implies that higher nominal long-term interest rates have been associated with a higher risk premium - indeed the point estimate of the impact here is greater than unity. The point estimates also indicate that £100 million extra in the quarterly EBR adds 77 basis points to the risk premium, but an additional 1 per cent difference on Irish inflation lowers it by 79 basis points. (The latter seems counterintuitive and alerts us to the danger of omitted variable bias: the estimated significance of the inflation differential may simply reflect the true significance of some other unobserved variable, which happens to be correlated with the inflation differential.) We will refer to the fitted value ⁷⁶ of the risk premium from this regression as ρ .

Is this result robust? The other regressions shown in Table 5.3 cast some doubt. Indeed, inclusion of a quadratic term in time makes the EBR variable wholly insignificant, and it does not add to the equation. By including just the time trends (with the dummies) gives almost as good a fit as the longer equation: joint insignificance of the three economic variables cannot quite be rejected.

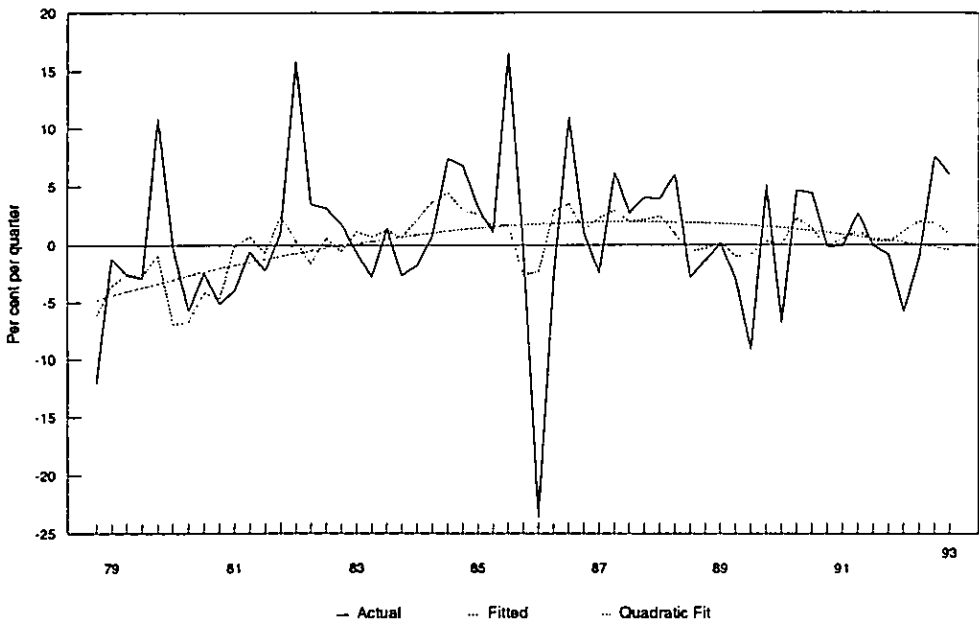
Figure 5.6 plots two versions of the fitted risk premium - both the quadratic time trend of equation (5.3.4) ρ' , or the more elaborate model of (5.3.1) ρ - along with the excess return μ . Overall, the contribution of the

⁷⁵ For the Exchequer Borrowing Requirement, we have smoothed and deseasonalised the actual quarterly data (since quarterly GNP data are not available, we have not scaled the EBR figures - the time trend will have to perform this function). The long-yield is pre-determined in this regression.

⁷⁶ Apart from the impact of four intercept dummies.

identified risk factors is modest but not negligible. The figure suggests that identified movements in the risk factors tended to increase the yield gap (long-term risk more important than short-term) during most of 1984-88; in contrast, 1980-81 are periods where the risk factors tended to reduce the yield gap (short-term risk relatively higher).

Figure 5.6 Excess Returns on Long-term Securities Actual and Fitted



7 Bond Price Expectations: Determinants of the Long Yield

Putting the various elements of the expectations theory together again, we use the fact that the yield gap will be the sum of a risk premium and the expected rate of change in the bond price (even if those expectations are not very accurate). After all, rearranging Equation 4, we obtain:

$$R_t - r_t = \rho_t + \mathcal{E} \left(\frac{\Delta P_{t+1}}{P_t} \right) \tag{7}$$

Projecting the expectation of bond price changes onto other economic variables X' :

$$E\left(\frac{\Delta P_{t+1}}{P_t}\right) = X'_t \alpha' + u'_t \quad (8)$$

and adding a modelling disturbance v_t , we obtain a relationship which can be estimated:

$$R_t - r_t = \rho_t + X'_t \alpha' + u'_t + v_t \quad (9)$$

The domestic short-term interest rate, foreign interest rates, time trends, and the other economic variables used in the previous section, are all possible candidates for the explanatory variables X .

Table 5.4: Regression Results: The Yield Gap

Regression No:	5.4.1	5.4.2	5.4.3	5.4.4	5.4.5	5.4.6
	Coeff t-stat		Coeff t-stat		Coeff t-stat	
Intercept	-0.63 (2.3)	-0.54 (1.3)	7.63 (3.4)	6.71 (2.9)	4.44 (1.9)	4.62 (2.9)
Fitted risk premium rho'	-0.29 (2.1)	-0.44 (1.7)				
Irish short rate			-0.82 (16.1)	-0.86 (17.8)	-0.75 (12.2)	-0.72 (13.3)
- same led one quarter				0.13 (2.7)		
Smoothed EBR					2.30 (2.2)	2.38 (3.6)
German yield gap	0.82 (4.6)	0.86 (3.4)				
World long rate			0.84 (5.6)	0.76 (5.2)	0.87 (6.5)	0.82 (7.8)
Time			-0.09 (4.9)	-0.08 (4.2)	-0.07 (4.3)	-0.07 (6.8)
Autoregression coefficient						
AR(1)		0.44 (3.6)	0.61 (5.4)	0.65 (5.9)	0.45 (3.2)	0.60 (4.1)
AR(2)						0.39 (2.9)
RSQ / DW	0.280 1.08	0.444 1.55	0.900 1.64	0.912 1.63	0.876 1.67	0.895 1.34
F / d.f.	10.5 2.54	11.9 3.53	117.1 4.52	106.1 5.51	69.2 5.49	67.9 6.48
SEE / Log-likelihood	1.76 -111.5	1.57 -102.7	0.67 -55.2	0.63 -51.5	0.65 -51.1	0.61 -46.7
Method / No. of obs	OLS 57	AR(1) 57	AR(1) 57	AR(1) 57	AR(1) 55	AR(2) 55
Sample Period	79 Q1 - 93 Q1	79 Q1 - 93 Q1	79 Q1 - 93 Q1	79 Q1 - 93 Q1	79 Q1 - 92 Q3	79 Q1 - 92 Q3

Dependent variable: Long minus short yield

We refer to the regressions reported in Table 5.4 in order to summarise briefly the findings of a regression strategy which included all of these variables and successively removed the insignificant ones. We assumed the disturbance terms had a simple structure, serially independent or with a first-order autocorrelation.

Figure 5.7

Yield-Gap (Long minus Short)
Ireland and Germany

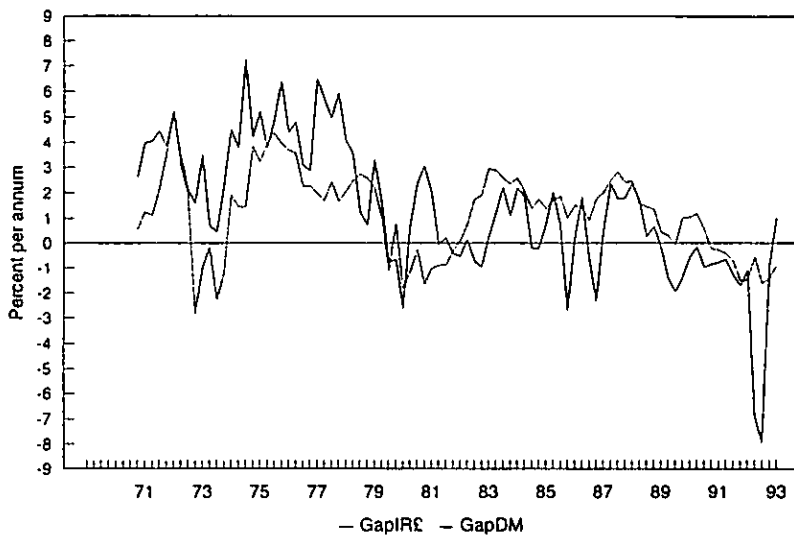


Figure 5.8

Yield-Gap (Long minus Short)
Ireland and UK

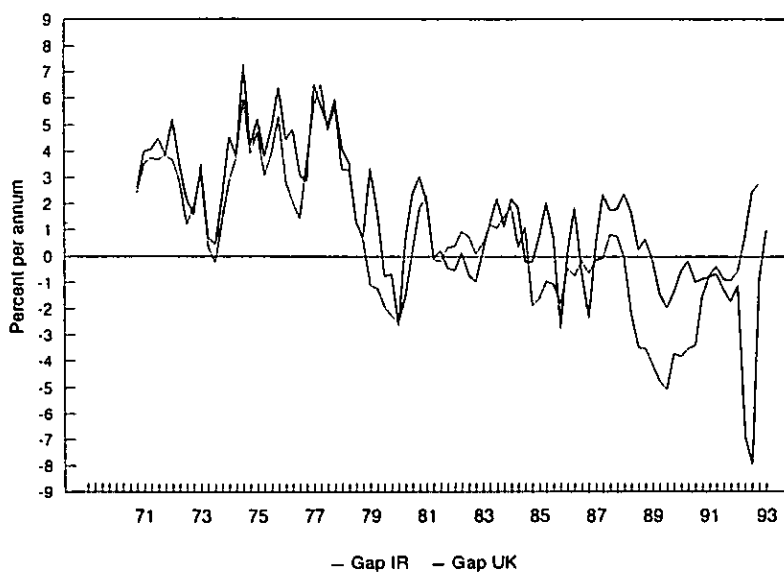
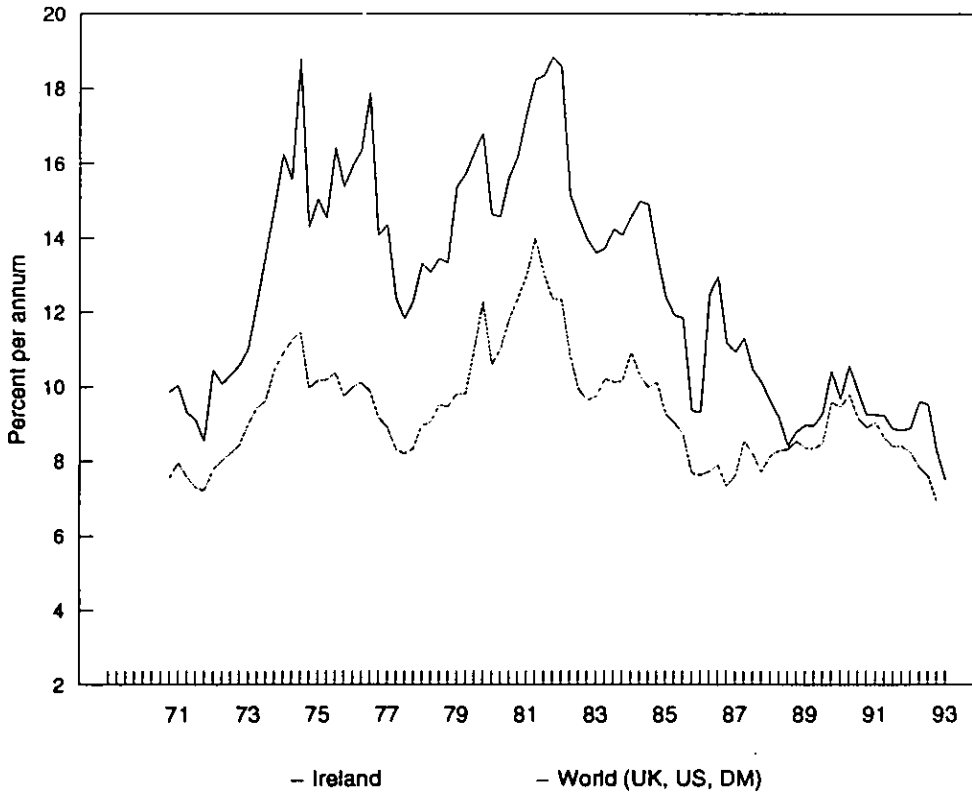


Figure 5.9
Irish and World Interest Rates
Long-term



First of all, we did not find the fitted values ρ' , ρ'' of the risk premium (from the previous section) to be helpful in the regressions. Two simple models (5.4.1-2 both using ρ') are indicative of what we found here. They explain the yield gap by the fitted risk premium and the German yield gap. (The co-movement of international yield gaps is evident from Figures 5.7 and 5.8). However, the fitted risk premium is far from its predicted value of unity and indeed has the wrong sign.

By far the most successful equations are those including foreign long yields (instead of the foreign yield gap) and also including the domestic short rate.⁷⁷ Indeed, the negative sign on the short rate is a

⁷⁷ As r^f is potentially endogenous we also experimented with instrumental variables estimators for this regression with similar results.

classic expectational relationship also found with other countries: when shorts are high that usually means they will fall. The size and significance of the foreign long rate is noteworthy. The best results were obtained with an equally-weighted average of UK, US and German long rates, which we call the "world interest rate" (plotted in Figure 5.9).⁷⁸

So far as other potential explanatory variables are concerned, neither the international inflation differential nor the sterling exchange rate is significant, and the EBR term remains significant only if we omit the last two observations relating to the turbulent period in the winter of 1992-93. The point estimate of Regression 3.3.5, which uses an exponentially smoothed and seasonally adjusted EBR, implies that a £100 million reduction in EBR is worth 0.2 percentage points off the yield gap.

8 Concluding Remarks

Two major empirical findings of this Chapter are that, first, over a short horizon, long-term interest rates can help predict short-term rates better than do short-term rates themselves and second, the world long-term interest rate is closely correlated with the Irish long-term rate.

From a conceptual point of view, this second finding might seem surprising, i.e. that fluctuations in foreign *nominal* long yields should be transmitted so reliably to Irish nominal long yields. If such fluctuations reflected changes in expectations regarding inflation differentials or exchange rates in the different currencies, they would surely not be transmitted to a currency which has experienced only moderate long-term stability in domestic inflation and exchange rates. The fact that the average of the international rates is the relevant one does suggest that it is the common international factor in long-term rates that is being transmitted. It is likely that what is being transmitted through this variable are chiefly fluctuations in the real (*ex ante*) long-term interest rate.⁷⁹ If so, we could interpret the variable as capturing the world real cost of loanable funds.

Irish long yields fell in nominal and *ex post* real terms from 1982 - and fell faster than those in other countries. This fall reflected greater optimism regarding the future medium-term value of Irish bonds, evidently related to

⁷⁸ This average variable outperforms any single currency's long-term rate, and the restriction that the three long-term rates all enter with the same coefficient is not rejected.

⁷⁹ Combined, perhaps, with changing expectations of "world" inflation.

optimism about the medium-term evolution of inflation, exchange rates and Government borrowing. Of these variables, the EBR survives best in the regressions, but this finding cannot be said to be altogether robust. Furthermore, at the estimated coefficients, the time trend still explains four-fifths of the relative decline in interest rates. Therefore, we cannot be sure that it was the improvement in the EBR which caused the more optimistic medium-term expectations and a reduction in the international interest differential. In particular, our quarterly data does not strongly support the specific model used on annual data by the OECD: as mentioned, the smoothed EBR series is only just significant, and the inflation differential is not significant at all.

The difficulty of pinning down just what aspect of improved Irish economic prospects most strongly influenced the decline in the gap of long yields over short is not surprising. After all, trends in long-term inflation are not independent of those in the fiscal position. We should not expect to find a mechanical relationship between current indicators and the market's future expectations.

Nor should we over-rate the market's forecasting ability. Long yields totally failed to forecast the sharp decline in inflation, and also performed very poorly as forecasters of movements in short-term rates.

Chapter 6

CONCLUDING REMARKS

This paper has highlighted the role of expectations in influencing Irish interest rate movements. Market expectations, as captured in interest rate differentials, have not been very accurate. The fear of more frequent or larger realignments than occurred prevented short-term Irish interest rates from falling as close to German interest rates as they could have in a world of perfect foresight.

Of the factors that influenced high frequency fluctuations in expectations, movements in the value of sterling have been of paramount importance. Only a part of the usual response of Irish interest rates to a decline in sterling has been justified by subsequent exchange rate movements: the market has tended to overreact.

The more gradual expectational adjustments, which have tended to reduce both short and long-term rates over the years, are probably linked to improvements in the fiscal position and to the secular decline in inflation during the 1980s. It is not possible to be categorical about the relative importance of these factors, as available data refers to outcomes rather than to expectations, but the fiscal element seems more important.

Implications for the Future

What does all this mean for the future, now that the currency is free to fluctuate much more widely against the DM than during the narrow-band regime of the EMS? The initial experience, during the first year of the wider bands, has been of generally lower and more stable interest rates. Irish short-term rates have been close to, and occasionally below, German rates. Even in mid-1994, with renewed sterling weakness bringing the Irish pound close to the old one-for-one parity, the response of interest rates was modest: the differential remaining well under one per cent. The removal of the potential for sharp exchange rate adjustments does seem to have had a calming effect on the market.

Irish long yields have retained a much higher differential over German, and moved up in sympathy with world long yields in early 1994, retaining the correlation we have noted in Chapter 5.

With the authorities intervening in the foreign exchange market but rarely, the potential for conflict between the objectives of exchange rate policy and the desire to smooth interest rate developments may seem to have vanished. But problems could re-emerge, perhaps in unexpected ways.

The risk that financial markets could steer Irish interest rates and the exchange rate into undesirable territory is one that cannot be neglected. The poor forecasting record which we have noted has been a feature of many other countries and has, perhaps, been more conspicuous in the early years of any new exchange rate or monetary policy regime, as witness the overvaluation of sterling and the US dollar in the early 1980s, and of the Spanish peseta in the later 1980s.

But the wider margins will greatly reduce the impact of such shocks on Irish interest rates. Whereas shifting expectations and confidence factors previously showed up in sharp interest rate fluctuations because of the risks that they conveyed of a sudden devaluation, the wider margins allow, for example, a substantial fall in sterling (against the DM) to be absorbed by a gradual movement of the Irish pound within the wider margins. In other words, the exchange rate is likely to bear the initial brunt of such shifts. That will be a stabilising factor for interest rates: the markets will, for example, tend to react to sterling weakness by pushing the Irish pound down against the DM. This has already happened to some extent.⁸⁰

On the other hand adverse reaction to an undue expansion in government spending or borrowing will now tend to show up in a fall in the currency instead of upward pressure on interest rates. The danger may be more of a cumulative drift than of sharp, temporary fluctuations (though these cannot be ruled out, especially if the fiscal position should begin to deteriorate once more), but it is none the less serious. This will be a new experience for Ireland as, flexible though it was, the EMS allowed only for occasional realignments. With a virtually floating exchange rate it will be difficult to engineer a reversal in exchange rate movements so caused through intervention in the money markets.

Thus there are clear dangers, as well as some advantages, in the new exchange rate regime. The advantages are of a likely smoother path to Irish interest rates and a lower risk premium over German rates. The dangers are primarily of currency drift and increased exchange rate uncertainty. These dangers could be reduced by having a firmer anchor for exchange rate and

⁸⁰ During February and March 1994, the Irish pound fell by almost 5 per cent against the DM, and appreciated by less than one per cent against sterling.

interest rates policy than now exists (Honohan, 1993). While the system has worked smoothly up to now, it has not been severely tested. The absence of a clear and explicit policy (backed up where necessary by direct action in the foreign exchange and money markets) adds unnecessarily to overall risk in the financial markets.

BIBLIOGRAPHY

- AGENOR, P.-R., J.S. BHANDARI and R.P. FLOOD. 1992. "Speculative Attacks and Models of Balance of Payments Crises", *IMF Staff Papers*, Vol. 39, pp. 357-394.
- BALDWIN, R.E., 1990. "Reinterpreting the Failure of Foreign Exchange Market Efficiency Tests: Small Transactions Costs, Big Hysteresis Bands", London: Centre for Economic Policy Research, Discussion Paper 407.
- BANKING COMMISSION, 1938. *Report of the Commission of Inquiry into Banking, Currency and Credit*, Dublin: Government Publications.
- BARTOLINI, L., 1993. "Devaluation and Competitiveness in a Small Open Economy: Ireland 1987-1993", IMF Working Paper WP/93/82, *Economic and Social Review*, forthcoming.
- BLACKBURN, K. and M. CHRISTENSEN, 1989. "Monetary Policy and Policy Credibility: Theories and Evidence", *Journal of Economic Literature*, Vol. 27, pp. 1-45.
- BLANCHARD, O.J., 1993. "Movements in the Equity Premium", *Brookings Papers on Economic Activity*, Vol. 2, pp. 75-138.
- 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*, Vol. 9, pp. 41-59.
- BROWNE, F.X. and P. MANASSE, 1990. "The Information Content of the Term Structure of Interest Rates: Theory and Evidence", *OECD Economic Studies* Vol. 14, pp. 59-86.
- BROWNE, F.X. and T. O'CONNELL, 1978. "A Quantitative Analysis of the Degree of Integration between Irish and UK Financial Markets", *Economic and Social Review*, Vol. 9, pp. 283-300.

- BRYANT, R.C., 1987. *International Financial Intermediation*, Washington, D.C., Brookings Institution.
- CAMPBELL, J.Y. and R.H. CLARIDA, 1987. "The Term Structure of Euromarket Interest Rates" *Journal of Monetary Economics*, Vol. 19, pp. 25-44.
- CHEN, Z. and A. GIOVANNINI, 1993. "The Determinants of Realignment Expectations under the EMS: Some Empirical Regularities", London: Centre for Economic Policy Research, Discussion Paper 790.
- CHRISTIANO, L.J. and M. EICHENBAUM, 1992. "Liquidity Effects and the Monetary Transmission Mechanism", *American Economic Review*, Vol. 80, Papers and Proceedings, pp. 346-353.
- CLARIDA, R.H. and M.P. TAYLOR, 1993. "The Term Structure of Forward Exchange Premia and the Forecastability of Spot Exchange Rates: Correcting the Errors", London: Centre for Economic Policy Research, Discussion Paper 773.
- CLARK, G., 1991. "The Long-Term Decline in Real Interest Rates: Comment", *Journal of Economic Perspectives*, Vol. 5, pp. 213-215.
- COCHRANE, J.H., 1991. "Volatility Tests and Efficient Markets: Review Essay", *Journal of Monetary Economics*, Vol. 27, pp. 463-485.
- COLEMAN, W.J., Jr., C. GILLES and P. LABADIE, 1992. "The Liquidity Premium in Average Interest Rates", *Journal of Monetary Economics*, Vol. 30, pp. 449-465.
- CUMBY, R.E. and F.S. MISHKIN, 1986. "The International Linkage of Real Interest Rates: The European-U.S. Connection", *Journal of International Money and Finance*, Vol. 5, pp. 5-23.
- CUMBY, R.E., 1988. "Is It Risk?: Explaining Deviations from Uncovered Interest Parity", *Journal of Monetary Economics*, Vol. 22, pp. 279-299.

- DAVIS, E.P., 1991. "International Diversification of Institutional Investment", Bank of England Discussion Paper (Technical Series), No. 44.
- de ROOVER, R., 1963. *The Rise and Decline of the Medici Bank*, Cambridge University Press.
- DICKEY, D.A. and W.A. FULLER, 1981. "Likelihood Ratio Statistics for Autoregressive Time Series with a Unit Root", *Econometrica*, Vol. 49, pp. 1057-1072.
- DIXIT, A.K., 1989. "Entry and Exit Decisions Under Uncertainty", *Journal of Political Economy*, Vol. 97, pp. 620-638.
- DORNBUSCH, R., 1989. "Credibility, Debt and Unemployment: Ireland's Failed Stabilization", *Economic Policy*, Vol. 8, pp. 173-209.
- DORNBUSCH, R., 1990. *Ireland and Europe's New Money*, The Twenty First Geary Lecture, October 1990, Dublin: The Economic and Social Research Institute.
- DOYLE M.F., 1990. "Interest Rates - Preserving a Balance", *Central Bank of Ireland Quarterly Bulletin*, Spring.
- DRIFFILL, J., 1990. "The Term Structure of Interest Rates: Structural Stability and Macro Policy Changes in the UK", London: Centre for Economic Policy Research, Discussion Paper 430.
- EDIN, P.A. and A. VREDIN, 1993. "Devaluation Risk in Target Zones: Evidence from the Nordic Countries", *Economic Journal*, Vol. 103, pp. 161-175.
- EDISON, H.J. and B.D. PAULS, 1993. "A Re-assessment of the Relationship between Real Exchange Rates and Real Interest Rates, 1974-1990", *Journal of Monetary Economics*

- EDISON, H.J. and B.D. PAULS, 1993. "A Re-assessment of the Relationship between Real Exchange Rates and Real Interest Rates, 1974-1990", *Journal of Monetary Economics*, Vol. 31, pp. 165-188.
- ENGEL, C., 1992a. "The Risk Premium in Foreign Exchange Markets", *International Economic Review*, Vol. 33, pp. 871-879.
- ENGEL, C., 1992b. "On the Foreign Exchange Risk Premium in a General Equilibrium Model", *Journal of International Economics*, Vol. 32, pp. 305-319.
- FITZ GERALD, J.D., 1986. *The National Debt and Economic Policy in the Medium Term*, Dublin: The Economic and Social Research Institute, Policy Research Series No. 7.
- FLOOD R.P., A.K. ROSE and D.J. MATHIESON, 1991. "An Empirical Explanation of Exchange-Rate Target Zones", *Carnegie-Rochester Conference Series on Public Policy*, Vol. 35, pp. 7-66.
- FRAIN, J., 1993. "A Critique of Recent Analyses of the Relationship Between the Sterling Exchange Rate and Irish Interest Rates", Central Bank of Ireland Research Paper 2/RT/93.
- GERTLER, M. and S. GILCHRIST, 1993. "The Cyclical Behavior of Short-term Business Lending: Implications for Financial Propagation Mechanisms", *European Economic Review*, Vol. 37, pp. 623-631.
- GIAVAZZI, F. and M. PAGANO, 1988. "The Advantage of Tying One's Hands: EMS Discipline and Central Bank Credibility", *European Economic Review*, 32, 1055-1082.
- GIAVAZZI, F. and L. SPAVENTA, 1990, "The 'New' EMS", London: Centre for Economic Policy Research, Discussion Paper 369.
- GOLDSTEIN, M., D.J. MATHIESON and T. LANE, 1991. "Determinants and Systemic Consequences of International Capital Flows", Occasional Paper No. 77, Washington D.C., International Monetary Fund.

- GROS, D. and N. THYGESEN, 1992. *European Monetary Integration*, London: Longman.
- HALL, F.G., 1949. *The Bank of Ireland 1783-1946*, Dublin: Hodges Figgis.
- 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. 829-853.
- HARDOUVELIS, G.A., 1994. "The Term Structure Spread and Future Changes in Long and Short Rates in the G7 Countries: Is There A Puzzle?", *Journal of Monetary Economics*, Vol. 33, pp. 255-284.
- HOMER, S. and R. SYLLA, 1992, *A History of Interest Rates*, New Brunswick, N.J.: Rutgers University Press.
- HONOHAN, P., 1982a. "Is Ireland a Small Open Economy?", *Administration*, Vol. 29, pp. 356-375.
- HONOHAN, P., 1982b. "The Yield Curve", *Central Bank of Ireland Annual Report 1981*, pp. 98-110.
- HONOHAN, P., 1989. "Comment on Dornbusch", *Economic Policy*, Vol. 8, pp. 210-213.
- HONOHAN, P., 1992. "Fiscal Adjustment in Ireland in the 1980s", *Economic and Social Review*, Vol. 23, pp. 185-314.
- HONOHAN, P., 1992. *Intersectoral Financial Flows in Ireland*, Dublin: The Economic and Social Research Institute, General Research Series 158.
- HONOHAN, P., 1993a. *An Examination of Irish Currency Policy*, Dublin: The Economic and Social Research Institute, Policy Research Series 18.
- HONOHAN, P., 1993b. "Interest Rate Policy in Practice, A Review with Some Implications for the Irish Banking System in the EMS", Dublin: The Economic and Social Research Institute, Working Paper 46.

- HONOHAN, P., 1993c. "The EMS and the Theory of Target Zones", London: Centre for Economic Policy Research, Discussion Paper 845.
- HONOHAN, P., 1994a. "Costing the Delay in Devaluing: 1992-93", *Irish Banking Review*, Spring, pp. 3-15.
- HONOHAN, P., 1994b. "Currency Board or Central Bank? Lessons from the Irish Pound's Link with Sterling, 1928-79", London: Centre for Economic Policy Research, Discussion Paper 1040.
- HONOHAN, P., and C. CONROY, 1994. "Sterling Movements and Irish Pound Interest Rates", *Economic and Social Review*, Vol. 25, pp. 201-220.
- HUGHES, J. and M. HURLEY, 1993. "Simple Tests of Target Zones: The Irish Case", *Applied Economics*, forthcoming.
- HURLEY, M., 1990. "The Information in the Term Structure of Interest Rate Spreads: the Irish Case", *Economic and Social Review*, Vol. 22, pp. 25-34.
- HURLEY, M., 1994. "Realignment in Target Zones where More than One Exchange Rate Matters", Maynooth College, Department of Economics Working Paper.
- JORION, P. and F. MISHKIN, 1991. "A Multicountry Comparison of Term-Structure Forecasts at Long Horizons", *Journal of Financial Economics*, Vol. 29, pp. 59-80.
- KAMINSKY, G. and R. PERUGA, 1990, "Can a Time-varying Risk Premium Explain Excess Returns in the Forward Market for Foreign Exchange?", *Journal of International Economics*, Vol. 28, pp. 47-70.
- KELLY, J., 1993, "The Development of Money and Foreign Exchange Markets in Ireland", Central Bank of Ireland *Annual Report 1992*, pp. 119-31.
- KINDLEBERGER, C.P., 1993. *A Financial History of Western Europe*, 2nd Edn., Oxford University Press.

- KOEDIJK, K.G. and C.J.M. KOOL, 1992. "Dominant Interest and Inflation Differentials Within the EMS", *European Economic Review*, Vol. 36, pp. 925-944.
- KREMERS, J., 1990. "Gaining Policy Credibility for a Disinflation: Ireland's Experience in the EMS", *IMF Staff Papers*, Vol. 37, pp. 116-45.
- LEAMER, E.E., 1981. "Is it a Demand Curve, or is it a Supply Curve? Partial Identification Through Inequality Constraints", *Review of Economics and Statistics*, Vol. 63, pp. 319-27.
- LEDDIN, A., 1988. "Interest and Price Parity and Foreign Exchange Market Efficiency: The Irish Experience in the European Monetary System", *Economic and Social Review*, Vol. 19, pp. 215-231.
- LEDDIN, A., 1989. "Efficiency in the Forward Foreign Exchange Market: An Application of Cointegration: A Comment", *Economic and Social Review*, Vol. 20, pp. 281-285
- LEDDIN, A. and B.M. WALSH, 1993. *The Macro-economy of Ireland*, Dublin: Gill and Macmillan.
- LEEPER, E.M. and D.B. GORDON, 1992. "In Search of the Liquidity Effect", *Journal of Monetary Economics*; Vol. 29, pp. 341-369.
- LeROY, S.F. and R.D. PORTER, 1981. "The Present Value Relation: Tests Based on Implied Variance Bounds", *Econometrica*, Vol. 49, pp. 555-574.
- LUCAS, R.E., Jr. (1990), "Liquidity and Interest Rates", *Journal of Economic Theory*, Vol. 50, pp. 237-264.
- LUCEY, B.M., 1988. "Efficiency in the Forward Exchange Market: An Application of Cointegration", *Economic and Social Review*, Vol. 20, pp. 27-35.
- LUCEY, B.M., 1989. "Efficiency in the Forward Exchange Market: An Application of Cointegration: Reply", *Economic and Social Review*, Vol. 20, pp. 286-288.

- MacDONALD R. and M.P. TAYLOR, 1992. "Exchange Rate Economics: A Survey", *IMF Staff Papers*, Vol. 39, pp. 1-57.
- MATHIESON, D.J. and L. ROJAS SUAREZ, 1993. *Liberalization of the Capital Account: Experiences and Issues*, Washington, DC: International Monetary Fund, Occasional Paper 103.
- McENTEE, P. and P. DOWNWARD, 1994. "Time-varying Risk Premia in the Foreign Exchange Market: A GARCH-M Application", Staffordshire University, mimeo.
- McGOWAN, P., 1990. *Money and Banking in Ireland*, Dublin: Institute of Public Administration.
- McGOWAN, P., 1992. "The Operation of Monetary Policy in Ireland", read to the Statistical and Social Inquiry Society of Ireland and forthcoming in the Society's *Journal*.
- MANKIW, N.G., 1986. "The Term Structure of Interest Rates Revisited", *Brookings Papers on Economic Activity*
- MENTON, B., 1990. "Exchange Rate Policy and Irish Interest Rates", *Irish Banking Review*, Autumn, pp. 39-50.
- MISHKIN, F.S., 1990a. "What Does the Term Structure Tell Us About Future Inflation", *Journal of Monetary Economics*, Vol. 25, pp. 77-95.
- MISHKIN, F.S., 1990b. "The Information in the Longer Maturity Term Structure about Future Inflation", *Quarterly Journal of Economics*, Vol. 105, pp. 815-828.
- MITCHELL, B.R., 1988. *British Historical Statistics*, Cambridge University Press.
- MOYNIHAN, M., 1975. *Currency and Central Banking in Ireland 1922-60* Dublin: Gill and Macmillan.

- NEVIN, E., 1962. *The Capital Stock of Ireland*, Dublin: The Economic and Social Research Institute, General Research Series Paper No. 17.
- NUGENT, J., 1990. "Further Evidence of Forward Exchange Market Efficiency: An Application of Cointegration Using German and UK Data", *The Economic and Social Review*, Vol. 22, pp. 35-42.
- O'DONNELL, M., 1993. "Devaluation Expectations for the IR£/DM: Some Empirical Estimates and their Relation to Fundamentals", Maynooth College, mimeo.
- OGRÁDA, C. 1994. *A New Economic History of Ireland*, Oxford University Press.
- O'LEARY, J. and O. MANGAN, 1993. "Irish Interest Rate Markets: Post-Devaluation Scenarios", Davy Fixed Interest Research, February.
- OECD (Organization for Economic Cooperation and Development), 1992. Ireland (OECD Economic Surveys).
- PAGAN, A.R. and M.R. WICKENS, 1989. "A Survey of Some Recent Econometric Methods", *Economic Journal*, Vol. 99, pp. 962-1025.
- POWER, J., 1993. "The Irish Gilt Market", *Irish Banking Review*, Spring, pp. 19-29.
- ROSE, A.K. and L.E.O SVENSSON, 1991. "Expected and Predicted Realignments: The FF/DM Exchange Rate During the EMS", London: Centre for Economic Policy Research, Discussion Paper 552.
- SHILLER, R.J., 1979, "The Volatility of Long-term Interest Rates and Expectations Models of the Term Structure", *Journal of Political Economy*, Vol. 87, pp. 1190-1219.
- SHILLER, R.J., 1981. "Do Stock Prices Move Too Much to be Justified by Subsequent changes in Dividends", *American Economic Review*, Vol. 71, pp. 421-436.

- SHILLER, R.J., 1990. "The Term Structure of Interest Rates", in B.M. Friedman and F.H. Hahn, eds., *Handbook of Monetary Economics*, Amsterdam: North Holland.
- SHILLER, R.J., J.Y. CAMPBELL and K.L. SCHOENHOLTZ, 1983. "Forward Rates and Future Policy: Interpreting the Term Structure of Interest Rates", *Brookings Papers on Economic Activity*, 1983-1, pp. 173-224.
- SIEGEL, J.J., 1992. "The Real Rate of Interest from 1800-1990: A Study of the U.S. and the U.K.", *Journal of Monetary Economics*, Vol. 29, pp. 227-252.
- SINGLETON, K.J., 1990. "Specification and Estimation of Intertemporal Asset Pricing Models", in B.M. Friedman and F.H. Hahn, eds., *Handbook of Monetary Economics*, Amsterdam: North Holland.
- SVENSSON, L.E.O., 1992a. "The Foreign Exchange Risk Premium in a Target Zone Model with Devaluation Risk", *Journal of International Economics*, Vol. 33, pp. 21-40.
- SVENSSON, L.E.O., 1992b. "Why Exchange Rate Bands? Monetary Independence in Spite of Fixed Exchange Rates", London: Centre for Economic Policy Research, Discussion Paper 742.
- TAYLOR, M.P., 1992. "Modelling the Yield Curve", *Economic Journal*, Vol. 102, pp. 524-537.
- THOM, R., 1994. "The Influence of Sterling on Irish Interest Rates", University College Dublin, mimeo.
- WALSH, B. 1993. "Credibility, Interest Rates and the ERM: the Irish Experience", *Oxford Bulletin of Economics and Statistics*, Vol. 55, pp. 439-452.
- WRIGHT, J., 1993. "A Cointegration-Based Analysis of Irish Exchange Rate Determination Using the Johansen Procedure", *The Economic and Social Review*, Vol. 25, pp. 261-278.

THE ECONOMIC AND SOCIAL RESEARCH INSTITUTE

RECENT PUBLICATIONS BY STAFF MEMBERS

(All reports are published by the Institute except where otherwise stated)

General Research Series

- Low Pay in Ireland* (1993, Brian Nolan, Paper No. 159, IR£12.00).
Alcohol Use in Ireland: Some Economic and Social Implications (1993, Denis Conniffe and Daniel McCoy, Paper No. 160, IR£12.00).
Pathways to Adulthood in Ireland: Causes and Consequences of Success and Failure in Transitions Amongst Irish Youth (1993, D. F. Hannan, S. Ó Ríain, Paper No. 161, IR£15.00).
The Financial Assets of Households in Ireland (1993, Patrick Honohan and Brian Nolan, Paper No. 162, £12.00).
Male-Female Wage Differentials: Analysis and Policy Issues (1994, Tim Callan and Anne Wren, Paper No. 163, IR£12.00).
Drinking Among Post-primary School Pupils (1994, Mark Morgan and Joel W. Grube, Paper No. 164, IR£12.00).

Broadsheet Series

- The Pilot Programme for Integrated Rural Development 1988-90* (1992, Eoin O'Malley, Paper No. 27, IR£10.00).
Family Problems - Substitute Care: Children in Care and Their Families (1993, Kathleen O'Higgins, Paper No. 28, IR£10.00).
Lone Parents in the Republic of Ireland: Enumeration, Description and Implications for Social Security (1993, A. McCashin, Paper No. 29, IR£10.00).

Policy Research Series

- The Economic Effects of Carbon Taxes* (1992, John Fitz Gerald and Daniel McCoy (eds.), Paper No. 14, IR£8.00).
European Community Lending and the Structural Funds (1992, Patrick Honohan, Paper No. 15, IR£7.00).
Integration, Federalism and Cohesion in the European Community: Lessons from Canada (1993, J. Frank Strain, Paper No. 16, IR£8.00).
Ireland and Europe: Challenges for a New Century (1993, Rory O'Donnell, Paper No. 17, IR£8.00).
An Examination of Irish Currency Policy (1993, Patrick Honohan, Paper No. 18, IR£8.00).
Charging for Public Health Services in Ireland: Why and How? (1993, Brian Nolan, Paper No. 19, IR£8.00).
Issues in Irish Energy Policy (1993, John Fitz Gerald and Daniel McCoy (eds.), Paper No. 20, IR£8.00).
Analysis of Basic Income Schemes for Ireland (1994, Tim Callan, Cathal O'Donoghue and Ciarán O'Neill, Paper No. 21, IR£8.00).
Waste Water Services: Charging Industry the Capital Cost (1994, S. Scott and J. Lawlor, Paper 22, IR£8.00).

Medium-Term Review

- Medium-Term Review: 1994-2000* (1994, S. Cantillon, J. Curtis, J. Fitz Gerald, No. 5, IR£27.50).
Economic Perspectives for the Medium Term (1994, S. Cantillon, J. Curtis, J. Fitz Gerald (eds.), IR£27.50).

A COMPLETE LIST OF PUBLICATIONS IS AVAILABLE FROM THE INSTITUTE