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EXPECTATIONS AND RISK PREMIA IN THE DETERMINATION OF LONG-TERM INTEREST RATES IN IRELAND

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Abstract

The role of expectations in influencing long-term interest rates in Ireland is examined. In the case of long-term securities, interest rate risk is added to exchange rate risk as a barrier to arbitrage between yields at home and abroad. Nevertheless, we find that fluctuations in world interest rates seem to have a strong influence on Irish long rates. Domestic influences are also undoubtedly important, but cannot easily and reliably be modelled in terms of either rational expectations of short rates or inflation, or by reference to quantifiable indicators of confidence such as current inflation differentials or government borrowing.

Expectations and risk premia in the determination of long-term interest rates in Ireland

1 Introduction

In this paper we examine the role of expectations in influencing long-term interest rates in Ireland. A companion paper has examined the international transmission of short-term interest rates, and argues that, during the EMS period, there has been a strong influence from German short rates, modulated by exchange rate expectations related to fluctuations in the Irish pound sterling exchange rate. In the case of long-term securities, interest rate risk is added to exchange rate risk as a barrier to arbitrage between yields at home and abroad. Nevertheless, we find that fluctuations in world interest rates seem to have a strong influence on Irish long rates. Domestic influences are also undoubtedly important, but cannot easily and reliably be modelled in terms either of rational expectations of short rates or inflation, or by reference to quantifiable indicators of confidence such as current inflation differentials or government borrowing.

2 Long-term interest rates in Ireland

An active market in Irish Government Securities (annual turnover has been of the order of 125 per cent of GNP in recent years) justifies application of market-oriented theories of the determination of long yields in Ireland. Indeed, at end 1992, over £5.8 billion of fixed interest gilts with more than five years to run was outstanding, an amount that is equivalent to 22 per cent of GNP. About £2.6 billion of these (10 per cent of GNP) had maturity greater than ten 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 long-term funds, with the banks, 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 fixed 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. The non-financial 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, 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 much trading in both short-term and long-term Government securities: in recent years the average short-term - less than five years - security has been turned over every 3.5 months; the average long-term security once every 5 months).

3 Real Returns - Ireland, UK, Germany.

The two most important reference points for the yield on long-term securities are the inflation rate for goods and services, and the movements in short-term nominal interest rates. In following sections, we focus on the nominal holding return on long-term securities by comparison with that on short-term paper. But what about the return relative to goods and services. How has the *real* rate of return on long-term bonds stood? 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 realized. Both present measurement difficulties. The expected rate of inflation is not directly measurable, (and indeed is often inferred from the long-term nominal interest yield, a procedure which requires assumptions we would like to probe); the realized 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-term securities.

To get as close to realized real rates as possible, one approach is illustrated in figures 1 to 3. These figures plot the nominal long-term interest yield and two measures of estimated realized average inflation during the subsequent maturity of the bond. Thus, for example, at the first quarter of 1982, we show a nominal long-term interest yield 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 just under 5 per cent, which is the annual average inflation from the first quarter of 1982 to mid-1993. The difference of about 14 per cent may be taken as the real realized long-term interest yield at the first quarter of 1982.

The figure is a kind of compromise between simplicity and conceptual accuracy. For one thing, the average inflation is computed over a period which declines steadily from 22 years (the 1971 observations) to just one year at 1992. In contrast, the nominal interest yield[1] refers to a constant 15-year maturity[2]. An alternative approach (shown in the second inflation curve) is to adjust the inflation figures for early years by computing the average inflation for only 15 years, and to adjust the later years by imputing an constant inflation rate of 3 per cent per annum to 1993 and beyond. As shown in the figures, the general pattern is little affected by such adjustments. For Ireland (and the UK) the 15-year average inflation from the early 1970s is higher than the average to 1993,

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[1]Taken from *International Financial Statistics*

[2]At first the interest yield is a representative long-term rate; since about 1980 it is taken off a par-yield curve calculated by the Central Bank of Ireland.

thus implying lower (more negative) real interest rates at that time. For the UK and Germany, the assumption of 3 per cent inflation from 1993 on has the effect of lowering the average inflation for dates in the latter part of the sample. Because of the relatively modest difference between the two interest rate series, we will focus on the simpler "average to 1993" series. The difference between nominal yields is never great beyond about ten years, so there is no need to worry unduly about the exact maturity of the nominal interest rate.

A clear pattern emerges. For borrowers and lenders at long-term in the early 1970s realized real interest rates 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 realized real interest rates, peaking (as has been remarked) in the first quarter of 1982 at about 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 "realized" long-term real interest rates have remained high - at about 5-8 per cent per annum.

The Irish data can be compared with that for other countries. 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 interest rates during the 1980s, though future (post sample) inflation experience in the two countries may reduce the difference here.

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, realized real long-term interest rates in Germany have been much lower than in Ireland after 1973.

Interpreting the very high realized real interest rates in Ireland and the UK (by comparison with Germany and the US) is a controversial business indeed. For Ireland, the discussion elsewhere in this paper about risk premia related to Government borrowing is obviously relevant. 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 generalized 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.

4 Excess returns on long gilts

The standard approach to the pricing of long-term interest rates refers to the expectations theory of the term structure as a benchmark. If investors are to be induced to hold long-term securities 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. This could be due to systematic expectation errors, so that the actual path of short-term interest rates does not at all correspond to expectations. Actually there appears to be a built-in risk-premium on long-term yields. An alternative explanation of this fact, not relying on systematic forecasting errors is an absence of sufficient 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".

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 realized 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*, we can write the excess return as:

$$\mu_t = R_t - r_t + \frac{\Delta P_{t+1}}{P_t}. \tag{1}$$

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

$$\mu_t = R_t - r_t + \frac{R_t - R_{t+1}}{R_{t+1}}. \tag{2}$$

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:

$$\mu_t = R_t - r_t + \frac{\gamma_n}{1-\gamma_n}(R_t - R_{t+1}), \qquad (3)$$

where,

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

According to the expectations hypothesis this excess return 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. Of course these excess returns can be computed for a variety of maturities, but yield curves tend to be very smooth, and rather flat for long-term securities, 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.

Just as exchange rate movements are the dominant factor in fluctuations of international excess returns, bond price movements are the dominant factor in the fluctuations of excess returns on long-term securities. The summary statistics of these excess returns is shown in Table 5. The quarterly excess returns are plotted in figure 4. 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 coefficient of variation was about 1100 per cent. 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 1.8 per cent, for the UK 4.2 per cent and for the US 6.6 per cent. So the riskiness of short-term returns on holding long bonds is very considerable.

Cumulative excess returns are plotted in figure 5. Generally rising long yields have been associated with a general tendency towards negative excess returns in the first three years of the EMS. 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.

5 *Does the yield gap predict short-run changes in bond prices well?*

Subtracting the yield gap from the excess return gives the percentage change in long-term bond prices. According to the expectations theory, the yield gap (long minus short interest yield) should be the best predictor of this change. A simple test of the hypothesis that the yield gap predicts changes in bond prices reveals that it is a very poor predictor indeed. Table 1 shows the results of regressing the change in bond prices on the yield gap. Instead of the coefficient on the yield gap being close to unity, it comes out at about 0.3 with a standard error of over 0.4 - making the estimate insignificant. The point estimate is not significantly different from unity, but the explanatory power of the yield gap is extremely low with an R^2 of 0.01. Even if we remove the four largest outliers (81Q1, 82Q2, 85Q4 and 86Q2) on the grounds that the yield gap would only be expected to predict modest changes in bond prices, it remains insignificant. Essentially, the very large bond price movements have the effect of swamping the yield gap (figure 5).

6 Do long rates predict interest and inflation rates over a longer period?
Even if it is hopeless as a short-term forecaster of future changes in bond prices, the long interest rate might conceivably be a reasonable forecaster of the general trend of interest or inflation. In order to test this[3], we estimated the average short-term interest rate and inflation rate over the life of the 15-year bond by applying actual rates to 1993 and an estimated constant rate thereafter - 7 per cent per annum for interest and 3 per cent for inflation. Figure 12 shows the average short rates computed, including an alternative series which just calculates the average short-rate from each date to 1993. (The average inflation is the second inflation series plotted in Figure 1).

In order to find whether the long-term rate can help predict the average inflation rate, it is necessary to estimate a regression which includes a correction for an autoregressive and moving average errors, since errors in forecasting the inflation rate will tend to have such a structure (Table 4). An ARMA (2,3) model seemed to provide a parsimonious representation of the error process. With this error structure and the inclusion of a time trend, the point estimate of the forecasting coefficient on the long-yield is about 0.01, a figure which does not vary much with different error specifications. This estimate is not significantly different from zero, but is highly significantly different from unity. The long-rate is a poor forecaster of long-term inflation, The point estimate implies that a 1000 basis point (10 percentage point) jump in long-term yields would predict about a 10 basis point (0.1 percentage point) increase in inflation.

A rather similar finding is obtained for average interest. Here an ARMA (3,3) process worked well. Here the time trend was highly significant, and implied a 2 per cent fall in inflation per annum. The coefficient on the long-yield was significant, but again was little greater than 0.01. This is in line with international findings of "excess sensitivity" of long-term yields to the volatility of short interest rates (Leroy and Porter, 1981, Shiller, 1981, Cochrane 1991).

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[3]An earlier application to Ireland of a similar methodology is Hurley (1990).

7 *Does the yield gap incorporate a predictable risk premium?*

Even if it is a poor predictor of short-term bond movements, the yield gap may incorporate some element of allowance for risk. 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.

These variables are in line with previous work on Irish long-term interest rates by the OECD. 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 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. We explore this proposed relationship on quarterly data below.

Turning first to examine the possible impact of the EBR and inflation differentials on excess returns, we assume that the excess return μ can be decomposed into a "risk premium" ρ and an unanticipated return shock ε. The risk premium (at time *t*) is in turn modelled as a linear function of some variables observed at *t* and a modelling disturbance u_t.:

$$\mu_t=\rho_t+\varepsilon_t$$

where the unobserved ρ is modelled as:

$$\rho_t=X_t\alpha+u_t$$

And substituting, we obtain a regression equation:

$$\mu_t=X_t\alpha+\varepsilon_t+u_t$$

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. Doing so, we find an apparently significant role for the international inflation differential (Irish minus German) and the smoothed EBR[4], as well as for the long-yield in explaining the risk premium (Table 2). One implication of the regression is 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.

Indeed, inclusion of a quadratic term in time makes the EBR variable wholly insignificant, and it does not add to the equation. Indeed, just including the time trends, and the dummies gives almost as good a fit as the longer equation: joint insignificance of the three economic variables cannot quite be rejected. Figure 6 plots two versions of the estimated risk premium - both the quadratic time trend of equation (2.4) ρ', or the more elaborate model of (2.1) ρ" - both ignoring the dummy terms - along with R and μ. The modest size of the estimated risk premium is noteworthy.

8 *Bond price expectations*

The yield gap should reflect expectations about bond movements (as well as a risk premium) even if those expectations are not very accurate. After all, from the definition of excess returns and the "risk premium",

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

where υ is the forecast error of bond price changes. Projecting the expectation of bond price changes onto other economic variables X':

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

we obtain a relationship which can be estimated:

[4]For the Exchequer Borrowing Requirement, we have smoothed and deseasonalized 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).

$$R_t - r_t = \rho_t + X'_t \alpha' + u_t + u'_t + \varepsilon_t + v_t$$

Table 3 presents some results along these lines, assuming the disturbance terms have a simple structure, serially independent or with a first-order autocorrelation. One simple model (3.1) explains the yield gap by ρ' and German yield gap. The comovement of the two yield gaps is already evident form figure 7 (figures 8 and 9 show the apparently weaker link with UK and US yield gaps). However, the fitted risk premium ρ" (though significant) has the wrong sign, even when the equation is corrected for first-order autocorrelation, and so it seems necessary to the estimate a less restrictive model[5]. Unrestricting the components of the German yield gap and allowing the short-term interest rate to be an explanatory variable also gives better results, for example with equation (3.3).

The time trend here captures the long-run downward movement, and the world long-term interest rate captures most of the short-run movement. (Inclusion of the short-term interest rate on the right hand side[6] has the effect of making this equation almost an equation for the long rate itself). So far as other potential explanatory variables are concerned, the international inflation differential is not significant, and the EBR term is significant only if we omit the last two observations relating to the turbulent period in the winter of 1992-93.

The most striking feature of this modelling is the strength of the link between foreign and domestic long-term rates. That foreign long-term interest rate movements are an important determinant of Irish rates is strongly suggested by figures 10 and 11, where the "world interest rate" is the unweighted average of US, UK and German long-term rates. The latter 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.

From a conceptual point of view, it might seem surprising that fluctuations in nominal long-term interest rates should be transmitted so reliably to Irish long-term nominal yields. If such fluctuations reflected changes in expectations regarding inflation differentials or exchange rates, they would surely not be transmitted to a currency which showed only moderate long-term stability in domestic inflation and exchange rates. The fact that the fluctuations are transmitted thus seems to imply that these fluctuations are also fluctuations in the real (*ex ante*) long-term interest rate, or in expectations of "world" inflation, rather than in expectations regarding international inflation differentials or 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.

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[5]Using ρ" is no better - still a wrong sign and this time insignificant (D49).

[6]As r^s is potentially endogenous we also experimented with instrumental variables estimators for this regression with similar results.

Local interest and exchange rate expectations undoubtedly also play a role in influencing Irish long-term interest rates, and have probably been a major contributory factor in seeing the international differential shrink. However, it is not clear precisely how these expectations are formed. In particular, our quarterly data does not provide very strong support for the OECD model of the idiosyncratic component of the Irish long term rate. As mentioned, the smoothed EBR series is barely significant, and the inflation differential is not significant at all. Something happened to lower the average international interest differential in the late 1980s, but it is far from clear what it was: the lower inflation or the lower borrowing are reasonable candidates, but the time trend works as well, cautioning against jumping to conclusions.

Conclusions

The expectations theory receives little support from the analysis of long-term interest rates and the yield gap in Ireland. Rates fell in nominal and *ex post* real terms from 1982 - and fell faster than those in other countries (figure 13), but there is no evidence that this reflected good forecasts of inflation or short-term interest rates. There could have been a confidence factor, though the link with Exchequer borrowing is not a tight one, and a simple quadratic time trend tends to do as well as concrete proxies for confidence. The clearest message that we can offer is that fluctuations in international long-term interest rates have been an important influence on Irish long-term rates. Because of the interest rate and exchange rate risk involved, it seems unlikely that short-term interest rate or exchange rate expectations were the mechanism by which this international transmission occurred.

The apparent informational inefficiency of the long-term market may reflect the predominance of the Government as a borrower in the market. As more participants enter, this may change.

Excess Returns on Irish pound long-term assets		
Summary statistics, 1978:Q4-1993:Q1 (% per quarter)		
	Perpetuities	15-year
Mean	1.28	0.58
Std. Dev.	7.85	6.23
Variance	0.62	0.39
Max Return	25.70	16.60
Min Return	-24.43	-23.64

vis-à-vis short-term.

TABLE 1: FORECASTING BOND PRICE CHANGES WITH THE YIELD GAP

Dependent variable: Percentage change in price of long bond

Equation no:	1.1		1.2	
	Coeff	t-stat	Coeff	t-stat
Intercept	-0.563	(0.7)	-0.235	(0.4)
Yield Gap	0.311	(0.8)	0.281	(1.0)
Dum 80q1			-10.5	(2.3)
Dum 82q2			-15.5	(3.5)
Dum 85q4			-16.6	(3.7)
Dum 86q2			23.8	(5.3)
RSQ / DW	0.010	1.69	0.472	1.51
F / d.f.	0.57	1,55	12.3	5,51
SEE / Log-likelihood	6.31	-184.9	4.44	-162.6
Method / No. of obs	OLS	57	OLS	57
Sample Period	79 Q1 -	93 Q1	79 Q1 -	93 Q1

TABLE 2: MODELLING THE RISK PREMIUM

Dependent variable: Excess return on long bond

Equation no:	2.1		2.2		2.3		2.4	
	Coeff	t-stat	Coeff	t-stat	Coeff	t-stat	Coeff	t-stat
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)
Autoregression coefficient								
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		6,50
SEE / Log-likelihood	3.75	-151.3	3.79	-151.3	3.96	-155.0	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

TABLE 3: THE YIELD GAP

Dependent variable: Long minus short yield

Equation no:	3.1		3.2		3.3		3.4	
	Coeff	t-stat	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)
Fitted risk premium rho'	-0.29	(2.1)	-0.44	(1.7)				
Irish short rate					-0.82	(16.1)	-0.86	(17.8)
- same led one quarter							0.13	(2.7)
German yield gap	0.82	(4.6)	0.86	(3.4)				
World long rate					0.84	(5.6)	0.76	(5.2)
Time					-0.09	(4.9)	-0.08	(4.2)
Autoregression coefficient			0.44	(3.6)	0.61	(5.4)	0.65	(5.9)
RSQ / DW	0.280	1.08	0.444	1.55	0.900	1.64	0.912	1.63
F / d.f.	10.5	2,54	11.9	3,53	117.1	4,52	106.1	5,51
SEE / Log-likelihood	1.76	-111.5	1.57	-102.7	0.67	-55.2	0.63	-51.5
Method / No. of obs	OLS	57	AR(1)	57	AR(1)	57	AR(1)	57
Sample Period	79 Q1 - 93 Q1		79 Q1 - 93 Q1		79 Q1 - 93 Q1		79 Q1 - 93 Q1	

TABLE 4: USING THE LONG RATE FOR LONG-TERM FORECASTING

Dependent variable: Average future inflation or short interest rate

Equation no:	4.1		4.2	
	Inflation		Interest	
	Coeff	t-stat	Coeff	t-stat
Intercept	2.05	(2.9)	11.7	(21.0)
Irish long rate	-0.006	(0.8)	0.013	(3.6)
Time	0.011	(1.3)	-0.054	(8.9)
Autoregression coefficients:				
MA(1)	0.097	(1.2)	1.132	(9.4)
MA(2)	0.272	(3.4)	0.700	(8.6)
MA(3)	0.778	(9.8)	0.170	(2.3)
AR(1)	0.570	(4.8)	0.848	(5.0)
AR(2)	0.317	(2.3)	0.238	(0.7)
AR(3)			-0.153	(0.8)
RSQ / DW	0.998	1.88	0.9997	2.00
F / d.f.		7,49		8,48
SEE / Log-likelihood	0.056	85.2	0.024	129.1
Method / No. of obs	ARMA	57	ARMA	57
Sample Period	79 Q1 - 93 Q1		79 Q1 - 93 Q1	

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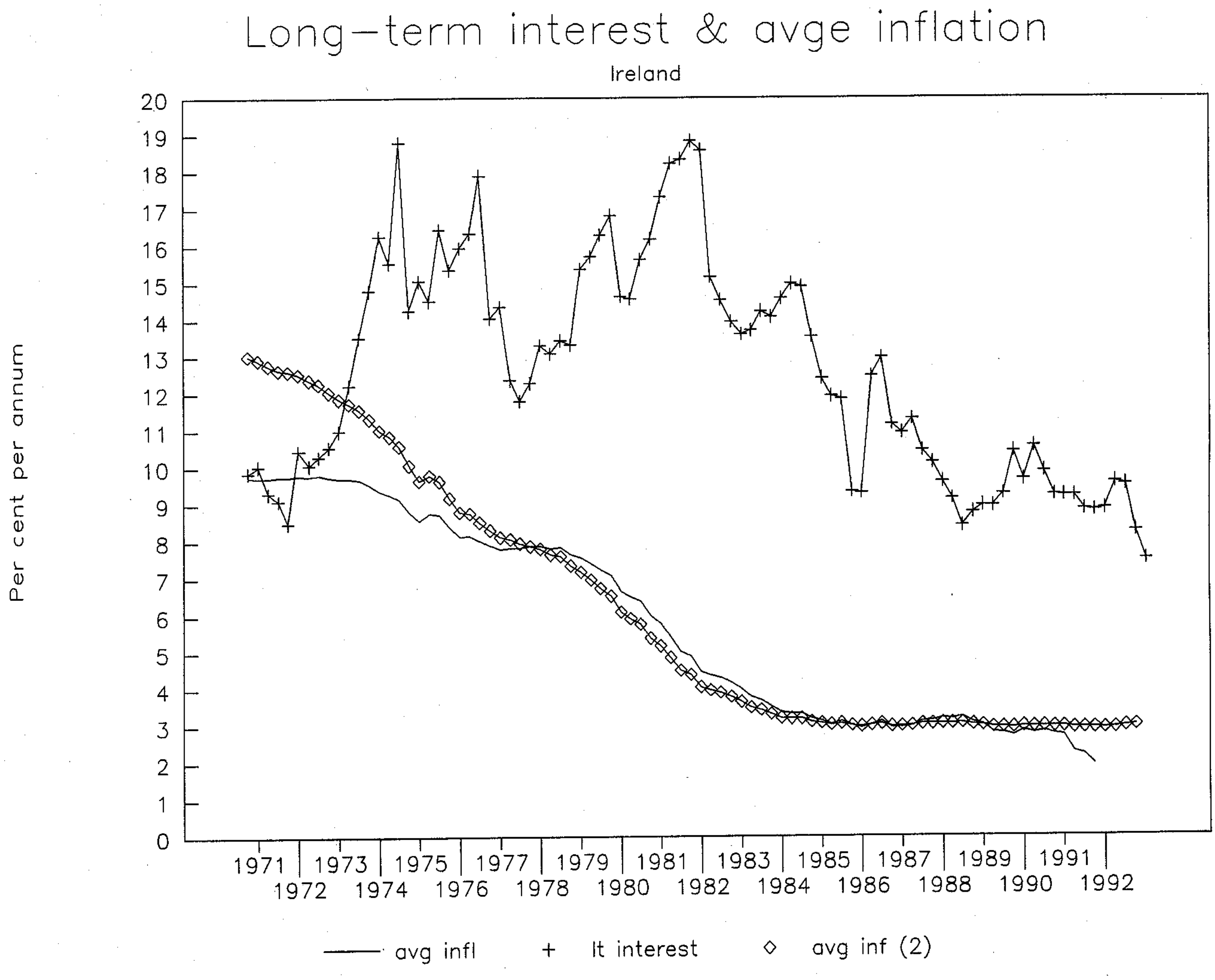
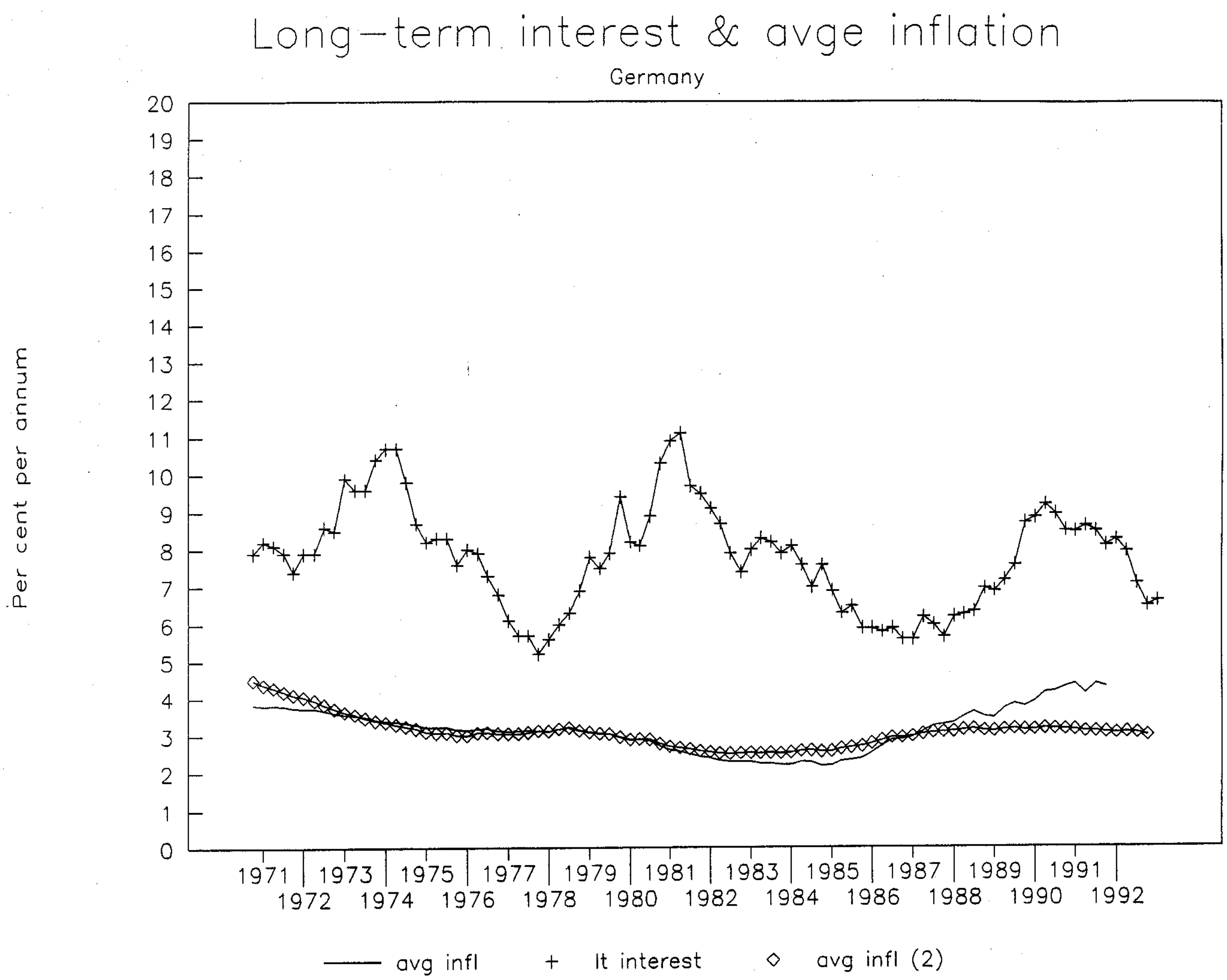
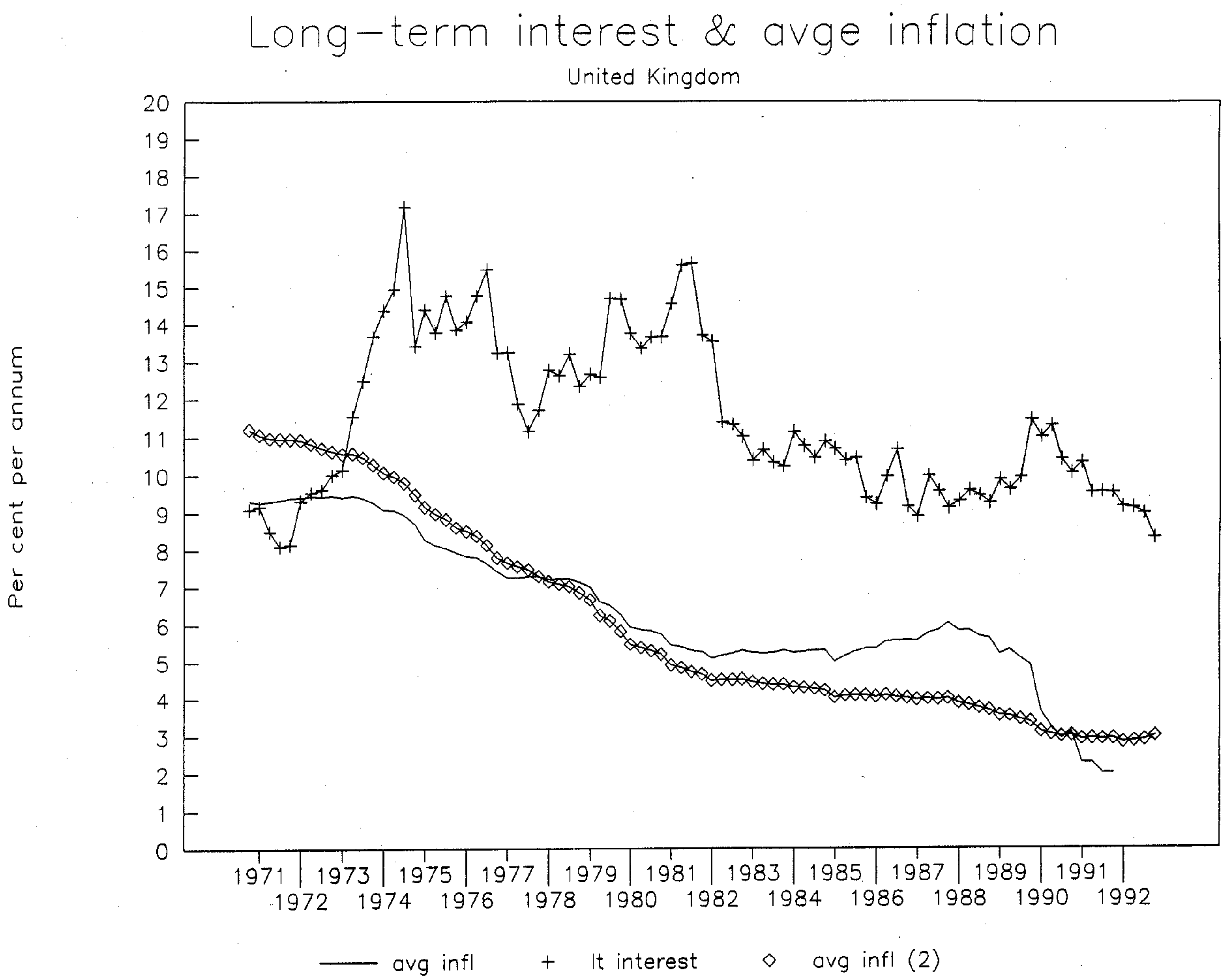


Long-term interest & avge inflation
Ireland
Per cent per annum
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
avg infl
lt interest
avg inf (2)


Long-term interest & avge inflation
Germany
Per cent per annum
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
avg infl
+ lt interest
◇ avg infl (2)

16

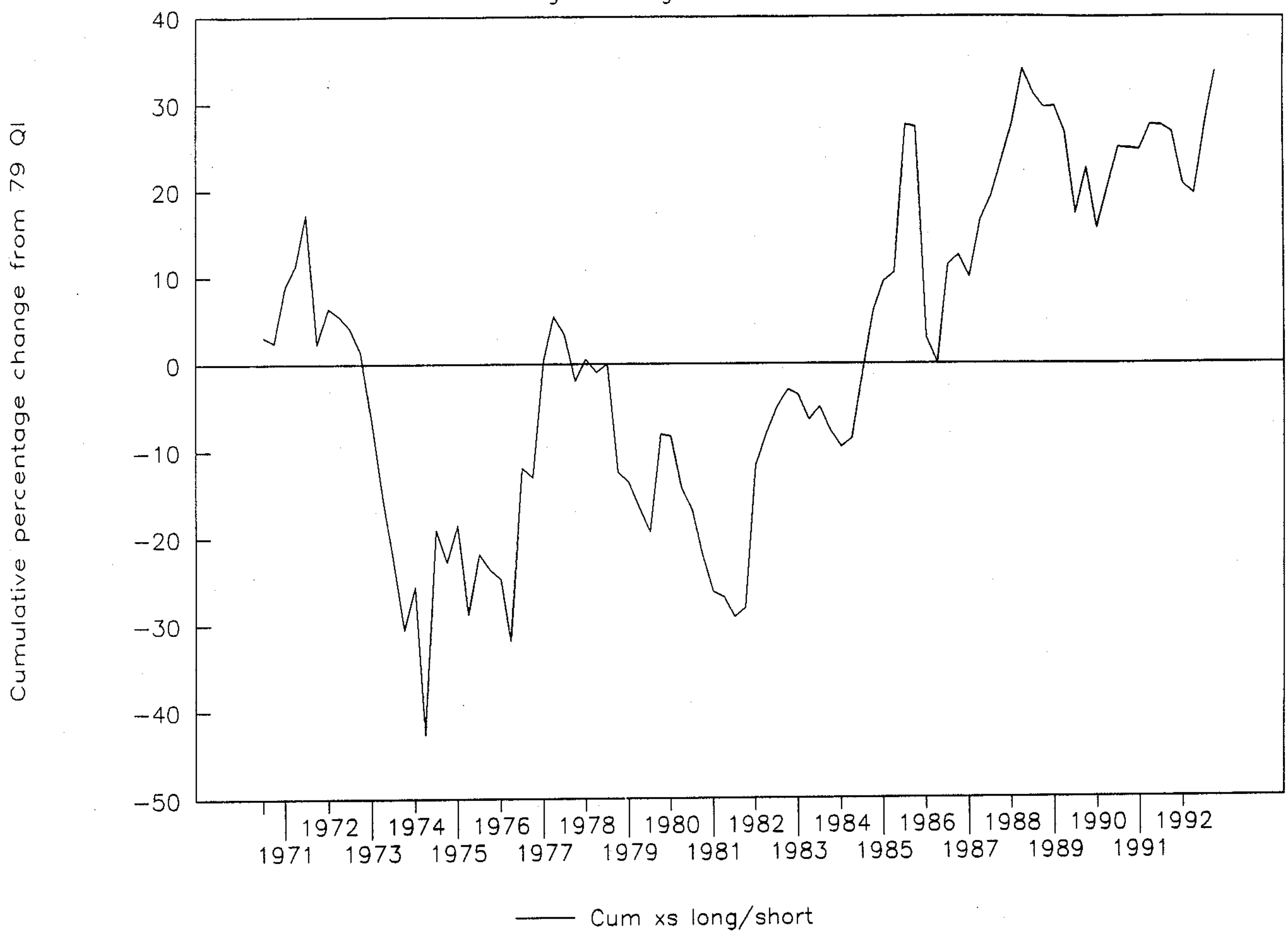


Long-term interest & avge inflation
United Kingdom
Per cent per annum
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
avg infl
lt interest
avg infl (2)

١٦

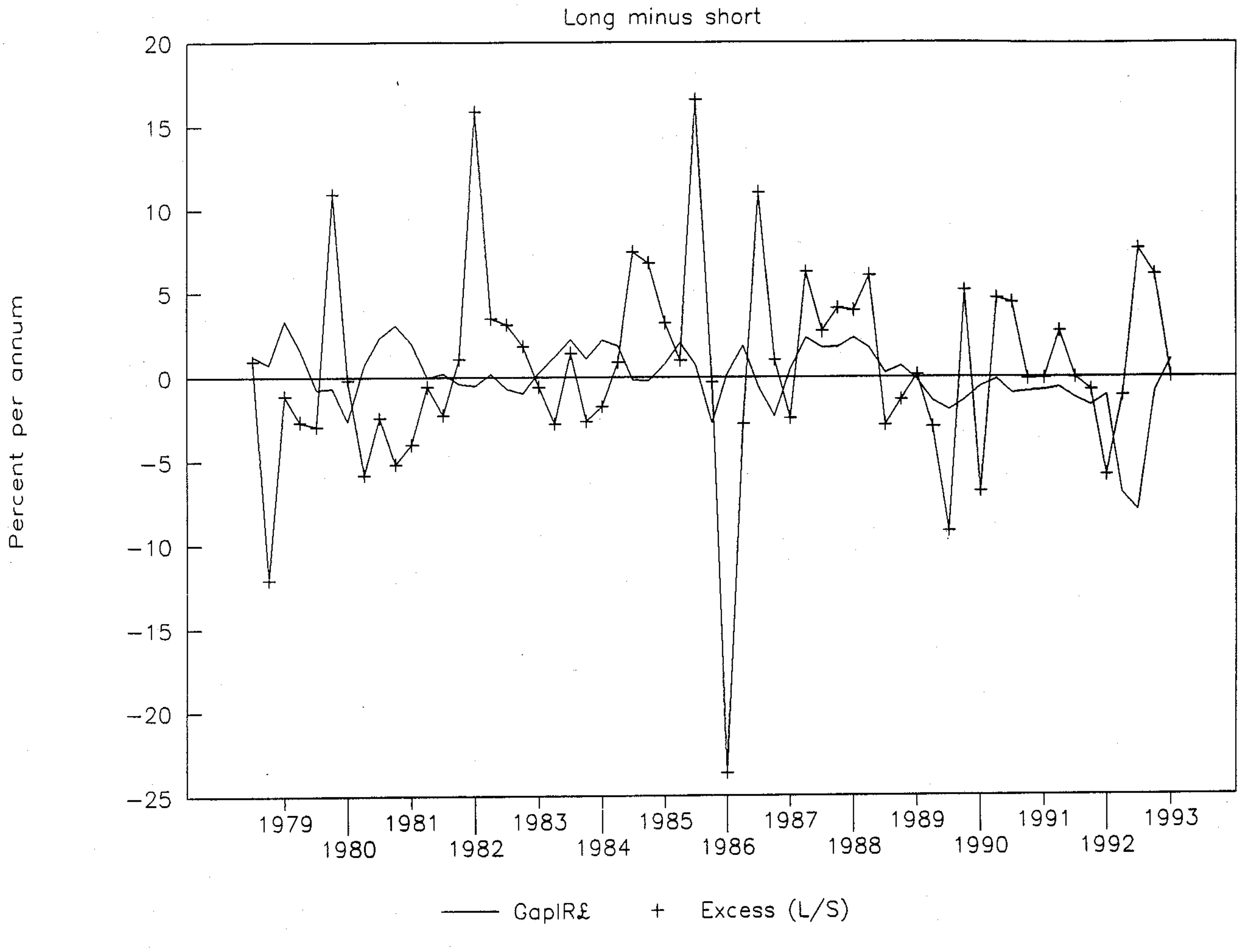
Cumulative Excess Retns on Irish Assets

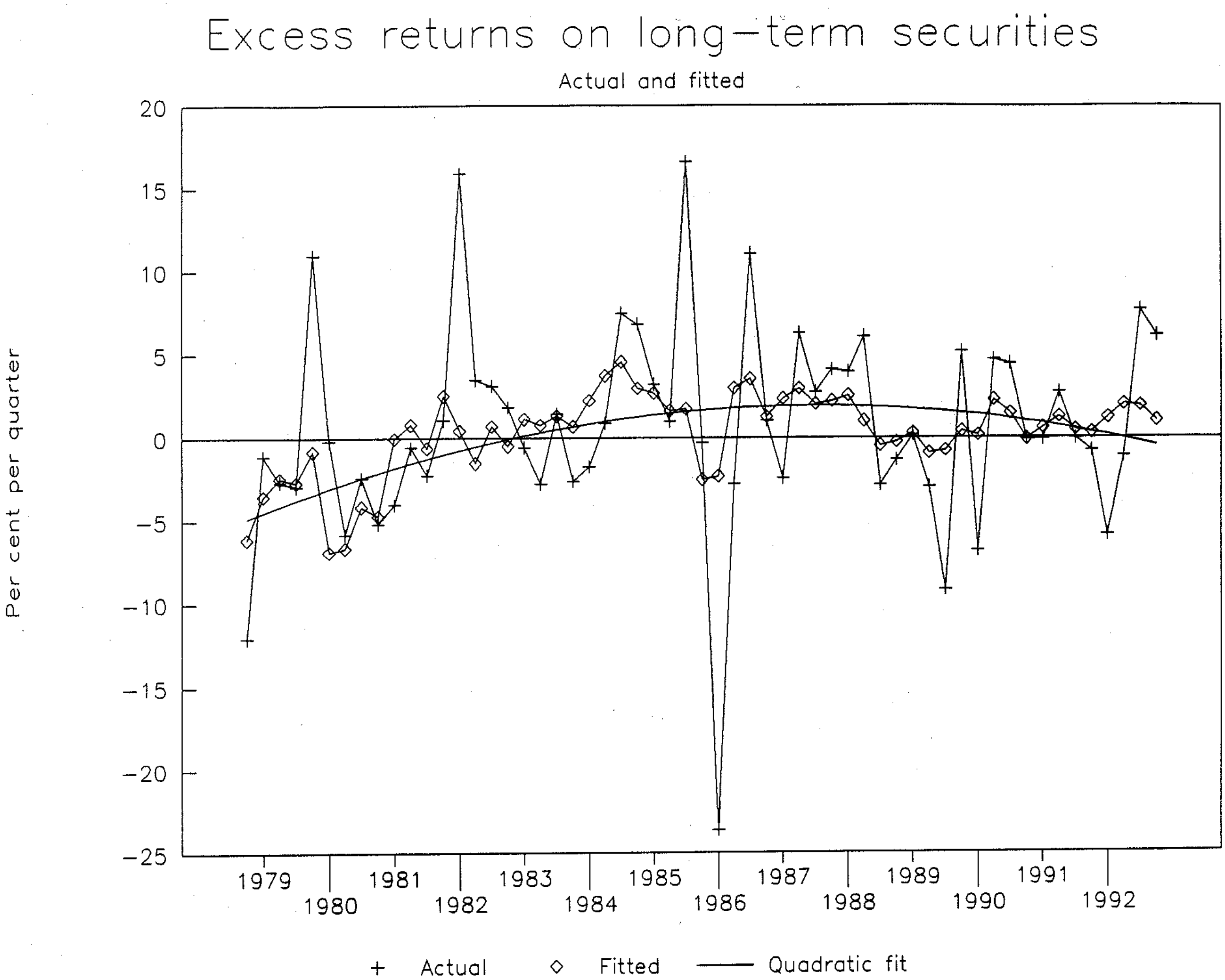
Long–term against short–term



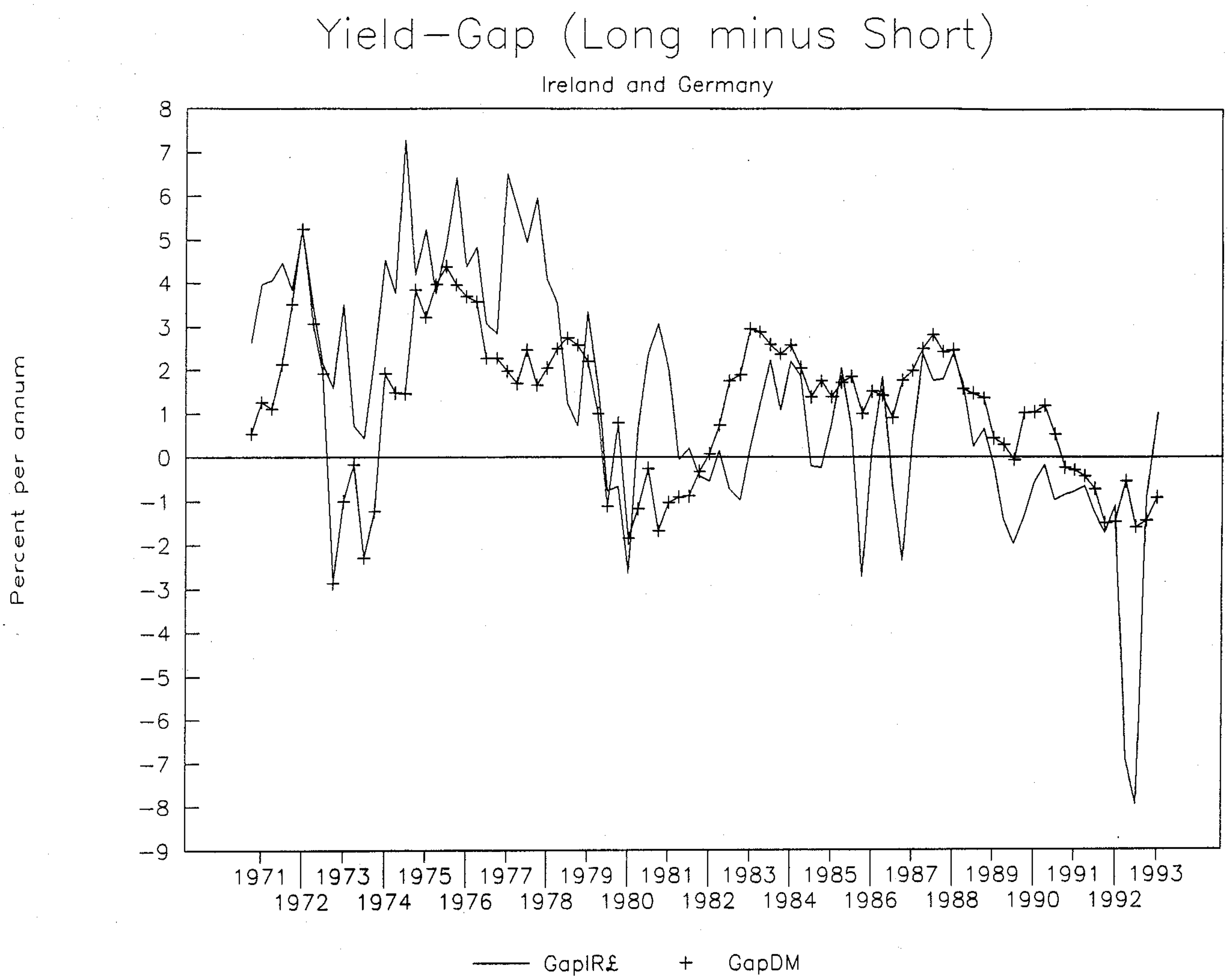
18

Yield–Gap and Excess Return

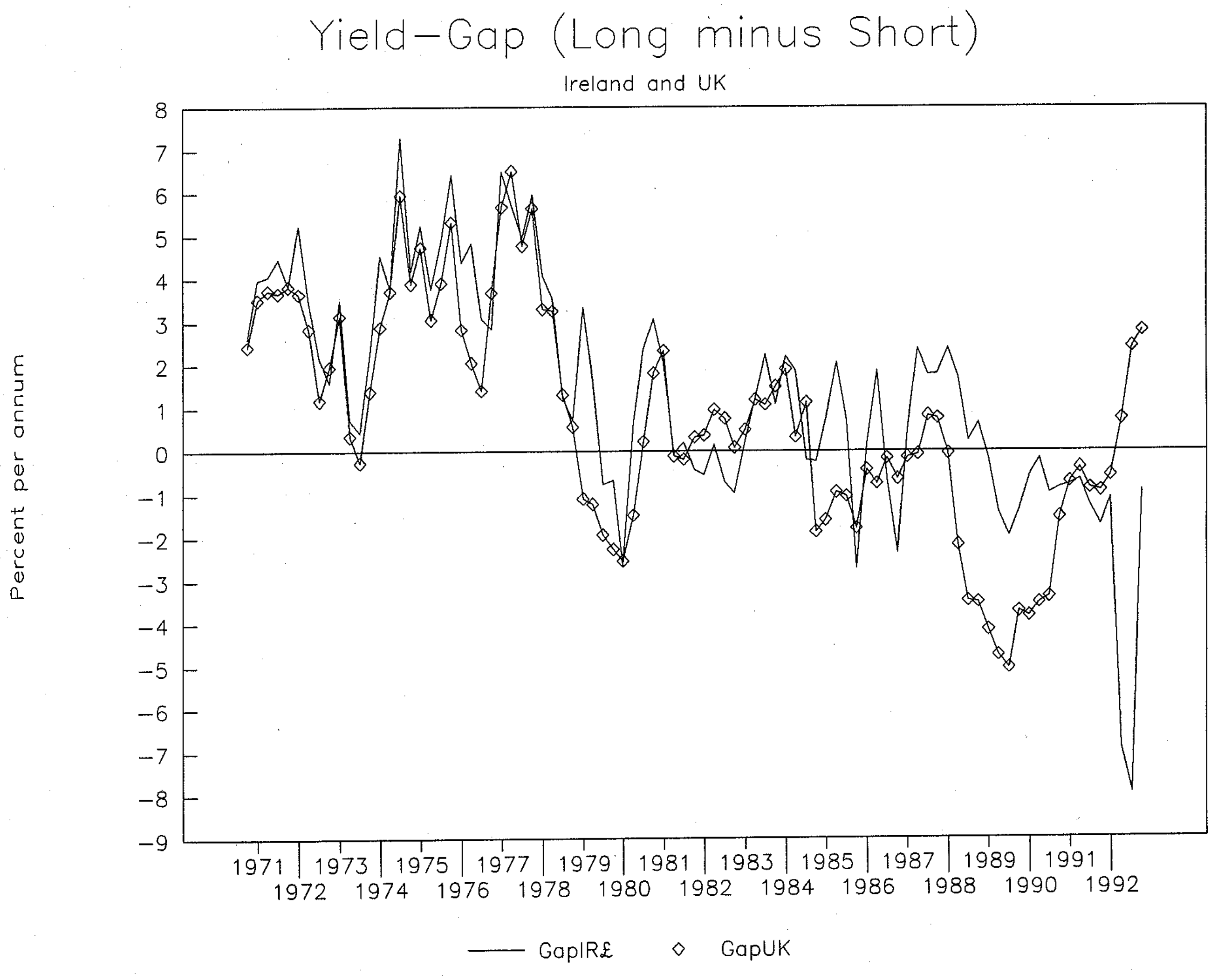



Excess returns on long-term securities
Actual and fitted
Per cent per quarter
20
15
10
5
0
-5
-10
-15
-20
-25
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
+ Actual
◇ Fitted
Quadratic fit

20

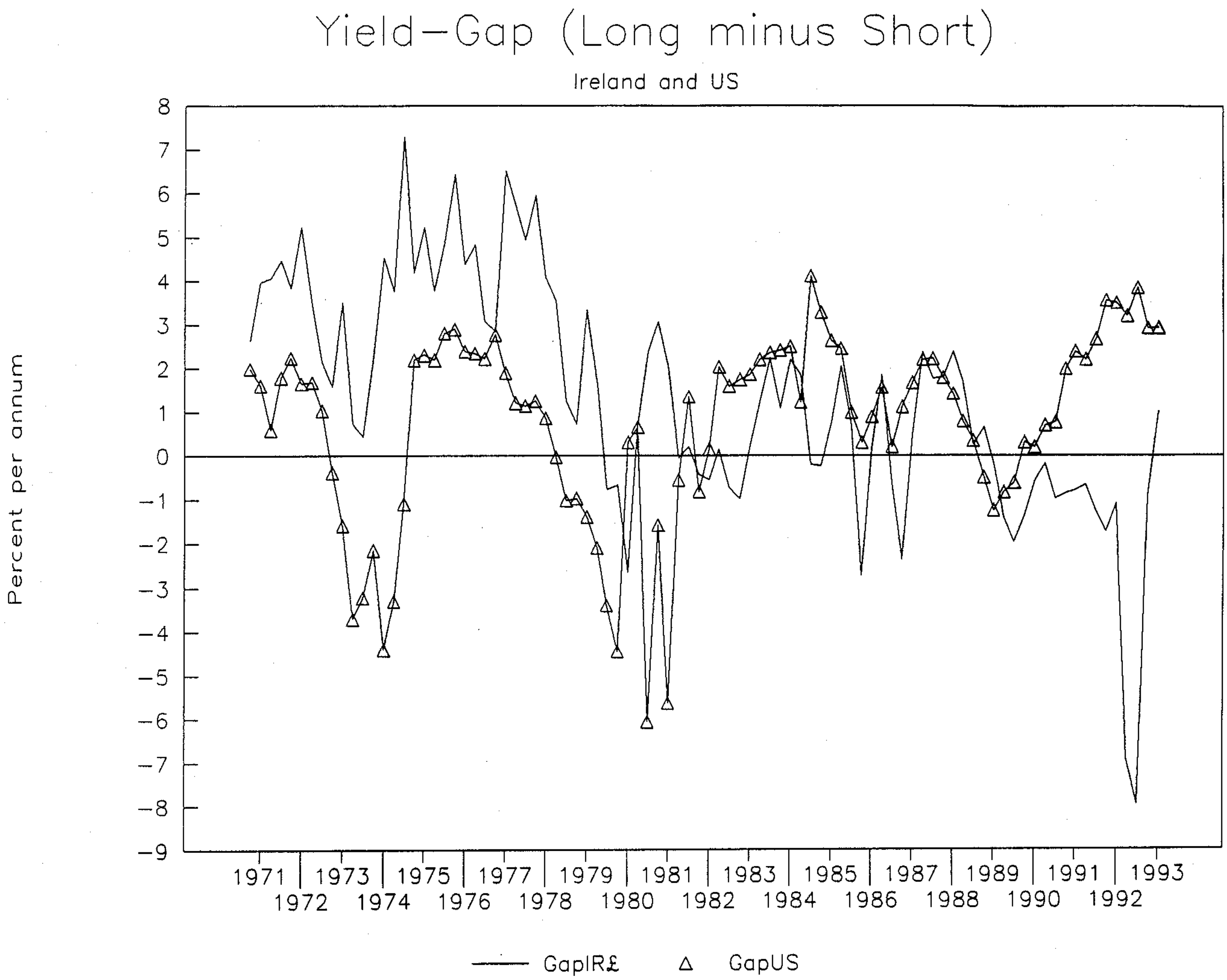

Yield–Gap (Long minus Short)
Ireland and Germany
Percent per annum
8
7
6
5
4
3
2
1
0
−1
−2
−3
−4
−5
−6
−7
−8
−9
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
GapIR£
GapDM

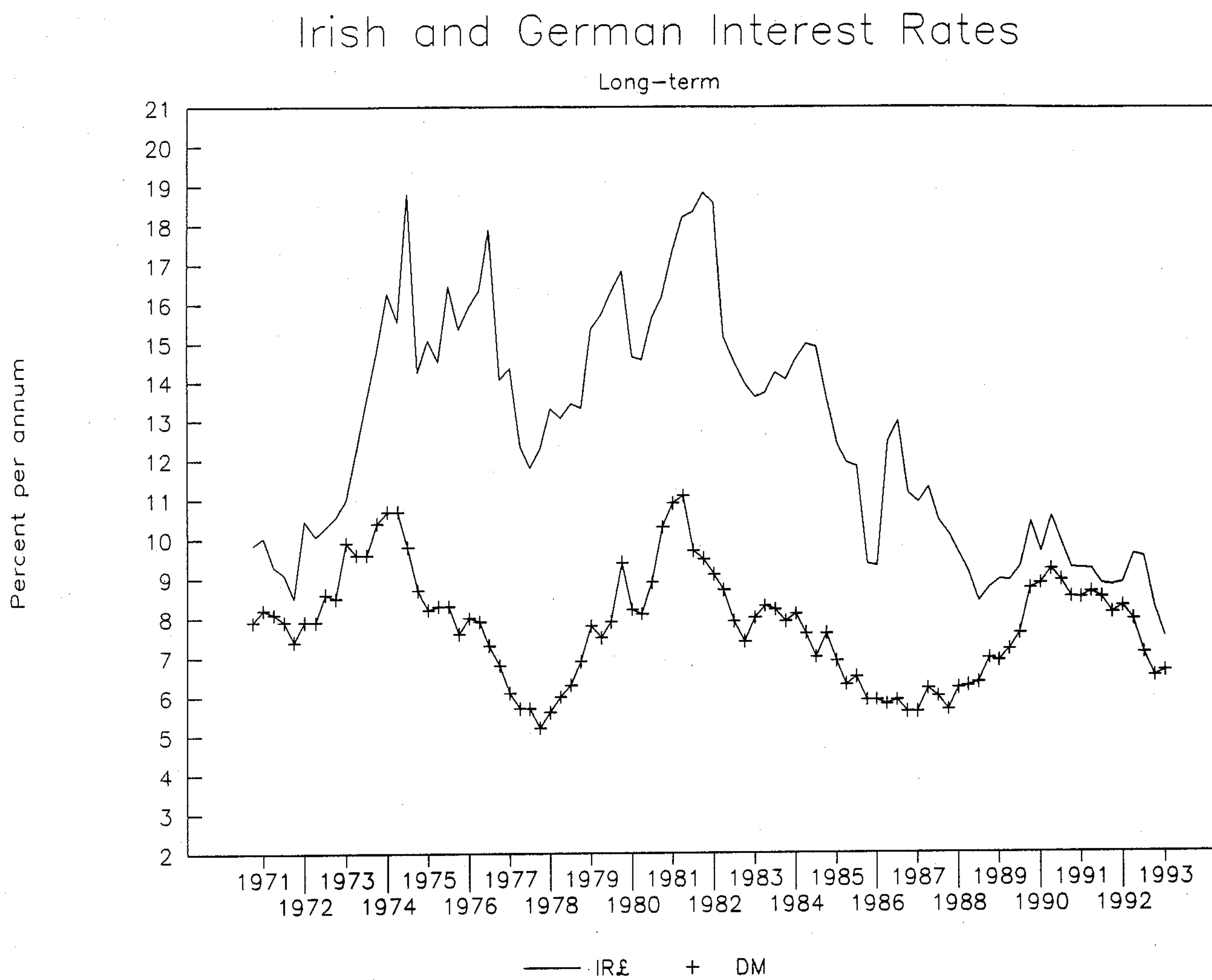
2↑

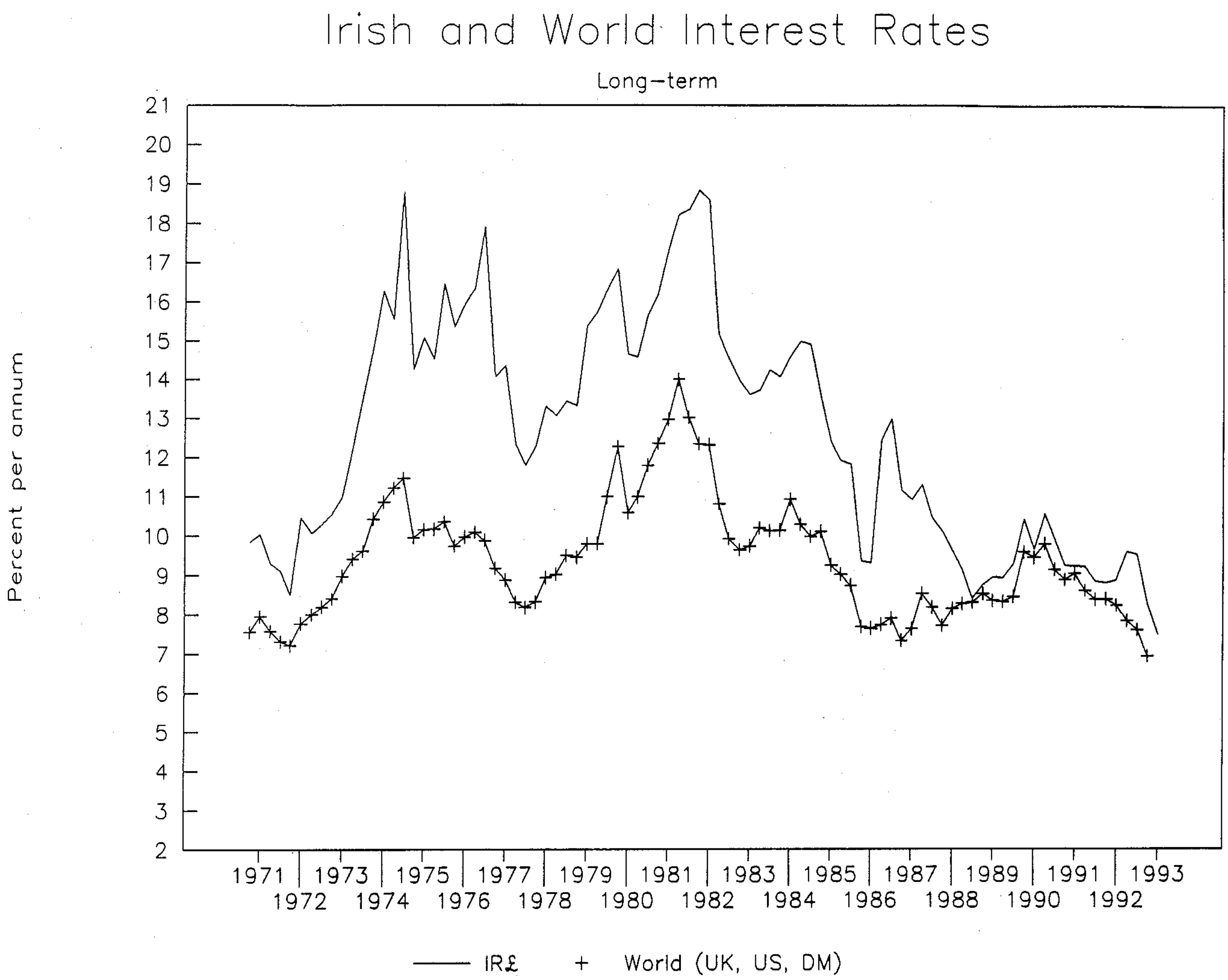


Yield–Gap (Long minus Short)
Ireland and UK
Percent per annum
8
7
6
5
4
3
2
1
0
−1
−2
−3
−4
−5
−6
−7
−8
−9
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
GapIR£
GapUK

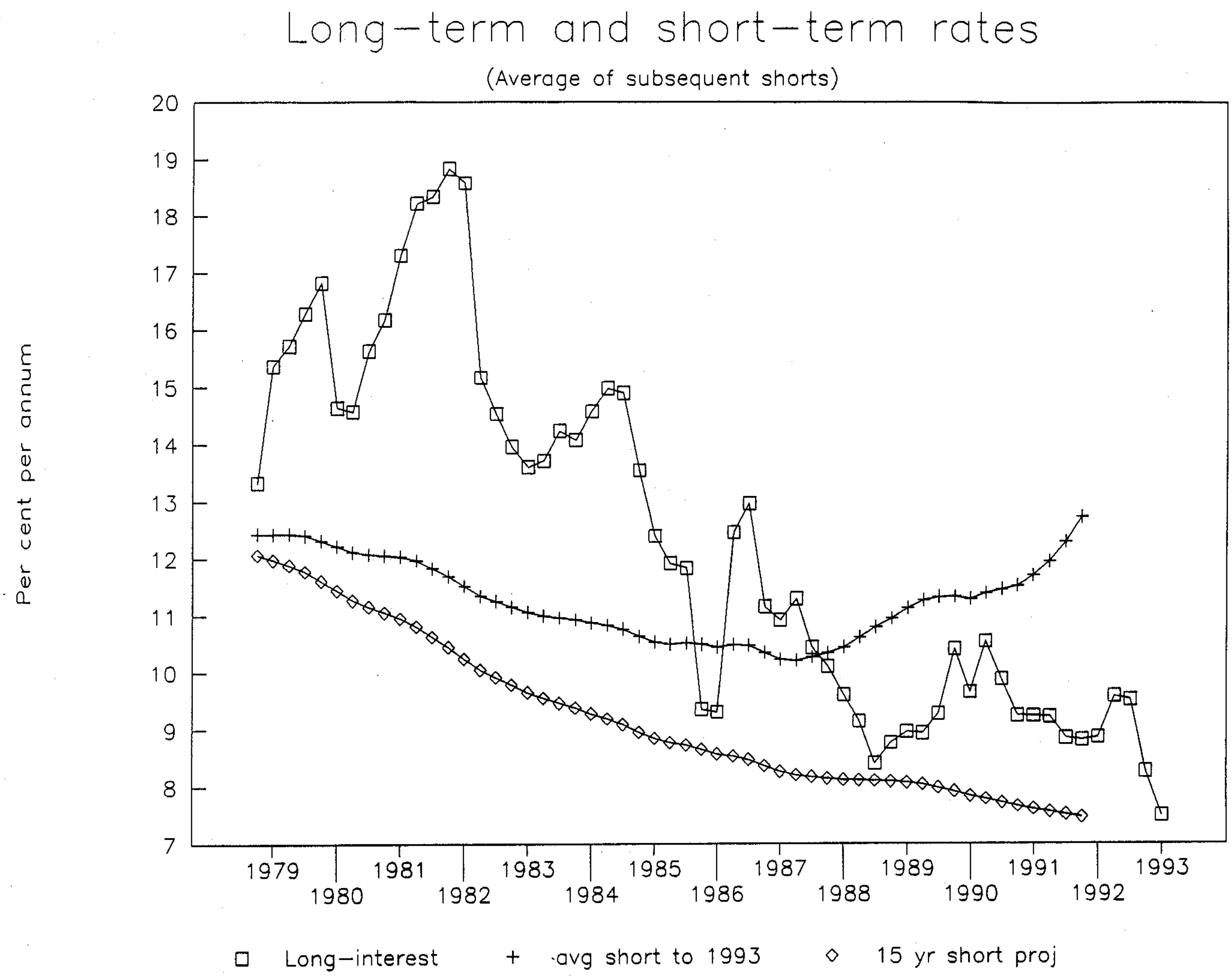
22


Yield-Gap (Long minus Short)
Ireland and US
Percent per annum
8
7
6
5
4
3
2
1
0
-1
-2
-3
-4
-5
-6
-7
-8
-9
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
GapIR£
GapUS

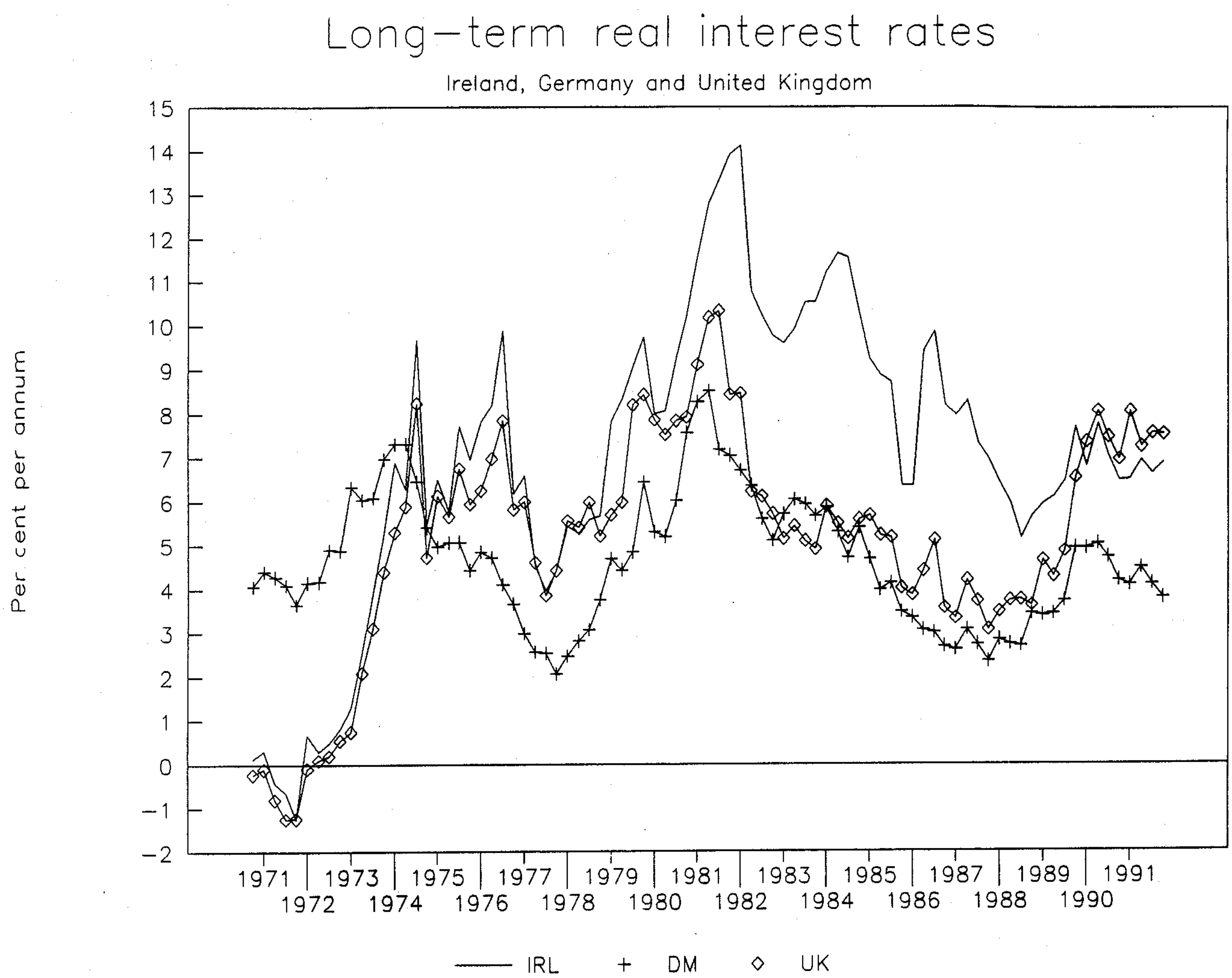

Irish and German Interest Rates
Long-term
Percent per annum
21
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1971 1973 1975 1977 1979 1981 1983 1985 1987 1989 1991 1993
1972 1974 1976 1978 1980 1982 1984 1986 1988 1990 1992
IR£
+ DM


Irish and World Interest Rates
Long-term
Percent per annum
21
20
19
18
17
16
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
IR£
+ World (UK, US, DM)

25



Long−term and short−term rates
(Average of subsequent shorts)
20
19
18
17
16
15
14
13
12
11
10
9
8
7
Per cent per annum
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
Long−interest
avg short to 1993
15 yr short proj


Long-term real interest rates
Ireland, Germany and United Kingdom
Per cent per annum
15
14
13
12
11
10
9
8
7
6
5
4
3
2
1
0
-1
-2
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
IRL
DM
UK

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