DYNAMICS OF THE IRISH GOVERNMENT SECURITIES MARKET

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Declaration

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ABSTRACT

In this dissertation, the dynamics of the Irish government securities markets over the last eighteen years are analysed. The first chapter fits and models the Irish term structure of interest rates using a bootstrapping spline methodology. Problems such as a lack of sufficient data, particularly for the longer maturity dates, very significant outliers at the short end and the behaviour of bonds with embedded options are discussed and addressed. This is followed by estimates of the parameters for the stochastic process followed by the Irish term structure. The findings have important ramifications for the suitability of particular arbitrage free term structure models of the behaviour of bond values.

The microstructure underlying the term structure is examined together with the efficiency of the existing agency structure. Using the revenue and cost functions of the agency structure, the microstructure is analysed. The viability of market making is investigated. The moments of the primary dealers profit probability density function are identified and simulated on an annual basis. Primary dealing is developed and integrated with actuarial ruin theory to quantify market maker's capital requirements and the probability of the failure of a primary dealer system is estimated.

These findings are applied to different types of financial institutions in order to identify their investment freedom. A continuous trading model is used to develop a contingent immunisation analysis and apply it to portfolio management to model how these firms move from an immunised portfolio allocation.

KEY TO MATHEMATICAL SYMBOLS

$r(t)$	-	vector of a set of spot rates
$d(t)$	-	vector of a set of discount present value values
P_i	-	price of a default free par bond
$CF_i(t)$	-	expected cashflow at time t
T	-	length of time to maturity
α_l	-	coefficient applied to approximating function
$p(x)$	-	polynomial of order n or of degree less than n
$B_p^k(t)$	-	a k-order B spline
y(t)	-	gross redemption yield for bond maturing at time t
P	-	price vector
CF	-	cash flow matrix
V	-	the present value vector
r_t	-	spot rate of interest for maturity t
f_t	-	forward rate of interest for maturity t-1 to t
$u(x,t)$	-	temperature in a long thin uniform bar of material its temperature varies only with distance *x* along the bar and with time *t*
$-\delta u / \delta x$		temperature gradient
S	-	asset
μ	-	expected return on drift
σ	-	volatility and represents the stochastic shock
dz	-	infinitesimal change in a Wiener process
dt	-	infinitesimal interval of time
$f(S)$	-	function of the asset value is continuous
P	-	Portfolio

Δ - fraction of opposite position in other asset

dP - infinitesimal change in portfolio value

$\lambda\, dt$ - excess return earned over the spot risk free rate

$\alpha(\gamma - r)$ instantaneous drift of the process brings the stochastic rate towards long term average γ with a power α which is proportional to the deviation of the process from the mean

p_S - Bid Price

$\lambda_S(p_S)$ - Market Makers Demand For Sell Orders

p_B - Offer Price

$\lambda_B(p_B)$ - Market Makers Demand For Buy Orders

$I_c(0)$ - Initial Cash Position

p - Price

$r_{\text{Market Maker}}$ – Required return on bond market making activities

$r_{Risk\ free}$ – Required return on money market

$\beta_{Market\ Making}$ – Beta coefficient of bond market making activities

$r_{Equity Market}$ – Required return on equity market

A_t - Present Value of all assets at time t

L_t - Present Value of all liabilities at time t

α_t - Proportion by which A_t exceeds L_t at time t

t(x) - Duration of cash flow vector x

c - coupon payment on bond per unit time

y - yield or internal rate of return on the bond

n - term to maturity of the bond

P(cn;y) - price of the bond

v - discount factor

R	-	redemption value per unit nominal
b_t	-	borrowing for the payment of the liability maturing at time t
i_t	-	cost of borrowing for the period t
B_O	-	total borrowing at time 0.
αA_t	-	mismatch reserve
A_t	-	endowment of assets
${}_3A_t$	-	mismatched assets
ε	-	insolvency ruin barrier
β	-	proportion of mismatch and ${}_2A_{t+1}$ divided by ${}_3A_{t+1}$
$f(A)$	-	probability density function of daily price movement of the immunising asset portfolio
$g_A({}_3A)$	-	probability density function of daily price movement of the mismatched asset portfolio.
${}_1A_t$	-	random value of the immunising asset portfolio at time t
${}_3A_t$	-	value of the mismatched asset portfolio
$C - e^{-r}\alpha A_t$		option premium
$\alpha A_t = C$	-	amount available for mismatching
σ_1^2	-	variances of the mismatched assets
σ_2^2	-	variances of the immunising assets

Chapter 1

Introduction

1.1 Introduction

The objective of this dissertation is to investigate the Irish government bond market from several perspectives, namely: bond pricing, the evolution of the Irish term structure, the microstructure of the Irish sovereign debt market and an analysis of the Irish general insurance sector as a user of the market.

While Kearney (1985) modelled the gross redemption yield[1] curve and the demand for money, there has been no work done on the measurement of Irish spot rates. Economists like Kearney (1985) have used the gross redemption yield curve in their econometric modelling, but did not question whether such yields are the most appropriate measure of Irish interest rates. Their approach is probably largely due to the difficulty in accessing the raw data to estimate the spot rates. Consequently, there is no body of research on the dynamics of Irish interest rates and the most efficient approach to the management of interest rate risks.

The cost of government borrowing in Ireland has been a focus of attention for the government, investors, other borrowers and academics for a very long time. Norton (1974) completed the first study on Irish government borrowing and his concern is the impact of varying debt service costs on future economic plans. If investor behaviour is correctly understood, the relationship between yields of different maturities can be investigated in relation to expectations[2] about how interest rates change through time.

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[1] The gross redemption yield of a bond is that discounting rate which when applied to all future cashflows of the bond will generate a present value equal to that of the current price of the bond in the market.

[2] There are at least three schools of thought on the term structure; namely: Preferred Habitat, Liquidity Preference and Rational Expectations.

Early work[3] by Fisher (1930) examined borrowing for different time periods, hence the name, 'term structure'. In Fisher's (1930) model, a two time-period horizon is assumed and there is an endowment of wealth in both time periods. Fisher (1930) modelled an agent who borrows or deposits against his present and future endowments in order to maximise utility over his time horizon. Fisher's (1930) model is extended to a series of time periods covering an individual's life with expectations about the level of income and consumption along with their respective variances. An individual seeks to maximise his utility and can expect to borrow or lend between different periods of his life. The term structure of yields acquires greater significance as governments and supranational organisations interact with investors (with international capital mobility and liquidity) who seek to redistribute or diversify their wealth on behalf of themselves or their principals.

1.2 Identification & Quantification of Term Structure

In chapter two, the spot term structure of interest rates between 1980 and 1997 is estimated. Knowledge of spot rates is necessary in order to investigate the process underlying the term structure and to investigate the market's efficiency or bias in estimating future interest rates.

The development of the Irish government debt market over the past eighteen years is documented to serve as a database from which to estimate parameters. Considerable problems are faced due to lack of data. As mentioned above, there has been some work concerning gross redemption yields in the macro and monetary economic area[4]. The selection of term structure model is discussed along with sources of market data and sampling problems. Raw data from past dealing sheets has been collected for eighteen years.

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[3]Charging interest stretches back into ancient times. It is forbidden to members of the early Christian Church and left to the Judaic races to provide the service. Theologians such as St.Thomas Aquinas has spoken about the social justice of money lending and some Islamic countries have usury laws on their statute books.

In the Irish market the prices of zero coupon bonds are not observed, so their prices and corresponding term structure must be estimated from a set of coupon bonds issued by the government. The economic background to national debt management is described along with changing market conventions. A bootstrap methodology is used to generate the prices of notional zero coupon bonds from those of coupon-bearing bonds.

Mathematical functions known as B Splines with a number of knots are fitted to discount factors, spot rates and forward rates, and the optimal technique is chosen for the fitting of the bootstrapped spot rates. Significant outliers over the entire sample period are identified and excluded from the data set. The results of estimation are analysed and used to parameterise the discount function appropriate to bond pricing. Since only government securities denominated in their own currency are considered, default risk is not considered an issue. The Irish term structure has been estimated for the first time.

1.3 Modelling the Stochastic Process

With the spot rates estimated in chapter two, the process underlying the term structure is investigated and it is established that three factors describe the evolution of the term structure over the sample period. The principal components of the changes in spot rates are estimated and they demonstrate that the time series of Irish term structure is similar to that found in other studies. The results of the previous chapter are used to identify the parameters that drive the Irish term structure over a particular time horizon to generate a risk profile of the changes in value of government debt in chapter four.

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[4]Kearney (1985) examined the short and long gross redemption yields rather than the spot rates.

1.4 Microstructure of Irish Government Bond Market

The microstructure of the Irish government bond market, which generates the term structure, is investigated. The hypothesis to be tested is whether a competitive dealership market could be supported and would be preferable to the then existing agency microstructure. The Irish market is small relative to its European peers and constitutes around 1% of the debt of European Union sovereign country debt.

The issues concerning the authorities are: the different costs associated with different structures; immediacy; liquidity[5] and transparency. The relevant literature on microstructure is reviewed and the historical performance of the agency market is examined. An industry analysis for financial intermediation is developed to determine the capacity for transformation of the market from an agency-based order-driven system to a principal-based market-making system.

The approaches taken in the literature to financial intermediaries, trading limits and market making are discussed. The European Union Capital Adequacy Directive is investigated to see if it is adequate for the Irish market in terms of prescription of risk capital. This is followed by a simulation in a Monte-Carlo framework for a primary dealer to establish whether such a structure is viable using the term structure estimation methodology of chapter two and the analysis of the process in chapter three. A model of the daily profitability function appropriate to a primary dealer is fitted and examined. The likelihood of failure of a market maker over a trading year time horizon is simulated and the conclusion is that a competitive dealership market could be supported.

[5] Liquidity is defined as the limit of the size of a transaction upon which the market price can be dealt.

1.5 Free Mismatch Reserves of Irish General Insurance Companies

The Irish general insurance market is analysed by using the estimates of the discount factors of the term structure from chapter two, to identify its immunising portfolio. To do this, a framework is developed in which managers attempt to maximise the value of the funds under management, subject to a minimum terminal value. The performance of the companies under such a strategy is compared with their actual achievements and those that would have occurred if their portfolios had been immunised. The performance is found to be highly varied and important implications for the insurance industry can be drawn. There is a greater investment risk taken relative to that required to immunise their liabilities and most of the excess investment return is used to subsidise underwriting losses. This is true for the majority of the insurers for all the data points in the time series.

A method of overcoming the problems of illiquidity and asset span in the set of possible Irish fixed income assets, is developed using interest rate swaps[6]. By using interest rate swaps to increase duration, long-term liabilities can be immunised. A reconciliation of duration is calculated to illustrate that immunisation had been achieved. A model portfolio with a simple liability is formulated and required immunisation by appropriate allocation of Irish bond assets.

The concept of mismatch reserve is developed over a one-year time horizon. The contingent claims analysis framework is used to value the mismatch reserve as an at the money relative performance option of two portfolios, the matching immunised portfolio and a mismatching portfolio. This is illustrated with an Irish general insurer's accounts and statutory returns.

[6] The interest rate swaps would still have a residual credit risk, but this risk is minimised with the NTMA being the principal originator of 97% of all fixed rate bonds and the government's historical implicit guarantee of the local banking market.

The historical liability profile of the industry is reviewed and the actual investment performance by the industry as a result of mismatching is estimated under a given set of assumptions. The general insurer sector is investigated because it represents 10% of the bond market and its liabilities can only be matched with Irish assets. It is also very heavily dependent on investment performance.

Chapter 2

Term Structure of Irish Interest Rates : 1980 - 1997

2.1 Introduction

The term structure of interest rates represents the pricing relationship that exists at any point between default-free[1] securities arrayed by maturity. The objectives of this chapter are; first, to identify discount factors from existing bonds trading in the secondary market using a bootstrapping methodology; second, to estimate the discount function; and third, from the discount function to estimate the spot[2] curve along with the forward rates. The purpose is to present the first ever estimation of the Irish term structure.

This chapter is divided up as follows; section two reviews the background of the recent history of the Irish government securities market; section three examines the selection of a term structure model; section four discusses sources and inadequacies of market data; section five investigates the bootstrap estimation of the term structure and applies the estimation of the discount function to bond pricing; section six presents the summary and conclusions.

An estimation of the term structure is required to examine the evolution of Irish interest rates through time in chapter three. In that regard, apart from Exchequer Bills that have maturities less than 270 days and Exchequer Notes[3] that have maturities less than 365 days, there have been no discount securities in the Irish market. It is proposed to introduce a strips market in 1999. The sample data cover the period 1980 to 1997 at six monthly intervals.

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[1] This only holds for governments for debt denominated in their own currency which, as a last resort can be printed to repay the debt. A default free bond is defined as one for which at any point in time in the future, the probability of the occurrence of the cash flow is 100%. Even this assumption is contingent on the political stability of the sovereign nation; since the world has seen defaults by Russia and China this century. At a more subtle level, there have been partial defaults in real terms over the past three decades by many nations with the inflation of the early 1970s and early 1980s.
[2] In financial markets, this is referred to as the zero coupon curve or pure discount or spot rates and is used when there is only one future cash flow being discounted to its current price.
[3] The National Treasury Management Agency (NTMA) which manages Irish government debt on a daily basis for the Minster for Finance is replacing the Exchequer bills which were only issued on a Wednesday for 1,3,6,9 months via a

Daily Irish data on yield curves from 1980 to 1997 have been compiled from the dealing sheets of the four principal Irish brokers and the Irish Stock Exchange tickets that are reported to the Exchange. There remains a problem with paucity of data on an intra-day basis. Consequently, similar care is necessary in relation to tax effects that have been identified in the studies by Chambers, Carleton & Waldman (1984) in the US or Steeley (1988) in the UK.

2.1.1 Overview

Fisher (1930) first examined the term structure in the context of deferred income or saving in a two period model. Term structure of interest rates is defined as the vector of spot rates *r(t)* arrayed by maturity. The discount values *d(t)* arrayed by maturity, corresponding to the present value or price of IR£1 to be received at time t in the future is an alternative form of the term structure, being the inverse of the compounded spot rates.

Spot rates are used when valuing individual cash flows, in particular those of coupon bearing fixed income securities, (which are then seen as comprising a portfolio of individual zero coupon bonds). Term structure estimates are required to test the theories of the evolution of the term structure as in Ho and Lee (1986), and for normative uses such as the development of portfolio immunisation strategies as in Fisher and Weil (1971). Term structure estimates are used for direct valuation of cash flow streams and the pricing of fixed income securities (Houglet (1980)), pricing a bond as a series of individual stripped cash flows, and the valuation of futures contracts and contingent claims (Brennan and Schwartz (1977)).

Spot rates have been used to estimate a liquidity premium (McCulloch (1975a)); to assess the effect of taxation on bond yields (Schaefer (1981)); to assess consensus expectations of future interest rates, together with the analysis of the accuracy of such market implicit forecasts (Fama (1975)); and to arbitrage between bonds of different maturities.

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tender auction with notes which can be issued at any time for any maturity up to a year and in which they maintain a two way price. A strips program similar to that in the US is under consideration.

However, because there are no pure discount Irish government securities (zero coupon bonds) for maturities exceeding one year, the term structure of spot rates cannot be immediately observed and, accordingly, an indirect approach must be followed. Thus implied discount factors may be extracted from interest rates payable on coupon bearing securities. As discussed later, such an extraction process is complicated by the pricing disturbances, such as the irregularity of the dates on which coupons are paid.

2.2 Recent History of Irish Government Securities Market

A market valuation of National Debt[4] denominated in Irish pounds at six monthly intervals from Spring 1980 to Autumn 1997 inclusive has been constructed. In exhibit 2.1, the nominal amount of Irish debt outstanding from the Central Bank of Ireland's Annual Reports at certain dates is compared to the market's mark to market valuation. For most of the time period the market value lies below the nominal value, implying that the average yield is higher than the average coupon due to a rising yield environment.

[4] Debt which is denominated in foreign currencies or raised in the money market which is not an obligation of central government and had a first floating charge over receipts into the Central Fund of tax receipts has been excluded.

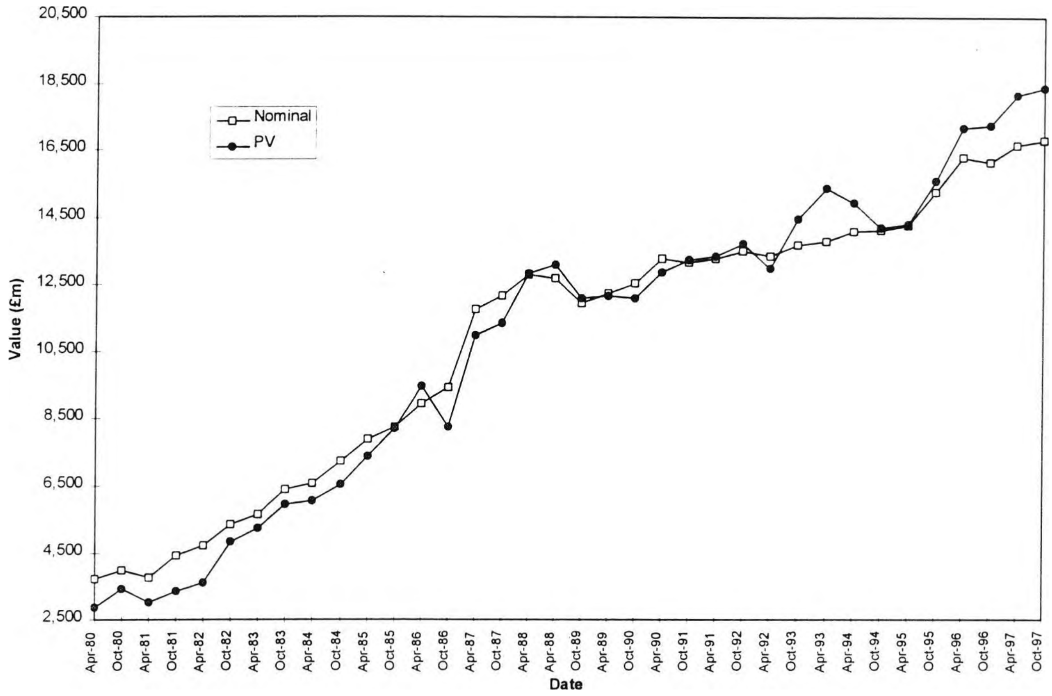

Exhibit 2.1 Irish National Debt Denominated in Domestic Treasuries

Source : ABN Amro Stockbrokers, Central Bank of Ireland & Empirical data

The semi-annual increase in debt outstanding has been approximately linear, amounting to an extra IR£374m in nominal terms and IR£444m in market value terms. The secondary market value of the debt stood at a twenty percent discount to nominal value for the early eighties but fell to eight percent for the last decade. These changes are illustrated in exhibit 2.2 below;

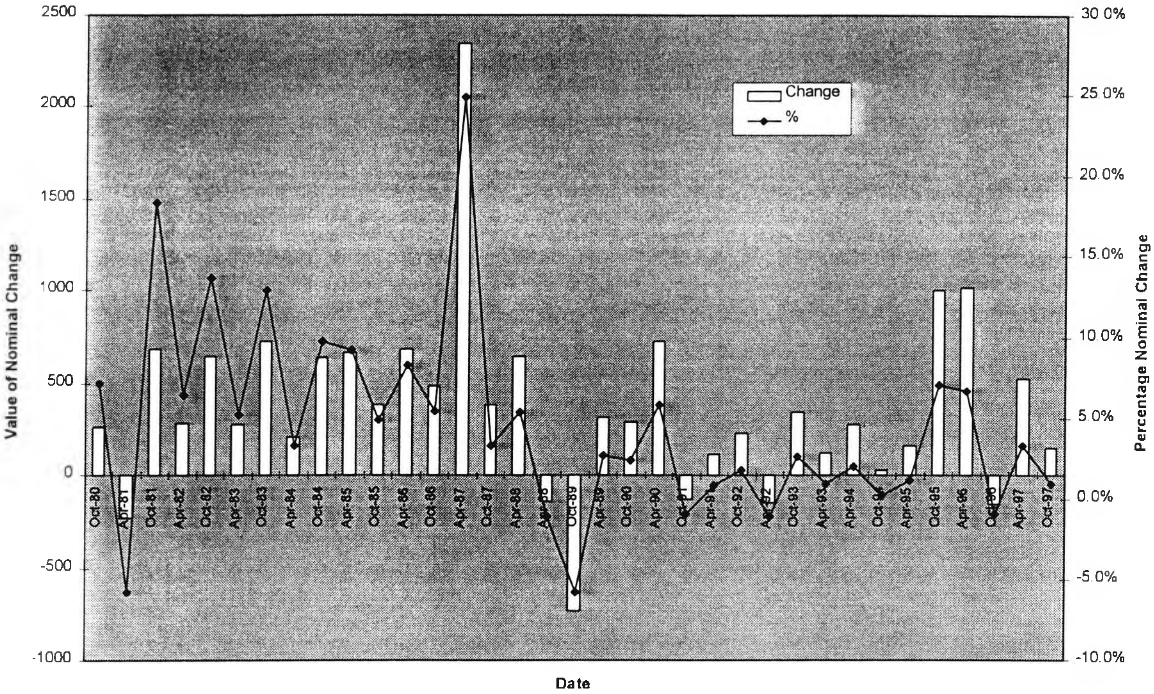

Exhibit 2.2 Changes in Irish National Debt Denominated in Domestic Treasuries

Source : ABN Amro Stockbrokers & Empirical data

Duration and maturity of the National Debt during the time period 1980 to 1997 is examined and shown in exhibit 2.3. While the maturity moves in a cyclical pattern between 5.25 years and 9.25 years, the duration is in a much narrower range. The financial crisis of the second half of 1986 can be clearly seen, when the government raised an extra IR£2.4bn after yields rose 600 basis points from the first half of 1986. This crisis compounded the country's financial problems because the funding involved issuing long dated maturity bonds reversing a policy of the previous decade which only issued short dated maturity bonds.

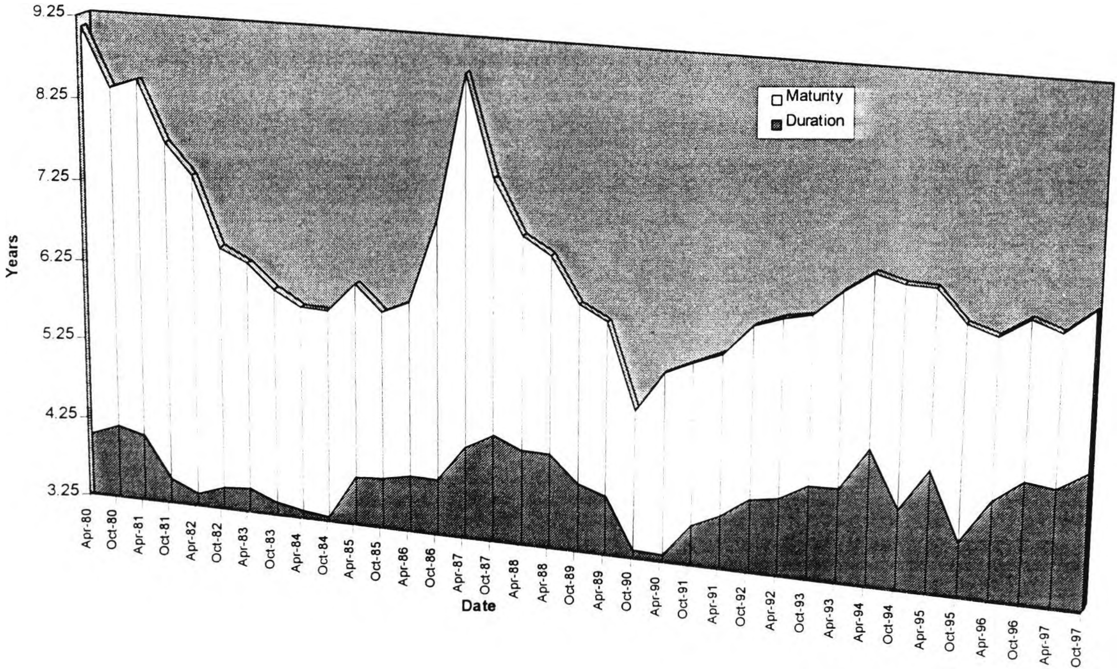

Exhibit 2.3 Characteristics of Irish Domestic Treasuries Market

Source : ABN Amro Stockbrokers & Empirical data

The average duration of the debt over 1980 to 1997 is 4.02 years and, interestingly, it lay in a relatively narrow range of 3.28 years to 4.88 years throughout the study. The average maturity dropped from the start of the 1980's to April 1986 implying a decision by government authorities to fund in the shorter maturity sector in the expectation that interest rates would fall.

Throughout the period of 1980 to 1989 exchange controls were operative. These controls were substantially removed in 1989. Since investors, such as life offices and pension funds, match a proportion of their liabilities by investing in bonds with long maturities, it is probable, with the government's funding pattern, that a shortage of suitable bonds existed and rationing prevailed in the long maturity sector of the market. If a rationing premium existed, it could have been of such a magnitude that forward rates might have been negative though spot rates remained positive.

Historical changes in maturity are illustrated in exhibit 2.4. If the government funded longer than the average duration of the outstanding stock of national debt, duration would obviously increase.

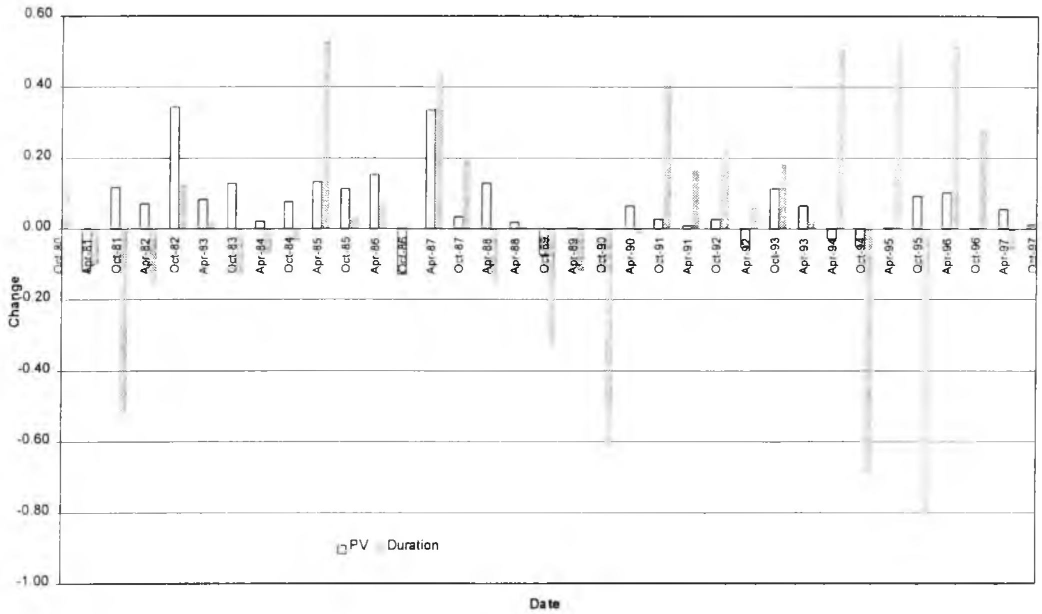

Exhibit 2.4 Funding and Timing Impact on Duration Profile

Source : ABN Amro Stockbrokers & Empirical data

The expansion in the size of the market can be explained by looking at the trend in Government borrowing over the past 15 years or so. Following the first oil crisis in the early 1970's, Ireland embarked on a policy of fiscal expansion in order to help offset the negative impact of spiralling oil prices on domestic output and demand.

The Exchequer Borrowing Requirement (EBR) increased substantially from 1975 onwards in both absolute terms and as a percentage of GNP, and, despite stringent attempts to bring it under control, the EBR remained in double digits as a percentage of GNP for most of the period up to 1987. Initially there was a large balance of payments deficit and a limited pool of domestic savings resulting in heavy reliance on foreign currency borrowing, but gradually this reliance on foreign borrowing diminished as the 1980's progressed and the emphasis shifted towards Irish pound denominated debt. The increased emphasis on Irish pound funding was facilitated by ERM entry in 1989. The termination of the fixed exchange rate between Sterling and the Irish pound meant that the Irish pound then emerged for the first time effectively as a currency in its own right. However, it is only after 1987 that Irish pound denominated debt assumed a position of prominence, when foreign institutional investors began to invest in the market as a successful effort was made to reduce the Government's overall borrowing needs and new foreign borrowing was largely eschewed against a background of a much improved balance of payments position.

Gross government debt was estimated at just over IR£27bn at the end of 1991 and the government stock denominated in Irish pounds accounted for IR£13.8bn. The rest of the IR£13.2bn debt is accounted for by Exchequer bills, personal savings products, national instalment saving and foreign currency borrowing. In 1980 Irish pounds accounted for IR£2.9bn which rose to IR£9.5bn by 1986, jumped to IR£11.4bn in 1987 and is IR£18bn at the end of 1997.

2.3 Selection of Term Structure Model

Many attempts have been made, using a variety of methods to estimate the term structure of interest rates in other markets. The earliest approaches were simple gross redemption yield curves. In the following subsections, the different approaches are examined and consideration is given to the underlying assumptions, constraints, data requirements and overall simplicity or complexity.

2.3.1 Gross Redemption Yield to maturity

The first distinction which should be made is between attempts to construct gross redemption yield to maturity (GRY) curves, and those which endeavour to model the term structure of interest rates proper, (i.e. the array of spot rates, discounts and forward rates corresponding to their associated maturities). Among the early GRY estimates, Durand (1942) and Durand and Winn (1947) were prominent.

A number of criticisms may be directed at the concept of gross redemption yield to maturity, including the following; Malkiel (1966) and Buse (1968) state that only when the yield curve is flat can the GRY be so used as a surrogate measure, (i.e. when all the spot rates are equal). Carleton and Cooper (1976) criticise the notion of GRY, stating that it is an "ambiguous concept", and that its "economic meaning was moot", in so far as the reinvestment of intermediate cash flows is expected to occur at this internal rate of return. However, this method was developed in the absence of present day computing power and has the redeeming feature of simplicity and ease of implementation.

The gross redemption yield curve is a complex mixture of discounts and coupons. Carleton and Cooper (1976) note that the averaging process implicit in calculation of a gross redemption yield destroys some important basic information, particularly with respect to coupon differences, the primary source of yield and price differentials.

Schaefer (1981) pointed out that, when the term structure of interest rates is upward sloping, the coupon effect comes into play, causing the GRY to underestimate spot rates of corresponding maturities. In particular when GRY are used as a proxy for spot rates, the errors introduced are related to the shape of the curve and typically are much greater when the term structure is steeply sloping.

Gross redemption yields are commonly used in less liquid markets (than say the US), especially in longer term. These failings are well known; GRY must be regarded as an inadequate estimate of the term structure of interest rates and this approach is rejected.

2.3.2 Discrete Estimation of the Term Structure

This procedure estimates the present value coefficients of each cash flow directly; in other words, the discounts associated with each flow represented by the following equation:

$$P_i = \sum_{t=1}^{T} CF_i(t)\, d(t) \qquad (2.3.2.1)$$

where t indexes time

P_i - price of a default free par bond[5],

$CF_i(t)$ - expected cashflow at time t,

d(t) - present value coefficients,

T - length of time to maturity.

For analytic solution, there must exist an equal or greater number of bonds with linearly independent vectors of cash flows than there are payment dates[6]. Then, as prices and cash flows are known, the discount function can be derived and the spot rate curve estimated.

In many markets, this simple constraint is binding. Even for the US, Carleton and Cooper (1976) could only estimate a discrete version of the term structure for maturities up to 7 years.

They observed that the absence of cash flows at regular intervals (i.e. due to the non-existence of securities at certain maturities) and the use of approximations could result in instabilities and implausible results.

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[5]Sometimes, these are called dirty prices and they consist of the market principal prices and the accrued interest since the last dividend payment date.

[6] Otherwise the solution could have large standard errors or be indeterminate.

Carleton and Cooper (1976) did, however, successfully employ this method, using for their estimation sample a selection of US Treasury Bonds. US Government Coupon Securities (i.e. notes and bonds) with rare exception, make regular semi-annual payments on only four days of each year, (i.e. February 15th, May 15th, August 15th and November 15th), which facilitates this form of analysis.

Due to the relative paucity of issues and problems associated with consistent pricing in longer-term US securities, and in order to ensure the cash flow matrix had sufficient rank, the maximum maturity of the discount function estimation had to be severely restricted, i.e. to seven years. Carleton and Cooper (1976) demonstrated that their discount functions did exhibit the appropriate properties, i.e. discount factors that are non-negative and monotonically decreasing. However, Shea (1984) observed that Carleton and Cooper (1976) did not succeed in constraining their discount function to mature at par.

Vasicek and Fong (1982) address the question of transposition from discrete spot rates to forward rate curves. This curve may be saw-toothed in appearance and consequently unreliable. They add a requirement that the forward rate curves exist and are smooth.

McCulloch (1971), pointed out that, because of the multiplicity of payment dates, estimating a discrete discount function can encounter serious difficulties. Ireland, which has a multiplicity of payment dates, faces these difficulties.

Another major complication and reason for rejecting the discrete discount function is that, while the discount function meets at each point estimated, it is not continuous leading to an unstable forward curve.

As a result of the difficulties in estimation of discrete discount functions, Steeley (1988) developed linear approximation functions for the continuous discount or spot rate curves. Instead of attempting to use discrete discount factors which may be unavailable, an approximation for the discount function *d(t)*, in the following form is modelled:

(2.3.2.2) $$d(t) = \sum_{l=1}^{L} \alpha_l f_l(t)$$

where α_l coefficients are applied to the approximating functions.

2.3.3 Polynomial Approximations

The background and basis of polynomial approximations in numerical analysis lie with the Weierstrass Theorem, which holds that a 'continuously differentiable function can be approximated in some interval to within an arbitrary error by some polynomial defined over the same interval'.

Polynomials are used for approximation because they can be evaluated, differentiated and integrated easily using the basic arithmetic operations of addition, subtraction and multiplication. A polynomial of order n a function in the form:

(2.3.3.1) $$p(x) = a_1 + a_2 x + \dots\dots\dots\dots\dots\dots + a_n x^{n-1} = \sum_{j=1}^{n} a_j x^{j-1}$$

Several criteria are available for choosing the 'goodness of fit of a polynomial'. Shea (1984) focuses on the 'least squares criterion'. In order to achieve good fit with the data, one could be tempted to use relatively high degree polynomials, endeavouring to reach the 'Weierstrass Ideal' of an approximation passing through all or very close to each observation points. Polynomials of at least order three must be used in order to ensure a smooth forward rate curve, which is twice continuously differentiable.

One of the great dangers associated with higher degree polynomials is that the approximation is likely to fluctuate wildly over its range when being fitted through limited data. The choice must be made between accuracy of fit and paucity of parameters – a trade-off of parsimony and error. Such polynomial approximations tend to weave around the exponential structure, leading to a set of unstable forward rates. This criticism is particularly apt with respect to the global nature of the fit. Vasicek and Fong (1982) criticised the use of polynomial approximations for the discount function, which may be considered principally an exponential decay.

It is difficult to fit both ends of the term structure simultaneously using polynomial approximation. When investigated by McCulloch (1971) using US data, this technique appeared to fit the long end best. Since the average weighted duration of the Irish national debt is 4.02 years over the entire sample time period, it was decided not to use this technique. Comparison later of polynomial splines and polynomial approximations also rejects the approximation on grounds of accuracy.

2.3.4 Polynomial Splines

Polynomial splines offer an alternative to general polynomial regression due to a concentration on local fit. In effect, sections of high degree polynomials can be closely approximated by several lower degree polynomials, thus eliminating the problems associated with higher order functions. Polynomial splines generate better solutions than polynomial approximations, since the latter need to oscillate widely in order to fit all or most of the points. This may be thought of as moving the entire function rather than merely spline sections of it. A knot to the next piece joins each piece of the approximation space, and it is customary to force these piecewise polynomials to join smoothly at the knots. Thus, it is possible to approximate a continuous but complex shape.

Polynomial splines have uniform convergence properties and provide a high order of derivative continuity, with the added advantage of fixing some of the degrees of freedom and reducing the number of parameters to be estimated. In order to investigate whether a polynomial spline[7] is superior to fitting a yield curve by a polynomial approximation, a spline with a single knot is fitted and compared with the polynomial approximation shown in 2.3.3.1. The cumulative deviance[8] of annualised yields of a polynomial approximation for all the Irish yield 1980 to 1997 curve models is 0.1335141 which is greater than the worst fitting spline model at 0.1310494. This means that spline functions are a better estimator of the effective GRY curve irrespective of the position of knots and as a result, the polynomial approximation approach to modelling the yield curve is rejected.

Hastie and Tibshirani (1990) note that piecewise cubic polynomials are a popular method, although many different configurations are possible. The spline output has two continuous derivatives that agree at the "knots", i.e., the spline has a continuous second derivative. Shea (1985) recommends the use of polynomial splines when the functional form of the term structure is unknown. This avoids some questions raised by assuming a functional form such as exponential decay.

Until the studies of McCulloch (1971) and Schaefer (1981), the problem of continuous yield curve approximation was rarely solved by techniques based in numerical analysis. Schaefer (1981) used a mathematical form known as Bernstein Polynomials. With Bernstein Polynomial functions, the term structure curve may be fitted to the entire range of available data or marurities, which compares favourably with polynomials which seem to accommodate longer maturities more than short.

[7] The spline technique is a piecewise polynomials with their explicit local fit that meet in a continuous fashion at breakpoints called knots.

The primary advantage is that different parts of the term structure may be approximated without affecting other parts, and the discount factors are relatively easily constrained. Steeley (1988) pointed out that the speed of convergence of these Bernstein Polynomials is relatively slow as compared to spline functions.

McCulloch (1971) is among the first to pioneer the application of splines in the estimation of the term structure. He initially used a quadratic spline, i.e. a piecewise quadratic function to approximate the discount function. The main problem encountered with this function is that as it is only once continuously differentiable, discontinuous first derivatives or "knuckles" plagued the estimated forward rate curves.

As mentioned earlier, the main source of difficulty encountered when working with polynomial splines is the selection of the number and position of the knots, or breakpoints, with the most direct approach being referred to as cardinal splines, which require a single parameter, the number of interior knots. The positions can then be chosen, possibly uniformly over the range of the data. A slightly more adaptive version places the knots at appropriate quantiles of the predictor variable, whereas more complex schemes use data driven search criteria to select the number and position of the knots.

With respect to setting the within-sample knots, Steeley (1988) pointed to one, a priori guideline: when dividing the bonds between short[9], medium and long bonds, it is important to remember that there exist market participants with different perceptions with respect to what can be regarded as short, e.g. 5 or 7 years, and such definitions of short can cause clustering around the short end, leaving the long end of the market poorly represented, and also that such clustering can warrant a subdivision within the short end.

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[8] Deviance is the residual sum of squares.

The particular approach followed by Steeley (1988), referred to as the "general to specific" modelling approach was originally developed by Hendry (1979). The use of constraints is vital to the success of polynomial approximations, to avoid the estimated discount factors displaying undesirable properties.

Determining the number and location of polynomial pieces, along with the polynomial order that determines degree of continuity at the breakpoints, is the most difficult decision to be made. In addition, constraints can be altered, removed or added, as appropriate, if the model is yielding implausible results, such as negative forward rates[10]. There is one constraint that is invariant; that the discount function must contain the point (0,1), i.e., par at maturity. The McCulloch (1971) cubic spline model yielded anomalous negative interest rate estimates. Schaefer (1981), using the Bernstein approach, counteracted the existence of negative forward rates by placing a negative slope constraint on the discount function.

Shea (1985) argued that, although preventing negative forward rates, this negative slope constraint is not helpful in obtaining stable forward rate structures, one of the primary objectives of term structure modelling. The primary motive behind polynomial approximation is to let the approximations over separate subintervals be to some degree independently determined. It is this dependence on local data that in turn argues against the use of negative slope constraints.

Experimentation with the order of the basis functions or variation of the number and position of the breakpoints, may also be used to iron out any offending part of the approximation, but Shea's (1985) opinion is that this approach can be self-defeating if it results in deterioration of measure, or quality, of fit. Also, lowering the order of the basis functions affects the higher order derivatives and may result in discontinuities.

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[9] Short bonds have a remaining maturity of less than five years, medium bonds have a remaining maturity of more than five years and less than ten years and long bonds have a remaining maturity of more than ten years.

The most widely favoured approach by econometricans like Johnston (1984) is to design additional constraints to reduce local dependence on data in the offending area. Experimentation with 'ad hoc' constraints can be easily accomplished with a restricted least squares approach. Spline bases facilitate the addition, deletion or alteration of constraints.

It is difficult to constrain estimation so that both the level and shape of a yield curve are satisfied simultaneously. With respect to this notion, Shea (1985) pointed out that the Vasicek and Fong (1982) exponential model is good at modelling the shape of the discount function when an exponential decay is indeed its true form. However, to be regarded as a generally reliable technique, it can need to be constrained in the levels or shapes of its associated yield curves.

Primarily Vasicek and Fong (1982) pioneered exponential splines. The logic behind their use is that discount functions are essentially exponential decays. Others, such as Shea (1985), doubt this to be their true form in a number of circumstances. Vasicek and Fong (1982) clearly state that the difference in curvature, which exists between the polynomial functions and discount functions, explains the previous findings of Shea (1984) and Rose and Schworm (1980) that term structures estimated using spline functions often generate forward rates that are unstable and fluctuate widely - frequently drifting to negative values.

Shea (1984), among other practitioners, disagreed with Vasicek and Fong (1982) pointing to Taylor series expansions. This series lies at the heart of the theory of local approximation to continuous functions. Shea (1984) felt that the entire logic behind the use of these complex functions is without adequate foundation and recommended instead the use of the ordinary polynomial splines methodology, which yields similar curves, without added complications.

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[10] As already mentioned, special circumstances did exist in Ireland that can have lead to rationing of longer maturity bonds which would have allowed forward rates to be negative during the rationing period.

Using exponential decays, Vasicek and Fong (1982) estimated that the discount function would be linear; thus complicated non-linear estimation procedures would be avoided. But, as Shea (1984) noted, if Vasicek and Fong (1982) are so committed to this belief, why use a polynomial spline (which has rarely been seen to be linear or near linear), rather than an ordinary regression line.

Vasicek and Fong (1982) made numerous claims about their model. Their term structure of interest rate approximation exhibits desirable asymptotic properties for long maturities. However, these asymptotic restrictions are of little use in defining an estimated discount function with the curvature of an exponential decay, and the asymptotic forward rate exhibits little influence over the shape or level of the forward rate curve within the estimation range. The asymptotic forward rate appears only to have relevance at maturities greater than 30 years for which there are no (relevant) bonds in issue.

The Vasicek and Fong (1982) model exhibited sufficient robustness to produce stable forward rates, and sufficient flexibility to fit a wide variety of shapes. Shea (1985) again admitted that it is difficult to fault the Vasicek and Fong (1982) model relative to any other spline model for its ability to smooth term structure data.

In an attempt to incorporate this exponential characteristic in a different manner to that proposed by Vasicek and Fong (1982), Carleton and Waldman (1984) have suggested that the spot rate curve rather than the discount function should be approximated, using an exponential function. The model is rejected for measuring the Irish term structure because non-linear estimation procedures are computationally more intensive than ordinary polynomial spline models, such as *B* spline spot rates. These approach the same values of the forward rate curve as exponential splines and these are as stable as the exponential spline method, while computationally less onerous.

2.3.5 B Splines

In this case the discount factors are a discrete estimation from a bond vector where the *B* splines model is again used, along the lines of cubic polynomial but with an appropriate choice of knots and constraints in order to generate a smooth forward curve. Spline approximation using the truncated power series, as portrayed by Chan, Karolyi, Longstaff and Saunders (1991c), is equivalent to approximations using other bases. Not all spline bases are equally capable of defining spline regressors useful for reliable estimation.

A number of basis functions generate a regressors matrix in which the columns are nearly collinear and are thus they are ill conditioned. Even if the error in the discount function *d(t)* is small, the slope and level of the term structure of interest rates could still be in significant error. Thus, reliable spline approximation can depend crucially upon intelligent selection of the basis. Good corrective action in such circumstances would be to use a *B* spline basis.

Since DeBoor's (1978) original work, *B* splines have been recommended by Powell (1981) as a suitable alternative to the general polynomial splines counteracting the problems of collinearity. Deacon and Derry (1994) note that *B* splines, which are identically zero over a large portion of the approximation space have good convergence properties and prevent the loss of accuracy due to cancellation.

The ease with which the *B* spline can be constrained is another primary advantage associated with this function, although this can also be flexibly accomplished with a restricted piecewise polynomial structure.

However, some models do not exhibit such flexibility; e.g. with respect to the McCulloch (1971) model the particular cubic spline functions cannot simultaneously constrain the slope and the level of the yield curve.

Svensson (1993) estimates spot and forward rates using McCulloch's (1971) approach of fitting a discount function to a bond data set, but uses the Nelson and Siegel (1987) functional form instead of a spline. While he increased the flexibility of their model, he concluded that the original Nelson and Siegel (1987) model produced a satisfactory fit most of the time.

Steeley (1988), when using *B* splines, adopted the following function:

$$(2.3.6.1) \qquad B_p^k(t) = \sum_{l=p}^{p+k+1}\left[\prod_{h=p,h\neq l}^{p+k+1}\frac{1}{(t_h - t_l)}\right](t - t_l)_+^k \quad -\infty < t < \infty$$

which is known as a k-order *B* spline, where the subscript "p" denotes that $B_p^k(t)$ is only non zero if "t" is in the interval $[t_p, t_{p+k+1}]$.

Regression splines or piecewise polynomials, of which *B* splines are a variant, are attractive because of their computational ease, when the "knots are given". In particular, standard linear model estimation is very convenient when using additive models. The main drawback of this approach is the difficulty associated with choosing the number and position of the knots. When a small number of knots are used, the smoother can show some disturbing nonlocal behaviour. With more knots, this global influence would be dampened, but frequently there are not many degrees of freedom to spare. Also, as discussed earlier, another problem with regression splines is that the smoothness of the estimate cannot be easily varied continuously as a function of single smoothing parameter. This is the primary advantage associated with other smoothers such as loess, kernel, running line or smooth spline.

The B Splines model that is chosen to measure the Irish term structure is constructed from bootstrapped discount factors and spot rates of the existing bonds' prices and the money market curve used for pricing government Exchequer Bills and Exchequer Notes.

There are a number of methods that can be employed to estimate spot rates;

- Bootstrapping,
- Exponential polynomials,
- Different spline methodologies,
- Various kernel smoothing techniques.

As discussed above, in the case of Ireland, where the term structure of interest rates cannot be directly observed (e.g. from zero coupon bonds), it can be indirectly estimated using a bootstrap approach to obtain the discount factors. Spline approximation can be used on the discount factors, spot rates or the forward rates with different assumptions about tax or liquidity effects. In the case of Ireland a two stage process was used. Firstly, the discount factors were bootstrapped using the exact date of each cash flow from the existing money market and bond set at each data point arrayed by maturity. Although not perfect, this approach provides an attempt to estimate the term structure of interest rates in a small bond market like Ireland with frequent 'gaps' in the maturity spectrum. The null hypothesis is that all Irish bonds are part of the data set held by institutional investors with a tax rate of zero and the identified outliers are placed in Appendix two. These outliers are excluded and the bootstrapped vector of present value coefficients[11] $d(t)$ is then estimated.

After the bootstrapping procedure has been estimated on the coupon bearing government bonds, the following data sets exist;

- Six-monthly data points at the end of each maturity bucket,
- Maturity of each bond's principal payment,
- Each individual bond's cash flows in a sequence of increasing maturity.

Since each sequential bond was used to iteratively to allow for different payment frequency to estimate the spline, a problem arises due the partial overlap of prior fitted spline functions. It is important to recall that any bond's final payment will have a significant influence when fitting any discount function to a bond's cash flows and the objective is to minimise the error with a bond's observed price.

Another problem that needs to be addressed was the problem of 'gaps' in the maturity spectrum (i.e. there is not always a suitable bond, or any bond maturing within a six-month maturity bucket). In order to fill the gaps, a decision on the appropriate trade-off between 'smoothness' (i.e. removing 'noise' from the data) and 'responsiveness' (i.e. flexibility to accommodate a genuine movement in the term structure) was required. This issue was overcome by interpolation from the previous known six-month maturity bucket.

The spline can be fitted to one of the data sets with constraints to ensure that the curve meets at each knot, is continuous at every point, contains the point (0,1) (i.e. all discount bonds mature at par) and the first derivative is negative and approaches 0 in the asymptotic limit. (as time progresses to positive maturity.) The spline can use any of the following representations of the data set;

- Discount factors,
- Spot rates,
- Forward rates.

[11] Otherwise known as a discount function or zero curve.

The spline was fitted to both the discount factors and the spot rates of the Irish data set and applied to the bond set at each data point to determine whether it was preferable to estimate the term structure via the discount factors or via the spot rates (see exhibit 2.8). Mastronikola (1991) developed a model for Bank of England's from estimating the term structure of spot rates by fitting a curve through redemption yields, derived directly from observed prices according to Deacon and Derry (1994). This invokes the assumption that the redemption yield curve is a realistic approximate to the par yield curve which may not be the case depending on market conditions. The less well this assumption matches the reality of the market place, then this approximation will perform poorly.

The spline requires knots in the data set and they may be specified as follows;

- Directly given to the estimation procedure
- Number of degrees of freedom specified

An important decision that has to be made when using any kind of spline function is the appropriate number and position of knot points. If the number is too low then the model will not fit the data closely when the term structure takes on difficult shapes, while if it is too high the estimated may be unduly influenced by unrepresentative outliers. When the specification is by degrees of freedom as in the Bank of England model, then the position of knot points will vary with the information content of the underlying data-set. This seems to have been little interest in the literature apart from Steeley (1991) in testing sophisticated techniques for specification of the optimal number and location of knot points. Knots are chosen (see Section 2.5) by using an iterative search method of the Irish data series employing one knot for each maturity point between one to seventeen years, then two and three knots and by investigation of the extra explanatory power of additional knots. Three sections are identified in a similar manner to the approach taken by Steeley (1991), as up to one year; up to five years; and over five years, with approximately equal quantities of bonds in each segment.

An issue arises with regard to the different possible treatments of the overlapping spline function:

- they may be given a weighting of zero and replaced with those from the currently fitted spline,
- they may be averaged at each data point by the numbers of bonds estimated to that data point,
- they may be weighted by some method such as the market value or turnover of the bond issue relative to the market values of all bonds fitted to that maturity point.

This approach explicitly constrained cashflows from different bonds due at the same time to be discounted at the same rate. and estimates a discount function from which the term structure can be derived.

While it would have been preferable to use bond turnover as a weight for price discovery concentration, the mixing of REPO activity in turnover measurement prior to 1995 ruled this out as a reasonable approach and the market value was used for weighting. This was caused by foreign European investors use to the funding market where the REPO was booked by the brokers as separate sale and repurchase and treated as three bond market transactions in the Stock Exchange and the Gilts Settlement Office of the Central Bank of Ireland. Then the investors sold the currency outright in the forward market for a maturity date coinciding with the 'REPO' and eliminating the currency exposure. This practice evolved at the brokers competed for market share and there was little surveillance by the authorities.

2.4 Data

Data is collected for all Irish government bonds in issue, half yearly over the period April 1980 to October 1997. It is not possible to obtain reliable data prior to 1980 other than the overnight rate, Exchequer Bill tender rate (provided by the Central Bank to the OECD database) and the "average" long government bond yield (provided by the Department of Finance to the IMF for their database).

The data is extracted from the published daily dealing sheets of ABN Amro, Davy, AIB Capital markets and NCB/Nat West stockbrokers, who collectively held 90% market share of all bond dealings over the period April 1980 to October 1997. The information on the dealing sheets consisted of gross prices, coupon levels and term to maturity. From this information, the individual yields to maturity are estimated. The yields are shown on an Actual/365 bonds basis[12], although the National Treasury Management Agency issued 30/360 annual basis bonds from 1990 to 1997 before conforming with European Actual/ Actual market practice.

Table 2.1 shows a list of all government bonds in issue at selected time periods throughout the fourteen-year sample. Since the Irish treasury bond market is relatively small in international terms, the collection of straight bonds arrayed by maturity is insufficient to employ the bootstrap procedure. As a result, straight bonds are supplemented with convertible, variable rate and dual redemption date bonds in order to increase the number of data points from which to model the structure.

[12] This is calculated according to the standard set down by the Bank of England when Ireland had a fixed parity exchange rate against Sterling.

With respect to dual[13] redemption date bonds, where the market yield is very close to their coupon value[14], these bonds are more likely to be identified as outliers, as can be seen in the next section. Where the market yield is greater than the corresponding coupon level, these bonds are positioned at their respective later redemption dates, since redemption is not likely to occur until then, and vice versa with respect to market yields lower than their coupon level. The yield curves and other market data are shown in Appendix 1. The last closing price is chosen (provided it is not marked as a small bargain of under IR£50,000) from the dealing sheets and observations are confirmed by comparison with the previous and following days' trading levels.

This is done on a randomly chosen date, 18 April 1980, in the first six monthly interval in 1980 and repeated every six months until 1997. From Appendix 2, it is evident that short-term bonds dominate the sample, with a distinct lack of bonds at the longer end of the maturity range. There is a shortage of bonds with a maturity greater than 9 years in the sense that a debt obligation does not mature in every year. Over the sample period yields reached a high of 21% and a low of 5%.

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[13] The issuer has the right to call the bonds after a certain exercise date from the issue of the bonds and this American style option call exists up to three months before the maturity of the bonds. A notice period of three months exists if the issuer wishes to exercise this option.

[14] They are at the money in option pricing theory terminology and a highly valued embedded option, which distorts their yield.

Date	18-April-80		18-October-97
1	IR.FUNDING 9 1/2% 1980	1	IR.DEVELO. 11 1/2% 1997/99
2	IR.FINANCE 8 % 1980	2	IR.FUNDING VAR% 1998
3	IR.NATION. 4 1/4% 1975/80	3	IR.FUNDING VAR% 2000
4	IR.SAVING 5 % 1971/81	4	IR.CAPITAL 9 3/4 % 1998
5	IR.FUNDING 8 1/2% 1981	5	IR.FINANCE 14 1/2% 1998/00
6	IR.EXCHEQR 10 % 1981	6	IR.TREASU 6 1/4% 1999
7	IR.FINANCE 11 1/2% 1981	7	IR.CAPITAL 7 1/2 % 1999
8	IR.EXCHEQR 11 1/2% 1982	8	IR.CAPITAL 11 3/4% 2000
9	IR.FINANCE 10 1/2% 1982	9	IR.DEVELO. 12 1/4% 2000/03
10	IR.CONVER 9 % 1980/82	10	IR.EXCHEQR 6 1/2% 2000/05
11	IR.FUNDING 11 3/4% 1983	11	IR.TREASU 8 % 2000
12	IR.FINANCE VAR% 1983	12	IR.GOVER 9 % 2001
13	IR.FINANCE 12 % 1984	13	IR.CAPITAL 8 % 2001
14	IR.NATION. 5 1/4% 1979/84	14	IR.TREASU 6 1/2 % 2001
15	IR.NATION. 14 % 1985	15	IR.DEVELO. 14 3/4% 2002/04
16	IR.EXCHEQR 6 % 1980/85	16	IR.CAPITAL 9 1/4% 2003
17	IR.NATION. 7 1/2% 1981/85	17	IR.EXCHEQR 8 1/4% 2003
18	IR.NATION. 5 3/4% 1982/87	18	IR.TREASU 6 1/4% 2004
19	IR.CONVER 8 1/2 % 1986/88	19	IR.CAPITAL 12 1/2% 2005
20	IR.NATION. 9 3/4% 1984/89	20	IR.TREASU 8 % 2006
21	IR.EXCHEQR 5 3/4% 1984/89	21	IR.CAPITAL 9 % 2006
22	IR.NATION. 14 % 1985/90	22	IR.CAPITAL 8 1/4% 2008
23	IR.EXCHEQR 6 % 1985/90	23	IR.TREASU 6 % 2008
24	IR.NATION. 6 3/4% 1986/91	24	IR.CAPITAL 8 1/2% 2010
25	IR.EXCHEQR 14 % 1990/92	25	IR.CAPITAL 8 3/4% 2012
26	IR.NATION. 7 % 1987/92	26	IR.TREASU 8 1/4% 2015
27	IR.DEVELO. 7 1/2% 1988/93		
28	IR.NATION. 9 1/4% 1989/94		
29	IR.CONVER 12 % 1995		
30	IR.EXCHEQR 9 1/4% 1991/96		
31	IR.NATION. 9 3/4% 1992/97		
32	IR.NATION. 11 % 1993/98		
33	IR.DEVELO. 11 1/2% 1997/99		
34	IR.FINANCE 14 1/2% 1998/00		
35	IR.FINANCE 13 % 1997/02		
36	IR.DEVELO. 14 3/4% 2002/04		
37	IR.EXCHEQR 6 1/2% 2000/05		

Table 2.1 Government Bonds in Issue 1980 - 1997

Source : ABN Amro Stockbrokers & Empirical data

Schaefer (1981), when estimating the term structure in the UK, noted that the residual deviance/error term arising from high coupon bonds exhibits a negative slope with the coupon level. While the value of the debt increased from IR£2,856m to IR£18,382m between April 1980 and October 1997, the number of bonds declined from 37 to 26. This occurred as a result of the declared consolidation strategy of the NTMA of designating a benchmark bond in each maturity spectrum and only issuing these bonds. There has been an increase in the number of single-dated bullet bonds and a decline in bonds with small issue sizes with poor liquidity, embedded option feature such as dual dates or conversion options, and low coupon bonds carrying exemptions from capital taxes. The focus of the NTMA is on creating large liquid issues in which to concentrate the price discovery process.

2.5 Bootstrap Methodology

Before making any attempt to fit the term structure, the number and position of the knots or the degrees of freedom had to be selected to identify potential outliers in the yield curve data. The objective is to exclude them from the bootstrap methodology. As shown in exhibits 2.5 and 2.6 of the yield curve estimation deviance that includes outliers, knots are placed at a variety of positions within the maturity range. In exhibit 2.5, the first fit had no knots, and the sum of the residuals is 0.1332591. The knots are placed at yearly intervals from one to seventeen years and a knot at maturity one-year has a deviance of 0.1222294. A knot placed around year one is where the money market joins the bond market. The deviance of the gross redemption yield curves is summed for all observation points from 1980 to 1997. The deviance of one knot is an improvement of 8.27% in the size of the sum of residuals compared to having no knots (i.e. a polynomial).

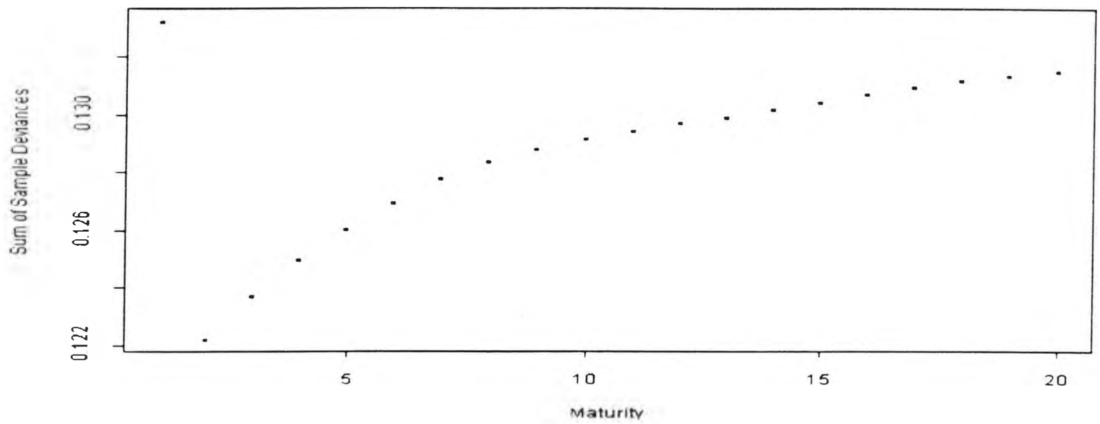

Exhibit 2.5 Sum of Sample Deviance Residuals, 1980-97 for no knot and one-knot

Source : Empirical data

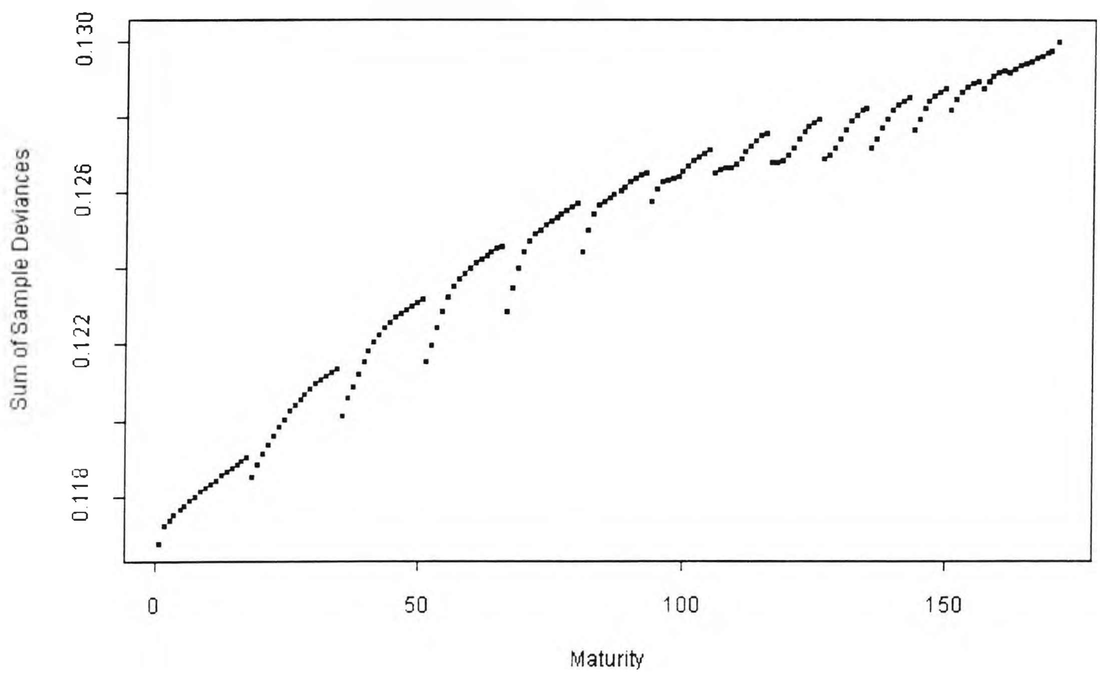

Exhibit 2.6 Sum of Sample Deviance Residuals, 1980-97 for two knots

Source : Empirical data

In exhibit 2.6, two knots are used for 171 combinations from one to nineteen years. When exhibit 2.6 is examined, it can be seen that if the first knot is placed at a maturity of one year, this knot has the lowest cluster of deviance residuals. Then, as the knots are moved to greater maturities, the sum of the deviance residuals increased. Placing the second knot at a maturity of five years gives a deviance residual of 0.1175362; at a maturity of six years gives a deviance residual of 0.1176748 and finally at a maturity of seven years gives a deviance residual of 0.1178010. The lowest of these is the combination of knots at one and five years with a deviance residual of 0.1175362 which is a 3.84% improvement over one knot and an 11.8% improvement over no knots. An example of this fitting procedure is shown in exhibit 2.7. A list of the different outliers is placed in Appendix 2 and the actual yield curves are shown in appendix 3. Outliers being found at the short end of the market would seem to be consistent with the findings of Steeley (1988) for the UK gilt market.

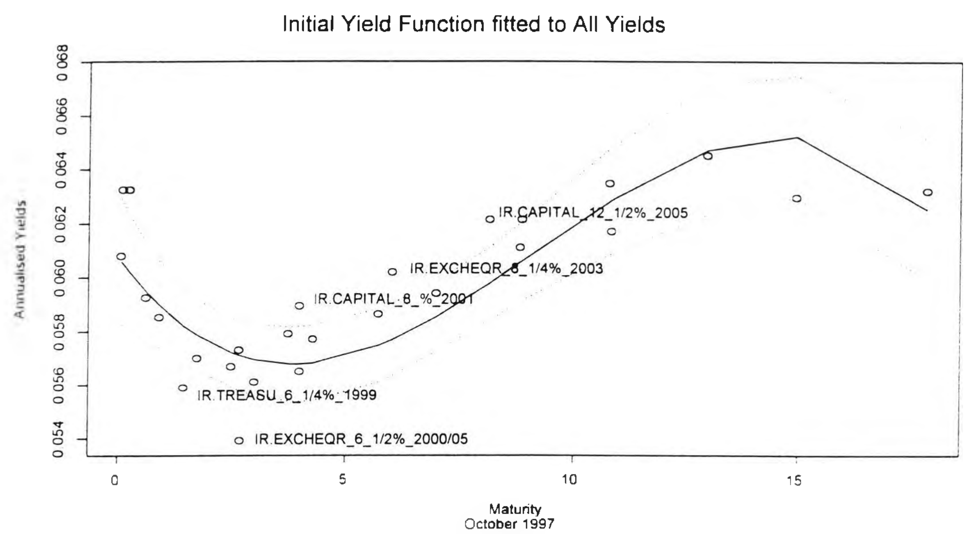

Exhibit 2.7 Yield function fitted with knots at 1 and 5 years maturity

Source : Empirical data

All bonds with a maturity under one year are included in the money market data set and are used to bootstrap the first year. The money market data is taken as a proxy for government paper since no data is recorded for that period and Corrigan (1998) considers that this approach represents the cost for government paper given his experience with Variable bonds and Exchequer Bills. Each bond is arrayed by increasing maturity and their cash flow projected for every six-month period. Then the spot or forward rates are iteratively extracted corresponding to each coupon payment period starting with the first two period covered by the money market. Since the basis on which bonds had been issued changed three times over the sample period, care is needed when dealing with the new Treasury bonds issued by the NTMA. In certain periods several bonds matured giving more than one spot rate for that particular period. When this happens there are several possible approaches;

- Simple average of spot rates,
- Other weighting of spot rates,
- Use spot rate closest to the end of period.

The weighting may be in relation to the different market capitalisations of the bonds maturing for that period. The approach that is employed when several bonds mature is to use an average of spot rates for that period and to continue using that rate for bootstrapping. When no bonds matured in a period, the spot rate is found by interpolating on a linear basis between two nearest spot rates. When this process has been completed for the last bond, there should be a matrix of discount factors (i.e. spot rates or forward rates) for each bond that relates it price to the time values of each of its cash flows.

$$[CF][V]=[P] \tag{2.5.1}$$

where P is the price vector, CF the cash flow matrix and V the present value matrix. With this data set, a number of different methods may be used to estimate the term structure. It is assumed that the discount factors can be modelled using a mathematical function of a *B* spline with two knots. The forward data presented a greater challenge for the fitting of any spline function than the spot rates or discount factors and is more suitable to some form of robust smoothing.

The B spline is fitted to each bond in the data set after being fitted to the money market using the same approach of Fisher, Nychka and Zervos,(1995). This gave the lowest weighted deviation of bond prices compared to using any other data set or the forward rates. Where the data sets overlapped, the bootstrapped spot rates are replaced with the fitted spot rates and the B spline is fitted through this data set. This process is repeated for each observation date of the time series using both discount and spot rate data sets.

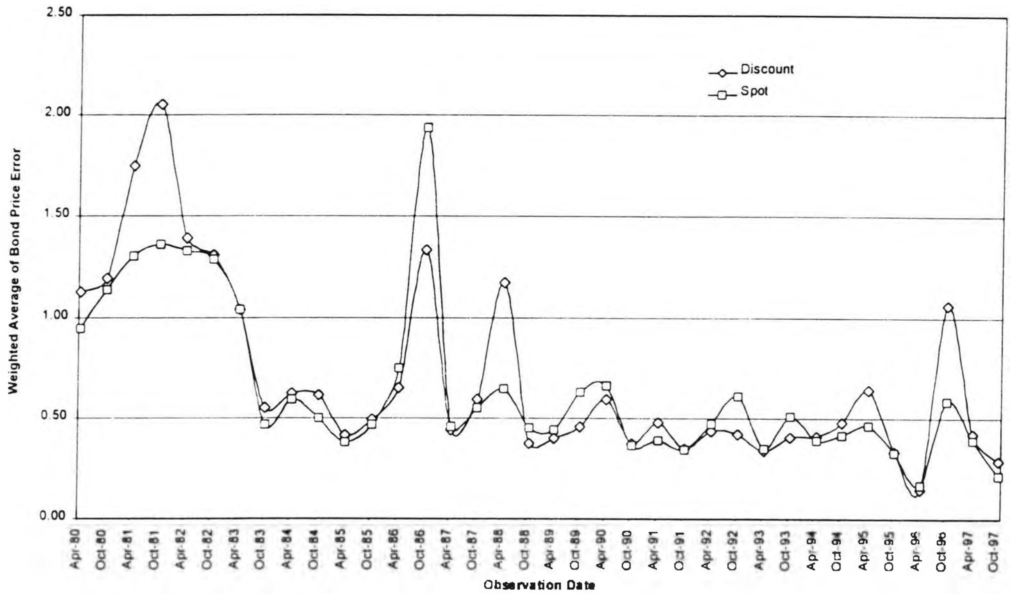

Exhibit 2.8 Weighted Average of Bond Price Error by Capitalisation 1980-1997

Source : Empirical data

The results for the spot rates is a cumulative bond price absolute error of 23.31 compared to a cumulative bond price absolute error of 25.18 for the discount factors as shown in exhibit 2.8. Each observation results is shown in appendix 3. Then using the estimated spot rate functions the time varying spot and forward rates from the period 1980 to 1997 are estimated and shown in exhibit 2.9 and 2.10.

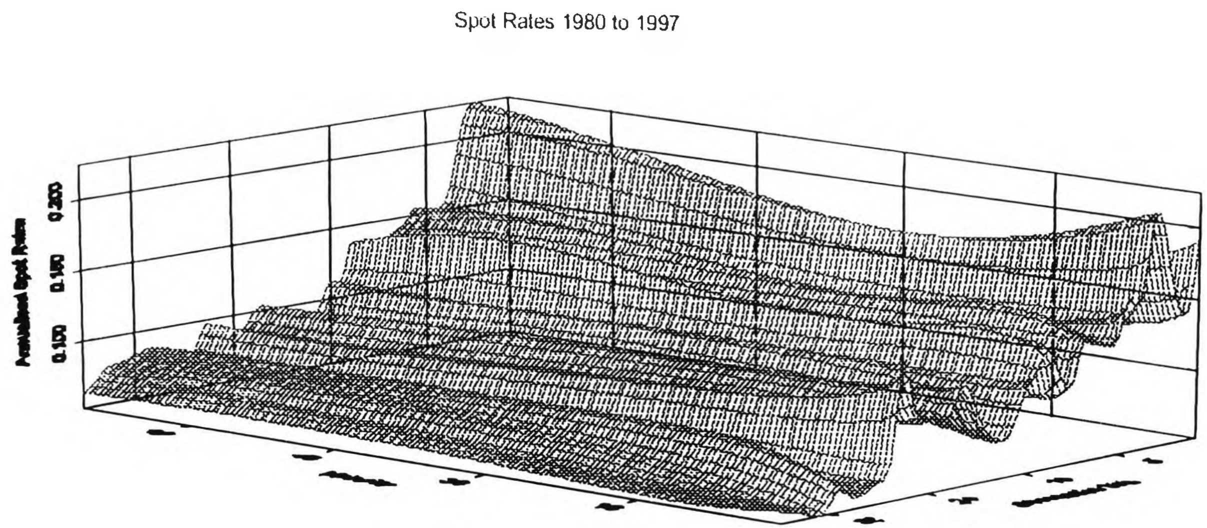

Exhibit 2.9 Spot Surface 1980-1997

Source : Empirical data

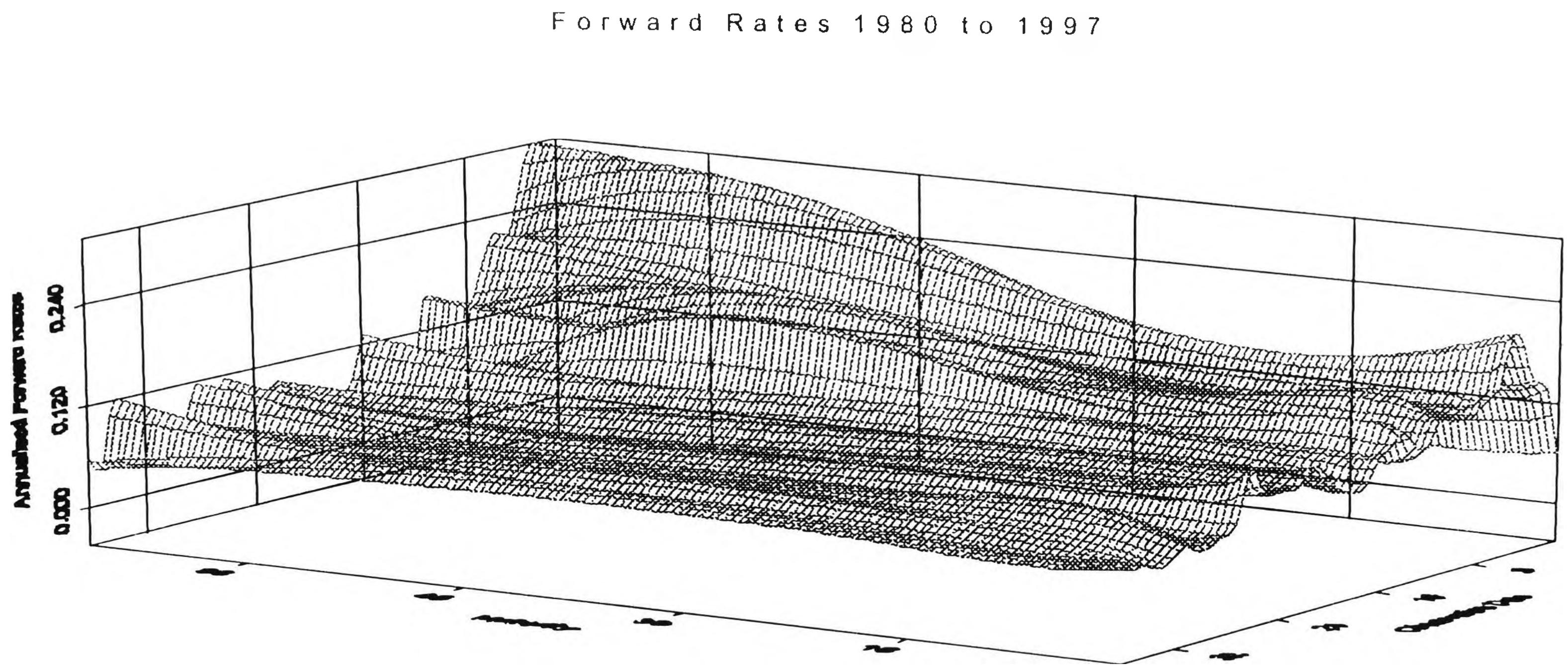

Exhibit 2.10 Forward Surface 1980-1997

Source : Empirical data

In chapter three, the evolution of spot rates will be modelled from the discount functions and factor models will be developed to enable bond pricing. In this section, the estimated discount functions from previous sections will be applied to historical bond prices for October 1997 and the resulting bond price errors are shown in exhibit 2.11.

Outlier Bond Price Identification from Step-wise Spot Rate Data

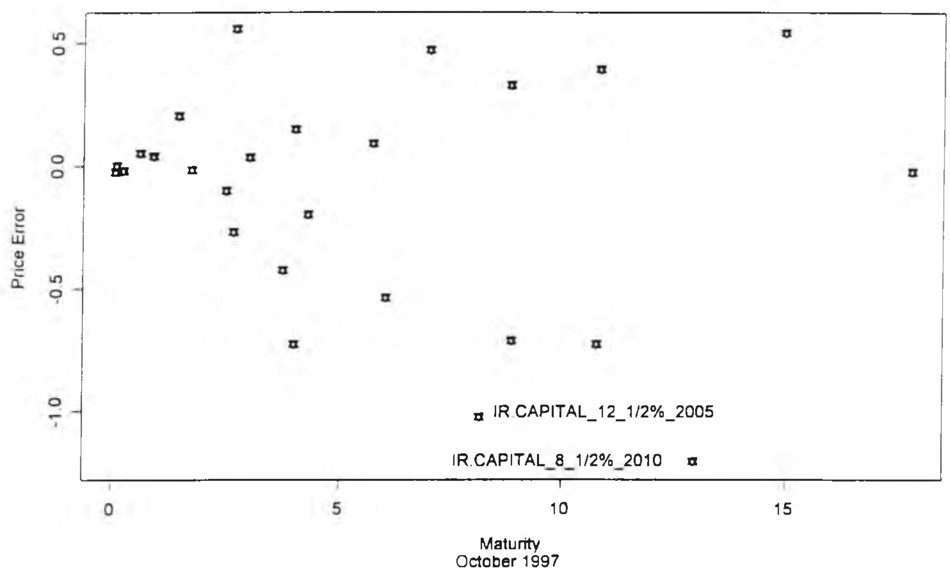

Exhibit 2.11 October 1997 Bond Price Error

Source : Empirical data

The outliers are the high coupon 12 /5% Capital bond 2005 and the 8 1/5% Capital 2010 with a small issue size. As can be observed in the exhibit 2.12, the bonds errors have an average of zero and are randomly scattered across the maturity spectrum.

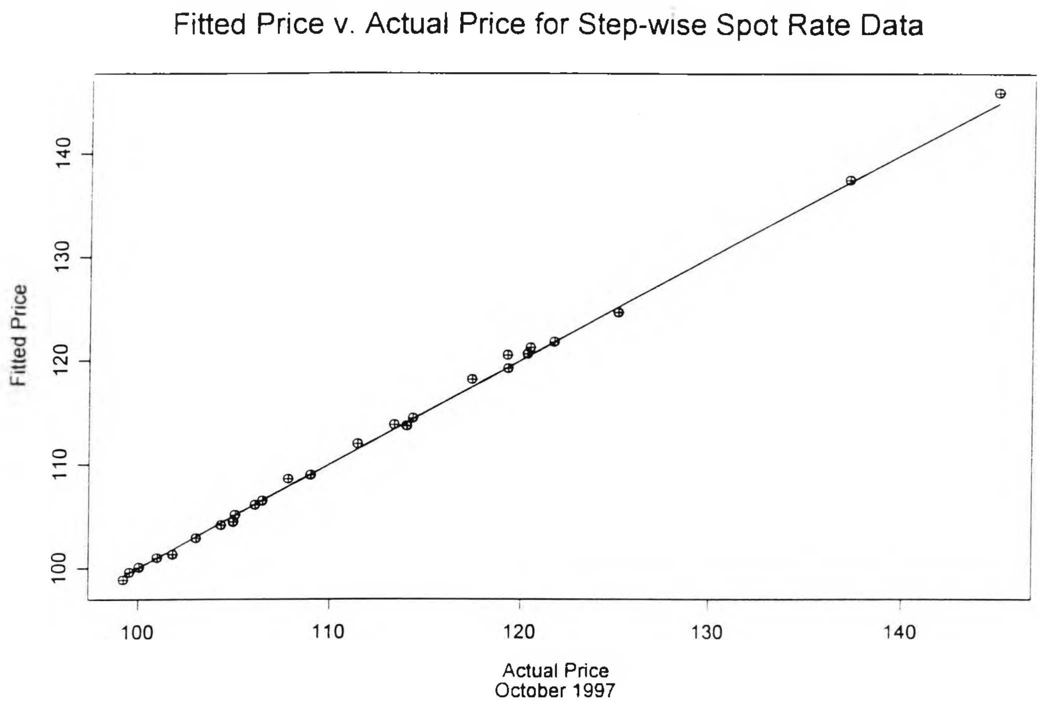

Exhibit 2.12 October 1997 Comparison of Bond Prices

Source : Empirical data

When the actual market prices are compared to the price generated by the fitted discount function from the spot curve in exhibit 2.12, actual market prices can be observed to lie along a 45-degree line containing the origin. This shows a good approximation to the relationship between the fitted spot curve and the observed gross redemption yield curve. The other years are shown in appendix 3.

2.6 Summary and Conclusions

The Irish government treasury bond market from an historical perspective from 1980 to 1997 has been illustrated. The government has kept the duration close to 4 years over this period. The sample of available bonds is biased towards the shorter maturities. It is necessary to adjust some of the calculations of the gross redemption yield as data sources while having the same prices generates small differences in their yield calculations.

Different approaches taken to describe the term structure are explained. These include yield to maturity, discrete estimation of the term structure and polynomial approximations. When interpolating a number of points, a spline can be a much better solution than a polynomial interpolation, since the polynomial can oscillate wildly in order to hit all the points. The techniques of polynomial splines, *B* splines and exponential splines are examined. After explaining why the *B* splines are chosen, the methodology employed in the estimation of the observed term structure of interest rates is described.

Choosing two knots generates a basis matrix for a cubic spline. These enforce the constraint that the function be linear beyond the boundary knots, which are taken to be at the extremes of the data. An iterative search process, which identified the minimum residual deviance for different numbers of knots, is demonstrated. The model specifying five degrees of freedom with knots at a maturity of one and five years is chosen because it had the lowest residual and is superior to no knots and a knot place at a maturity of one year. A third knot is excluded since the additional explanatory power is marginal. There is a significant difference between the money market up to one-year maturity and the bond market beyond.

A bootstrapping methodology is employed to strip the curve and then a B spline is fitted to the money market and bonds with a maturity greater than one year for both the discount factors and the spot rates. The results of the model using a two data sets are shown for the entire time series. Finally, the spot and forward surfaces are identified and estimated over the entire sample period.

The spot rate curve is applied to the sample data for October 1997 where the valuation of bonds by observed gross redemption rates and fitted spot rate curves are compared for the first time.

The spot rate curves produced in this chapter will be used to investigate the stochastic evolution of the term structure. The time series of the spot rates will be used to quantify the numbers of factors required to model the term structure stochastic process. In chapter four the spot rate curve determine the capital required by a Primary Dealer in government securities when the inventory has different positions in the maturity spectrum. Finally in chapter five, the discount function will be used to value general insurance liabilities. This will permit the calculation of their duration and consequently their matching index portfolio from market accepted indices.

Chapter 3

The Stochastic Process Underlying Observed Spot Rates

3.1 Introduction

3.1.1 Objectives

The objective of this chapter is to investigate the behaviour of the term structure of the Irish spot rates estimated in the last chapter and to use estimate the orthogonal factorswhich are associated with the changes in the term structure over time. This chapter is divided up as follows: section two reviews the background to stochastic processes; section three models the dynamics of the term structure; section four analyses the time series of spot rates; section five investigates the spread process and the orthogonality proposition for the Irish term structure and the summary and conclusions are in section six.

Over the past three decades two approaches to modelling the term structure have developed in the literature. The first approach is to start with a plausible stochastic process, or processes for the specified sources of uncertainty (i.e. stochastic factors) that drive the evolution of the spot rates through time. From these assumed processes, prices of pure discount bonds and bond yields are determined in the literature as functions of the specified state variables and risk adjusted parameters. These specifications allow a full span of spot rates to be determined, allowing in turn a value to be placed on all bonds and any contingent claims of the stochastic term structure on a consistent basis. In modern financial institutions engaged in multicurrency asset/liability management, this is a very important prerequisite for efficient risk management of their capital and exposures.

The second approach involves modelling the term structure in a way which is consistent with the initially observed spot rate curve. This constrains the choice of stochastic process to the present level and shape of the term structure and ignores whether it is consistent with the time-series of previous term structures.

When deciding on the choice of stochastic process a trade off must be made between a simple model that can only describe a subset of all possible paths of the term structure against a more complex model that can be difficult to identify and estimate. These latter models have frequently been referred to as whole yield curve models, and incorporate the models of Ho and Lee (1986); Hull and White (1990); and Heath, Jarrow and Morton (1992).

A term structure must perform two tasks for option valuation purposes. First, it must provide a stochastic process that can identify all possible future term structures. Second, it must be consistent with the term structure at any point in time. From the perspective of those wishing to develop Irish capital markets, this chapter can allow them to compare and contrast their present position with how it might be possible to proceed with the development of a derivatives market. In the last chapter, equation 2.4.8.6 denoted the relationship between spot rates and the discount function. This can be rewritten as:

(3.1.1) $$r_t = \frac{1}{t} \ln v^t$$ for time t

and the forward curve 2.4.8.7 can be rewritten as:

(3.1.2) $$f_t = \frac{\;}{t} \ln v^t$$

While the approach taken by Cox, Ingersoll, and Ross (1985) is a single factor model, it can be viewed as a general equilibrium representation of the underlying economy in a stochastic framework.

Strickland (1993) holds that a single factor model is the equivalent of the arbitrage-free approach by invoking the "Fundamental Theorem of Asset Pricing" of Dybvig and Ross (1989). Vasicek's (1977) single factor model uses the arbitrage-free approach by assuming perfect correlation of spot rates. In the next chapter, the microstructure of term structure is examined together with how the marginal cost and revenue of price making maintain the arbitrage-free condition.

3.2 Stochastic Processes

In this section, the general background to stochastic processes in financial markets is reviewed. Stochastic processes use partial differential equations[1] to model the behaviour of a random variable through time. An equation is sought that is well behaved and consistent with the initial condition of the observed term structure and final boundary conditions of discount bonds maturing at par. Wilmott, Dewynne & Howison (1996) discuss how partial differential equations modelling the term structure are developed from a model of the diffusion of heat flow in a continuous medium which are described by the equation:

(3.2.1) $$\frac{u}{t} = \frac{{}^{2}u}{x^{2}}$$

In this model of the diffusion of heat in one space dimension where $u \; x,t$ denotes the temperature in a long thin uniform bar of material whose sides are perfectly insulated so that its temperature varies only with distance x along the bar and with time t,. Fourier's Law states that the heat flux is proportional to the temperature gradient $- \; u / \; x$ and this equation can be used to model the molecular diffusion of a substance through a substratum.

The theory of stochastic processes in financial markets is concerned with the investigation of the structure of families of random variables which denote the path of the value of an asset through time. According to Fama's (1963) efficient market hypothesis, prices in financial markets reflect past facts and the arrival of expected future information. This means that markets behave as a Markov process by being independent of the past and are only affected by the arrival of unexpected information.

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[1] A partial differential equation is an equation that relates in a non-trival manner two or more derivatives of that unknown function with respect to independent variables and its order Is the of the order of the highest derivative. The degree of a partial differential equation which can be written as a polynomial in the derivatives is the degree of the highest ordered derivative which then occurs.

A partial differential equation for the change in the value of an asset S is;

(3.2.1) $$dS = \quad S\,dt + \quad S\,dz$$

where is the expected return on drift while is called the volatility and represents the stochastic shock. Expressed in terms of a relative return on the asset, rather than in absolute terms, (3.2.1) gives the stochastic differential equation;

(3.2.2) $$\frac{dS}{S} = \quad dt + \quad dz$$

where dz is an infinitesimal change in a Wiener[2] process in an infinitesimal interval of time dt. This is a generalised mathematical model in continuous time of the behaviour of the return on any asset S. While (3.2.2) is not solvable for a particular market path because it follows a random walk, it allows the modelling all the possible paths of any market.

Ito's (1961) lemma is used to relate the infinitesimal change dS in a function of a random asset price variable to the small change in the random variable itself. If the function of the asset value $f(S)$ is continuous and varies by an infinitesimal change dS then $f(S)$ also changes by an infinitesimal amount. By using a Taylor series expansion about zero and ignoring the cubic and higher terms;

(3.2.3) $$df(S) = \frac{df(S)}{dS}\,dS + \frac{1}{2}\,\frac{d^2f(S)}{dS^2}\,dS^2 + \cdots$$

From equation 3.2.1;

(3.2.4) $$dS^2 = \quad S\,dt + \quad S\,dz \quad ^2$$

which expanded is;

(3.2.5) $$dS^2 = \ ^2 S^2\,dt^2 + 2 \quad S^2\,dt\,dz + \ ^2 S^2\,dz^2$$

According to Wilmott, Dewynne & Howison (1993), the last term is the largest for small dt and dominates the other two terms leaving;

---

[2] A Wiener process is a Markov process with a mean of zero and a variance of dt.

(3.2.6) $$dS^2 = \;{}^2 S^2 dz^2 + \cdots$$

with $dz^2 \to dt$, then 3.2.6 becomes;

(3.2.7) $$dS^2 \to \;{}^2 S^2 dt$$

Substituting 3.2.7 into 3.2.3 and use 3.2.1, then;

(3.2.8) $$df(S) = \frac{df(S)}{dS} dS + \frac{1}{2} \frac{d^2 f(S)}{dS^2} dS^2 + \cdots$$

These equations are first exploited by Black & Scholes (1973) with a view to pricing equity options. In their model, a portfolio of a long position in an option and a short position in a fraction of the underlying stock is equated to the risk free rate of return. If the portfolio is constantly rebalanced through time, then the portfolio would earn the risk free rate of return upon the maturity of the option. The option consists of two components, an intrinsic value[3] and a time value[4] and as the option approaches maturity, its value must approach the intrinsic value. Equities behave in a more independent manner than fixed income securities where there is a large positive correlation in adjoining maturities.

When the stochastic process of the spot rate curve appropriate to fixed income securities is being modelled, the spot rate curve or its equivalent discount function can be observed. The spot rate curve for April 1980 is illustrated in exhibit 2.10, and the equivalent discount function is shown in exhibit 3.1.

[3] The intrinsic is the value the option would have if it is exercised immediately.
[4] The time value is the excess of the option over the intrinsic value.

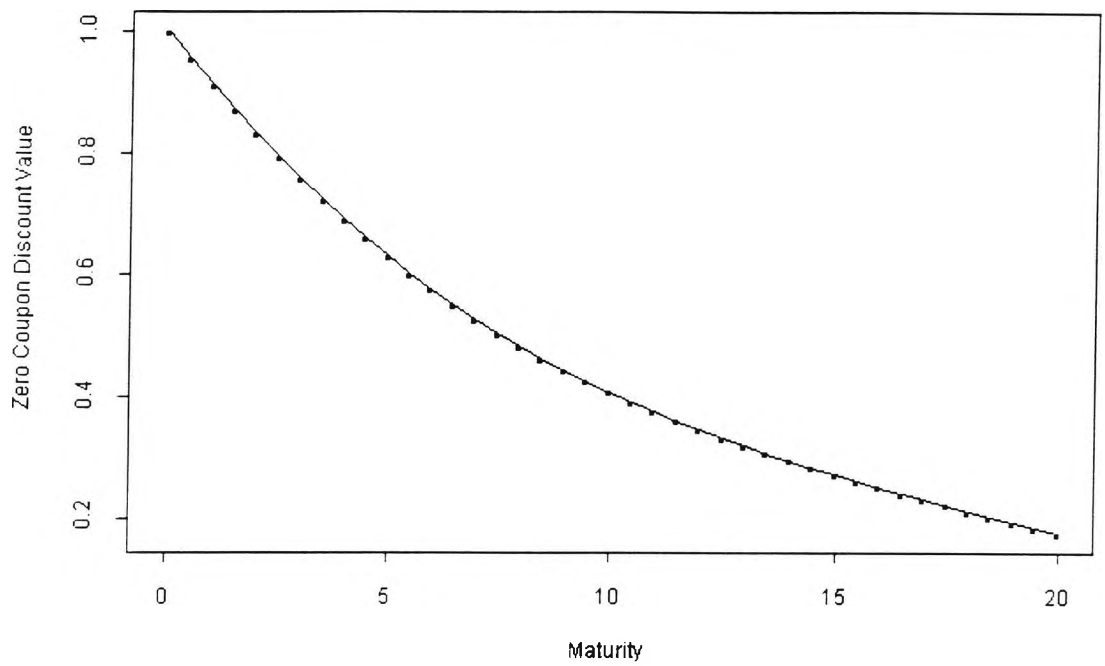

Exhibit 3.1 April 1980 - Irish Term Structure Discount Function

For a time interval dt, the arbitrage free drift of the spot rate curve is known. Assuming that unlimited short positions are possible, then an arbitrage free bar-bell portfolio can be formed with long positions around a particular maturity in which a short position is established (because its yield is too low relative to the neighbouring spot rates of the long positions in the portfolio). The avoidance of arbitrage implies that a level of high correlation should exist between adjacent maturity points, and it can be possible to specify a simple model with few factors because all the different points on the discount function are related.

An explicit relationship is needed between these model factors and all other maturities of the spot rate curve which takes account of the high correlation and price risk[1]. This correlation is exploited by developing term structures that is driven by a few factors and all other maturities are derived by virtue of some strong relationship that exists between all other points and those driving factor maturities. The spot rate r can be described as a lognormal walk in the stochastic differential equation:

(3.2.9) $$dr = a(r,t)\,dt + b(r,t)\,dz$$

The functions $a(r,t)$ and $b(r,t)$ describe the behaviour of the spot rate r. The different models of Merton (1973), Vasicek (1977), Dothan(1978) and Cox, Ingersoll, and Ross (1985) in section 3.3 have the common partial differential equation structure of 3.2.9 but differ in their functional forms. When Black & Scholes (1973) used 3.2.9, they had an underlying security which formed the offsetting hedge against the option in their portfolio. This underlying security does not exist in the case of spot rates so bonds of different maturities must be used for hedging.

Steeley (1989b) uses two bonds with different maturities t_1 and t_2, priced at V_1 and V_2 to form a portfolio. In the portfolio P, one unit of bond one is held against being short Δ units of bond two which gives:

(3.2.10) $$P = V_1 - \Delta V_2$$

[1] In terms of any discount function, price risk is strictly increasing with maturity, and the rate of increase in price risk is strictly decreasing with maturity.

From 3.2.1, 3.2.3 and 3.2.8 Ito's (1961) lemma is used to relate the infinitesimal change dP in portfolio value as a function of an infinitesimal interval of time dt and an infinitesimal change in a Wiener process for the spot rate dr:

(3.2.11) $$dP = \frac{\partial V_1}{\delta t}dt + \frac{\partial V_1}{\delta r}dr + \frac{1}{2}b^2\frac{\partial^2 V_1}{\delta r^2}dt$$
$$-\Delta\left(\frac{\partial V_2}{\delta t}dt + \frac{\partial V_2}{\delta r}dr + \frac{1}{2}b^2\frac{\partial^2 V_2}{\delta r^2}dt\right)$$

If Δ is set equal to;

(3.2.12) $$\Delta = \frac{\partial V_1/\delta r}{\partial V_2/\delta r}$$

then 3.2.11 becomes;

(3.2.13) $$dP = \left(\frac{\partial V_1}{\delta t} + \frac{1}{2}b^2\frac{\partial^2 V_1}{\delta r^2} - \frac{\partial V_1/\delta r}{\partial V_2/\delta r}\left(\frac{\partial V_2}{\delta t} + \frac{1}{2}b^2\frac{\partial^2 V_2}{\delta r^2}\right)\right)dt$$

(3.2.14) $$dP = r\left(V_1 - \frac{\partial V_1/\delta r}{\partial V_2/\delta r}V_2\right)dt$$

and the return on the portfolio is the risk free spot rate r;

(3.2.15) $$dP = rP\,dt$$

Equation 3.2.15 can be rewritten in terms of V_1 and V_2;

(3.2.16) $$\left(\frac{\partial V_1}{\delta t} + \frac{1}{2}b^2\frac{\partial^2 V_1}{\delta r^2} - rV_1\right)\Big/\frac{\partial V_1}{\delta r} = \left(\frac{\partial V_2}{\delta t} + \frac{1}{2}b^2\frac{\partial^2 V_2}{\delta r^2} - rV_2\right)\Big/\frac{\partial V_2}{\delta r}$$

While this is an equation with two unknowns t_1 and t_2, the equality holds iff both sides are independent of the maturity date giving;

(3.2.17) $$c(r,t) = \left(\frac{\partial V}{\delta t} + \frac{1}{2}b^2\frac{\partial^2 V}{\delta r^2} - rV\right)\Big/\frac{\partial V}{\delta r}$$

This can be expressed as;

(3.2.18) $$c(r,t) = \lambda(r,t)\, b(r,t) - a(r,t)$$

where $\lambda(r,t)$ is the market price of risk. This gives the partial differential fundamental zero-coupon pricing equation;

(3.2.19) $$\frac{\partial V}{\delta t} + \frac{1}{2} b^2 \frac{\partial^2 V}{\delta r^2} + (a - \lambda\, b)\frac{\partial V}{\delta r} - rV = 0$$

Equation 3.2.19 can be solved uniquely[2] if the boundary condition is imposed that zero-coupon securities must mature at par. This becomes clearer in the case of a portfolio with a single bond maturing at t and the infinitesimal change dV in portfolio value as a function of an infinitesimal interval of time dt;

(3.2.20) $$dV = \left(\frac{\partial V}{\delta t} + \frac{1}{2} b^2 \frac{\partial^2 V}{\delta r^2} \right) dt + b \frac{\partial V}{\delta r} dz$$

From the partial differential fundamental zero-coupon pricing equation;

(3.2.21) $$dV = \left(b\lambda \frac{\partial V}{\delta r} + rV \right) dt + b \frac{\partial V}{\delta r} dz$$

which becomes;

(3.2.22) $$dV - rV\ dt = b \frac{\partial V}{\delta r} (\lambda\, dt + dz)$$

This expresses the return on the bond as an excess return earned over the spot risk free rate for taking an excess $\lambda\, dt$ of risk. The spot rate random walk in 3.2.9 has coefficients that are more complex than those found in the equity market random walk. However, focusing on the price of pure discount securities (i.e. time equivalent inverse of spot rates), gives information about the behaviour of r.

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[2] While the first concern is that a solution does exist, the second concern is that there is exactly only one solution to the differential equation that has the required properties.

There are different classes of solutions for $a(r,t)$ and $b(r,t)$ in 3.2.9. Two of these functional forms identified by Wilmott, Dewynne & Howison (1996) are;

(3.2.24) $$a(r,t) = \sqrt{\alpha(t)r - \beta(t)}$$

and

(3.2.25) $$b(r,t) = \left(-\gamma(t)r + \delta(t) + \lambda(r,t)\sqrt{\alpha(t)r - \beta(t)}\right)$$

The time dependent functions in 3.2.23 and 3.2.24 can be restricted to fit the data and still have a random walk for spot rates with the property of mean reversion such that the spot rates cannot become negative. The solution of the partial differential fundamental zero-coupon pricing equation 3.2.19 is;

(3.2.26) $$V(r,t) = A(t)e^{-rB(t)}$$

If the values of α, β, γ and δ are assumed to be constant then;

(3.2.27) $$\frac{2}{\alpha}\log A = a\psi_2 \log(a - B) + \left(\psi_2 - \frac{1}{2}\beta\right)b \log((B + b)/b) + \cdots$$

$$\cdots + \frac{1}{2}B\beta - a\psi_2 \log(a)$$

and

(3.2.28) $$B(t) = \frac{2\left(e^{\psi_1 t} - 1\right)}{(\gamma + \psi_1)\left(e^{\psi_1 t} - 1\right) + 2\psi_1}$$

where

(3.2.29) $$b, a = \frac{\pm\gamma + \sqrt{\gamma^2 + 2\alpha}}{\alpha}$$

and

(3.2.30) $$\psi_1 = \sqrt{\gamma^2 + 2\alpha}$$

and

(3.2.31) $$\psi_2 = \frac{\delta + a\beta/2}{a + b}$$

In the case of the term structure, the initial spot and forward curves and their associated volatilities can be observed from the market and a model would be expected to be consistent with these observations.

3.3 Modelling the Stochastic Process of the Irish Term Structure

In this section, the changes in the spot rates are examined to see whether there are common factors in the Irish term structure. The parameters of the distribution of the Irish spot rates and their changes are identified to see whether they are normally distributed. The behaviour of the time series of spot rates and their changes have important implications for the specification of the stochastic process that seeks to describe their operation through time. The results can give some indication about arbitrage free term structures and the behaviour of bond prices for different hypotheses.

The main purpose of a factor analysis is to transform the correlated spot rate time series into factors that explain a substantial part of the common variance in the original data by a small number of common sources. It is important to understand the behaviour of each of the factors and their relative importance in explaining the comovement of the spot rate time series. The objective is to identify the first factor that reflected to the major movement of the whole term structure. Longstaff and Schwartz (1992) found it useful to simplify the analysis by considering a smaller number of linear combinations of the original spot rates.

Litterman and Scheinkman (1991) demonstrated that the stochastic process of the term structure can be represented by a small set of common factors that represent bond returns on US data. A considerable element of the variance of bond portfolios can be explained by three factors which represent shifts in level, steepness and curvature of the term structure. A variance-covariance matrix is used to identify the principal component for calculation of factor sensitivies and the correlation matrix is shown in exhibit 3.2.

The correlation matrix illustrates the fact that the comovement of spot rates decreases with increasing maturity. For example, the three month Irish spot rate changes and one year Irish spot rate changes are 93.6% correlated, the correlation between correlation between three month Irish spot rate changes and seventeen year Irish spot rate changes is 53.7% over the period 1980 to 1997.

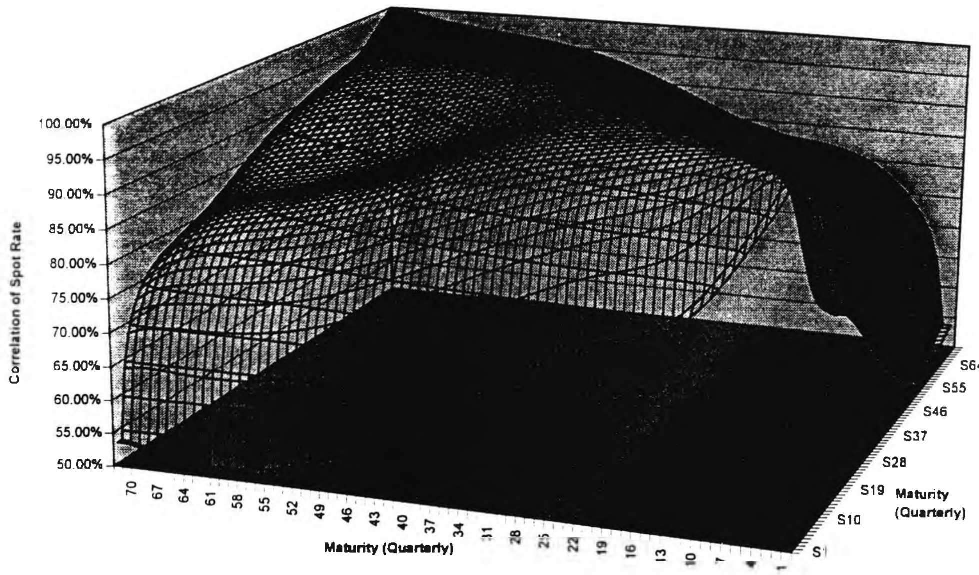

Exhibit 3.2 Spot rate changes Correlation matrix 1980 to 1997

Source : Empirical

In exhibit 3.3, the Irish term structure of volatility is examined. Volatilities of spot rate changes decrease monotonically to a maturity of nine years; then increase monotonically to a maximum at a maturity of eighteen years before decreasing monotonically to a maturity of twenty years. This is an unexpected result that has not been borne out in empirical research in other markets.

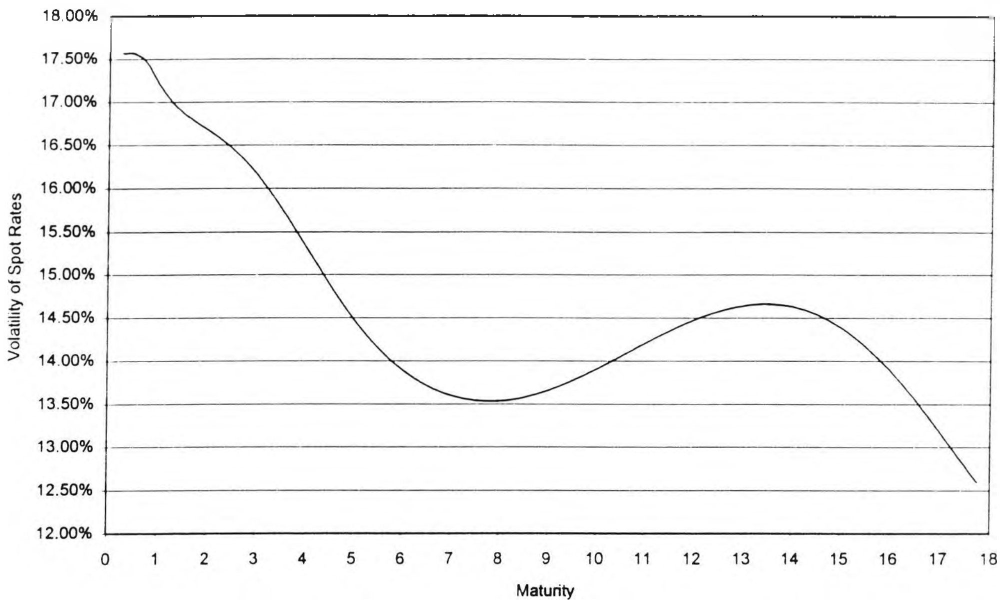

Exhibit 3.3 Volatility of Irish Spot rate changes 1980 to 1997

Source : Empirical

Furthermore, when we focus on the period when exchange controls are removed from 1989 to 1997 in exhibit 3.4, the volatility term structure falls strictly monotonically over the entire maturity range. This confirms that the Irish term structure behaved in an unusual manner between 1980 and 1989 and the findings in other European markets that long spot rate fluctuate less than short rates (Buhler and Zimmermann (1996)).

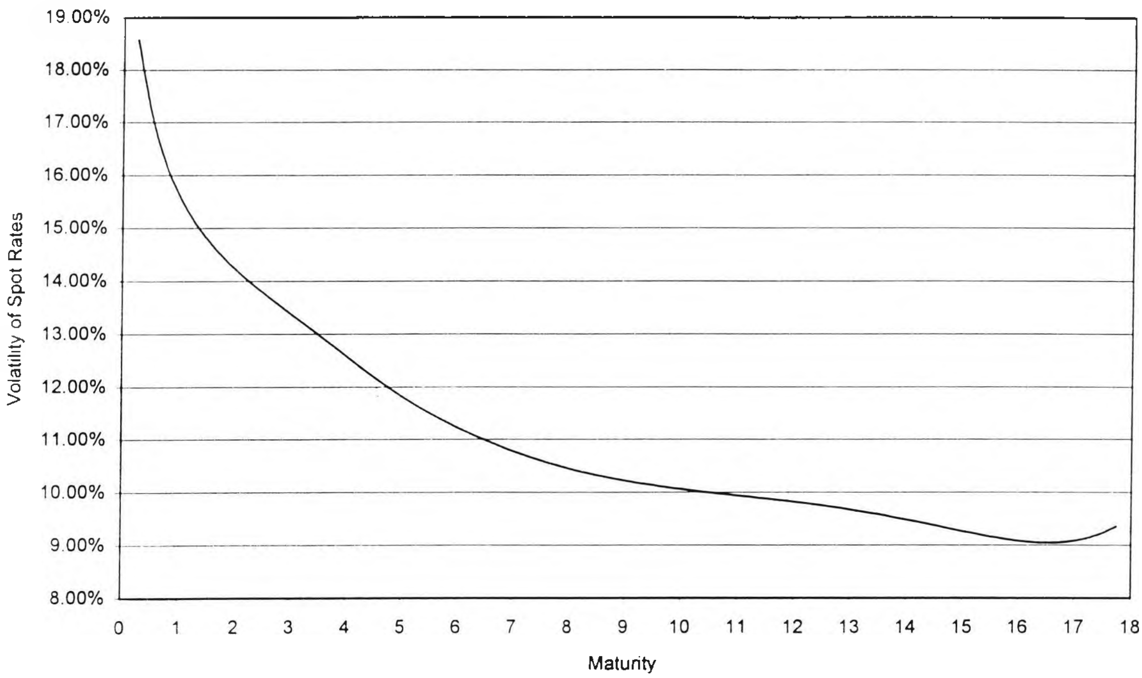

Exhibit 3.4 Volatility of Irish Spot rate changes 1989 to 1997

Source : Empirical

Since some of the factor models assume that volatilities and correlations are constant and stable, the standard deviation and correlations of the first differences are plotted for a moving five year period between 1985 to 1997 in exhibit 3.5 and 3.6 for the six month, 5 year, ten year and eighteen year spot rates.

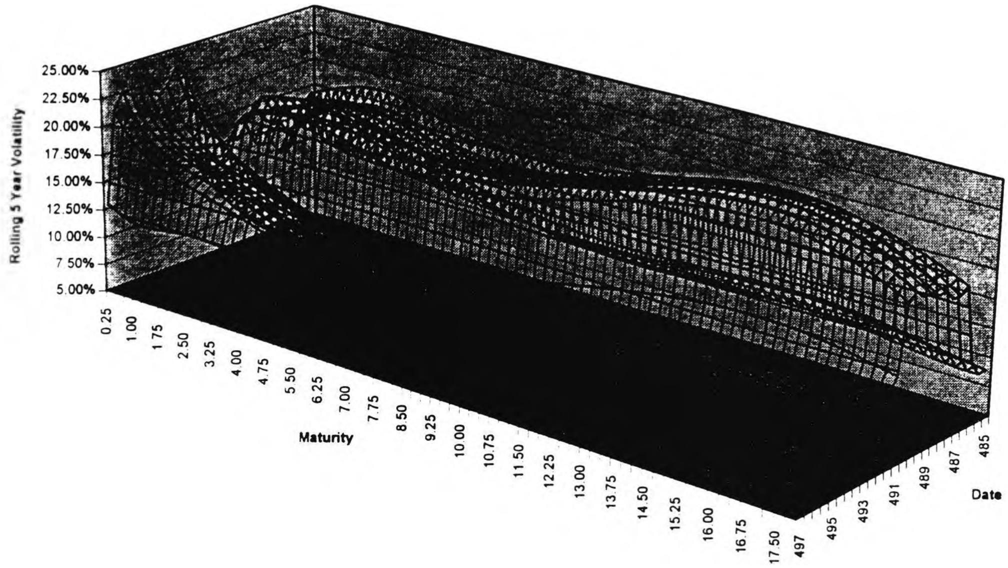

Exhibit 3.5 Volatilities of Irish Spot rate 1985 to 1997

Source : Empirical

During this period the spot rate is rather unstable and its behaviour can be broken into three very significantly different periods, firstly, 1980 to 1987, secondly, 1988 to 1991 and thirdly, 1991 to 1997. By using the standard two-sample t-test, the t-value of 2.207 (p-value equal to 3.92%), the first significant break in the time series of volatility is between the first period 1980 to 1987 and the second period 1988 to 1991. The second significant break with a t-value of 5.1368 (p-value equal to 0.02%) is between the second period 1988 to 1991 and the third period 1991 to 1997. Volatility of the short rate is higher than the long rate, but both have fallen in recent years. While volatilities do not change in a parallel manner, there is clearly a strong relationship in adjoining spot rates.

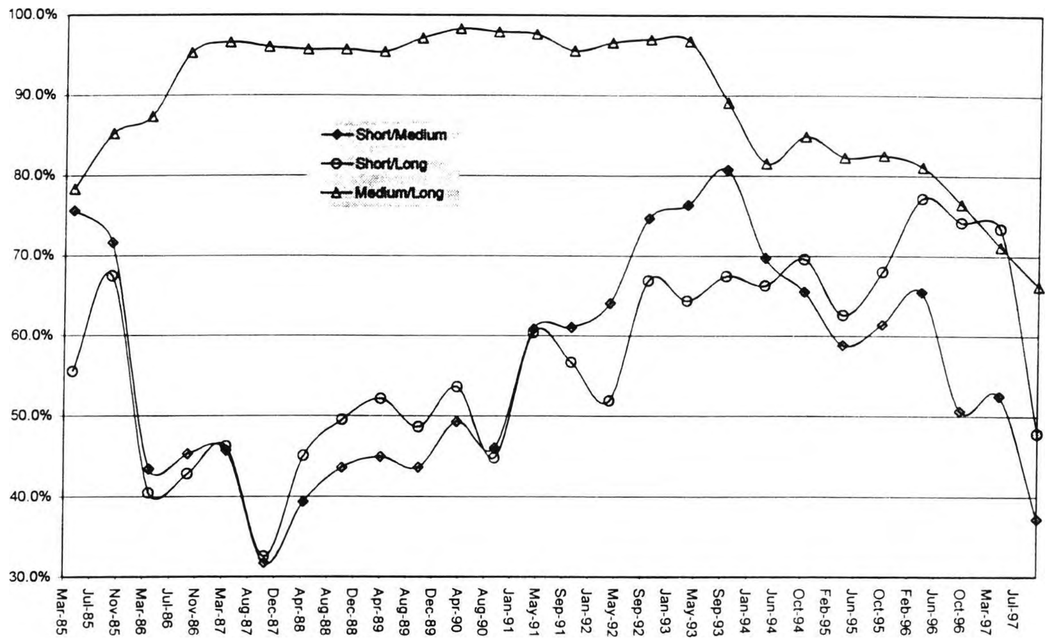

Exhibit 3.6 Correlations of Irish Spot rates 1985 to 1997

Source : Empirical

In exhibit 3.6, the correlation is calculated for a moving five year period for the three month spot rate changes against the ten year spot rate changes, then for the three month spot rate changes against the eighteen year spot rate changes and finally for the ten year spot rate changes against the eighteen year spot rate changes. The results are similar to the volatility finding and the correlations are not very stable through time.

The first three components of the changes in the spot rates are shown in exhibit 3.7 and their importance is shown in table 3.1. It can be observed that the first factor is broadly similar for all maturities implying that it caused a paralled shift of the term structure. These results support the observation of Litterman and Scheinkman (1991) that the first factor represents a pure level shift or duration factor.

From exhibit 3.7, the short and long spot rates are inversely related to the second factor meaning that they move in opposite direction for a given factor shift. This second factor captures the inversion of the term structure and it can be described as a slope factor. The third factor captures curvature shifts in the term structure where the long and short spot rates move in a different direction from intermediate spot rates.

Measure	Shift	Slope	Curvature
Standard deviation	0.1433455	0.03991129	0.01848747
Proportion of Variance	90.76%	7.04%	1.51%
Cumulative Proportion	90.76%	97.80%	99.31%

Table 3.1 Irish Term Structure Factors Relative Importance 1980 to 1997

Source : Empirical

The degree to which each factor explains the variance of spot rate changes is of interest. The first factor explains 91% of the variance, and the first two factors together explain 98% of the variance. Overall, the factors explain 99% of the variations of the term strucutre of spot rates. The factor loadings are the coefficients of the principal component transformation and provide a summary of the influence of the original spot rate changes on the principal components. In terms of interpretation, a large coefficient in absolute terms corresponds to a high loading, while a coefficient near zero has a low loading. The loadings for the first factor are all of the same sign and a reasonable interpretation is that they represent a paralled shift or change in spot rates. The second component contrasts by being negative for the first seven years, then are positive from year 8 to year 18 and a reasonable interpretation is that it represents the slope in spot rates. Finally, the third factor is positive for the first two years, marginally negative between years 3 to 13 and positive from years 13 to 17 and a reasonable interpretation is that it represents the curvature in spot rates.

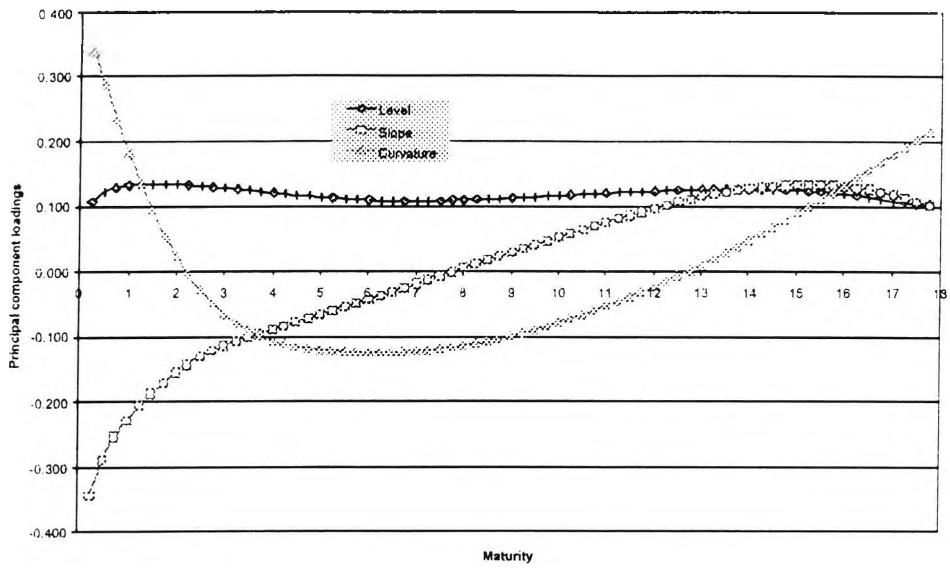

Exhibit 3.7 Irish Term Structure Factors 1980-1997

Source : Empirical

One of the issues in building a factor model is the number of factors to be considered. The purpose of factor analysis is to reduce the complexity of multivariate data by transforming the spot rate data into the principal component space, and then choosing the first n principal components that explains most of the variation in the original spot rates. There are different approaches to determing the number of factors required for term structure modelling:

- Cattell's criterion
- Include enough components to explain an arbitrary amount
- Kaiser's criterion

Cattell's criterion is a screeplot where the eigenvalues λ_j is plotted against j and has the disadvantage that it can include too many components.

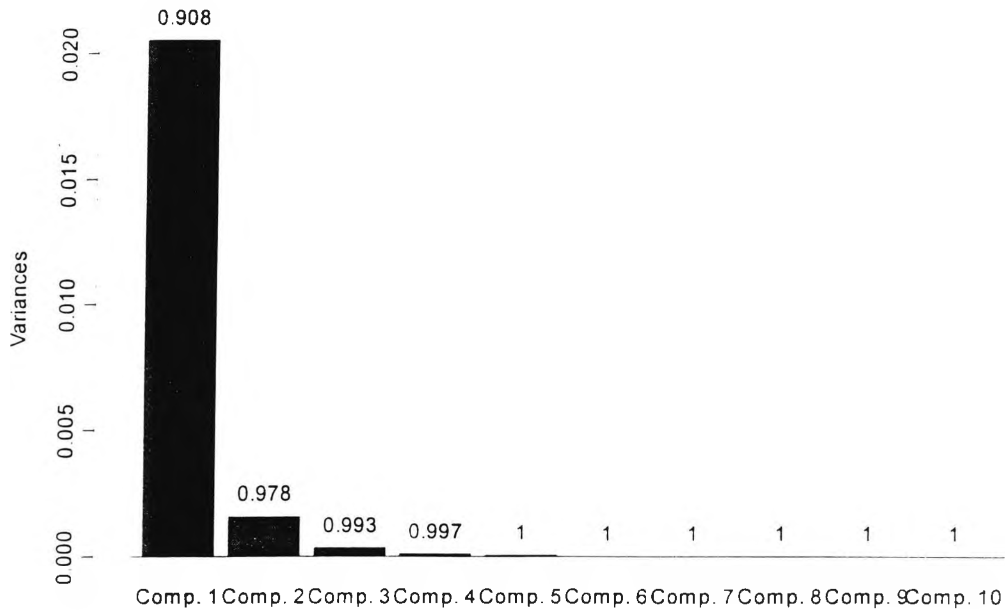

Exhibit 3.8 Cattell Plot of Eigenvalues for Irish Term Structure data 1980-1997

Source : Empirical

A screeplot plots the eigenvalues against their indices, and generally breaks visually into a steady downward slope and a gradual trailing away. The break from the steady downward slope indicates the break between the important principal components and the remaining components which make up the scree. The screeplot for the changes in spot rate by maturity is shown in exhibit 3.8 and only the first three components appear important, explaining 99% of the variance. If Kaiser's criterion for excluding eigenvalues is applied, all components except the first three are excluded. The 99% criterion suggests keeping the first three factors.

Exhibit 3.8 does not give a comprehensive view of both factors and the original data. The biplot in exhibit 3.9 allows the representation of both the original spot rate changes and the transformed observations on the principal components axes. By showing the transformed spot rate changes, the original data can be interpreted in terms of the principal components.

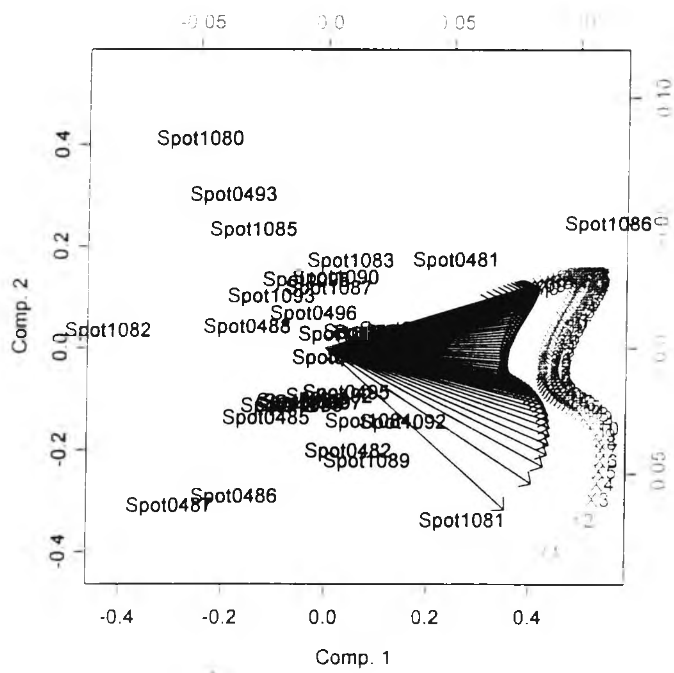

Exhibit 3.9 Biplot of Irish spot rate changes data 1980 to 1997

Source : Empirical

The biplot is interpreted with the x-axis representing the scores for the first principal component, the y-axis the scores for the second principal component. The original values are represented by arrows which graphically indicate the proportion of the original variance explained by the first two principal components. The direction of the arrows indicates the relative loadings on the first two principal components. For example, the variable spot rate changes of three months maturity has the largest loading in absolute value for both the first and second components. and the loading on the second component has a negative sign.

Thus, spot rate changes of three months maturity are represented by a long, downward sloping arrow. The variable spot rate changes of seven and three quarters years maturity has the smallest loadings on the two components with the second component having a value of zero. Thus, spot rate changes of seven and three quarters years maturity is represented by a short horizontal arrow. The variable spot rate changes of 17 years and nine months maturity has the largest loading in absolute value for both the first and second components, and the loading on the second component has a positive sign.

3.4 Examining the Irish Term Structure as a time series

In this section, univariate time series models are identified for short, long and spread rates of interest. The statistical properties of *r*, the six month short spot rate, *l*, twenty year long spot rate, and *s*, spread between long and short spot rate and their differences are described in table 3.2 with the appropriate statistical distribution for the spot rate time series.

	R	L	S	ΔR	ΔL	ΔS
Minimum	5.186%	6.386%	-4.367%	-5.762%	-4.320%	-3.786%
Maximum	21.057%	22.462%	5.847%	6.234%	6.386%	4.180%
Mean	10.847%	11.480%	0.634%	-0.050%	-0.155%	-0.105%
Std Deviation	4.039%	4.351%	2.000%	2.345%	1.955%	1.773%
Variance	0.163%	0.189%	0.040%	0.055%	0.038%	0.031%
Skewness	0.595	1.167	-0.032	-0.058	1.211	0.148
Kurtosis	0.078	0.428	0.814	1.795	3.479	0.069

Table 3.2 Summary Distribution of Irish Spot Rate Parameter Factors 1980 to 1997

Source : Empirical

By using the Kolmogorov-Smirnov test for different statistical distributions, the statistical distribution identified to best fit the short spot rate time series from 1980 to 1997 is a Gamma distribution with the parameter estimates; α of 8.99 and β of 0.0119, with a Kolmogorov-Smirnov value of 0.0774 shown in table 3.10. The Gamma distribution is:

$$f(r) = \frac{\beta^{-\alpha}}{\Gamma(\alpha)} e^{-r/\beta} r^{\alpha - 1} \quad (0 \le r < \infty), 0 < \alpha, 0 < \beta \tag{3.4.1}$$

In exhibit 3.2, the decline in the short spot rate from a high of over 20% in 1981 to a low of 5% in 1997 can be seen.

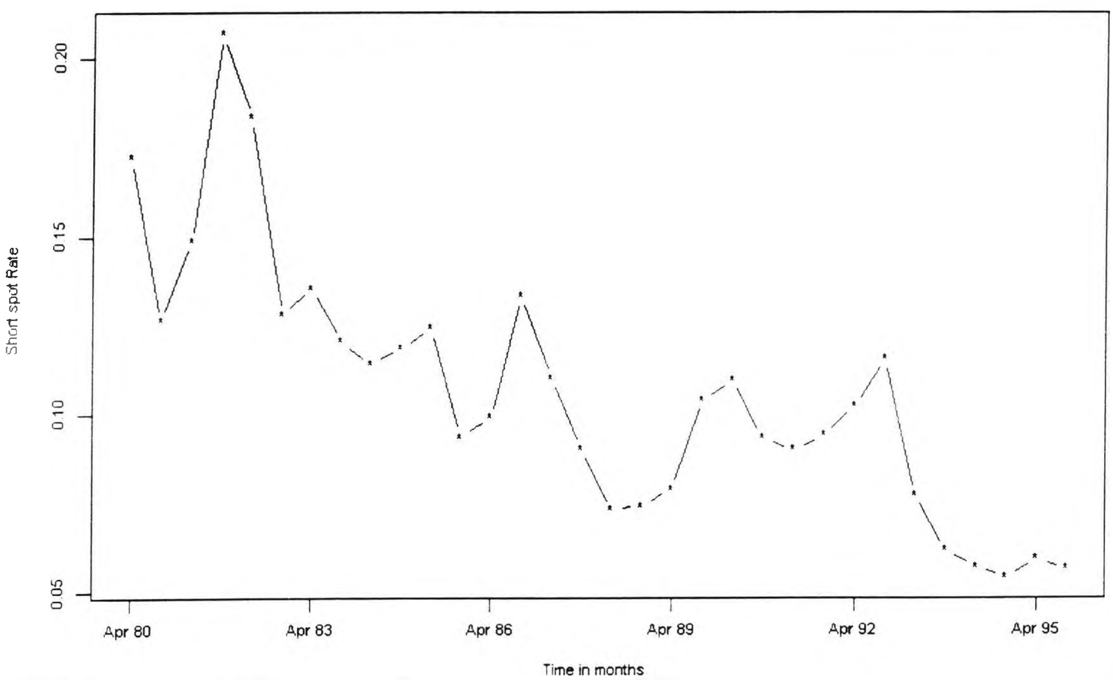

Exhibit 3.10 Irish Short Spot Rates - 1980 to 1997

Source : Empirical

Since the values of successive short spot rates tend to be close together, serial correlation is a problem. In exhibit 3.11, the lagged scatter plots consist of scatter plots of pairs of short rates (r_t, r_{t+j}) of the time series separated by j semi-annual units of time for $j = (1,2,\ldots 4)$.

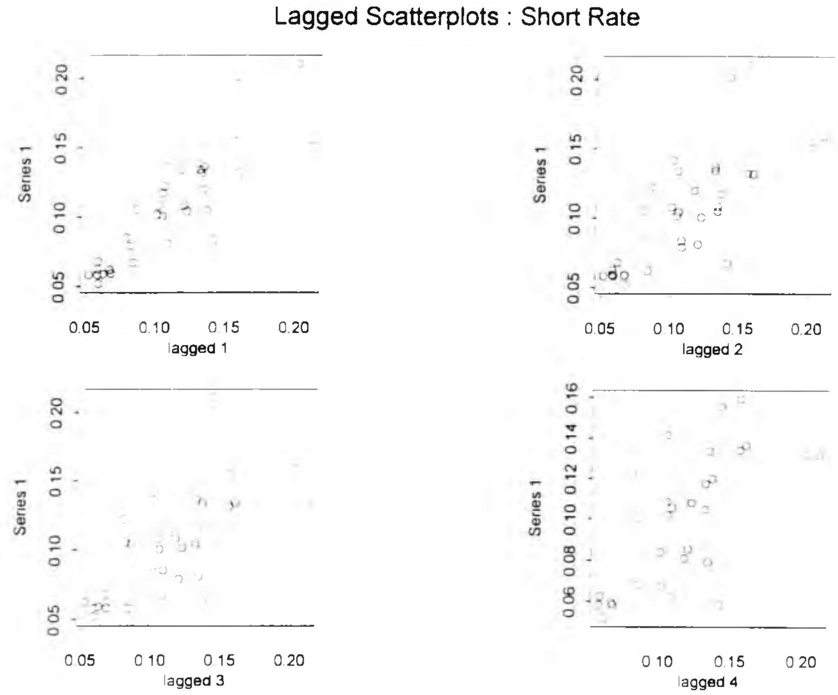

Exhibit 3.11 Irish Lagged Short Spot Rates - 1980 to 1997

Source : Empirical

An elliptical shape for up to 4 lags in the 45° direction indicates positive correlation up to the fourth lag. The plot of the autocorrelation in exhibit 3.12 illustrates the estimation of the correlation between spot rate observations separated by a lag of j semi-annual units of time.

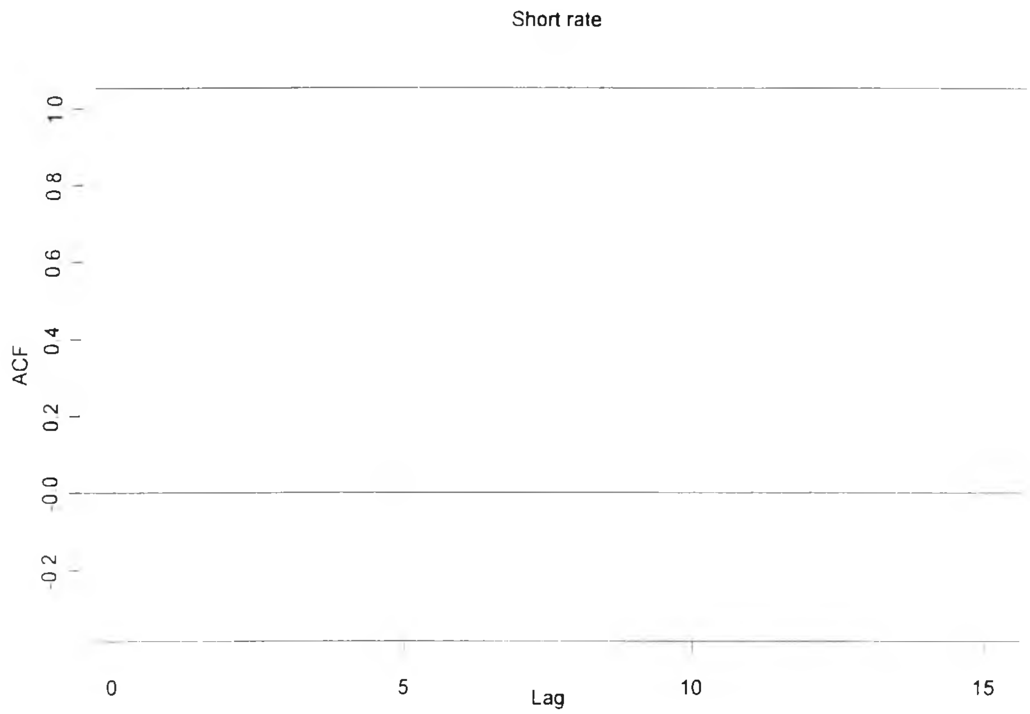

Exhibit 3.12 Autocorrelation of Irish Short Spot Rates - 1980 to 1997

Source : Empirical

The horizontal dashed line is the 95% confidence interval for the autocorrelation estimate at each lag. The plot indicates autocorrelation for the first three semi-annual lags or one and a half years.

The distributions of the long spot rate, the spread between the long and short spot rates and the changes are in appendix four. When the kurtosis values for changes in the short, long and spread spot rates are examined in table 3.2, they range from 3.54 to 5.41 indicating an element of leptokurtosis, particularly in the distribution of the long rates. However, the normal and Weibull distributions are the closest fitting distributions for changes in the short, long rates and changes in their spread. The other time series models are in appendix 4.

3.5 Spread Process and the Orthogonality Proposition

In this section, the Ayres and Barry (1979) orthogonality proposition is examined in relation to the spread process. Brennan and Schwartz's observation of the short and long rates being permitted to influence each other is also examined. This orthogonality proposition originating from the Ayres and Barry (1979) study has been consistently observed and supported in a number of separate studies {Schaefer (1980); Nelson and Schaefer (1983).

Since a number of authors have found the long rate and short rate to be highly correlated, whereas the long rate and the spread between the long and the short rate, on many occasions is found to be orthogonal and thus more appropriate for use in a two factor model, spreads between the various rates are calculated and, along with the rates themselves are tested for correlation. The correlation table is thus used to aid the selection of possible factors.

	r	l	s	Δr	Δl	Δs
r	100.00%					
l	89.90%	100.00%				
s	-8.56%	38.02%	100.00%			
Δr	-30.40%	-12.28%	34.67%	100.00%		
Δl	-30.98%	30.09%	-2.89%	67.38%	100.00%	
Δs	6.05%	-16.93%	-49.06%	-57.97%	21.14%	100.00%

Table 3.3 Orthogonality Tests of Factors 1980 to 1997 of Irish Term Structure

Source : Empirical

The correlation of the level of the short rate and the long rate is 90% and the correlation of their changes is 67% which is in keeping with the Brennan and Schwartz (1979) observation.

Their model is estimated in Appendix 4. The correlation is estimated between the levels of the long rate and the spread between the long and short rate at 38%, indicating somewhat orthogonal behaviour. Despite the apparent significance of this value (Inverse F=0.33 for 35 degrees of freedom at the 5% level), the non-normality of both data sets can induce spurious correlation in a product moment correlation of more significant magnitude. At -17% in table 3.3, there is no relationship between the long rate and the change in the spread.

3.6 Summary and Conclusions

The nature of the stochastic processes that generated Irish yield curves is analysed in this chapter. One of the major problems is that the data have been confined to six monthly observations giving thirty-two sample points from which the spot rate curve factors describing the yield curve are identified. A number of different approaches to modelling the term structure of spot rates are then analysed. Each possible approach has advantages as well as disadvantages when compared on the basis of the tractability of the model solution, the number and ease of estimation of parameters, and the amount of market information used. While the hypothesis that changes in the short and long spot rates could not be rejected, they did display a high degree of leptokurtosis.

The dynamics of the Irish term structure are examined from 1980 to 1997 and three factors explained more than 99% of the term structure movement. The first factor implied a parallel shift of the term structure: the second factor implied a change in the slope of the term structure, and the final factor implies a change in the curvature of the term structure. It is interesting to note that the term structure of spot rate volatilities is not strictly monotonically decreasing until exchange controls are removed in 1989. This has strong implications for bond portfolio risk management which uses only duration measures for control purposes. However, the stability of correlation and volatilities across the term structure is a major concern between 1980 to 1989 from a risk management perspective, but with the advent EMU the correlation should increase between different European bond markets, reducing this risk.

Volatility is the most important model parameter and two factor models are better than single factor models. Two factor models of the term structure allow a more realistic representation of the yield curve than their single factor equivalents.

They can be characterised by their tractability and ease of use, but with the resulting disadvantages of unrealistic assumptions about the stochastic process for the short rate, and the limitation of possible shapes that the term structures can take. The changes in the spread between the short and long spot rates and the long spot rates are found to be orthogonal. This phenomenon has been observed in other markets and points to a two factor models involving these parameters. The parameters that are required for the Vasicek (1977), Cox, Ingersoll & Ross (1985), Hull & White (1990) are estimated in the final section. Futher research could be done if the spot rates are available on a weekly basis for the past ten years.

In the next chapter, the microstructure of the price discovery process of the term structure will be analysed using the findings of the second chapter to model the discount function and the findings of this chapter to build a Monte-Carlo simulation model of a dealer in government securities. Then in chapter five, the behaviour of a particular sector that invests in government securities will be analysed using the findings of the second chapter to quantify the duration of its liabilities. A matching immunised portfolio of goverment bonds using third party indices will be constructed and the findings of this chapter allow a Monte-Carlo simulation model to be built of a mismatch reserve for a non-matching portfolio.

Chapter 4

Microstructure of the Irish Government Treasury Market

4.1 Introduction

The application of explicit trading rules to securities priced in line with processes outlined in chapters two and three is examined in this chapter. The hypothesis to be tested using simulation methods is whether a competitive dealership market could be feasible in terms of long-run bankruptcy risk, and preferable to the then existing agency microstructure. The efficient and effective operation of the price discovery process is an area of concern to both the borrower and investor.

The issues concerning the authorities are: the different costs associated with different structures; immediacy; liquidity[1], ease of regulation and transparency. This chapter is divided up as follows: section two reviews the relevant literature on microstructure; section three reviews the microstructure of the agency bond market; section four investigates whether the European Union Capital Adequacy Directive is adequate for the Irish market; section five simulates a Monte-Carlo framework for a primary dealer and the summary and conclusions are in section six.

4.2 Literature Review

4.2.1 Definition of Microstructure

Garman (1976) defines market microstructure as the study of the process and outcomes of exchanging assets under explicit trading rules and of the resulting prices. Any price represents today's value for a future set of cash flows whose size and/or timing can be deterministic or stochastic.

For the Irish government, the risk-free[2] cash flows are set down in the issue terms of its bonds of which 90% were fixed coupons with the remaining 10% being variable (due to the coupon setting mechanism or embedded options features). If there are any additional risks other than credit involved in the market microstructure, a higher return may be required to compensate for these risks. In this scenario, the government through the NTMA would have a greater cost of service on the National Debt, which could be lowered by changing the market microstructure.

There are three factors that can create a demand for the immediate execution of a trade. Firstly, as a result of analysis the asset/liability allocation of a portfolio can be re-aligned. Secondly, a response can be required to offset the risk of a new liability. Finally, a trader can be anticipating changes in the price of an asset not already fully discounted by other traders in the market. In all three cases there is a cost to the trader of delaying the execution of the particular trade. The most common cost in all three situations is the possible adverse price movement that could occur in the period prior to the execution of the trade. Price volatility can increase the demand for immediacy. In general, a bad price outcome is just as likely as a good one when prices are variable. The larger the underlying price variance per unit time, the greater the risk faced by the trader in the period before the trade is executed and the greater the demand for immediacy.

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[1] Liquidity is defined as the limit on the size of a transaction upon which the market price can be dealt.

4.2.2 Types of Microstructures

There are three broad categories of continuous or batch trading procedures. They are as follows. Firstly, a dealer, who has to continuously quote bid and ask prices at which he is willing to trade, dominates a dealer market. Secondly, the open auction is a continuous market clearing procedure under which traders continuously submit buy or sell orders to the market. Thirdly, the batch auction clearing house where traders submit orders to buy or sell specified quantities of the traded security either at the market price or subject to a limit price qualification. In batch trading, orders are allowed to accumulate over time, rather than being transacted immediately.

Continuous trading does not mean that transactions occur all the time, but that a transaction can occur whenever the orders of two traders cross. There are two distinctions made in continuous trading systems and matching systems. Firstly, in a dealer system, an intermediary "makes the market" by satisfying the customer's order from the intermediary's own account, while in a matching system, traders act as agents for the customer. Secondly, matching systems invariably have dealers (in the sense of professional traders who are usually willing to supply immediacy by trading to or from inventory), but public limit orders are given equal or preferred status.

There are a variety of stabilisation techniques to cope with excess demand or supply. The most common type of stabilisation is by the use of maximum price change limits, e.g., Chicago Board of Trade limit up and limit down on price movement within a trading session. Alternatives are to halt trading temporarily when an excessive price would otherwise occur, to indicate a price, or to accumulate orders for a time period and then resume trading with no price limit.

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[2] The credit risk is assumed to be zero because bonds have the first fixed charge on tax receipts which flow into the Central Fund and do not require additional legislation in the government's budget Finance Act because the operation of the Central Fund is set out in the Constitution.

Market makers can have an affirmative obligation to stabilise security prices if transaction-to-transaction price changes exceed certain limits. The NTMA uses the stabilisation method of making purchases and sales in the market of it's own bonds.

The necessary climate for evolutionary innovation in electronic trading includes the availability of technology and economic gains from adoption but the failure of Irish Futures and Options Exchange (IFOX) in 1996 can mean waiting for this evolution until after the advent and development of the single EURO currency in European Monetary Union.

4.2.3 Liquidity and Bid/Ask Spread

One market variable long thought to be a factor in price adjustment is trading volume. McDermott (1993) maintains that volume is larger when prices move up than when they move down. The reporting of Irish volume has been made difficult because it contains a level of REPO activity to facilitate differences in one day Government Settlement Office[3] (GSO) local settlement and one week Cedel or EUROCLEAR settlement. Empirical research has identified a strong link between volume and the absolute value of price changes.

Volume's role in the price adjustment process is to facilitate certainty. An important feature in this result is the common error in the information. If price and volume together revealed the true value of the risky asset, then higher volume need not necessarily accompany the absolute value of price changes: whatever volume arose would be sufficient to move prices to full information values.

Liquidity has long been recognised as an important determinant of market behaviour. While it is common today to ascribe only beneficial properties to liquidity, such a view has not always been held. Keynes (1936) said that:

> *"Of the maxims of orthodox finance, none, surely, is more anti-social than the fetish of liquidity, the doctrine that it is a positive virtue on the part of investment institutions to concentrate their resources on the holding of liquid securities ".*

Ultimately, all assets are liquid over the time horizon of the assets' life, in that they can return all the cash flows on the designated payment dates, assuming no default risk. Liquidity is the possibility of facilitating the exchange of these future cash flows for one cash flow today by transacting with counterparty in the secondary market. The single cash flow today is the price of the asset and represents a discounted value of the sum of these future cash flows.

Liquid markets are generally viewed as those that allow trading with the least effect on price. In liquid markets it should be possible to trade, if not continuously then at least with some frequency, without unduly affecting prices. If prices move after trades, then these price revisions can provide a more accurate reflection of the costs of trading than do bid and ask prices. This view of liquidity involves a time series dimension quite distinct from the cross sectional properties normally associated with the earned spread. This is the focus of Grossman and Miller's (1988) analysis of liquidity. Their focus is on the role of liquidity as the price of immediacy, or essentially the notion that a trader willing to delay transacting commands a better price than one who demands immediate execution.

Grossman and Miller's (1988) view is the greater the number of speculators willing to provide immediacy, then the greater the liquidity of the market. Since the return to speculators increases due to increased price variance, markets with greater price volatility can have more speculators, but they in turn require a higher return to compensate them for the greater risk.

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[3] The legislation was passed in 1997 to rename the CBISS, which is an acronym for Central Bank of Ireland Settlement System.

Liquidity can be enhanced in a market by improving the return to speculators (and thereby inducing more to enter) until the marginally revenue on a risk adjusted basis is equal to the marginal cost of maintaining a market presence.

If the number of traders and their risk capital affects liquidity, then the scale of trading can affect market performance. In particular, if prices are more transparent in a more liquid market, there should be a natural incentive for traders to converge on one market, rather than split their trades across markets.

Ho (1984) investigated the relationship between the bid-ask spread and market liquidity. In the case of the government debt market, the traders were involved in the price discovery process at two levels, firstly the individual bond values and secondly the underlying term structure described in chapter 2 which orders and put bounds on their prices in an arbitrage free framework. Ho (1984) believes[4] that bond values and the underlying term structure were not independent of each other and the bid-ask spread represents the portion of the value of the transaction that pays for dealer services. He states that the return on capital of the dealer market determines the number of dealers, and hence the liquidity in the market.

If there is free entry and exit into and from the market, and there are no subsidies to dealers for their market making activities, there must be a direct relationship between the bid-ask spread and market liquidity. Ho (1984) showed this to be true when transaction volume is kept constant. That is, a tight spread can decrease dealer revenue, causing some of the dealers to leave the market leading to a loss of liquidity in the market. The number of market makers in a bond is central to the dealer market structure. Market makers could differ from each other with regard to their capitalisation and trading portfolio size. However, the capital committed to a particular bond and the trading strategy of a market maker must meet a minimum level across all market makers to comply with the European Union Capital Adequacy Directive.

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[4] Personal communication.

Since there are few economies of scale to trading, each dealer must reach his optimal capitalisation and pricing strategies for a particular bond. In Admati - Pfleiderer's (1988) model, uninformed liquidity traders were assumed to be of two types. There are non-discretionary liquidity traders who must transact a given amount at a specific time. The second group must also trade a given amount but they have some discretion with respect to the timing of their trades. Unlike Ho's model (1984), they recognise that by seeing the flow of orders from different types of counterparties, they could use information as input into their price making process.

4.2.4 Capital, Order Flow and Ruin Barrier

A seminal paper was written by Garman (1976) where he investigated the security market microstructure and argued that an exchange market could be characterised by a flow of orders to buy and sell. The question then arises: if buyers and sellers arrive at different points in time, to what time period do the supply and demand schedules refer? This flow of orders would arise as the solution to individual traders' underlying optimisation problems. As these orders go into the market, imbalances between the demand and supply of a certain good could temporally arise.

He examines two market clearing frameworks, a dealer structure and a double auction mechanism. The imbalance that would arise dictates an importance to the temporal microstructure and the requirement to carry an inventory. This is the essence of how the exchange between buyer and seller actually occurs at any point in time. In his model, Garman (1976) assumes that his position at any point in time is determined by the order arrival rates. If orders to buy and sell are not always balanced in the selected time period, how does the price change reflect the order flow?

Garman (1976) considers a single monopolistic market maker that sets prices, receives all orders and clears trades. The dealer's objective is to maximise expected profit per unit of time. Failure arises when the dealer runs out of inventory or cash.

Garman's (1976) assumptions were that the market maker is not allowed to borrow and the level of demand associated with these order processes is exogenous to the market maker. As the orders arrive, the dealers' cash position changes and it is this dynamic movement that is important for the dealer. Since he cannot augment his cash or bonds except through trading, the question is whether the market maker can avoid running his cash position to zero and thus failing. This is known as the Gambler's Ruin Problem. The gambler is assumed at the start to have some initial wealth $I_c(0)$ and wagers until he reaches a certain level, or loses all of his money.

As an embedded Markov chain the failure probability, provided that the value of the supply rate times the offer price exceeds the value of the demand rate times the bid price, can be expressed as:

(4.1) $$p_f = \left[\{p_S \lambda_S(p_S)\}/\{p_B \lambda_B(p_B)\}\right]^{I_c(0)/p}$$

where

$p_S -$ bid price,

$\lambda_S(p_S) -$ Market makers demand for sell orders,

$p_B -$ offer price,

$\lambda_B(p_B) -$ Market makers demand for buy orders,

$I_c(0) -$ initial cash position,

$p -$ price.

Even with odds favouring winning the gambler faces a positive probability of ruin. If a significant fraction of the trader's capital is involved in a given transaction (an example being when a Government bond dealer buys a large inventory of bonds) then a given level of price variance can, during a period of delayed execution, be very costly as observed. This occurs when arbitraging or spreading on a large scale between two or more markets.

There can be little risk once all the components of the arbitrage are in place but much risk while one side is still open. Since the market maker is dealing in the efficiency of price discovery of the term structure, he can be exposed to three levels of risks. He can have an outright position in a bond, or one of two possible positions of where either he is long one bond and short another bond on an inter or intra maturity[5] sector basis. In order to understand the risk caused by trading delays, the reason for trade must be understood. Bond holdings represent accumulated wealth and are often held for individuals by institutions such as trusts, insurance companies etc..

Daily trading volume for bonds can also be generated by trade between investors who want to move their portfolio of risky bonds into less risky bonds or from securities with mostly cash returns to those offering more price appreciation possibilities. Informational motives can also arise leading some to take a position in a bond because they feel they have some information not possessed by other traders.

The classic case of arbitrage occurs when an investor buys a security in one market where it is under priced and simultaneously sells the same security in another market where it is overpriced. Usually these trades involve narrow spreads, which means that profits depend on large volumes of activity. With the increased number of arbitrage participants and improved communications systems, markets have become efficient thus reducing the scope for such trades.

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[5] The risk capital requirement on an inter maturity basis will be greater than on an intra maturity basis.

4.2.5 Inventory Management

Stoll (1978) focuses on determining the costs the dealer faces in providing dealer services or immediacy. These are: (1) the holding costs imposed by the sub-optimal portfolio position; (2) the order processing costs (e.g. fees, taxes etc.); (3) the cost of trading with informed traders. The first formal analysis of the dealer's problem was undertaken by Stoll (1978). The dealer must delineate the risks he faces and he must choose an optimal pricing strategy to maximise his utility. Stoll (1978) focuses on the portfolio risk that the dealer function entails. The dealer is assumed to be risk averse.

In this model, inventory matters largely because of the dealer's inability to hedge his inventory exposure. The model is simplistic, e.g., if the dealer were risk neutral or able to diversify then the cost of providing dealer services would fall and could fall to zero. It is not obvious how this theory would explain phenomena such as differences in spreads during the trading day in the same bond.

4.2.6 Information Signalling in Price Changes

Another issue in microstructure theory is the generation of new information and its reflection in trading volume and price. A distinguishing characteristic is the attempt to model trading out of equilibrium. The reason is that security market information arrives with great frequency; an attempt to delay trading would deny traders the speed of execution, which they demand. Assuming a Walrasian or other equilibrium price formation model, then various observed phenomena such as market orders and bid-ask spreads cannot be explained. Glosten (1989) explores the revelation of inside information. He assumes a pure limit order book market and two classes of traders: the informed trader and the uninformed trader. If insider information is held monopolistically, an insider trader can offset his gains from trading against the probability that his trades can reveal the information. On the other hand, competition among insiders can drive up their collective rate of order arrival and the information can be revealed immediately.

If there exist other traders who are willing to provide immediacy, then a specific specialist need not be necessary in the market. For example, if traders can submit limit orders, then any market orders requiring immediate execution can be crossed with such orders, leaving no role for the specialist.

Cohen, Maier, Schwartz and Whitcomb (1981), propose a model which investigates the order strategies of traders who can choose between submitting a market order for immediate execution or a limit order which specifies a specific price for execution. There is no active specialist and they assume that the market ask (bid) price depends only on the last previous market ask, and hence is a Markov process.

If a trader submits a limit order between the current market bid and ask, what is the probability that the limit order can in fact execute over the next trading period? If it is one, then it can clearly be optimal for the trader to submit a limit order and hence reduce the price at which he trades. The authors however show that this is not the case. No matter how close the trader places his limit order to the current market price, the probability of the limit order executing is always less than one.

In Cohen, Maier, Schwartz and Whitcomb (1981) model, the limit orders held in the trading book determine the market spread. If the spread is wide then a trader has much to gain from submitting a limit order because, if it executes, the trader can have transacted at a much better price. There are two properties of this process. First, the "gravitational pull" of the market orders dictates that a non-zero spread is an equilibrium property of the market. Second, the size of the spread depends on the movement of traders between limits and markets, and this in turn partially depends on the execution probability of the limit order.

They noticed that there is a distinction in the market between market gains and trading gains. In market gains the notion is that when market prices go up in general, most investors gain; when they fall, most investors lose. In trading gains information costs can make an average investor lose money relative to the market return over time. This information loss arises because of the presence in the market of traders who have superior information of the market. These informed traders have the option not to trade, unlike the market maker who must always quote bid and ask prices. The market maker knows that when he is trading with an informed trader he usually loses. Therefore, in order to stay in business, he must be able to offset these loses by making gains from uninformed traders. These gains arise from the bid-ask spread that is adjusted to reflect their superior anticipation of order flow.

The first model to formalise this concept of information costs is by Copeland and Galai (1983). Their analysis develops a one period model of the market maker's pricing problem given that some traders have superior information. The model includes two approaches to viewing the bid-ask spread. One approach assumes a risk neutral dealer who sets bid and ask prices to maximise his expected profit. Another approach views the bid and ask prices as calls and put options provided by the dealer to the traders.

The most important result that emerges from this model is that even with risk neutral competitive dealers, a spread arises. The size of the spread differs with various market parameters, in particular the elasticities of traders demand functions. As long as there is a positive probability that some traders were informed, the spread is never zero. The Copeland and Galai (1983) model thus quantifies the concept introduced by Bagehot (1971) that information alone is sufficient to introduce market spreads.

If some traders have superior information, then the market maker loses on average to those traders. It is this insight that Glosten and Milgrom (1985) develop in their model of market maker's pricing decision that leads to three interesting conclusions. The first is that a spread arises that is independent of any exogenous transaction or inventory costs.

The spread arises because someone wishing to buy causes the market maker to revise his expectation of the assets value upward and his quotes move accordingly; the willingness of someone to sell causes the opposite revision.

A second conclusion of the model is that transaction prices form a stochastic martingale. This means that a market observer following prices cannot do better in predicting the future price than by simply using the current price. This suggests a linkage between the price behaviour in the model and the concept of market efficiency.

The final conclusion is that under some conditions the adverse selection induced by asymmetric information can cause the market to collapse or shut down. If there were too many informed traders, then the market maker can have to set the spread so large as to preclude any trading at all. But since information is reflected in prices through trades, this lack of trade results in a breakdown of the market system.

The advantage of this model is its ability to characterise the bid-ask spread. By demonstrating how market parameters such as the size of the market or the fraction of large to small trades affect quotes and spreads, the model shows how asymmetric information affects market behaviour.

Another aspect of the model is that it is possible to demonstrate that prices do indeed converge to full information values. However, this actual convergence takes place only in the limit. Hence, one limitation of this model is that it provides little insight into how long this adjustment process takes.

A third aspect of this model is the actual mechanics of the sequential trading process. In the model traders form a queue and trading takes place sequentially. How traders arrive at the queue is problematic. A final issue relates to the ability of the model to incorporate strategic behaviour. In the model traders and market makers were assumed to behave competitively.

For uninformed traders, the lack of any coherent trading motivation is clearly an area of major weakness in the model. The question of how a single informed trader can best exploit his informational advantage to maximise his profit needs to be considered. This strategic behaviour is analysed by Kyle (1985).

His model involves a framework in which a single risk neutral informed trader and a number of uninformed liquidity traders submit orders to a risk neutral market maker. The market maker aggregates the orders and clears all trades at a single price. Kyle's (1985) model therefore does not allow for a bid-ask spread. What his model does allow is the explicit characterisation of how an informed trader would choose to transact to maximise the value of private information.

It can be possible to calculate the effect on prices of trader's orders and hence permit investigation of the effect of multiple informed traders on market behaviour. This is the approach taken by Kyle (1984). There are two sources of information, one private and the other public. The public signal is observed by all market participants whereas the private signal is known only to the informed traders.

One aspect of the results found is that they are derived in an environment of risk neutrality. In the model, all traders and the market maker are assumed to be risk neutral. This assumption greatly simplifies trader's behaviour because only mean effects need be considered. In particular if informed traders are risk averse then the total scale of trading can affect each agents decision, leading to very different effects when the number of informed traders is allowed to vary.

Another important model is by Blume and Easley (1990). Using a game theoretic approach, they demonstrate that, regardless of the number of traders, if any trader has information which he alone possesses then there is no trading game or mechanism that can result in a rational expectations equilibrium for all standard economies. The difficulty is that if a trader can be an "information monopolist" then the prices predicted by the rational expectations models are unattainable.

A significant assumption is that the information is short lived. The public information arriving at the beginning of the next period dictates that private information is valuable for only one trading interval. Consequently, informed traders have no choice but to trade on their information in the period in which they receive it. Foster and Viswanathan (1990) consider an analysis of interday trading patterns. Their analysis involves a variant of the Kyle (1985) model in which trade occurs only once a day and information is "lumpy".

Given that information is "lumpy" it follows that uninformed traders might prefer to delay their trades and transact when the terms of trade are more favourable. Foster and Viswanathan (1990) assume that there were both discretionary and non-discretionary uninformed traders. Discretionary traders were allowed to delay their trades for at most one day. They were not permitted to split trades across trading days nor can they skip trading altogether if market prices seem unreasonable.

Grossman and Stiglitz (1980) noted that, if traders act competitively, their trades can result in prices impounding so much information that, in equilibrium, the price reveals all private information to uninformed traders. In this case, the issue of price adjustment is moot; prices instantly adjust to full information values and markets are full information efficient.

In actual markets such instantaneous adjustment is rarely observed. While uninformed traders recognise that prices are related to information, it can be difficult to isolate the pure information effects on security prices from the more transitory liquidity effects. While some trades can acquire information, it is not always obvious how that information relates to the ultimate value of the firm and hence not immediately apparent how unbiased is the information. These difficulties imply that simple models of price adjustment can yield little insight into the behaviour of actual asset markets. What underlies the difficulty in characterising the price adjustment process is that price movements depend on how market participants learn from the market information they obtained, and this in turn depends on other factors such as trader's risk preferences and endowments, the nature and extent of uncertainty and even the market structure itself.

In a noisy rational framework, prices are affected both by private information and by supply uncertainty. Information affects prices because some traders are assumed to receive a private signal of the asset's true value. The signal can be the truth or it too can contain noise that interferes with agents knowing with certainty the actual value. Supply uncertainty is incorporated to capture transitory effects on price that are not related to information.

This supply uncertainty can be introduced in a number of ways, but its role is always the same: with multiple sources of uncertainty, traders cannot immediately sort out the information effects on price from the supply effects on price.

Another possible explanation for a separate mechanism is the information problem inherent in large trades. If market participants interpret trade size as a signal of information, then a large seller can prefer some other trading approach than simply submitting a large order to the market maker. McDermott (1993) observes that block trades coming from the European continent do not have the same price sensitivity as local trades. A background review of the foreign government bond market microstructures in appendix five.

Which market structure better aids the price discovery function? In the quote driven market, dealers post prices before orders are submitted. Such a system is typified by NASDAQ, and is in effect a continuous dealer market. In an order driven market, orders are submitted and then trading prices determined.

4.3 Microeconomic Industry Structure of Irish Treasury Market

This section reviews the revenue and cost structure of the agency system, the requirement of the NTMA in a primary dealing system and the relative economic cost of price discovery in the Irish market relative to the German bond market.

As mentioned in chapter 2, the Irish bond market is almost totally dominated by Government issues. In terms of market capitalisation, the government fixed interest market has grown from IR£4.15bn in 1980 to almost IR£16.2bn at the beginning of 1996. In terms of the actual structure of the bond market, there is a wide range of securities available to suit the various requirements of investors; bullet bonds, callable bonds, convertible bonds and variable rate bonds. Irish Government bonds are listed and dealt on the stock exchange in Dublin. Prices are formally fixed twice a day on the stock exchange floor, although these prices could fluctuate as market conditions dictate between fixings.

The NTMA is responsible since 1990 for issuing bonds to the market and it quotes bid prices for existing bonds, but it can also quote an offer price when it wishes to sell bonds. Bond sales were normally achieved through a tap system in the past, but the NTMA has instigated changes in bond issuing procedures. In the secondary agent market, a deal takes place without the involvement of the authorities.

This involves two investors dealing through one or two brokers. In this market, one broker can deal with another broker on behalf of a client. Most of the dealing in government securities takes place without the involvement of the NTMA in what is termed the 'secondary market' and market prices are effectively observed there.

The move from the downstairs floor to a upstairs trading room took place many years ago on the Irish stock exchange with off the floor put-throughs representing 95% of total volume. O'Connor (1993) believes that poor liquidity is generally cited as one of the major structural impediments to further convergence with other European bond markets, but the size of the market and the lack of liquidity in particular bonds is a more pressing problem. The costs of immediacy include the costs of providing brokerage services, costs of providing a central place where matching of customer orders can be effected, the costs of operating a clearing house that the different parties can trade in, the fixed costs to a market maker of maintaining a presence on the exchange floor, and the costs incurred by a market maker providing a customer with immediate execution of an order by trading directly with the customer or by trading a broker representing the customer.

The historical experience of the market is investigated in terms of revenue, costs and turnover on the historical agency basis in this section. From the perspective of a cash trader, the slope of the yield curve can influence cost of carry. Also of interest are the constituent sectors of the market and how they have changed through time. These are shown in exhibit 4.1 and show a slight decline in the shorter end of the market due to falling yields and funding at longer maturities of ten to twenty five years. It is necessary to calculate these to identify the returns distribution for all maturity bands.

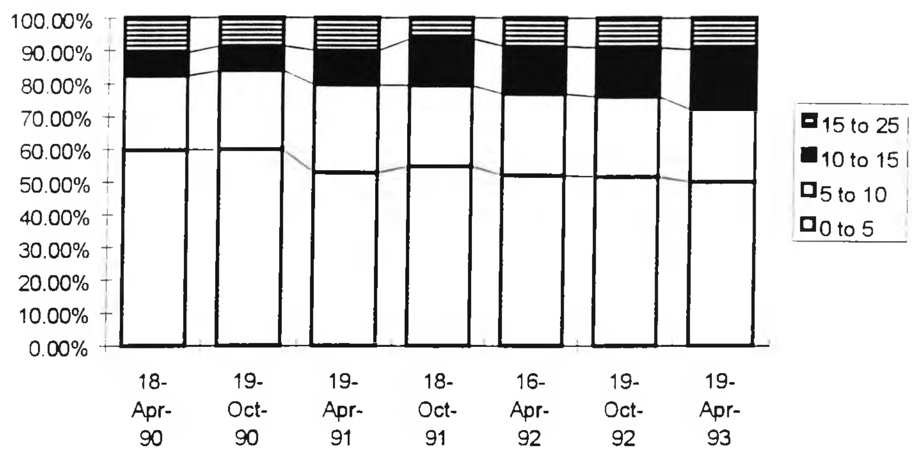

Exhibit 4.1 Analysis of Irish Government Treasury Market Turnover

Source : Irish Stock Exchange

McDermott (1993) analysed daily volumes of dealings and market share for 1992 in exhibit 4.2, to sample the average commission paid per transaction paid by his client base. This sample represents 30% of the market and can be extrapolated to other market participants. The average commission paid by each client per £1m traded is £217.28. The market shares are shown in exhibit 4.2 and are consistent with other known sources.

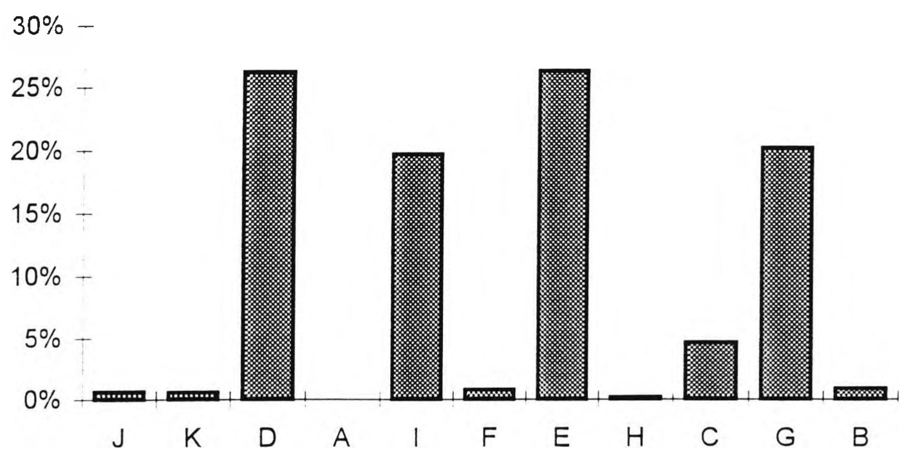

Exhibit 4.2 Agency Broker Market Share of Commission

Source : McDermott (1993), Irish Stock Exchange & IAIM

The Stock Exchange provided the history of turnover on a monthly basis of Irish treasury bonds over the past decade. A linear regression model is used on the data to forecast the turnover until 1995 (exhibit 4.3).

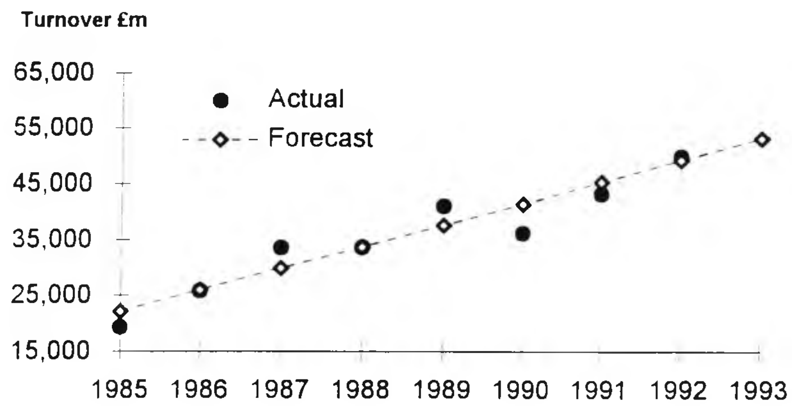

Exhibit 4.3 Market Turnover

Source : Irish Stock Exchange

It is very difficult to estimate the turnover by foreign institutions other than the net inflows shown in the Central Banks report. However, foreign institutions are very significant because of their relatively large holdings and the consequent liquidity that they bring to an otherwise innately small market. Assuming the stockbrokers' earn a net price 10p commission when dealing with non-residents and they represent c.5% of the total turnover, non-residents represent revenue of £2,350,984 in 1993. The stock brokers as financial intermediaries for government bonds on an agency basis have total revenues as shown in table 4.1 below;

Date	Actual (£m)	Fitted (£m)	Foreign (£m)	% Foreign	Domestic (£m)	£1,000.00 Foreign Revenue	£217.28 Domestic Revenue	Total Revenue
1985	19,326	22,137	856	4.43%	18,470	£856.109	£4,208,876	£5,064,985
1986	25,752	26,004	1,141	4.43%	24,611	£1,140,770	£5,608,350	£6,749,120
1987	33,526	29,871	1,485	4.43%	32,041	£1,485,145	£7,301,396	£8,786,541
1988	33,625	33,738	1,490	4.43%	32,135	£1,489,531	£7,322,956	£8,812,487
1989	41,016	37,604	1,817	4.43%	39,199	£1,816,940	£8,932,591	£10,749,531
1990	36,097	41,471	1.599	4.43%	34,498	£1,599,031	£7,861,288	£9,460,319
1991	43,215	45,338	1,869	4.32%	41,346	£1,868,850	£9,411,448	£11,280,298
1992	49,811	49,205	2,259	4.54%	47,552	£2,259,000	£10,848,092	£13,107,092
1993		53,072	2,351	4.43%	50,721	£2,350,984	£11,558,103	£13,909,087
1994		56,938	2,522	4.43%	54,416	£2,522,277	£12,400,230	£14,922,507
1995		60,805	2,694	4.43%	58,112	£2,693,571	£13,242,357	£15,935,928

Table 4.1 Estimated Total Revenue on an Agency Basis

Source : McDermott (1993) & Empirical Work

The agency commission level scale is a function of the maturity with the cost increasing with maturity. The mix between shorts (i.e. less than five years to maturity) and longs (i.e. greater than five years to maturity) for 1992 is illustrated in exhibit 4.4. The Stock Exchange is unable to provide a breakdown of such data for earlier time periods.

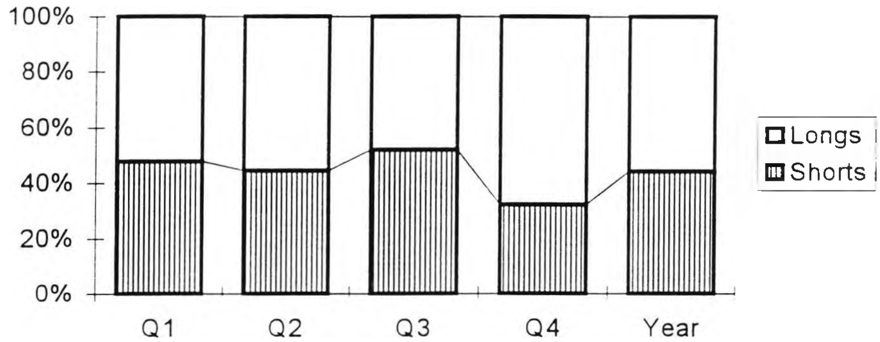

Exhibit 4.4 Market Turnover Split by Maturity Sector

Source : McDermott (1993) & Irish Stock Exchange

The sample is extended to estimate the stock brokers cost base. The cost structure is divided into short run costs (i.e. less than 90 days) and medium run (i.e. greater than 90 days). The long run costs are defined as greater than one year and these consisted of a risk-adjusted return to the equity capital base. The estimated costs are shown per dealer in table 4.2:

Cost Category	Short run	Cost Category	Medium run
Office Services	£1,200	Training	£700
Lighting & Heating	£800	Rent (£53 per sq.m.)	£5,000
Reuters	£11,000	Insurance	£500
Telephone	£3,000	Bloomberg	£1,000
Post	£2,500	Datastream	£3,000
Salary	£45,000	Computer maintenance	£500
PRSI	£8,250	Business entertainment & publications	£2,000
		Travel, accommodation & Car expenses	£5,000
		Portion of operations cost	£15,000
		Computers deprecation	£3,000
		Car lease	£5,000
		Bonus	£15,000
		VHI	£1,000
		Pension	£6,000
Total Short Run cost	**£71,750**	**Total Medium Run cost**	**£62,700**

Table 4.2 Estimated Operating Costs per Dealer per year

Source : McDermott (1993) & Farrell (1993)

The term PRSI[6] in table 4.3 refers to social insurance and the term VHI refers to voluntary health insurance. From tables 4.2 and 4.3, the stockbrokers would be expected to have the following profit and loss accounts shown in table 4.4.

[6] Pay Related Social Insurance.

Broker	Commission Market Share	Revenue	Number of Dealers	Short Run Costs	Medium Run Costs	Total Variable Costs
K	1.20%	£157,285	1	£71,750	£62,700	£134,450
B	1.40%	£183,499	1	£71,750	£62,700	£134,450
C	3.10%	£406,320	1	£71,750	£62,700	£134,450
A	1.14%	£149,421	1	£71,750	£62,700	£134,450
D	28.00%	£3,669,986	9	£645,750	£564,300	£1,210,050
E	21.30%	£2,791,811	6	£430,500	£376,200	£806,700
F	2.10%	£275,249	2	£143,500	£125,400	£268,900
G	22.76%	£2,982,555	7	£502,250	£438,900	£941,150
I	19.00%	£2,490,347	5	£358,750	£313,500	£672,250
J	N/A	N/A	1	£71,750	£62,700	£134,450
Total	**100.00%**	**£13,107,092**	**34**	**£2,439,500**	**£2,131,800**	**£4,571,300**

Table 4.3 Estimated Costs of Agency Market Structure

Source : McDermott (1993) & Empirical Work

In the long run, capital is employed to allow a broker to cover a quarter of his annual working capital requirement and the cost of default by a counterparty in a deal matched. The required return on capital employed is 14% derived from the capital asset pricing model using the money market, Murray's (1993) estimate of beta coefficients and the Riada total return on Irish equities from 1988 to 1993. The difference is "excess return" which can represent excess reserve profits to the brokerage community.

Broker	Profit Before Tax	Tax @ 40%	Profit After Tax	Capital Employed	Return on Capital	Excess Return	Excess Reserve Profits
K	£22,835	£9,134	£13,701	£33,613	40.76%	26.26%	£8,827
B	£49,049	£19,620	£29,429	£33,613	87.55%	73.05%	£24,556
C	£271,870	£108,748	£163,122	£33,613	485.30%	470.80%	£158,248
A	£14,971	£5,988	£8,983	£33,613	26.72%	12.22%	£4,109
D	£2,459,936	£983,974	£1,475,962	£302,513	487.90%	473.40%	£1,432,097
E	£1,985,111	£794,044	£1,191,067	£201,675	590.59%	576.09%	£1,161,824
F	£6,349	£2,540	£3,809	£67,225	5.67%	0.00%	£0
G	£2,041,405	£816,562	£1,224,843	£235,288	520.57%	506.07%	£1,190,726
I	£1,818,097	£727,239	£1,090,858	£168,063	649.08%	634.58%	£1,066,489
J	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Total	**£8,669,623**	**£3,467,849**	**£5,201,774**	**£1,109,213**			**£5,046,876**

Table 4.4 Profit & Loss of Agency Market Structure

Source : McDermott (1993) & Empirical Work

For the final analysis commission breakdown is represent in the following pie chart;

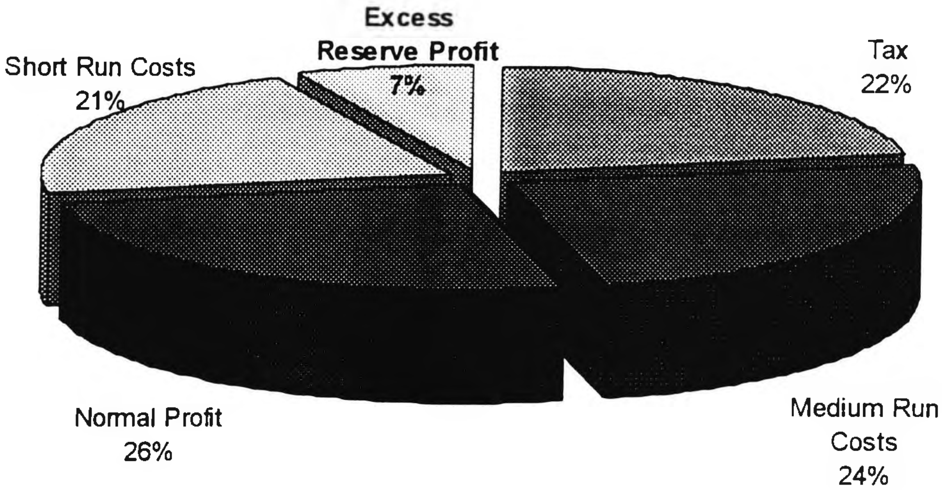

Exhibit 4.5 Commission Breakdown

Source : Empirical

McDermott (1993) observed that the market share division between foreigners and domestic institutions is probably too small at 5% versus 95% respectively, and found 25% of his trades were with foreigners. In addition, he pointed out that REPO's (Sell today and Re-Purchase of Government securities for a later date) distorted the overall turnover figures by 15% to 20%.

Farrell (1993) has held the view that Irish term structure has been significantly influenced by the German term structure. On an empirical analysis, ten-year yields were found to have a correlation of between 65% to 90% from 1988 to 1992 on an annual basis. The Irish yield is assumed to consist of a European element which is proxied by the German Bund and a local element which is proxied by the spread in yield over the Bund then commission can be divided between the bund yield and the spread over the bunds. The correlation between Ireland and Germany is 75.35% between June 1988 and the start of 1994.

In order to contrast the relative economic cost of price discovery in the Irish market relative to the German bond market, the cost of dealing in the ten year bond maturities of both markets is contrasted. A IR£1,000,000 Irish exposure equates to DM 2,495,000. A Bund 10-year contract is DM 250,000 so that 9.98 contracts is needed to achieve a IR£1,000,000 exposure. It costs DM 18 to DM 20 to "round trip" (i.e. purchase and sale of contracts) which directly implies a total cost of DM 212 or IR£85. It would cost IR£360 to deal £1,000,000 of the Irish 10-year bond, but under the 28 day rule where the trade would be closed out with the same broker within this time period, commission is only charged on one side of the transaction. In the brokers sample, it is found that 50% of deals have 'closing' so the cost would fall to IR£ 270 on average. The present yield on the 10 year Bund is 5.81% and the Irish 10 years is 6.29%. This suggests that investors were paying IR£185 for the 48 basis point spread. This means that 7.63% of the exposure is 68.52% of the cost and is illustrated in exhibit 4.6.

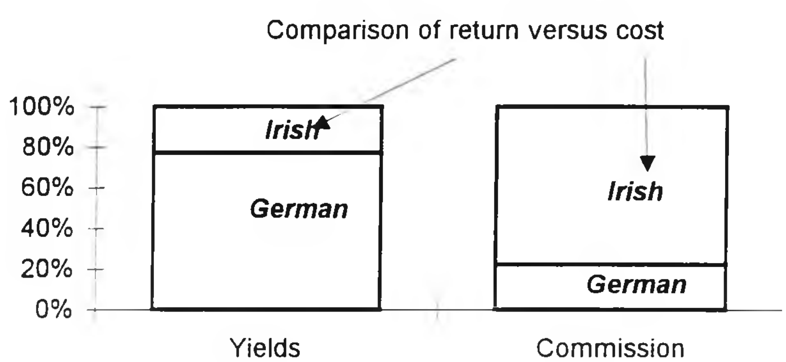

Exhibit 4.6 Components of Return by Cost of Exposure

Source : Empirical

The market was dominated by two firms up the end of the 1970's when there was a rapid increase in government borrowing and the break with Sterling in 1979 followed by membership of the ERM.

On the 18th March 1994, the Competition Authority ruled that the trading of Government gilts operates in an anti-competitive manner. According to Taylor (1994), "the Competition Authority criticises two key elements of the operation of the market for Government gilts ... the rule stipulating that all brokers charge investors the same fees for their dealing service is anti-competitive, because it stops price competition. Secondly, the current rule stipulating that stockbrokers should only act as agents for clients and must not buy or sell gilts on their own behalf also distorts competition".

Corrigan (1993) recognises that stockbrokers play a highly effective role in marketing and distributing bonds to a wide international base: in that respect their role was privileged in that the Agency offers and bids for bonds virtually exclusively through the Stock Exchange. The system of distribution works well as reflected in the exceptionally high non-resident institutional presence in the market.

However, liquidity on the Irish market is poor and is a cause of complaint to the NTMA. The "agency only" trading mechanism, which dates from 1799, gives rise to the following serious problems in the Irish market; firstly, lack of depth because of the absence of a natural pool of price makers means that the price discovery function is inefficient. With greater depth, the market would be relatively more stable.

Secondly, lack of 'immediacy' is a potential cost to the investor if the execution of a trade is delayed. In an agency only market, as exists in Ireland, where brokers match out buyers and sellers, immediacy is not usually provided by stockbrokers who operate to bring buyers and sellers together on the Stock Exchange. Under the existing system, there can be considerable delay in matching orders. If the market is more liquid then a higher degree of immediacy would be possible.

Thirdly, dealing costs: the bond market in Ireland was almost unique among OECD countries in operating until very recently on the basis of fixed minimum commissions with the exception being Greece. High dealing costs discourage active trading and consequently impair liquidity.

Fourthly, derivatives markets based on the Government bond market were seriously underdeveloped. This was largely due to the inefficiencies of price discovery in the underlying cash market and the lack of immediacy in that market.

The problems in the market are attributable to the fact that it does not have a natural pool of price makers. In seeking to promote a natural pool of price makers there are essentially two alternatives. The NTMA proposes a market making system consisting of primary dealers whom would be formally recognised as such by the NTMA. These dealers would commit themselves continuously to make two way prices in all market conditions.

The number of firms that might decide to become market makers was determined by the costs and benefits of being a market maker. As the number of market makers increases, the risk borne by each falls; but so does their expected return. On balance, the NTMA believes that the interests of the market generally would be served by 5-7 market makers on an on-going basis.

4.4 Risk Capital

In this section, the European Union Capital Adequacy directive is considered to determine whether it is sufficient for a small market like Ireland and a worked example is shown in appendix four. There are three types of capital requirements by a market maker:

Type 1 - Sector positioning (with intra sector hedging allowed).

Type 2 - Intra Sector positioning (core sector non diversifable risk).

Type 3 - Inter Sector positioning (hedging within a sector).

The first two types are combined to give the risk due to any potential change in the level and shape of the yield curve. They are distinguished in that if an equal but opposite nominal position was held in another sector of the yield curve, the type 1 risk capitals would be offsettable. The type 2 capital must always be carried irrespective of any other position in the portfolio. This core capital was required because of the different volatilities in each sector and the possibility of a non-parallel movement in the yield curve. In the case of type 3, this is for when a position in a sector was hedged within the same sector.

A market maker needs capital because he cannot make a profit on every trade. On an inter day basis his trades can profit or lose, but these can be marked to market and settled the following day. On an overnight basis, the regulator calculates the marked to market value of his holdings, present capital and this should be within prescribed limits. If not there can be an immediate requirement of an equity share capital infusion and/or a reduction of the position. These results can be ready by the next trading session.

Any position can have two elements of capital backing it, debt and equity. In the case of debt capital, this can have a financing cost. The debt capital can be financed using a repurchase agreement (i.e. REPO) which was an agreement between a seller and buyer of government treasury's whereby the seller agrees to repurchase the government treasury's at an agreed price at some stated time in the future. The market maker borrows from an investor to finance his inventory using the securities as collateral. The development of a REPO and Reverse-REPO market for the market maker can directly influence the cost of funding and was undertaken by the NTMA which reached an agreement with the Revenue Commissioners on the tax treatment of REPOs, advanced a variation of the ISDA Master Legal agreement between all the principal market participants and offered a facility to Primary Dealers if the market agreed to change its microstructure.

If the market structure were changed, one area of interest is the amount of liquidity that capital invested in these market makers would generate. This was a difficult question to answer because the same amount of capital would allow a far smaller position to be held on an outright basis in the 2012's than if an equal (i.e. intra maturity) but opposite position was held in the 2010's.

In exhibit 4.7 the turnover for 1993 was £36,465m and was composed of shorts (i.e. 0 to 5 years) £15,775m, mediums (i.e. 5 to 10 years) £12,679m and longs (i.e. 10+ years) of £8,011m. Overall, the Irish government bond market has turned over 2.52 times, 2.18 times in the shorts, 4.00 times in the mediums and 1.98 times in the longs in 1994 and the seasonal variation in size and composition can be observed.

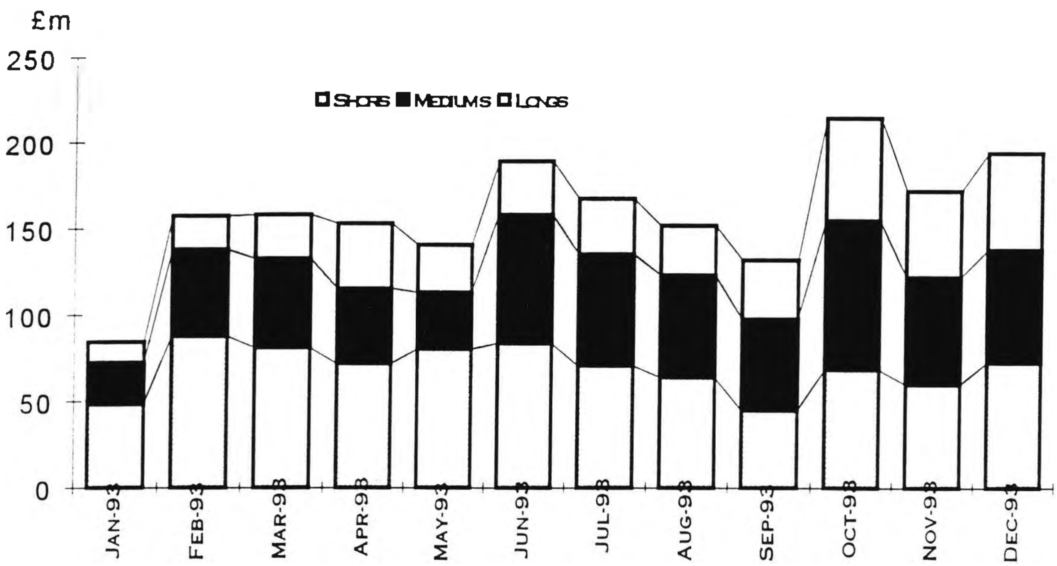

Exhibit 4.7 Average Daily Turnover

Source : McDermott (1993) & Irish Stock Exchange

Each month is investigated to establish the capital required to facilitate 1993's turnover. Each month is assumed to have 30 days. Four market makers were hypothesised and 99% confidence is required that the market has adequate capacity. The shorts require capacity of £76m that needs £2.1m capital.

Then the mediums require capacity of £72m that needs £2.7m capital. Finally, the longs require capacity of £50m that needs £3m capital. The total for the market makers was £7.8m. Market Makers would be expected to use 65% of their capital at any particular time. With market turnover growing at 15% compounded over the last eight years, then with an expected turnover in two year's time of £48bn from 1995, this implies that £10.4m would be needed for the market as a whole or £2.6m per individual Market Makers[7].

In the long run, there would have to be an adequate return on capital employed. Stockbrokers until recently have been taxed as a partnership, which at high marginal tax rates would constitute a disincentive to retain the money in the business. Murray (1993) has estimated beta coefficients in table 4.5 for Irish financial companies.

Stock	Raw	Method 1	Method 2	Method 3	Method 4	Bayesian
AIB	0.840	0.770	0.780	1.150	1.150	0.810
Bank of Ireland	0.860	1.020	1.000	1.020	0.790	0.820
Woodchester	-0.300	0.100	0.900	0.000	0.110	0.200
Anglo-Irish Bank	0.500	0.200	0.600	0.800	0.500	0.500

Table 4.5 Betas of Irish Banks allowing for thinness of Equity Market

Source : Murray (1993)

Direct costs were estimated at £4,878,400 or 1.34 basis points per £1m traded. There were two sources of capital costs, borrowing from the money market at the overnight rate and the market makers own capital. The overnight rate is exhibited in 4.8 below;

[7] Market Makers are called Primary Dealers in Ireland.

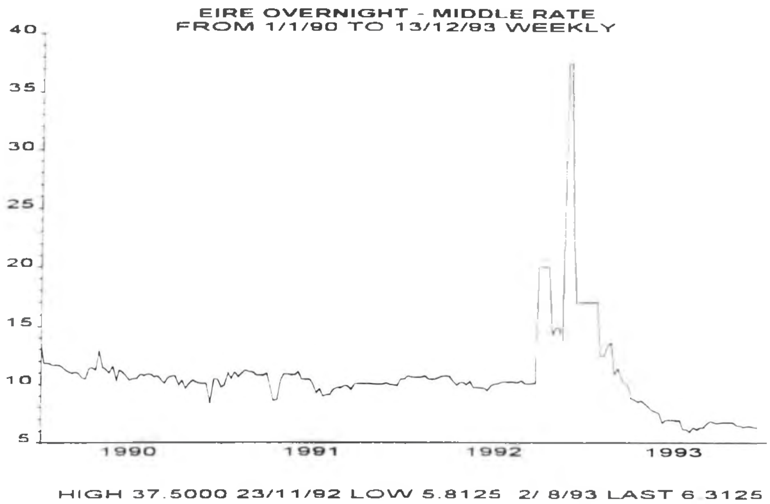

Exhibit 4.8 DIBOR Money Market as proxy for REPO Market

Source : Datastream

There were a number of approaches that can be taken to calculate the required return on the market makers capital. McDermott (1993) and O'Connor (1993) said that banks require a hurdle rate of return of 20% on the use of a bank's own capital. From Murray (1993), this implies that trading in government bonds is 16 times riskier than the rest of the banks activities over the past seven years of market returns. This hurdle rate of return should be provided by the return required by the shareholders using the Capital Asset Pricing Model (CAPM);

(4.5.3.1) $$r_{\text{Market Maker}} = r_{Risk\ free} + \beta_{Market\ Making}\left(r_{EquityMarket} - r_{Risk\ free}\right)$$

4.5 Simulation Model of Primary Dealer

The motivation for this model of dealer profitability was the desire to answer a pragmatic question that was prevalent at the time of organisational revisions to the market structure in Ireland. This question was: Could the Irish market support a system of six primary dealers, rather than the previous agency arrangement, in the absence of an Irish futures market? In the modified Garman (1976) model of a primary dealer, the following assumptions are made: market makers would need to dedicate IR£30 million in total to the operation, or IR£5 million on average per market maker, each primary dealer is a price-setter who would be required to quote continuously in a range of bonds in a minimum size and within a maximum spread, and in all market conditions.

The purpose of the model is limited to an investigation of dealer profitability and the probability of ruin; it is unconcerned with the strategic behaviour of firms. The bid-offer spreads are in consequence fixed and the dealer firm is in effect a privileged price taker at bid or offer in a market where the mid price is an exogenous variable. The model does not consider any possible growth or decline in trading activity arising from strategic interactions; it does make the assumption that turnover within the Irish Government market would rise to the European Union average, an increase of 25% in the first year over that previously observed. (In retrospect this assumption proved conservative as an increase of 40% was observed – the causation of this increase is of course complex.)

In order to model dealer profitability, it was necessary to gather data on the level of market activity by number, timing, value, bond maturity band, price and volatility, as well as the proportion of trades closed out or covered within a calendar trading day. No record was available of dealer orders received but unexecuted. In the preliminary investigation of this data, it was evident that there was a particular form of large order, or block trade, which was sourced from continental Europe.

The practice in the market at the time was to work these orders on a best efforts basis and the primary dealer candidates indicated that this practice was likely to continue; however, in the model these were executed upon arrival and subsequently traded down by the securities dealer. These large or block trades were incorporated into the model by using a mixture of distributions, usual and large.

Notwithstanding this, the assumption within the model remains that dealer inventories are zero at close of business and that price is independent of inventory. This premise is supported by McDermott (1995), who observes that 85% of positions are closed within a day. The market practices at that time were in fact a mixture of agency and principal practices, a form of dual capacity. Dealers were observed to use foreign futures contracts, such as the LIFFE Bund, or Danish cash government bonds to hedge these positions based upon correlation estimation and assumptions.

The model seeks to identify the likelihood of ruin of a dealer and under the assumption that ruin is an independent process defines failure as the number of remaining primary dealers falling below four. Ruin is defined as the loss of all capital and retained profits within a trading year. NTMA regulations required a dealer to hold capital of £5 million and report their position quarterly.

There was a concern prevalent within the market that dealer strategies could include market domination. The specific rule to ensure active competition was to limit dealer capital invested to a maximum of £8 million. This constraint was replicated within the model by an upper bound of £8 million capital and retained profits above which funds were no longer available for position taking.

In order to describe this model mathematically, let;

- K_t – Total system capital at time t,
- sp – bid/ask price spread,
- m – 13 bond buckets (corresponding to the EU Capital Adequacy Directive's maturity and coupon criteria),
- x_m - minimum size for maturity bucket m,
- dt – discrete time step,
- λ - Poisson arrival process – set at twenty minutes.
- Q – empirical order size usual distribution,
- J – empirical distribution of large order sizes,
- σ_m - standard deviation of intra-day bond prices within bucket m,
- b_m - bond in bucket m,
- I_t - inventory position at time t,
- ${}_i\mathbf{F}_t$ - capital and retained profits at time t of firm i,
- r – bond price correlation matrix,
- n – number of dealers,

Ruin is therefore defined as:

$$(4.5.1) \qquad {}_i\mathbf{F}_t = 0$$

and total systemic capital as:

$$(4.5.2) \qquad \mathbf{K}_t \equiv \sum_{i=0}^{6} {}_i\mathbf{F}_t$$

where the maximum number of dealers is six. Market failure is defined as:

(4.5.3) $\quad n < 4$

The objective of the model is to identify and quantify the probability of ruin of an individual dealer:

(4.5.2) $\quad \text{PROB}({}_{i}F_{t} \leq 0)$

At the start of the trading year, there are six dealers each with an initial endowment of £5 million capital. Dealers are required to quote and deal at either bid or ask prices continuously and under all market conditions. Market practice was to quote and deal in round lots of £2 million in maturities of five years or less, and £1 million in longer maturities. The empirical analysis of actual trade data showed larger averages than these (see sections 4.3 and 4.4). The simulation used random numbers to generate a sample from the empirical distribution of trade sizes. The distribution was lower truncated at a £2 million order size. As the empirical distribution contained a proportion of large "outlier" trades, it was necessary to build a mixture of distributions to accommodate the usual order size distribution and the infrequent but large trades. The way in which this was achieved was by a randomly generated choice between the usual and large distributions, constrained to satisfy the historic distribution.

Time between trades was empirically observed to be 20 minutes, and accordingly the Poisson arrival process of orders within the model was calibrated to a 20 minute lambda. The average order size is taken from samples provided by McDermott (1995), the official publications of the Irish Stock Exchange and the internal records of the NTMA.

The buy/sell characteristic of a trade was determined by drawings from a Bernoulli distribution. The effect of unusual runs of successive sequences of purchases or sales, or market trends, was also investigated. This appeared to have little effect on profitability. In other words, in this model the effect of the spread earned by transaction execution, which was set at one half of the bid-offer spread, dominates the effects of market movements on open positions.

The market trending, bullish, bearish or stable, was limited to 15% of the trades executed by a dealer within the day. This end of day open position is consistent with the McDermott (1995) findings. Market share is the combination of order arrival and order (or trade) size processes. A base case of a 20% market share for a dealer was investigated. Sensitivity to market share was also investigated (see section 4.5.4).

Schematically the model can be represented as:

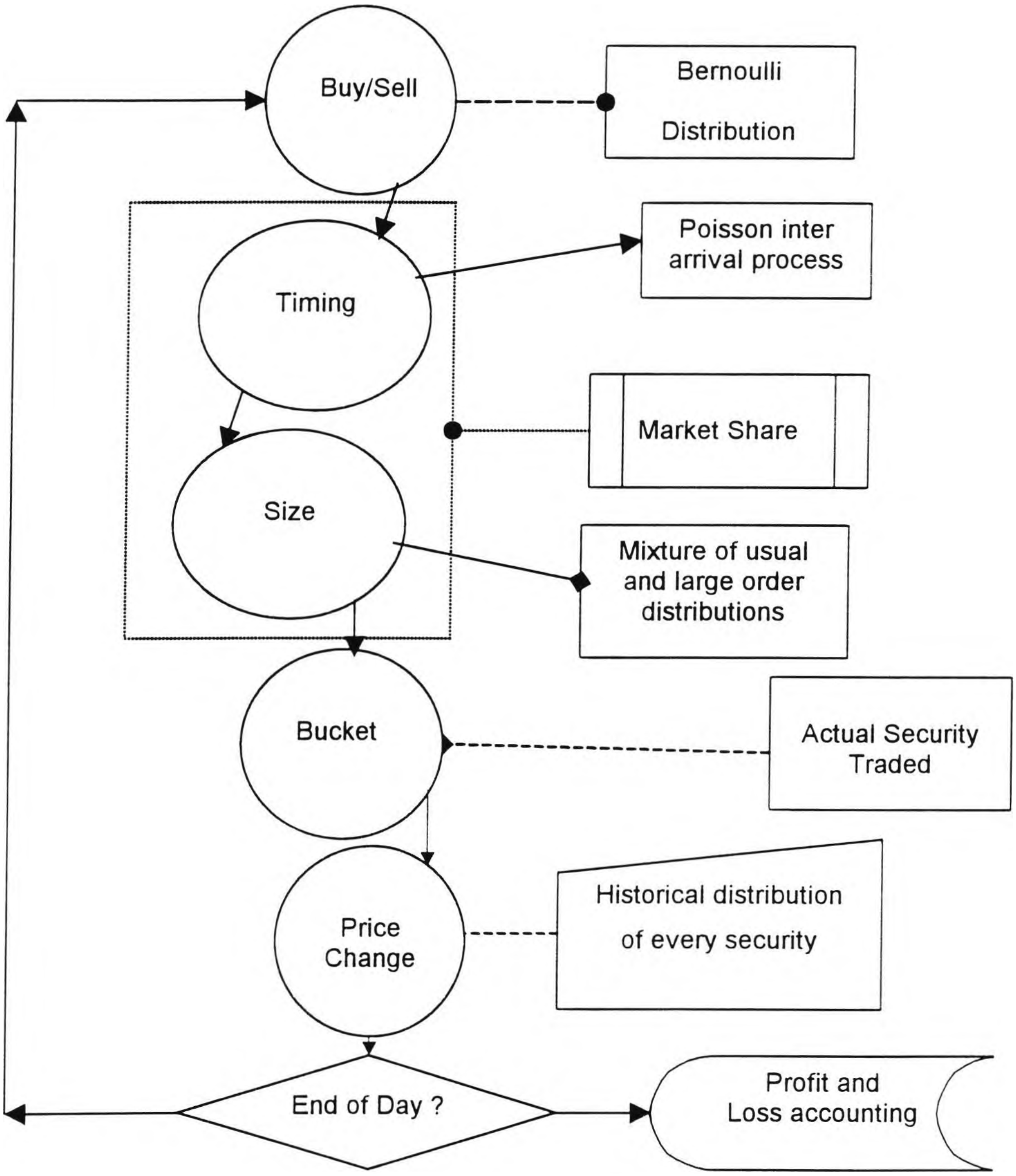

Exhibit 4.9 – Primary Dealer Simulation Model

Source : Empirical

The empirical data of market turnover was divided according to the following broad bands:

- 0 to 1 year
- 1 to 5 years
- 5 to 10 years
- 10+ years

Obviously, within these bands there is a considerable variation of price sensitivity by security. The turnover within a broad band was further differentiated on the basis of market capitalisation. This differentiated turnover was then reallocated according to the risk sensitivity buckets as defined by the European Union's Capital Adequacy Directive. For the model simulation, the overall empirical distribution of transactions between these buckets was used to determine which security dealt.

The relationship between the security dealt, or bucket, and the price change was constrained by the correlation matrix between buckets and the probability distributions of price changes for each bucket. These distributions were assumed to be log-normally distributed. Opening values for all securities (buckets) were assumed to be 100%. For maturity buckets 1 to 8, the minimum trading size was greater than or equal to £2 million and for all other maturities was greater than or equal to £1 million.

As in the Garman (1976) model all exchanges are made through one of the central market makers. which possesses a monopoly on all trading. No direct exchanges between buyers and sellers are permitted.

For

(4.5.3.)
$$
\begin{aligned}
For\ m &= 1{,}8 \quad x_m \geq 2 \\
m &= 9{,}13 \quad x_m \geq 1
\end{aligned}
$$

The dealing spread associated with a particular security or maturity bucket is

(4.5.4.)
$$
\begin{aligned}
For\ m &= 1{,}8 \quad sp_m \leq 10 \\
m &= 9{,}10 \quad sp_m \leq 20 \\
m &= 11{,}13 \quad sp_m \leq 30
\end{aligned}
$$

This dealing spread is the principal source of profit to a dealer. The profit or loss of a dealer is the sum of half the bid/offer spreads and the marked to market movement of open positions or inventory. This latter arises from the stochastic process governing term structure movements.

The model was constructed so that any transaction and price change would be reflected across the term structure. Thus any open positions in inventory would be revalued, or marked to market, during the trading day. Where a position was closed by a transaction the appropriate profit or loss was posted. At end of day the positions were marked to mid-market.

No transaction costs were included. Gross rather than net positions were used in the capital utilisation constraint. The dealer was allowed to leverage his capital up to the limits set down in the European Union Capital Adequacy Directive. In market practice, the NTMA operated a policy known as the "trailing market bid" which allowed dealers to close positions at end of day. The model had end of day mid market closure.

4.5.1 Identification of Primary Dealers Daily Profit Density Distribution

The main variables estimated are turnover, closing position, profit/loss, utilised capital, return on total capital (R.O.T.C.) and return on utilised capital (R.O.U.C.). Using a Latin Hypercube method, 10,000 Monte-Carlo simulations[8] appeared to deliver convergence and stability of the parameters of the daily profit distribution.

Minimum	-£2,390,480
Maximum	£1,567,592
Mean	**£34,481**
Std Deviation	**£302,373**
Skewness	-0.5563
Kurtosis	10.4983

Table 4.6 Moments of Profit Probability Density Function of the one day Monte-Carlo simulation

The mean daily turnover under this simulation was £54.271 million. The average daily profit is £34,481 and the risk or standard deviation is £302,373 that is a risk/reward ratio of 8.77 to 1. The utilised capital had a mean average of £1.201 million with a maximum of £2.952 million. It is interesting to note that the dealer was not bindingly constrained by Capital Adequacy even in the extremities of the simulation. The diagram in exhibit 4.9 illustrates the histogram of simulation results and a fitted normal distribution.

[8] The software package utilised was @Risk which is an add in for Micrsoft Excel and Bestfit developed by Palisade corporation.

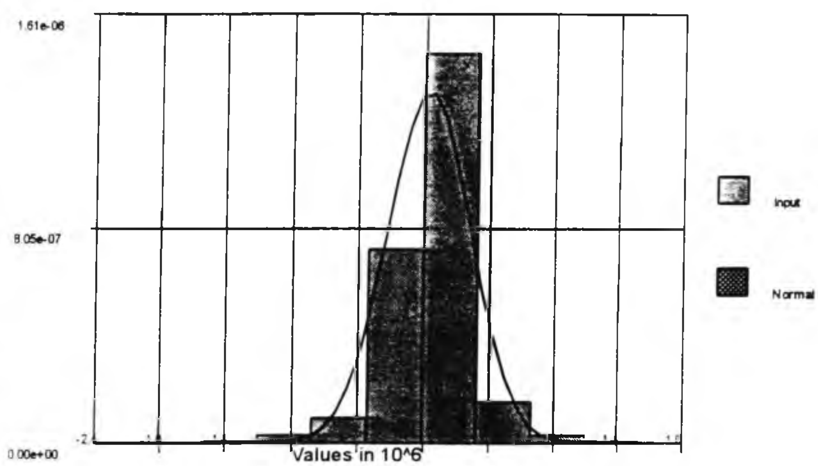

Exhibit 4.10 - Comparison of Input Distribution and Normal(£34,500,£302,000)

Source : Empirical

In order to estimate the ruin boundary, it is necessary to fit a continuous distribution to the histogram. The principle concern is accuracy of the tail estimation, the likely location of the ruin boundary.

The assumption of the model is that 20% of total exchanges are made through each market maker. The objective of the market maker is to earn his expected average profit per trade by earning the half the spread at the time of the trade and the other half of the spread when the opposite trade takes place or at the close of business. There can also be a trading profit or loss generated by the stochastic movement in security prices. The model assumed that the term structure changed in a continuous stochastic process with respect to time. There is no capital allowance made for offsetting hedges either within or across different maturity sectors.

If the first four moments (i.e. mean, standard deviation, skewness and kurtosis) of the profit function are fitted and compared to the equivalent moments of all possible profit probability density functions in table 4.6, the normal distribution with a mean of £34,500 and a standard deviation of £302,000 is the second closest fitting profit probability density function. The normal distribution is chosen over the logistic probability density function because of its over-malableness to fit any set of data. This is illustrated in exhibit 4.9.

The normal probability density function is chosen as the most appropriate profit probability density function by taking input data and converting to a density distribution. A first estimate of parameters is made using maximum-likelihood estimators from table 4.7. For example, the maximum-likelihood estimators of the normal function are μ equals mean and σ equals standard deviation. Therefore, the mean and standard deviation of the input is used to form a first estimate of parameters.

The fit is optimised using the Levenberg-Marquardt method. This is an iterative non-linear least-squares routine that minimises the chi-square goodness of fit statistic. The goodness-of-fit is measured for the optimised function and all functions are compared. (see table below) This optimisation requires an initial estimate of all parameters and it uses those generated by the maximum-likelihood estimators for each distribution. The values of the parameters are then varied in an attempt to minimise chi-square.

The Levenberg-Marquardt method does not find the absolute minimum for chi-square; rather, it finds a local minimum. The success of this method depends on the initial parameters used. The process of calculating maximum-likelihood estimators and optimising the chi-square value gives the best estimate for each distribution. Then each distribution function is ranked according to its chi-square value.

While the function with the lowest chi-square could have been chosen, two other measures of goodness-of-fit are calculated for the fitted distribution, the Kolmogorov-Smirnov statistic and the Anderson-Darling statistic. In certain cases, the best-fitting distributions selected by those tests can be different than those selected by the chi-square test because of the behaviour in the tails of the distribution an shown in table 4.7.

Function	Chi-Square	Rank	K-S Test	Rank	A-D Test
Logistic(34500,166000)	331.84	1	0.107	1	32.46
Normal(34500,302000)	7.96E+08	12	0.127	3	48.40
3960000Beta(24.26,15.3)-2390000	7.53E+16	14	0.121	2	51.11
PearsonVI(64.68,9.20e+3,3.45e+8)-2.39e+6	1.00E+34	16	0.140	4	51.14
ErrorFunction(0.00000234)	3.46E+08	11	0.170	9	60.08
InverseGaussian(2.42e+6,1.41e+8)-2.39e+6	1.00E+34	21	0.155	6	60.23
Lognormal(2430000,323000)-2390000	1.00E+34	20	0.153	5	60.71
PearsonV(51.94,1.24e+8)-2.39e+6	1.00E+34	17	0.167	8	71.46
Lognormal2(14.71,0.14)-2390000	1.00E+34	19	0.165	7	74.15
ExtremeValue(-1.02e+5,2.36e+5)	1.00E+34	23	0.174	10	83.71
Weibull(5.88,2510000)-2390000	846.69	2	0.246	11	138.30

Table 4.7 - Results of Fitting Different Function to Profit Data

Source : Empirical

The first step in interpreting the results is to consider the significance of the chi-square value; namely, how well the input data fit a certain distribution function. A lower chi-square value indicates a better fit. The quality of the results depends on the first estimate applied to the maximum-likelihood estimators because the Levenberg-Marquardt method does not find the absolute minimum for chi-square; rather, it finds a local minimum.

Since the profit density function is considered to be a continuous distribution, the fitted distribution is ranked by the Kolmogorov-Smirnov statistic and the Anderson-Darling statistic instead of by the chi-square value. As these tests (K-S & A-D) compare the empirical distribution to the hypothesised distribution, they may be more powerful for some types of distribution. In exhibit 4.9 the comparison graph displays a good visual fit in areas that are important. This difference graph does display an acceptable magnitude of absolute error when visually inspected.

4.5.2 Annual Profit Distribution & Ruin Barrier

Assuming that these probability distributions are independently distributed and that there are 252 trading days in a year, the simulation is run over a one year time span and these parameters are calculated on an annual basis. The probability of ruin of a primary dealers is estimated. With the initial capital of £5m and the daily profit probability density function, the sample paths evolution over one trading year is simulated. This allows the estimation of the probability of the primary dealer hitting the ruin barrier and exhausting all his capital. This is illustrated in 4.10.

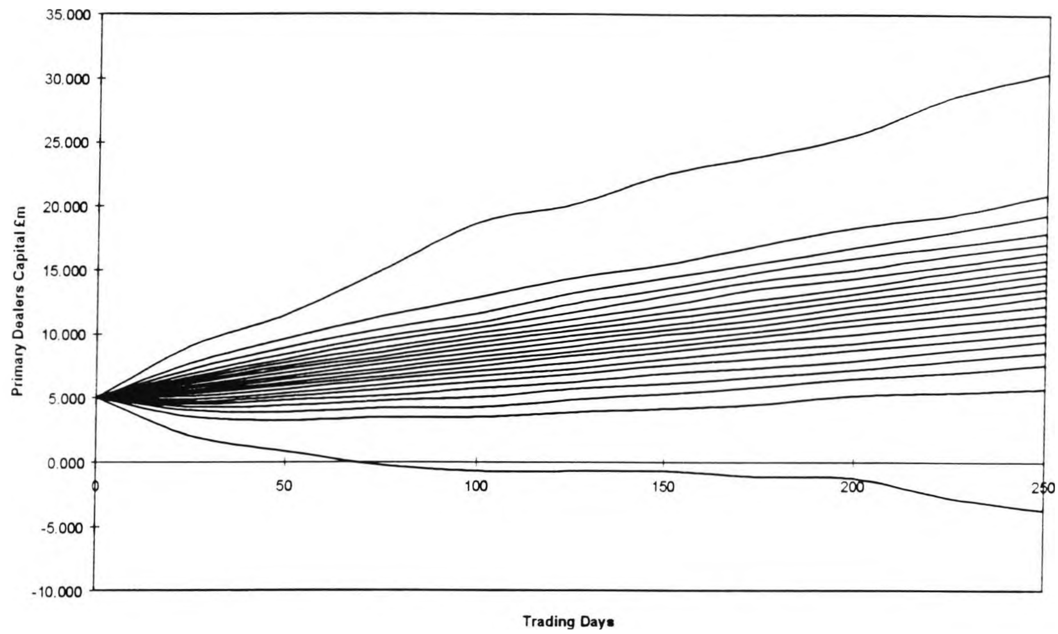

Exhibit 4.11 - Simulation of Primary Dealer over one Trading Year

Source : Empirical

The probability of the catastrophic[9] event that primary dealing breaches the ruin barrier for a time horizon of one year is 0.28%. On the other side a primary dealer could be worth £30.446m at the end of the year with a probability of 0.001%. The original capital is exposed to a 4.67% risk of not being intact at year-end and there is a 12.29% risk that all costs including the return on capital cannot be covered. In table 4.9 the market structure as a whole and the probability that a number of primary dealers can not cover their costs is considered. There is a 2.5% risk that 3 primary dealers can fail to cover costs in a particular year. The NTMA said that it would consider the primary dealing system to have failed if the number of primary dealers fell below four.

[9] Catastrophe theory is the branch of actuarial ruin mathematics, which is the topological description of systems that display abrupt discontinuous change with very small probabilities. These probabilities a lie in the upper and lower tails of distributions and can lie more that three standard deviations from the mean.

It is assumed that the primary dealers would withdraw if they failed to cover other costs over a trading year, then the risk of the primary dealing system failing is 2.8% as shown in table 4.9.

Primary Dealer	Loss Making
0	45.5%
1	38.3%
2	13.4%
3	2.5%
4	0.3%
5	0.0%
6	0.0%

Table 4.9 Probability of different number of Primary Dealers Failing

Source : Empirical

4.5.3. Risk/Reward Framework

This risk/reward ratio is useful for setting a probability framework of required success by the primary dealers. There is a 0.2% probability that he can make £1.6m or lose £2.4m on a single intra-daily basis. Apart from knowing the overall daily profit probability density function, he must be able to access the likelihood of making a profit with each individual client as shown in table 4.8.

The objective of such market research is to see if they merit an increased or decreased allocation of relationship development resources. Some client's business objectives are so close to that of the primary dealer that they are quasi competitors.

The objective of such market research is to see if they merit an increased or decreased allocation of relationship development resources. Some client's business objectives are so close to that of the primary dealer that they are quasi competitors.

0%	1000+ to 1	Not Possible
10%	9 to 1	Highly Unlikely
20%	4 to 1	Very Unlikely
30%	7 to 3	Unlikely
40%	3 to 2	Marginally Unlikely
50%	1 to 1	Evenly Balanced
60%	2 to 3	Marginally Probable
70%	4 to 7	Probable
80%	1 to 4	Very Probable
90%	1 to 9	Highly Probable
100%	1 to 1000+	Certain

Table 4.8 - Probability of Profitable Trade with Client

Source : Empirical

In terms of the overall daily profitability function, the probability of making a loss is 38.46%

4.5.4 Profit Distribution Parameter Sensitivity

The model is simulated over a range of values of each parameter and the required adjustment in the spreads is identified in order to break even. Market share is simulated using 0.5%, 5%, 10% and 30%. The optimal market share is seen to be just below 30%. The primary dealer can find it very hard to make a profit if his market share drops below 5%. Funding costs are simulated between 4% and 8%.

There does not however seem to be a significant impact on the primary dealers profitability as the funding costs increase. Market trend does not seem to have a major impact on profitability. Longer trading hours can bring greater profitability to the primary dealers, but the level of capital risk involved can increase. Spread changes cannot effect the primary dealers until the spread drops below 25% of original levels.

Changes in market volume can increase the level of profitability of the primary dealers but the probability of a potential loss also increases. In return for these obligations of primary dealers, the dealers would obtain certain privileges. Competitive auctions can be open to bids from primary dealers, agency brokers and retail institutional investors with a non-competitive facility in relation to the retail market share of a Primary Dealer after each auction.

From time to time a primary dealer could have difficulty in obtaining bonds to enable him to cover a short position. The NTMA would, at its discretion, facilitate the dealer either by offering a reverse-REPO under which the NTMA would lend the dealer the bonds for a limited period.

The NTMA can also maintain continuous firm bids in IR£5 million size in each of the benchmark bonds designated by the NTMA for ongoing funding purposes. This bid can be confined to market makers only. Market makers can from time to time seek to improve the balance of their book by switching bonds. The NTMA would be prepared to facilitate such switches. They would have exclusive access to tap issuance and inter dealer broker.

4.6 Summary and Conclusions

The development of the literature in terms of bid/ask spread and inventory management has been discussed. The microstructure of the existing agency system has been investigated. The conclusion is that there are excess reserve profits earned above those required that have not been eroded by movements in the labour market or entry of new firms. Since Ireland has a small government bond market relative to its European peers with a small pool of investors, it has to import liquidity from foreign investors to facilitate adequate turnover.

The decision by the Competition Authority reflected their shared belief with the NTMA that the system lacked competivness in the context of European bond markets and European law. The capital requirement in a primary dealing structure would be £25m to have the capacity for turnover that would be required to compete with other European markets.

A market maker would have to capture a mean spread of 5 pence per £100 nominal to stay in business in the long run. The normal distribution with a mean of £34,500 and a standard deviation of £302,000 is the most appropriate distribution for modelling a Primary Dealer daily profit distribution. On a daily basis, the probability of making a loss is 38.46% and this means that a primary dealer is between marginally unlikely and unlikely to lose money in a particular day. The NTMA said that it would consider the primary dealing system to have failed if the number of primary dealers fell below four. By assuming that the primary dealers would withdraw if they failed to cover the costs over a trading year, then the risk of the primary dealing system failing is 2.8%. The important profit distribution parameters are market share, earned spreads and volatility of the term structure. Having established the viability of a primary dealer market microstructure, the NTMA implemented the system and it survived for three years. At the end of the period two of the Primary Dealers exited and are replaced by two new entrants. In the next chapter the market will be examined from the perspective of an end user whose natural matching portfolio is to hold Irish government bonds, i.e., general insurance sector.

Chapter 5

The Impact of Contractual Liabilities on Investment Performance:

The Case of Irish General Insurance Companies

5.1 Introduction

The objective of this chapter is to analyse the investment performance of the Irish general insurance market[1] whose matching portfolio is Irish government bonds. The general insurance sector is investigated and its interaction with the Irish bond market is examined because; (a) it represents 10% of the bond market and its liabilities can currently only be matched with Irish government bond assets, (b) it is very heavily dependent on investment performance, (c) there is a history of difficulties in this sector associated with spiralling underwriting losses. It is not possible for an insurer to achieve an immunised portfolio by increasing duration beyond that which is currently available from any fixed income bond.

To do this analysis, a framework is developed in which managers attempt to maximise the value of the funds under management, subject to a minimum terminal value. The minimum terminal value is determined as the sum of the products of their projected liabilities and the estimates of the term structure over an eighteen-year period. When the duration of the matching liability portfolio has been identified, the performance of the companies under such a strategy is compared with their actual achievements. The performance is found to be highly varied and important implications for the insurance industry of over reliance on investment performance to subsidise underwriting losses can be drawn.

This chapter is divided up as follows: section two demonstrates that interest rate swaps can increase duration to match long term liabilities; section three defines the concept of mismatch reserves; section four reviews the historical liability profile of the industry; section five investigates the investment performance by the industry from mismatching from the matching portfolio of Irish government bonds and the summary and conclusions are in section six.

The implied spot rate on such a portfolio is defined as the insolvency risk free rate of return[2] which is different to the classical definition of risk free rate (i.e. the one period return of default risk free government paper). Even the prospect of being free of insolvency is only true for small changes in yields and continuous rebalancing of the portfolio. The second problem investigated is the approach taken to identifying the size of the mismatch reserve[3] and the contribution from historical mismatching for the industry.

5.2 Interest Rate Swaps & Duration

In this section, an investigation of how an insurer can match his liabilities for long tailed insurance whose duration[4] exceeds that of the assets with greatest maturity is undertaken. This is important because Redington (1952) demonstrated that an immunised portfolio would ensure solvency for a principal's liabilities when they are matched with the appropriate asset portfolio. The investment management risk free decision is to hold the duration matching portfolio unless the management believe that they can identify a superior portfolio in terms of incremental return or reduced risk.

As mentioned in chapter 2, there is a shortage of longer dated bonds in the Irish market. Certain lines of the insurance and assurance industry require these bonds because they have very long duration, e.g. liability insurance, re-insurance or pension liabilities.

In the Irish context, it is difficult but not impossible to achieve immunisation with the present structure of the government treasury market. Immunisation can be achieved using a combination of bank borrowings and interest rate swaps.

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[1]The raw date that made the empirical research in this chapter possible is provided by Martin Cosgrove, Principal Officer and Jimmy Joyce, Government Actury, Insurance Regulation, Department of Industry and Commerce and David O'Connor, AGF Insurance Corporation of Ireland along with discussions.
[2]Insolvency risk free rate of return refers to the return expected to be generated by an asset portfolio that guarantees the institutional solvency at the end of a particular time horizon.
[3] Mismatch reserve is defined as the excess of assets over those required to match the present value of liabilities or the Value at Risk required for holding a non-matching portfolio.

While this approach is not the most efficient in a perfect market with no transactions costs, no tax effects or no limitations on borrowing or lending, it is the only possible approach in a relatively illiquid and imperfect market such as the Irish government treasury market. Consider a fund whose sole liability is the payment of a known monetary amount at time t. Let;

A_t is the present value of all assets at time t,

L_t be the present value of all liabilities at time t,

α_t be the proportion by which A_t exceeds L_t ,

t(x) be the duration of cash flow vector x ,

(5.2.1) $\alpha_t = \left(\frac{A_t}{L_t} - 1\right)$

Using Redington's (1952) immunisation, a portfolio of two or more assets would be constructed such that, for a given term structure at time t, then;

(5.2.2) ${}_1A_t = L_t$

(5.2.3) $t({}_1A_t) = t(L_t)$

(5.2.4) $t^2({}_1A_t) > t^2(L_t)$

where ${}_1A_t$ is the present value at time zero of the specific immunisation assets with maturity t. There is an implicit assumption in the previous three equations that an investment return, regardless of timing of receipt, is capable of achieving an investment return equal to that obtained for investments of term t. Further implied assumptions are that transaction' costs are zero, markets are frictionless and that the yield curve is flat for all maturities.

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[4] Duration is defined as the weighted average life of the class of business or portfolio.

Redington (1952) has shown that, if the above assumptions and conditions are satisfied, the portfolio is immunised to the extent that small changes (i.e. a few basis points) in prevailing interest rates, spread uniformly along the yield curve, will produce small profits to the matching asset portfolio relative to the liability portfolio.

However, the asset portfolio is exposed to the risk of changes in the yield curve shape from the assumed flat structure. If the yield curve changes to an upward or downward slope, then the reinvestment yields may not match those assumed in the valuation basis and a shortfall could occur.

To achieve an insolvency risk free portfolio, this reinvestment risk must be eliminated. In that regard there can be a shortage of assets with sufficient duration; moreover, in a small market the assets could be very illiquid. It is in this shortage of assets with sufficient duration scenario that the equivalent zero coupon model is developed, interest rate swaps and bank borrowing to achieve target duration in the asset portfolio. There is no secondary (or for that matter primary) market in zero-coupon securities in Ireland. An interest rate swap is a contract in which two counter-parties agree to exchange interest rate payments of differing character based on an underlying notional borrowing that is never exchanged. Liquidity is a very important consideration in small markets.

Interest rate swaps are traded on a spread in relation to government treasuries, and this spread is a function of the financial intermediary internal and external costs of processing the trade and monitoring the transaction, a risk premium for the credit risk process. This reflects the risk-adjusted return to this type of exposure and the balance sheet charge for using the scarce resource of capital.

In this context, the interest rate payment characters are short term DIBOR (Dublin Interbank Offered Rate) on the borrowing and a semi-annual[5] fixed coupon on the bond. The following assumptions will be made;

1. A flat yield curve with no transaction costs, taxes or credit risks.
2. The asset portfolio consists of a coupon bond with a single redemption date at time n and no embedded options.
3. A vector of borrowings and interest rate swaps for time periods 1 to n-1 exist for these periods.

Let:

c - coupon payment on bond per unit time,

y - yield or internal rate of return on the bond,

n - term to maturity of the bond,

P(c,n;y) - price of the bond,

v - present value factor,

R - redemption value per unit nominal,

b_t - borrowing for the payment of the liability maturing at time t,

i_t - cost of borrowing for the period (0,t),

B_0 - total borrowing at time 0.

The present value factor is;

$$(5.2.4) \quad v = \frac{1}{(1+y)} = (1+y)^{-1}$$

Therefore, the price or value a bond that is a series of discounted cash flows is;

$$(5.2.5) \quad P(c,n;y) = cv^1 + cv^2 + \ldots + (R+c)v^n$$

[5] NTMA policy is to move all bond coupons to an annual basis.

$$(5.2.6) \quad P(c,n;y) = \sum_{t=1}^{t=n} cv^t + Rv^n$$

To eliminate the investment risk on the (n-1)th coupon payment, a vector of borrowings is constructed which mature in time period n-1, such that the cash flows net to zero. The portfolio borrows at floating rates for n-1 periods and uses an interest rate swap such that it receives floating rates and pays fixed rates so all future cash flows are known with certainty. The net result is that a known cost of funding is generated.

From assumption 1;

$$(5.2.7) \quad i_t = y$$

The required borrowing is;

$$(5.2.8) \quad b_{n-1} = c(1+i_{n-1})^{-1} = c(1+y)^{-1}$$

The resultant cash flow in time period n-1 is;

$$(5.2.9) \quad c + b_{n-1} + yb_{n-1} = 0$$

On a recursive basis moving to period n-2, and setting up a fresh borrowing after allowing for the cost of borrowing to be repaid in subsequent periods;

$$(5.2.10) \quad b_{n-2} = (c + yb_{n-1})(1+y)^{-1}$$

For time period n-3;

$$(5.2.11) \quad b_{n-3} = (c + yb_{n-1} + yb_{n-2})(1+y)^{-1}$$

For time period 1;

$$(5.2.12)\ b_1 = \left(c + yb_{n-1} + \ldots + yb_2\right)\left(1+y\right)^{-1}$$

In general for time period t;

$$(5.2.13)\ b_t = \left(c + y\left(b_{n-1} + \ldots + b_{n-t+1}\right)\right)\left(1+y\right)^{-1}$$

This equation can be rewritten as;

$$(5.2.14)\ b_t = \left(c + y \sum_{x=n-t+1}^{x=n-1} b_x\right)\left(1+y\right)^{-1}$$

$$(5.2.15)\ b_1 = \left(c + y \sum_{x=2}^{x=n-1} b_x\right)\left(1+y\right)^{-1}$$

By relaxing assumption 1 and interest rates are allowed to vary between periods;

$$(5.2.16)\ b_t = \left(c + \sum_{x=n-t+1}^{x=n-1} i_x b_x\right)\left(1+y\right)^{-1}$$

Then summing all the borrowings over time periods 1 to n-1;

$$(5.2.17)\ B_0 = \sum_{z=1}^{z=n-1} b_z$$

Then;

$$(5.2.18)\ \left(n-1\right)c + \sum_{z=1}^{z=n-1} b_z + y \sum_{z=1}^{z=n-1} \sum_{x=1}^{x=z} b_{z,x} = 0$$

(5.2.19) $(n-1)\,c+\sum_{z=1}^{z=n-1} b_z+\sum_{z=1}^{z=n-1}\sum_{x=1}^{x=z} i_{z,x} b_{z,x}=0$

The practical result of equation (5.2.19) is to transform a coupon bond into a zero coupon bond. This process will have lengthened the duration and the duration of the initial coupon bond must be chosen so that its stripped duration matches that of the underlying liability.

(5.2.20) $\alpha\,{}_2A_t = A_t - {}_2A_t$

The risk free asset portfolio has been established ${}_2A_t$ (from a solvency perspective) and the mismatch reserve αA_t , the excess of assets required to achieve the risk free of insolvency return. Specifically, with ${}_2A_t - L_t = 0$ and $\sigma^2 = 0$, the asset and liability portfolio will have identical distributions with regard to interest rate changes, hence the relative distribution will not exist.

If the endowment of assets is A_t ;

(5.2.21) $A_t = (1+\alpha)\ {}_2A_t \quad where\ A_t > {}_2A_t$

Then the excess return earned on the asset portfolio is;

(5.2.22) $(\alpha_2 A_t)\ \ (r_t^1\, \sigma_t^1)$

An example of a ten-year bond is set out below, with borrowings for years one to nine and the yield curve flat at a yield of 10%. This is shown in table 5.1;

Year	Cash Flow	Present Value	PV of CF	t by Cash Flow	PV of t by CF
1	10.00	0.9091	9.09	10.00	9.09
2	10.00	0.8264	8.26	20.00	16.53
3	10.00	0.7513	7.51	30.00	22.54
4	10.00	0.6830	6.83	40.00	27.32
5	10.00	0.6209	6.21	50.00	31.05
6	10.00	0.5645	5.64	60.00	33.87
7	10.00	0.5132	5.13	70.00	35.92
8	10.00	0.4665	4.67	80.00	37.32
9	10.00	0.4241	4.24	90.00	38.17
10	110.00	0.3855	42.41	1100.00	424.10
		Bond Price	100.00		675.90
		Duration	6.759	years	

Table 5.1 - 10% Bond with 10-Year Maturity

Source : Empirical

The duration is estimated to be 6.759 years. The sets of borrowings are determined by (5.2.13) & (5.2.17). These are shown in the table 5.2 that also contains the net cash flows.

Year	Borrowings	Bond	Net Cash Flow	In terms of 100
0	57.59	-100.00	-42.40	-38.55
1	-4.24	10.00	0.00	0.00
2	-4.67	10.00	0.00	0.00
3	-5.13	10.00	0.00	0.00
4	-5.64	10.00	0.00	0.00
5	-6.21	10.00	0.00	0.00
6	-6.83	10.00	0.00	0.00
7	-7.51	10.00	0.00	0.00
8	-8.26	10.00	0.00	0.00
9	-9.09	10.00	0.00	0.00
10		110.00	110.00	100.00

Table 5.2 Resultant Cash Flows with Borrowings

Source : Empirical

With the borrowings, the portfolio is now equivalent to a zero coupon bond. This has been rescaled in the final column so that it matures to the nominal £100. Since the longest duration is 6.76 years, and all the borrowings will have a shorter duration, how the duration becomes ten years is shown in the table 5.3;

Asset	Portfolio Value	Portfolio Weight	Asset Duration	Portfolio Duration (years)
Bond	100.00	235.8%	6.76	15.94
Borrowing Time 1	-4.24	-10.0%	1.00	-0.10
Borrowing Time 2	-4.67	-11.0%	1.91	-0.21
Borrowing Time 3	-5.13	-12.1%	2.74	-0.33
Borrowing Time 4	-5.64	-13.3%	3.49	-0.46
Borrowing Time 5	-6.21	-14.6 %	4 17	-0.61
Borrowing Time 6	-6.83	-16.1%	4.79	-0.77
Borrowing Time 7	-7.51	-17.7%	5.36	-0.95
Borrowing Time 8	-8.26	-19.5%	5.87	-1.14
Borrowing Time 9	-9.09	-21.4%	6.33	-1.36
Total Value	42.41	100.0%		10.00

Table 5.3 Duration Reconciliation

Source : Empirical

Since the portfolio weight is only 42.41 rather than the original 100 that is spent in buying the bond, this will increase the duration to 10 years.

Settlement Date : 27-Mar-92

Coupon Date	Time	GRY 8.70%	Cash Flow	PV of Cash Flow	Time by PV of Cash Flow
30-Mar-92	0.008	0.9993	0.00	0.00	0.00
30-Sep-92	0.512	0.9573	4.38	4.19	2.14
30-Mar-93	1.008	0.9178	4.38	4.02	4.05
30-Sep-93	1.511	0.8792	4.38	3.85	5.81
30-Mar-94	2.007	0.8429	4.38	3.69	7.40
:	:	:	:	:	:
:	:	:	:	:	:
30-Sep-10	18.511	0.2067	4.38	0.90	16.74
30-Mar-11	19.006	0.1982	4.38	0.87	16.48
30-Sep-11	19.510	0.1899	4.38	0.83	16.21
30-Mar-12	20.008	0.1820	4.38	0.80	15.93
30-Sep-12	20.512	0.1743	104.38	18.20	373.22
			Dirty Price	100.39	993.87
			Duration :	9.90	years

Table 5.4 - Irish Bond before being stripped at 8.70% yields

Source : McDermott (1992) & Empirical data

In table 5.4, the 8 3/4% Capital 2012 bond has a duration of 9.90 years. However, because the yield curve is not flat, the duration will not reconcile as in the previous example. To overcome this problem, the first ten years coupons are matched by borrowing and the internal rate of return of the portfolio is estimated at 8.44%. The interest rate swap curve prevailing in the market on the 27 March 1992 is used. The duration is reestimated for all series of cash flows using 8.44%.

This is shown in table 5.5. The duration of assets can be increased to match and immunise liabilities, for small changes in the yield curve. Such an asset with duration of 17.12 years did not exist, and has been synthetically created by the asset allocation in the portfolio.

Asset	Portfolio Value	Portfolio Weight	Asset Duration	Portfolio Duration years
Bond	102.96	230.5%	10.02	23.10
Borrowing Time 1	-1.66	-3.7%	0.51	-0.02
Borrowing Time 2	-1.84	-4.1%	0.98	-0.04
Borrowing Time 3	-1.91	-4.3%	1.44	-0.06
Borrowing Time 4	-2.05	-4.6%	1.87	-0.09
Borrowing Time 5	-2.13	-4.8%	2.29	-0.11
Borrowing Time 6	-2.28	-5.1%	2.68	-0.14
Borrowing Time 7	-2.36	-5.3%	3.07	-0.16
Borrowing Time 8	-2.51	-5.6%	3.43	-0.19
Borrowing Time 9	-2.61	-5.8%	3.78	-0.22
Borrowing Time 10	-2.77	-6.2%	4.11	-0.26
Borrowing Time 11	-2.89	-6.5%	4.44	-0.29
Borrowing Time 12	-3.06	-6.9%	4.74	-0.32
Borrowing Time 13	-3.19	-7.1%	5.04	-0.36
Borrowing Time 14	-3.36	-7.5%	5.34	-0.40
Borrowing Time 15	-3.51	-7.9%	5.60	-0.44
Borrowing Time 16	-3.68	-8.2%	5.87	-0.48
Borrowing Time 17	-3.84	-8.6%	6.12	-0.53
Borrowing Time 18	-4.03	-9.0%	6.37	-0.57
Borrowing Time 19	-4.21	-9.4%	6.61	-0.62
Borrowing Time 20	-4.40	-9.9%	6.83	-0.67
Total Value	44.67		Duration :	17.12

Table 5.5 - Duration Reconciliation of 8 3/4% Capital 2012 Bond

Source : McDermott (1992) & Empirical data

5.3 Derivation and Quantification of Mismatch Reserve

5.3.1 Theory

In the previous section, the asset portfolio free of any interest rate insolvency risk for small changes in yields is derived and borrowing is used to increase the portfolio duration. This section derives a mismatch reserve and quantifies for a major Irish insurer.

In financial markets with intermediation by agents[6] between principals[7], the principals must provide their agents with expected time horizon for dissaving[8] and the spread of the dissaving pattern. From these guidelines, the agent can communicate the expected return for this time horizon from the present implied internal rate of return on the principal's liability equivalent asset. He will also indicate an equivalent benchmark that reflects the target duration of dissaving from some class of market indices which the agent can replicate.

The agent receives his reward for Fama's (1968) standard role as a financial intermediary; collector and processor of financial data, retention of above market average expertise on market behaviour, economies of scale for transaction, execution and custodial services. Should the agent achieve an investment performance in excess of that initially expected, then there will be an excess of assets over liabilities. This excess solvency is defined as a mismatch reserve.

When such a successful mismatch occurs the principal has the choice to scale up the initial liability, maintain the same mismatch with a higher degree of solvency confidence, reduce contributions should future contributions be payable, or allow the agent more flexibility to maximise assets over liabilities while ensuring solvency with the same degree of confidence.

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[6] Agent is a person who is empowered to act for or represent another in a financial transaction.

[7] Principal is a person that has capital and empowers another to act as his representative in a financial transaction.

This is referred to as avoiding the insolvency ruin barrier that can be breached with ε% level of confidence. From this the agent's decision can be ranked on a hierarchical basis and the mismatch reserve allocated among the decisions which have been isolated to be independent events where possible. The allocation of mismatch per decision will then imply a set of limits per decision which the agent can take whilst ensuring solvency with (1- ε) % degree of confidence.

A mismatch reserve is the equivalent of holding an immunised portfolio and a relative performance option (Rainbow option) of an at the money call option on the return of the mismatched portfolio relative to the immunised portfolio for a specific time horizon. Alternatively, a mismatch reserve is the equivalent of holding a mismatched portfolio and a relative performance option (Rainbow option) of an at the money put option on the return of the mismatched portfolio relative to the immunised portfolio. When an excess of assets over liabilities exists, the principal decides to release this to the agent managing the asset portfolio in a timely manner. The principal can release the entire amount to be used in one time period, spread it as an annuity over the remaining life of the liability or release the return from the matched portfolio over infinite time periods.

A model of this approach is shown for an Irish general insurer in the next section. From this perspective, the yield curve is evaluated where the mismatch from the principals dissaving by the agent implies that the agent expects to earn an additional return. This additional premium can be evaluated using standard option pricing models or contingent claims analysis. At the macro level, the saving period by principals whereby they transfer their income from one time period to another has the open set of zero to infinity in terms of all individuals and organisations.

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[8] To reduce accumulated money from previous time periods.

While the principal's time horizon can be unbounded, it is assumed truncated at the longest maturity of government debt. O'Connor's (1993) spectrum of the principal's liabilities time horizon is shown in table 5.6.

Principal	Expected Time Horizon (years)
Property Insurer	0.5 year
Bank	2 years
Hire Purchase and Leasing	3 years
Liability Insurer	5 years
Building Society	7 year
Life Insurance	10 years
Pension Fund	20 years

Table 5.6 Principal Time Horizons

Source : O'Connor (1993) & Empirical data

The mismatch reserve is the capital value of the asset profit in the fund. It is free to enhance liabilities by revising these upwards, or if they are still being funded, to reduce the contribution flow. If they are not used for either of these purposes, then the mismatch reserve can be used to assume greater risk than the immunised return. Since a 'notional' set of assets if not actual matched assets can be in a fund, departure from such matching can be viewed as borrowing at unspecified rates of interest, to create a leveraged position in the final asset allocation. If such borrowings from the matched asset position are to persist for the life of the portfolio, the cost of such borrowings is the internal rate of return required on the matched assets to meet the liability.

A one period model is investigated such that at the start of the period, the total value of assets, total value of mismatched assets and the mismatch reserve are known;

(5.3.1) $A_t = (1+\alpha)_2 A_t$

The portfolio is allocated such that a proportion β was not immunised. This departure is financed initially with regard to capital cost from the mismatch reserve and subsequently if required from the matched asset. Let ${}_3A_t$ denote the mismatched assets. the risk free rate of return that would be earned on surplus assets is;

(5.3.2) $r_f \alpha {}_2A_t$

The return actually earned on assets is;

(5.3.3) $\beta\left({}_3A_{t+1} - (1+\alpha)_2 A_t\right) + (1-\beta)(1+\alpha)\left({}_2A_{t+1} - {}_2A_t\right)$

Since the expected return on the risky portfolio must exceed the risk free portfolio;

(5.3.4) $E\left[\beta\left({}_3A_{t+1} - (1+\alpha)\ {}_2A_t\right) + (1-\beta)(1+\alpha)\left({}_2A_{t+1} - {}_2A_t\right)\right] > E\left[r_f(1+\alpha)_2 A_t\right]$

where $\beta > 0$.

Because of the equality of starting assets ${}_3A_t$ in (5.2.21), the value of asset allocation is equal to the initial portfolio at time t. If the condition that ${}_2A_{t+1} = (1 + r_f)\ {}_2A_t$ is imposed, i.e. the value of fully matched assets a time t +1 equals the value of these assets at time t increased by the risk free internal rate of return.

Then, the first condition of risk assumption is;

(5.3.5) $E\left[\beta\left({}_3A_{t+1} - (1+\alpha)_2 A_t\right) + (1-\beta)(1+\alpha)\left({}_2A_{t+1} - {}_2A_t\right)\right] > E\left[r_f(1+\alpha)_2 A_t\right]$

The expected return on the diversified portfolio must exceed the expected value of the fully matched portfolio return.

(5.3.6) $E(C) = C$ so eliminating constraints implies.

$$(5.3.7)\quad E\left[\beta_3 A_{t+1} - \beta(1+r_f)(1+\alpha)_2 A_{t+1}\right] \quad > 0$$

$$(5.3.8)\quad E\left[\beta\left[{}_3A_{t+1} - (1+\alpha)_2 A_{t+1}\right] \quad > 0\right]$$

The second condition of risk assumption, which limits jointly the proportion which can be diversified and the choice of asset for diversification, is that the probability of the asset portfolio value at time t+1 being less than the increased value of the required matching assets be of a low order. Let the threshold chosen for this probability be ε, so that;

$$(5.3.9)\quad P\left[\beta_3 A_{t+1} + (1+\alpha)\left[\ (1-\beta)\ {}_2A_{t+1} -{}_2 A_t\right] - r_f \alpha_2 A_t - \alpha_2 A_t > 0\right] = 1-\varepsilon$$

The limiting condition for this inequality can alternatively be expressed as;

$$(5.3.10)\ \beta > (\beta + \alpha\beta - \alpha)_2 A_{t+1} / {}_3A_{t+1}$$

$$(5.3.11)\ (1+\alpha-\alpha/\beta)_2 A_{t+1}/{}_3A_{t+1} < 1 \quad \textit{with} \quad \textit{probability} \quad 1-\varepsilon$$

The extent to which risk can be assumed by the fund is a function of the insolvency ruin barrier ε, the size of mismatch reserve and subsequently of β, the proportion of mismatch and ${}_2A_{t+1}$ divided by ${}_3A_{t+1}$ the variability of the matched assets, relative to the chosen non-matched assets. If a high value for the mismatch reserve exists in the initial time period, this will increase the degree and type of allowable mismatch. Once the proportion of mismatch has been decided, the variability of assets allowable can be established. The variability of the asset allocation relative to the insolvency risk free rate of return on the matched asset is the product of a stochastic process.

In practice. the historical and implied returns and their respective volatilities will represent a guide to the expected behaviour of asset classes and different portfolios. However, the statutory authorities require different types of mismatch reserves for different financial intermediaries. The regulatory mismatch requirements for solvency maintenance are a three per cent rise in the yield curve and a twenty-five per cent decline in equities along with the second non-life directive of the European Union. Beyond the necessary solvency requirements, there is no specific mismatch requirement.

If the daily price histories for each of the asset portfolios under consideration re available, maximum likelihood estimates of probability density functions of daily price movements in each asset portfolio can be constructed.

Let;

$f(A)$ be the probability density function of daily price movement of the immunising asset portfolio,

$g_A({}_3A)$ be the probability density function of daily price movement of the mismatched asset portfolio.

The expected return on the immunising asset is:

(5.3.12) $\int_{-\infty}^{\infty} Af(A)dA$

and that on the mismatched asset is;

(5.3.13) $\int_{-\infty}^{\infty} Ag_A({}_3A)d_3A$

In order to justify mismatching;

(5.3.14) $\int_{-\infty}^{\infty} Af_A(A)dA - \int_{-\infty}^{\infty} Ag_A({}_3A)d_3A < 0$

Let $_1A_t$ be the random value of the immunising asset portfolio at time t. Let $_3A_t$ be the corresponding value of the mismatched asset portfolio. If αA_t is the mismatch reserve, then;

(5.3.15) $f_{\alpha A}(\alpha A) = \int_{-\alpha}^{\alpha A} f_A(A + \alpha A) f_3 A(_3 A) d_3 A$

is the probability of the daily distribution of the mismatch reserve. Since αA is the upper limit of the density function, a corresponding probability density mass is located at a value of zero. This mass cannot be more than ε, where ε is the arbitrary insolvency probability.

A scaling factor β is introduced, representing the proportion of the portfolio that can be mismatched while satisfying the above conditions. The scaling factor is identical to the factor β used in departures from immunisation in the previous section.

(5.3.16) Probability$\left[\alpha A < 0\right] \leq \varepsilon_\beta$ where ε is scaled by proportion β.

With an assumption of the mismatch reserve being normally distributed, the standard normal coefficient can be used to deduce β. However, the assumption of normality cannot be appropriate. When the distribution of both portfolio valuations in isolation is considered as having a log normal distribution, their inter-relationship can be viewed from the perspective of Contingent Claims Analysis (C.C.A.). A notional call option on the outperformance of the mismatched portfolio is purchased, subject to a minimum payment of the mismatch reserve at expiry. As a development of the methodology of Stultz (1982);

(5.3.17) $Max\left[_3A_{t+1} - _2A_{t+1}, \alpha A_t\right]$

for a one period option purchased at time t. $_3A_{(t+1)*}$ and $_2A_{(t+1)*}$ are jointly lognormal for a single asset portfolio and compound lognormal otherwise and represent the portfolio valuations at expiration.

The option premium is;

$$(5.3.18)\ C = e^{-r} E\left[Max\left[{}_3A_{(t+1)^*} - {}_2A_{(t+1)^*}, \alpha A_t \right]\right]$$

or written as a double integral;

$$(5.3.19)\ C - e^{-r}\alpha A_t = e^{-r} \int_{-\infty}^{\infty}\int_{-\infty}^{\infty} Max\left[{}_3Ae^{x} - {}_2A_te^{y}, 0\right] f(x,y)dxdy$$

where $x = \log\left(\frac{{}_3A_{(t+1)^*}}{{}_3A_t}\right)$, $y = \log\left(\frac{{}_2A_{(t+1)^*}}{{}_2A_t}\right)$ and $f(x,y)$ is the bivariate density function.

The expected value of the right hand side is the discount factor multiplied by the expected value of the mismatched portfolio given that the mismatched portfolio is more than the immunised portfolio at expiry.

This is given by;

$$(5.3.20)\ A_t e^{-r} \int_{\log\left(\alpha \frac{{}_3A_t}{A_t}\right)}^{\infty} \left[\int_{-\infty}^{x-\log\left(\frac{{}_3A_t}{A_t}\right)} f(y|x)dy \right] e^{x} f(x)dx$$

where $f(x) = \left(\frac{1}{\sigma_1\sqrt{2\pi t}}\right) e^{-\frac{1}{2}v_1^2}$ $\quad \& \, v_1 = (x - u_1t)/\sigma_t\sqrt{t}$,

$f(y) = \left(\frac{1}{\sigma_2\sqrt{2\pi t}}\right) e^{-\frac{1}{2}v_2^2}$ $\quad \& \, v_2 = (x - u_2t)/\sigma_t\sqrt{t}$,

$f(x|y) = \left(\frac{1}{\sqrt{2\pi\left(1-\rho^2\right)\sigma_1^2 t}}\right) e^{-\frac{1}{2}w_1}$ $\quad \& \, w_1 = \left[(x - u_1t) - \rho\left(\frac{\sigma_1}{\sigma_2}\right)(y - u_2t)\right]^2 / \left(1-\rho^2\right)\sigma_1^2 t$,

$$f(y|x) = \left(\frac{1}{\sqrt{2\pi\left(1-\rho^2\right)\sigma_2^2 t}} \right) e^{-\frac{1}{2}w_2} \quad \& \; w_2 = \left[\left(x-u_2t\right) - \rho\left(\frac{\sigma_2}{\sigma_1}\right)\left(y-u_1t\right) \right]^2 / \left(1-\rho^2\right)\sigma_2^2 t \; .$$

The formula utilises the normal density and conditional normal density functions. As a result, equation 5.3.20 becomes;

$$(5.3.21)\; f(x,y) = \left(\frac{1}{\left(2\pi\sigma_1\sigma_2\left(1-\rho^2\right)t\right)} \right) e^{-1/2u}$$

$$\text{where} \quad u = \frac{\left[\frac{\left(x-u_1t\right)^2}{\sigma_1^2 t} - \frac{2r\left(x-u_1t\right)\left(y-u_2t\right)}{\sigma_1\sigma_2 t} + \frac{\left(y-u_2t\right)^2}{\sigma_2^2 t} \right]}{\left(1-\rho^2\right)},$$

$$\text{and} \qquad u_1 = \log\left(\frac{G}{d_1}\right) - \frac{1}{2}\sigma_1^2 \text{ and } u_2 = \log\left(\frac{G}{d_2}\right) - \frac{1}{2}\sigma_2^2 \; .$$

where d_1 and d_2 are one plus the payoff rates of the two asset portfolios, σ_1^2 and σ_2^2 are the volatilities of the asset portfolios, ρ is the correlation of asset portfolios, and G is the natural logarithm of one plus the rate of return of the two underlying asset portfolios.

This implies;

$$(5.3.22)\; {}_3A_t e^{-r} \int_{\log\left(\frac{\alpha_3 A_t}{A_t}\right)}^{\infty} \left[\int_{-\infty}^{x-\log\left(\frac{\alpha_3 A_t}{A_t}\right)} f(y|x)dy \right] e^{-x} f(x)dx$$

$$(5.3.23)\; {}_3A_t d_2^{-1}\left\{ N\left[x_2\right] - N_2\left[-y_2, x_2; r_2\right] \right\}$$

in standard Black and Scholes (1973) terminology. N(d) is the normal distribution, N_2 is the bivariate normal distribution.

$$(5.3.23)\ x_2 = \left[\log\left(\frac{\left({}_3A_t d_2^{-1}/\alpha A_t e^{-r}\right)}{\sigma_2}\right)\right] + \tfrac{1}{2}\sigma_2$$

and

$$(5.3.24)\ y_2 = \left[\log\left(\left({}_3A_t d_2^{-1}/A_t e^{-r}\right)\right) + \Sigma\right] + \tfrac{1}{2}\Sigma$$

where $\Sigma^2 = \sigma_1^2 + \sigma_2^2 - 2\rho\sigma_1\sigma_2$ and $\rho_2 = \left(\rho\sigma_1 - \sigma_2\right)/\Sigma$ for a one period option.

On the left-hand side of the equation, the option premium amounts to $C - e^{-r}\alpha A_t$. The amount available for mismatching is limited to $\alpha A_t = C$. Thus the option premium allowing for perpetual option renewal is;

$$(5.2.25)\ \alpha\ {}_2A_t - \frac{\alpha\ {}_2A_t}{1+r} = \frac{r\alpha\ {}_2A_t}{1+r}$$

This is obviously a function of αA_t, the size of the mismatch reserve. In order that the left hand side equal the right, i.e. that;

$$(5.2.26)\ \frac{r\alpha\ {}_2A_t}{1+r} = A_t d_2^{-1}\left\{N[x_2] - N[-y_2, x_2, r_2]\right\}$$

and given that all quantities have previously been defined for any specific mismatch, a scaling factor b is required, under identical probability density function assumptions. This scaling factor is identical to the proportion of mismatch allowed referred to in the previous discussion.

The relationship between the variability of immunising assets as opposed to the allocated mismatched assets (i.e. ${}_2A_{t+1}/{}_1A_{t+1}$) is less obviously traceable in the above formulae, but would be reflected in the expression (1- ρ), reflecting the difference between perfect and actual correlation between immunising and mismatched asset portfolios, and in the entries relating to σ_1^2 and σ_2^2, the variances of the mismatched and immunising assets.

Since ${}_2A_{t+1}/{}_1A_{t+1}$ appear initially in the context of a limiting condition for an inequality based on ruin probability ε, whereas $(1-r)\sigma_1^2$ and σ_2^2 , appear in an option pricing formula, it is not possible to equate the random variable with its distribution. However, if the further assumption is made that ${}_2A_{t+1}$ and ${}_1A_{t+1}$ are jointly lognormally distributed then the ratio of these two assets will directly determine the payoff on the option in the contingent claims analysis section. It has been demonstrated that the size of the mismatch reserve dictates jointly the proportion and variability of mismatched assets. Further, it has been shown that the interest on the mismatch reserve can be regarded as a perpetuity of option premiums on the better performing of two portfolios of assets and that the proportionalities are identical under common assumptions whether departure from immunisation or contingent claims analysis is used.

5.3.2 Company Empirical Model

An example based on one of the major Irish general insurers is developed in this sub-section from their returns to the Department of Enterprise and Employment[9] over the sample time period of 1980 to 1997. The initial analysis is of the value and duration of their liabilities. These are Motor Vehicles, Fire and Property and Liability lines. Their liability claims ladder is estimated from their Form 8's (i.e. projected time triangle of claim settlements) which is shown in table 5.7 and is sometimes referred to as the run off triangle or claims ladder. Claims ladders show the percentage being settled and paid in a particular year that is a given number of years after the year in which the business is written. The overall duration will be the duration profiles of each line of business and the amount written in a particular year and the portfolio mix of liability lines. The term structure from chapter 2 is used to estimate the present value and duration of the liabilities. It must be also borne in mind that the claims are estimated from the Department's Blue Book (i.e. Net of Re-insurance) while the F8's are Gross of Re-insurance, so that forecast errors are subject to changing claims and re-insurance arrangements.

Since re-insurance is also shown for outside the country (e.g. Lloyd's), the industry is investigated to see if the individual firm is significantly different from the industry expected duration. Their business breakdown is shown in table 5.7. The duration of the Credit & Suretyship and Fire & Property is estimated to be six months. Accident and Sickness and Marine and Transit is consolidated because they amounted to 0.1% of the liability portfolio. Over the sample period of 1980 to 1994 the company has managed to hold 10% of market share. With the present value and duration of the liabilities is estimated from the data in chapter two, and the estimated duration of the Riada Short Government treasury Index it is possible to identify the appropriate benchmark. This had to be weighted with short-term money (one month) and the benchmark is rebalanced on an annual basis when the duration of the liabilities are reestimated.

Motor

Year	1	2	3	4	5	6	7	Later
Company	45.7%	35.7%	8.7%	5.4%	2.0%	0.9%	0.9%	0.7%
Industry	50.9%	33.6%	8.7%	3.7%	1.6%	0.8%	0.3%	0.4%

Employer's Liability

Year	1	2	3	4	5	6	7	Later
Company	19.2%	24.6%	15.8%	29.8%	1.4%	3.3%	2.3%	3.6%
Industry	18.8%	35.4%	19.4%	11.1%	5.8%	4.2%	2.0%	3.3%

Public Liability

Year	1	2	3	4	5	6	7	Later
Company	26.4%	41.7%	14.2%	9.6%	3.9%	2.1%	0.0%	2.1%
Industry	25.8%	35.0%	18.1%	7.8%	6.5%	3.0%	1.8%	2.0%

Total Liability

Year	1	2	3	4	5	6	7	Later
Company	22.4%	32.4%	15.1%	20.6%	2.6%	2.8%	1.2%	2.9%
Industry	22.1%	35.2%	18.8%	9.6%	6.1%	3.6%	1.9%	2.7%

Table 5.7 - Different Lines Run Off Triangles Percentage Settled for 1989

Source : Personal Communication (1993) - Insurance Corporation of Ireland

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[9] Formerly, Department of Industry and Commerce which is the Irish equivalent of the UK Department of Trade and

The split between employer's and public liability is 55% to 45%. In the motor class the maturity profile is very similar to that of the industry and in the liability the only unusual year is that of year four where the liability jumped to 29.8%. These cash flows can also be represented on a continuos time basis using either a gamma or loggamma function.

Class	Share	Growth
Accident & Sickness	0.1%	0.5%
Motor Vehicle	39.2%	8.0%
Fire & Property	44.7%	12.5%
Marine & Transit	0.0%	-2.1%
Liability	12.2%	12.0%
Credit & Suretyship	3.7%	11.3%

Table 5.8 Breakdown of Liability lines

Source : Cosgrove (1992) - Department of Industry & Commerce

With Fire and Property, the standard actuarial approach is that the broker will have use of the money for the quarter, the claim will occur half way through the year and the settlement of the claim will take two months. Credit and Suretyship relate to short term Bills of Exchange, Specific Contract performance and have a normal life of six months. The liability duration, maturity and present value for 1994 is shown in table 5.9.

Measure	Total	Motor	Fire	Liability	Other
Maturity (years)	1.32	1.42	1.00	2.26	1.00
Present Value	91%	90%	93%	84%	93%
Duration (years)	1.24	1.17	0.91	1.72	0.91

Table 5.9 Present Value and Duration Profile

Source : Department of Industry & Commerce & Empirical data

Industry. According to the government actuary, Joyce (1998), the liabilities are stable over the time period.

The present value represents the discounted liability stream, although in practice insurers do not represent their liabilities as such to external bodies. This is an area that has led to much debate in the literature Daykin, Devitt, Khan & McCaughan (1984) and Kahane (1979).

For immunisation, the liability portfolio is discounted by the appropriate discount factors from chapter two to obtain the present value and duration as set out in table 5.10. When this is done for 1989, the calculations are worked back to 1980 on a recursive basis. With the appropriate weights the required matched returns is estimated over the 1980-92 sample period on a gross basis since underwriting losses are offsetable against investment income.

Asset	Duration	Weight	Weighed Duration
Three Month DIBOR	0.25	50%	0.13
Riada Short Bond	2.20	50%	1.11
Matched Portfolio		100.00%	1.24

Table 5.10 Matched Allocation for 1994

Source : ABN-Amro Riada Stockbrokers

After this it is assumed that the investment returns could be approximated using Hardy's formula and these are estimated by combining underwriting profits and losses and changes in shareholder's funds to impute the return. These returns required the assumption that there are no capital injections by their parent over the decade, the returns on equities are reduced by the 15% withholding credit on Irish equity dividends and finally the accounting treatment of asset valuation is consistent throughout the period. In informal discussions with the company and the regulators they indicated that the approach taken is reasonable and consistent. The calculation of returns is shown in table 5.11.

Date	Actual	Matched	Surplus/Deficit	Money	Short Government Treasuries
1980	12.1%	17.81%	5.71%	18.0%	17.7%
1981	14.7%	10.33%	-4.37%	13.8%	8.0%
1982	4.6%	18.62%	14.02%	18.8%	18.6%
1983	28.4%	13.53%	-14.87%	15.5%	11.0%
1984	17.0%	10.23%	-6.77%	12.1%	7.4%
1985	36.9%	12.31%	-24.59%	15.0%	11.3%
1986	6.1%	8.36%	2.26%	12.4%	5.2%
1987	15.7%	11.63%	-4.07%	14.0%	10.1%
1988	14.2%	7.84%	-6.36%	8.7%	7.0%
1989	8.69%	5.75%	-2.94%	8.4%	2.7%
1990	4.99%	8.27%	3.28%	12.1%	5.1%
1991	13.36%	7.85%	-5.51%	11.4%	5.8%
1992	0.10%	6.61%	6.51%	10.8%	2.6%
1993	6.78%	13.73%	6.95%	17.0%	9.7%
Average	13.12%	10.92%	2.20%	13.4%	8.7%
Volatility	9.78%	3.95%	9.83%	3.2%	4.8%

Table 5.11 Matched versus Actual Returns

Source : Department of Industry & Commerce & Empirical data

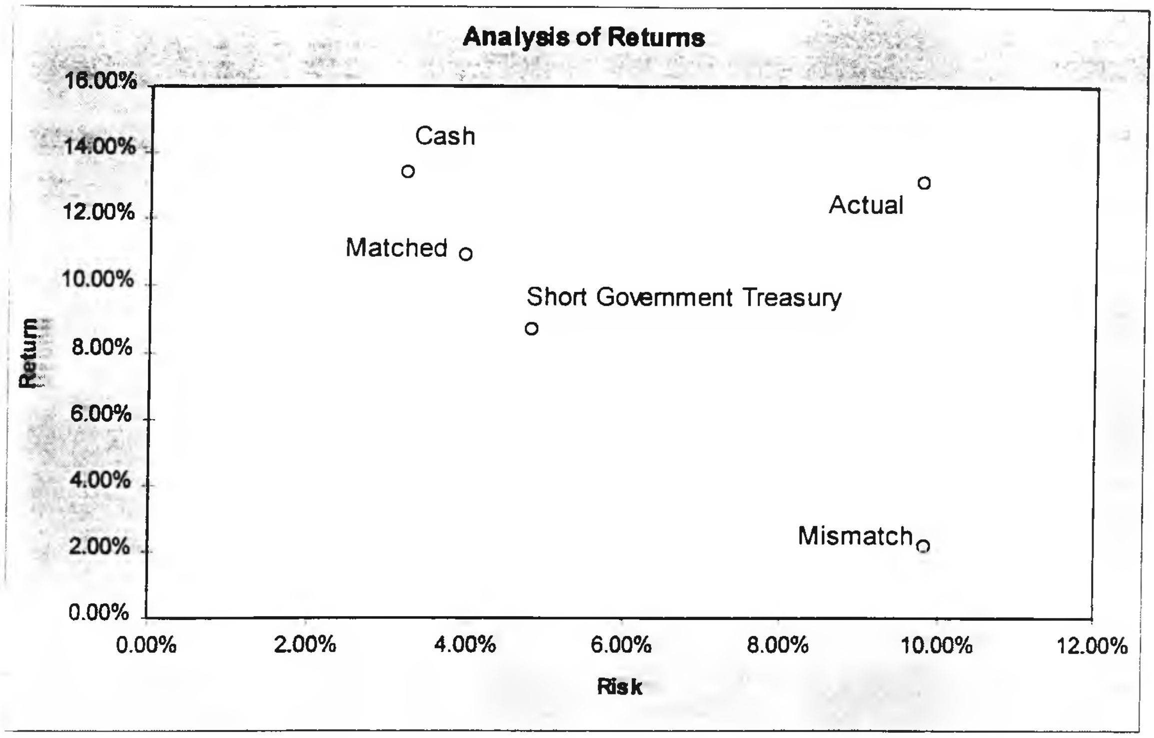

Exhibit 5.1 - Investment Performance over the time period 1980-1994

Source : Department of Industry & Commerce & Empirical data

As can be observed in exhibit 5.1, the matched investment performance is between the money and short government bond asset classes. The unmatched investment performance resulted in an increased return but with far greater risk. This is clearly seen by observing the surplus return and its risk (i.e. volatility). The next step is to choose a 'benchmark' portfolio that would either increase return and/or reduce risk relative to the matched portfolio.

Under the Irish regulators localisation rules, eighty percent of a general insurance companies assets must be held in the Irish market. Irish companies do not hold many foreign assets, though unlike life companies, they are not required to hold a mismatch reserve. Bounds are introduced into the portfolio in order that the theoretical mismatch reserve would be reduced.

These are shown in the table 5.12;

Asset Class	Lower Bound	Benchmark	Upper Bound
Cash	15%	20%	40%
Treasury's	30%	65%	80%
Property	0%	5%	10%
Equities	5%	10%	20%

Table 5.12 Bounded Benchmark Portfolio

Source : Empirical

From the constraints, portfolios are constructed to be low risk, matched, benchmark and high risk on a relative basis. Risk is defined in terms of absolute volatility that is estimated for each portfolio. These are shown in 5.13.

Date	Matched	Low Risk	Benchmark	High Risk
Property	0%	0%	5%	5%
Money	50%	40%	20%	15%
Treasury's	50%	55%	65%	60%
Equities	0%	5%	10%	20%
Return	9.64%	10.35%	10.45%	11.44%
Volatility	4.42%	5.44%	6.06%	7.66%

Table 5.13 Portfolio Weights and Performance Parameters 1980-1997

Source : Department of Industry & Commerce & Empirical data

Time	Description	Low	Medium	High
18 years	Return	0.72%	0.82%	1.80%
	Volatility	2.21%	3.73%	6.30%
9 years	Return	0.32%	0.45%	1.43%
	Volatility	2.24%	4.16%	6.78%
4 years	Return	0.95%	2.14%	4.01%
	Volatility	2.15%	3.69%	5.72%

Table 5.14 Surplus over different time horizons 1980-1997

Source : Empirical

A simulation is run to identify the surplus/deficit returns for the benchmark and two boundary portfolios. These are conducted over three time horizons and they are graphed in exhibit 5.2.

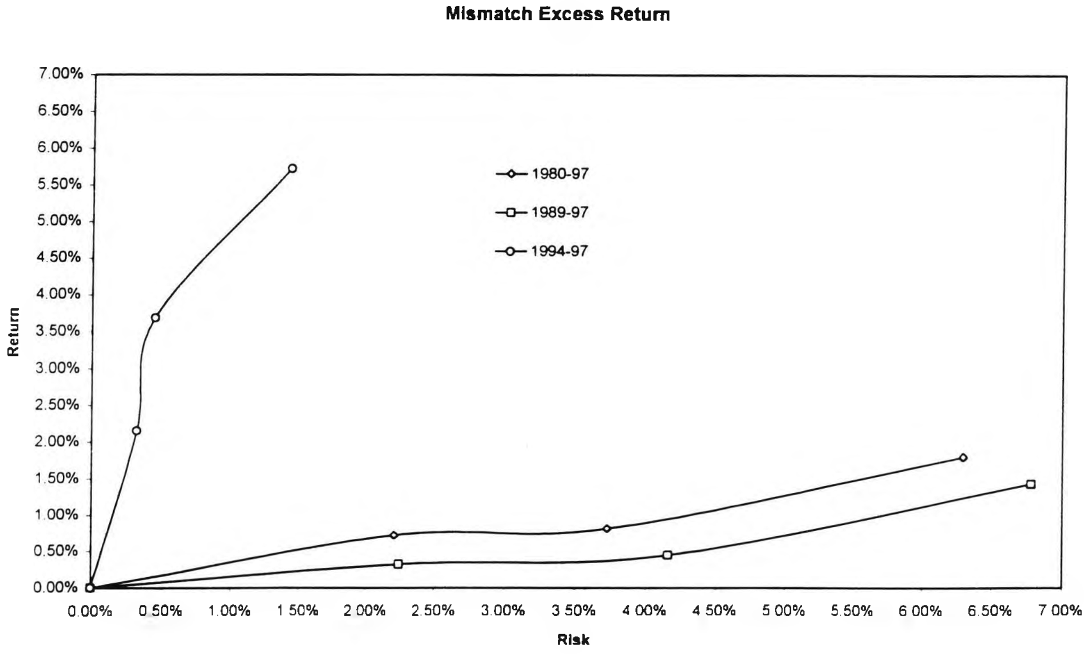

Exhibit 5.2 Historic Mismatch Excess Return/Risk Ratios

Source : Empirical

From these results and assuming a lognormal distribution for the portfolio returns, the required mismatch reserve is estimated. It is decided that two different levels of $\varepsilon\%$ would be used to illustrate the sensitivity of the insolvency ruin barrier. The formulae is set out in section 5.3 and the mismatch reserve matrix is set out in table 5.15. For the lowest risk portfolio the annual mismatch requirement would be 2.91% and the main risk of this portfolio is for the government yield curve two rise in a non-paralleled manner whereby it becomes more positively shaped.

Ruin	Low Risk	Benchmark	High Risk
5%	2.91%	5.32%	8.56%
0.5%	4.97%	8.80%	14.42%

Table 5.15 Mismatch Reserve Matrix for Alternative Portfolios

Source : Empirical

5.3.3 Mismatch Reserve Estimation

The model included the matched portfolio, long sector of the Irish bond market, equally weighted bond and equity markets in Ireland, UK, US, Japan, Germany and France with unhedged foreign exchange exposure. Correlation and volatilities using monthly data from 1985 to 1995 are estimated and the mismatch reserve is quantified. As in the previous section, the mismatch reserve probability function is quantified and a ruin barrier of 5% and 0.5% chosen. The simulation results are shown in Appendix Six. They range from low risk reserves for the money market of 4.6% to 30.1% for a local market asset allocation of 50% in Irish bonds and 50% in Irish equities for a 0.5% ruin barrier. There are diversification opportunities from holding international equities, but equities are very risky relative to international bonds. This time period would have included two Irish pound currency crises, 1987 equity market crash, and 1994 bond bear market.

5.4 Industry Analysis

In this section, the sample set is identified, and analyse of each company within the industry undertaken to determine it immunising portfolio over the sample time period. As mentioned in the previous section, the companies are analysed using the 'Insurance Annual Report' over the time period 1980 to 1997. The following companies are included in the 'Insurance Annual Report 1980' (Blue Book) and have remained in the industry over the period of investigation. The list of companies below can be taken as the sample set:

1. Church and General
2. Hibernian
3. Insurance Corporation of Ireland
4. Irish National
5. Irish Public Bodies
6. PMPA
7. Combined
8. Assicurazioni Generali
9. Cornhill
10. Eagle Star
11. Ecclesiastical
12. General Accident
13. Guardian Royal Exchange
14. Methodist
15. Norwich Union Fire
16. Prudential
17. Royal Insurance
18. Sun Alliance and London
19. Zurich

From the above sample set, it is important to realise that PMPA and ICI are only there due to government intervention. PMPA Insurance Company collapsed in 1983, with an accumulated deficit of IR£ 203m, but is rescued by the government. In 1989 the PMPA name, underwriting book and assets is sold to Guardian Royal Exchange for IR£87m. PMPA changed its name to Primor which continues in operation to run off the claims liabilities. Insurance Corporation of Ireland is a former subsidiary of AIB group that collapsed in 1985 with an accumulated deficit of IR£ 266m. The collapse is blamed mainly on the activities in the London reinsurance market. The Central Bank at the time warned the government that ICI's losses could have put the entire Irish insurance and banking system in jeopardy if the company is not rescued.

The government intervened and an administrator is appointed to ICI, who disposed of non-core and foreign-based parts of the group. Then after restoration of ICI back to financial health, the name, underwriting book and assets of ICI is sold to Assurance Generales de France (AGF) in 1990 for IR 100m. The underwriting liabilities are retained and the company name changed to ICARCOM, which continues in operation to run off the claims liabilities. The companies listed are included in the 'Insurance Annual Report 1980' but left the market during the period of the investigation for some reason or other:

1. AFIA	- exit at the end of 1985
2. European Fed	- exit at the end of 1985
3. Phoenix	- exit at the end of 1986
4. Insurance Company of North America	- exit at the end of 1987
5. National Employers	- exit at the end of 1988
6. Shield	- exit at the end of 1990
7. American International	- exit at the end of 1990

Also during the period of investigation there are entrants into the industry, which are listed as follows:

1.Celtic	- joined 1982
2. F.M.	- joined 1981
3.Construction Guarantee	- joined 1984
4.AMEV General	- joined 1984
5.Universal	- joined 1984
6.Ansvar	- joined 1984
7.Chubb	- joined 1985
8.CIGNA	- joined 1985
9.Lloyds	- joined 1985
10.De Montfort	- joined 1986
11.Financial Insurance	- joined 1988
12.Electra	- joined 1989
13.ICAROM	- joined 1990
14.Mutual Blood Stock	- joined 1990
15.NEM	- joined 1990
16.Primor	- joined 1990
17.Bankers Insurance	- joined 1990
18.Veterinary Defense Society	- joined 1990
19.Eagle Star Ireland	- joined 1991
20.Alfar Insurance Limited	- joined 1992
21.AIG Europe	- joined 1992
22.XL Europe	- joined 1992
23.Colonia Versicherung	- joined 1992

Primor and ICARCOM are not engaged in underwriting. To ensure that the sample is representative of the population it only contains companies that are in the industry from 1980 through to 1997. The market share held by each company is identified and how it has changed over the period. From table 5.16, the top five largest general insurance companies in the industry based on their earned premium income are as follows: Guardian Royal PMPA (20.4%), Hibernian (13.4%), Royal & Sun (13.1%), Church & General (8.7%) and F.B.D. (8.2%). The top five companies in this sample set account for 64% % for the general insurance industry. Over the period of investigation, PMPA lost approximately 10% of its market share while ICI lost approximately 1.5%. In 1980 PMPA held the greatest market share (22.4%) and Hibernian had 14.02% but after the collapse of PMPA in 1983 Hibernian took over as market leader until the Guardian Royal PMPA merger.

	1980	1981	1982	1983	1984	1985
Guardian Royal PMPA	28.13%	27.93%	25.51%	26.41%	24.28%	22.75%
Hibernian	17.63%	18.14%	21.08%	22.10%	25.88%	24.57%
Royal & Sun Insurance	6.32%	6.19%	6.18%	5.45%	5.58%	6.01%
Church & General	3.38%	4.17%	3.75%	3.75%	4.39%	5.00%
F.B.D	1.90%	1.95%	2.36%	2.72%	3.70%	4.62%
I.C.I	9.13%	9.27%	9.74%	11.70%	7.44%	9.53%
General Accident	10.13%	9.78%	9.61%	9.44%	8.72%	8.38%
Norwich Union Fire	7.55%	6.56%	5.72%	4.52%	5.09%	5.02%
Eagle Star	0.08%	0.07%	0.06%	0.05%	0.05%	0.05%
Irish National	8.51%	8.26%	7.65%	6.63%	6.92%	6.57%
Irish Public Bodies	1.78%	1.83%	2.08%	2.12%	2.50%	2.89%
Cornhill	0.47%	0.50%	0.66%	0.84%	1.18%	1.27%
Combined	1.34%	1.47%	1.70%	1.98%	2.13%	1.84%
Assicurazioni Generali	2.52%	2.90%	2.89%	1.30%	0.94%	0.87%
Zurich	1.13%	1.01%	1.01%	0.98%	1.18%	0.63%

Table 5.16 Market Share of Each Company 1980-1985
Source : Cosgrove (1997) - Department of Industry & Commerce

	1986	1987	1988	1989	1990	1991
Guardian Royal PMPA	19.80%	18.31%	17.32%	9.15%	18.59%	18.02%
Hibernian	23.77%	23.33%	22.38%	24.68%	23.26%	19.54%
Royal & Sun Insurance	6.25%	6.38%	6.85%	7.38%	6.99%	6.97%
Church & General	5.40%	6.45%	8.29%	9.15%	9.01%	8.81%
F.B.D	5.12%	5.18%	6.23%	7.05%	7.02%	6.24%
I.C.I	11.26%	10.76%	10.35%	10.85%	4.83%	9.24%
General Accident	8.46%	8.15%	8.39%	9.01%	9.03%	7.50%
Norwich Union Fire	5.03%	5.11%	5.27%	5.88%	6.09%	5.36%
Eagle Star	0.05%	0.07%	0.09%	0.10%	0.09%	0.07%
Irish National	6.47%	7.25%	5.79%	6.66%	5.43%	9.24%
Irish Public Bodies	3.92%	4.48%	4.49%	4.98%	4.55%	3.96%
Cornhill	1.37%	1.35%	1.30%	1.39%	1.53%	1.60%
Combined	1.59%	1.53%	1.55%	1.82%	1.76%	1.46%
Assicurazioni Generali	0.80%	0.87%	0.84%	1.02%	1.03%	0.98%
Zurich	0.73%	0.79%	0.87%	0.87%	0.79%	1.00%

Table 5.17 Market Share of Each Company 1986-1991
Source : Cosgrove (1997) - Department of Industry & Commerce

	1992	1993	1994	1995	1996	1997
Guardian Royal PMPA	17.60%	18.52%	16.37%	16.44%	22.87%	20.39%
Hibernian	20.25%	21.59%	17.86%	16.99%	15.38%	13.39%
Royal & Sun Insurance	7.52%	0.47%	5.68%	5.76%	4.95%	13.05%
Church & General	9.95%	9.70%	8.32%	8.50%	8.32%	8.67%
F.B.D	7.10%	8.22%	7.47%	8.00%	8.23%	8.25%
I.C.I	9.28%	10.90%	9.87%	10.11%	8.62%	7.92%
General Accident	7.51%	8.06%	7.09%	7.53%	6.92%	6.52%
Norwich Union Fire	6.52%	7.52%	6.73%	6.89%	6.40%	5.53%
Eagle Star	0.08%	0.07%	7.70%	6.96%	6.66%	5.52%
Irish National	5.75%	6.55%	5.59%	5.23%	4.31%	3.64%
Irish Public Bodies	3.86%	3.86%	3.14%	3.11%	2.96%	2.70%
Cornhill	1.52%	1.35%	1.24%	1.65%	1.72%	1.86%
Combined	1.48%	1.55%	1.31%	1.36%	1.53%	1.59%
Assicurazioni Generali	0.99%	1.47%	1.37%	1.27%	1.08%	0.90%
Zurich	0.60%	0.18%	0.25%	0.20%	0.05%	0.06%

Table 5.18 Market Share of Each Company 1992-1997

Source : Cosgrove (1997) - Department of Industry & Commerce

RANK	COMPANY	OVERALL	ANNUAL	CURRENT
1	Guardian Royal PMPA	-7.74%	-0.43%	20.39%
2	Hibernian	-4.24%	-0.24%	13.39%
3	Royal & Sun Insurance	6.73%	0.37%	13.05%
4	Church & General	5.30%	0.29%	8.67%
5	F.B.D	6.35%	0.35%	8.25%
6	I.C.I	-1.22%	-0.07%	7.92%
7	General Accident	-3.61%	-0.20%	6.52%
8	Norwich Union Fire	-2.02%	-0.11%	5.53%
9	Eagle Star	5.44%	0.30%	5.52%
10	Irish National	-4.87%	-0.27%	3.64%
11	Irish Public Bodies	0.92%	0.05%	2.70%
12	Cornhill	1.39%	0.08%	1.86%
13	Combined	0.25%	0.01%	1.59%
14	Assicurazioni Generali	-1.62%	-0.09%	0.90%
15	Zurich	-1.07%	-0.06%	0.06%

Table 5.19 Market Share of Sample Set

Source : Cosgrove (1997) - Department of Industry & Commerce

In table 5.19, the focus is on the market share of the companies in the sample set rather than the total current industry. The changes in market share have not been significant with growth accounted for by mergers.

5.5 Mismatch Returns Performance

5.5.1 Comparing the Mismatch Return Within the Industry

In this section, the return of the immunised portfolio is estimated and the mismatched return for each company in each year of the sample period. For certain companies such as Cornhill, Eagle Star, Ecclesiastical, Methodist and Prudential, it is found to be difficult to estimate the actual return with a reasonable degree of confidence. It is possible to estimate the matched return for all companies. The average and standard deviation of actual returns for actual and matched returns are estimated.

It is interesting to observe how the matched returns of the industry over the eighteen years is between 12% and 20% and the risk of the portfolios is clustered between 4% and 7%. The actual returns are considerably more scattered in relation to the matched returns. Some companies such as ICI, PMPA, Irish Public Bodies, Combined and Assicurazioni Generali would seem to have been better served if they had immunised their liability portfolios.

It is interesting to note the increased risk that they took to achieve greater returns by mismatching and investing in Irish equities and property. Church and General and Hibernian seem to have been very successful while others had considerable volatility in investment returns with a relatively modest increase in return.

Because of the different liability profiles of the companies in the industry, the incremental return for each company is estimated relative to its matching portfolio each year and the volatility or risk of such returns. In the case of ICI, Combined and Irish National, the finding suggests that they would have been better suited to matching (i.e. immunising) their portfolios.

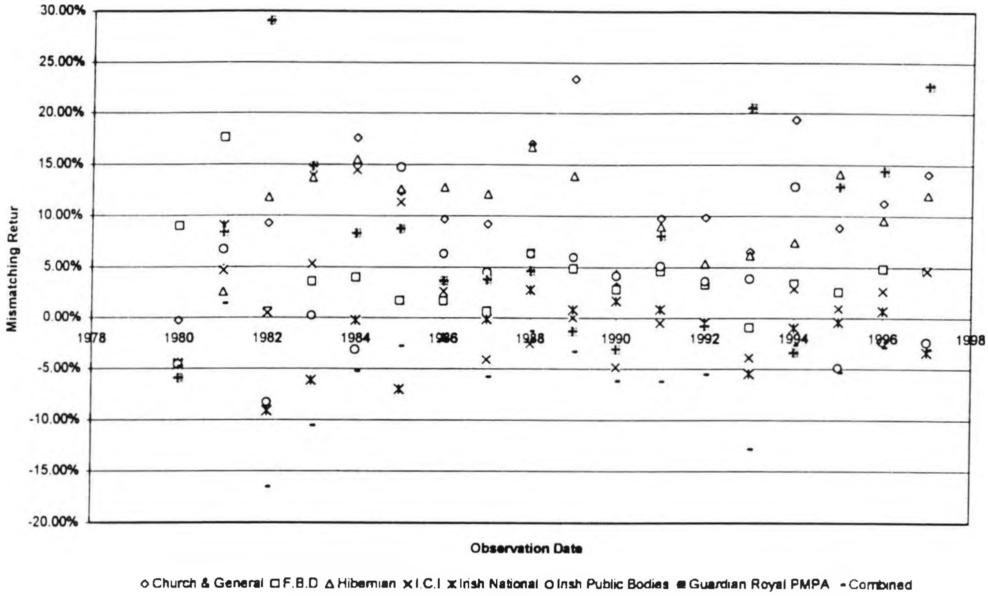

Exhibit 5.3 Actual Outperformance relative to Matched Portfolio

Source : Empirical

In table 5.20, the risk reward ratio is estimated by comparing the increase in percentage return for the risk taken to achieve the value added from mismatching. There is a marked contrast between Church & General and Hibernian where the ratio exceeds one and on the downside Irish National that had a negative ratio in excess of minus one over the entire sample period.

COMPANY	RISK	RETURN	RATIO
Church & General	20.48%	5.46%	3.75
F.B.D	13.55%	5.97%	2.27
Hibernian	19.12%	6.06%	3.16
I.C.I	11.00%	6.61%	1.66
Irish National	8.04%	4.35%	1.85
Irish Public Bodies	12.10%	6.55%	1.85
Guardian Royal PMPA	17.46%	11.53%	1.51
Combined	4.05%	4.02%	1.01

Table 5.20 Risk/Reward Ratio of Actual Portfolios 1980 - 1997

Source : Empirical

In every year that is analysed, there has been a cross subsidisation of poor underwriting by good investment returns. A period has not occurred in which there is a downturn in the investment returns cycle and underwriting cycle to confirm research by Daykin and Bernstein (1985) which suggests that the cycles can be inversely related.

Between 1980 and 1997 the industry (excluding companies for whom underwriting results are unknown) has had premium income of £7,128m (in historical terms) on which it had underwriting losses of £1,204m but an investment income of £1,539m and capital gains of £313m. Over the past five years the premium income is £3,109m with underwriting losses of £331m and investment income of £661m with capital gains of £269m which is a margin of safety cover of 54%.

5.5.2 Impact of the value of Under & Out-performance

It is assumed that firms achieved the matched return for those years in which it is not possible to identify the actual return.. This is performed over the periods 1980-97and in table 5.21.

	1980	1997	Return	Return	Deficit
	INVESTMENTS	INVESTMENTS	MATCHED	ACTUAL	SURPLUS/
Church & General	£8,064	£331,059	£38,507	£322,995	£292,552
Combined	£2,525	£17,429	£12,057	£14,904	£5,372
F.B.D	£5,583	£297,535	£26,660	£291,952	£270,875
General Accident	£28,562	£161,140	£136,389	£132,578	£24,751
Hibernian	£61,498	£460,141	£286,274	£398,643	£173,867
I.C.I	£59,950	£349,315	£293,666	£289,365	£55,649
Irish National	£29,560	£113,838	£141,155	£84,278	-£27,317
Irish Public Bodies	£10,126	£246,600	£48,354	£236,474	£198,246
P.M.P.A	£69,531	£819,930	£332,025	£750,399	£487,905
Zurich	£4,071	£24,354	£19,440	£20,283	£4,914

Table 5.21 Profit & Loss Mismatching Contribution

Source : Department of Industry & Commerce & Empirical data

The capital is accumulated for the matched and actual returns with the deviance been translated into a profit or loss added value. Investments are assumed equal to the actual return and imputed the value of the matched return investments if such a policy had been pursued. In certain firms such as Cornhill or Prudential there seemed to be problems that are likely to be associated with capital injections in the overall period. It is also assumed that in the case of companies that did not split asset classes, that the current assets could be broken into cash and debtors by using the industry average. During the more recent five years the problem seemed to have reversed in the case of such firms and they could be withdrawing from the market with capital reductions. The investment operation has seemed to add considerable value in firms like Church & General +£293m, FBD +£271m, Hibernian +£174m.

In the case of General Accident, it underperformed by £11.48m, ICI by £34m, Irish National by £7.09m, PMPA by £24.46m, Royal Insurance by £21.12m and Sun Alliance by £4m over the past five years. There are other possible reasons to explain these variances such as the often mentioned reduction in capital, mergers & reorganisations or being run down due underwriting losses. It has not been possible to eliminate these considerations from the analysis of investment performance.

5.5.3 Size of Investment Funds

Investment income has only covered underwriting losses by 2.25% annually over the entire sample period for Irish resident insurers and in the context of the volatility of investment returns it would be prudent to carry an explicit mismatch reserve. In table 5.22, the asset breakdown of the industry is shown for those that are declared and using the ratios of premium incomes made an assumption about the size of the rest of the industry.

Asset	Known	Industry (Investments)	Industry (Premium)
Bonds	£1,722m	£2,389m	
Equities	£533m	£739m	
Property	£82m	£113m	
Cash	£468m	£649m	
Total	£2,805m	£3,891m	£1,117m

Table 5.22 Investments of General Insurance Industry 1997

Source : Cosgrove (1997) - Department of Industry & Commerce

In the context of the Irish government treasury market alone that is £17bn the general insurance industry holds about 10% of all issues by the Irish government. While it is known that investments must be at least £2.8bn from the data in the Blue books, some investments are held under current assets the estimated bond holdings is revised up to be probably of the order of £3bn.

Over the past eighteen years the industry has increased its weighting in bonds by 13% and equities by 6%, and reduced its exposure to property by -10% and cash by -8%. It is not possible to tell from the Blue books whether these asset classes are in foreign currencies but exchange controls existed till 1990 along with a requirement for localisation of assets by the Department of Enterprise and Employment.

5.5.4 Returns on Shareholders Funds

This is difficult to estimate for the industry because of the defaults by ICI and PMPA and capital injections by the Irish government and changes in the Blue book returns in 1993. The sample set is reduced to Church & General, Combined, FBD, Hibernian, ICI, Irish National, Irish Public Bodies, Guardian Royal PMPA and Zurich.

Shareholders return are defined as the Net Transfers to Reserves, Profit Retained and Dividends and shareholders funds as capital issued, reserves and the profit and loss account. The return of the matched return is subtracted to isolate the increased return over the asset matching risk for the shareholders by exposing themselves to the underwriting cycle. Two time periods are selected to gauge the overall performance and recent experiences. This is shown in table 5.23.

Over the 1980-92 period the industry average shareholders funds had a return of 18.76% and the underwriting generated an additional return of 4.92% over the investment return. The recent five years show an improved return of 20.93%. However, some companies such as Irish National, Irish Public Bodies, PMPA and Zurichs' shareholders would have seen better results by investing into the matching portfolio directly and not taking any exposure to the insurance industry.

Company	1980-92 Return	Shareholders Risk	1980-92 Return	Insurance Risk	1988-92 Return	Shareholders Risk	1988-92 Return	Insurance Risk
Church & General	18.89%	13.54%	5.02%	15.88%	22.68%	10.80%	12.14%	10.82%
Combined	27.88%	9.14%	14.33%	8.54%	28.82%	11.50%	18.08%	10.81%
FBD	35.00%	33.06%	21.12%	34.70%	66.17%	26.73%	55.61%	26.11%
Hibernian	24.88%	12.98%	10.98%	12.12%	19.52%	17.82%	8.93%	17.87%
ICI	24.16%	30.21%	10.35%	30.47%	21.93%	36.99%	11.44%	37.17%
Irish National	2.68%	26.17%	-11.17%	27.24%	10.23%	9.72%	-0.35%	10.85%
Irish Public Bodies	15.35%	15.92%	1.50%	13.85%	8.48%	10.96%	-2.00%	9.67%
PMPA	13.55%	34.48%	-0.37%	34.39%	10.26%	28.05%	-0.33%	27.15%
Zurich	6.45%	30.88%	-7.46%	30.16%	0.28%	25.90%	-10.30%	24.39%
Industry	18.76%	22.93%	4.92%	23.04%	20.93%	19.83%	10.36%	19.43%

Table 5.23 Shareholders Overall & Underwriting Returns

Source : Department of Industry & Commerce & Empirical data

Earned premium income is divided by capital (i.e. shareholders funds) for each company by year since 1980. The industry average is £2.33m premium written per £1m capital with 1997 been one of the highest year on record. The most aggressive company seems to be FBD that writes £3.304m while Combined only writes £1.628m. If Irish National, Irish Public Bodies, PMPA and Zurich are to withdraw their capital of £88m, this would reduce underwriting capacity by £173m to £203m. Premium levels could be expected to rise by at least three per cent. The major firms would seem to be secure for the foreseeable future.

5.5.5 Value of Claims Paid

Claims settlement over the review period is approximated by adding the appropriate technical reserves and claims paid for each year. While earlier analysis indicates that claim inflation exceeded general inflation by c.3% depending up on the class of business, it is conservatively assumed that the claims settlement would be the C.P.I over the period.

Year	Original Claims Paid	Current Claims Paid
1980	£324,739	£995,921
1981	£411,704	£1,159,439
1982	£505,609	£1,312,280
1983	£600,513	£1,426,034
1984	£753,662	£1,643,449
1985	£827,672	£1,657,332
1986	£763,551	£1,403,983
1987	£838,861	£1,416,400
1988	£863,685	£1,339,132
1989	£927,648	£1,320,758
1990	£1,026,798	£1,342,447
1991	£1,212,775	£1,456,010
1992	£968,596	£1,067,822
1993	£1,153,298	£1,253,771
1994	£1,220,653	£1,296,944
1995	£1,055,314	£1,093,537
1996	£1,129,814	£1,152,410
1997	£1,230,749	£1,230,749
Total	£15,815,641	£23,568,417

Table 5.24 Size of Gross Claims Settlement

Source : Department of Industry & Commerce & Empirical data

On an adjusted basis, the industry has paid £15.82bn by 1997 and if when adjusted for inflation the value is about £23.57b. In 1997 the national debt is £28b. The run off for 1997 could be as high as c.£4bn with investments at £1.41bn and needing to be increased by £653m.

While it can be criticised as an unreasonable comparison, the growth in this industry that redistributes risk is having a substantial negative impact on the Irish economy. Between 1980 and 1997, the share of claims settlement by domestic insurers has risen from 26% to 50%.

5.6 Present Structure and Future of Insurance Market

Because of matching requirements, the general insurance investor's pool has continued to be a captive market even after exchange controls are removed. The regulators required localisation of assets and prescribed broad asset class headings, but in a regime of exchange controls international asset diversification is not an issue. This will cease to be the case when Ireland joins the Euro in 1999.

The population of all Irish insurance companies is identified and their individual importance in the market is identified. The nature of the liabilities is investigated and estimated the duration and liability of each individual class over the eighteen years. The top three classes are Motor, Liability and Property that accounted for 97% of all insurance underwritten. Over the entire sample period, the claims increase is compared to general inflation for each class and the claims rose in excess of inflation by c.3% every year on average since 1980.

The only class of insurance that has fluctuated as a percentage of the overall business written has been Treaty that is very small at 2.82%. The liability profile is estimated for each company since 1980 and the asset allocation of the matching portfolio identified. The risk/reward characteristics is investigated for each asset class over the sample period and the investment performance of each company and it's matching portfolio.

The performance of the matched is compared against the mismatched portfolio and the contribution of the mismatch return. The sample period is then subdivided into two and three periods to see if there is a difference in company's performance. Companies should know the portfolio that is expected to match their liabilities with its inherent risk versus reward characteristics. The annualised size of the mismatch reserve should be published along with duration of their liabilities in the Blue book.

An area of concern is the cross subsidisation of underwriting by investment performance and the risk of insolvency due to further increased mismatching. Against the background of the lifting of exchange controls and increasing pressure on management to increase returns, substantially greater investment risk may be taken than in the past. This raises the serious spectre of a third insurance company becoming insolvent.

This work could be developed if access is given to the form 8's for each company for each year over the past eighteen years for each class of business. Their individual experiences of claim inflation would be helpful along with knowledge of any material reinsurance's experiences. In relation to asset management, capital injections or disbursements, tax problems such as withholding tax on dividends or deposit interest retention tax and changes in asset allocation policies between Blue book publications.

5.7 Summary & Conclusions

While a considerable amount of research has been dedicated to analysing management of either asset or liability portfolios, little work has been done on the interaction of asset/liability management. It is this area that this chapter sought to address in relation to the Irish general insurance industry whose matching portfolio has always being determined by the Irish term structure. Some of the companies would have had a superior investment performance if they had matched their liabilities with Irish government bonds. There is also a substantial cross subsidisation between good investment returns and poor underwriting results. This means that the industry and its regulator that has prescribed mismatch reserving for the life assurance should consider mismatch reserving in the context of general insurance. Although general insurance companies do not discount liabilities, the duration and present value is estimated for liabilities and that of the matching portfolio consisting of the three month money market and the Riada Short bond index.

The mismatch reserve model uses the approach of contingent claims analysis (CCA) whereby the mismatch reserve is valued as an at the money call option on the relative outperformance of the mismatched portfolio against the matched portfolio for a particular time horizon. The time horizon should be the same as the review period by the asset/liability committee of the asset management performance. One company is chosen and analysed in detail. The benchmark asset allocation which is not a matched asset portfolio is chosen for a given mismatch reserve and limits are placed on the asset allocation consistent with risk/ruin theory, the size of the mismatch reserve and desire of the asset/liability committee to take greater investment risk than the matched portfolio. Information is confined to that of the Blue books and some general assumptions had to be made about different companies and the time period.

The is very strong evidence to suggest that the insurance industry takes investment decisions which are much riskier than their liabilities require. In some cases the companies would have been better off by matching their assets to their liabilities. At a minimum, the regulator should consider introducing a requirement for companies that mismatch to carry additional reserves to reflect their increased investment risk in a similar fashion to the life insurance sector. In the event of a downturn in investment performance, there will be upward pressure on premium levels.

Chapter 6

Summary and Conclusions

6.1 Introduction

In this dissertation, the Irish term structure is identified and estimated. The stochastic process through which Irish interest rates evolve is estimated and different factor models are tested on Irish data. From this analysis the price discovery process of the term structure is investigated to see whether a primary dealership market microstructure is viable relative to the agency market microstructure. Finally, the behaviour of Irish general insurers is analysed in terms of their historical investment performance in Irish bond markets.

6.2 Summary

The dataset used comprised Irish government bond prices from 1980 to 1997. All data had to be sampled, collated and confirmed with the transactions passing through the Stock Exchange and the ante-sample and post-sample points.

Different approaches taken to term structure identification are examined and criticised including; yield to maturity, discrete estimation of the term structure, polynomial approximations and polynomial splines, *B* splines and exponential splines. Since it is not possible to estimate the discount function directly in the Irish case, it is identified indirectly by bootstrapping the discount factors from the existing bonds. This fitted curve is constrained to generate a non-singular cash flow matrix.

After the term structure had been identified and estimated from 1980 to 1997, the behaviour of the stochastic process governing Irish spot rates is investigated. The aim is to identify the risks facing investors in Irish bonds and the most plausible model of the stochastic process of the Irish term structure during this period. The background to stochastic processes and the different attempts to model the term structure stochastic process are reviewed. This is followed by modelling the dynamics of the term structure and the orthogonality proposition of the spread process for the Irish term structure.

The microstructure of the existing agency system of transacting is investigated. The hypothesis to be tested is whether a competitive dealership market could be supported and would be preferable to the existing agency microstructure. The findings favoured a competitive market due to:

a) provision of immediacy,

b) price transparency,

c) limit on size of spreads,

d) capitalised primary dealer system recognised by NTMA,

e) NTMA allied commitment to develop REPO market,

f) minimum market depth leading to increased liquidity.

The investment performance of Irish general insurers is investigated. To do this a framework is developed in which managers attempt to maximise the value of the funds under management, subject to a minimum terminal value. The performance of the companies under such a strategy is compared with their actual achievements and those that would have occurred if their portfolios had been immunised. The performance is found to be highly varied, so important implications for the insurance industry can be drawn. These implications are that the framework developed in chapter five should be adopted and mismatching from the immunising portfolio should be tightly controlled.

6.3 Conclusions

There have been cycles in debt maturity and duration that have been in a maturity range of 5 years to 9 years and a duration range of 3.28 years to 4.88 years respectively. The average duration has been 3.94 years over this period. On examination of Irish government treasury market it is found that the authorities had funded at the shorter maturities when yields are high in the early 1980's. This resulted in observations at the sample points being clustered for short maturities.

The *B* spline model specifying five degrees of freedom with knots at a maturity of one and five years is chosen to fit the Irish yield curve because it had the lowest residual deviance and is superior to both no knots and a knot placed at a maturity of one year. A third knot is excluded since the additional explanatory power is marginal. There is a significant difference between the money market up to one year maturity and the bond market beyond. When outliers are identified and removed, the size of the residual deviance is reduced by up to 90%.

The parameters of the fitted yield spline and the discount function are estimated empirically and tabulated since these results have not been achieved before in the case of Irish government treasury market. When the estimated term structure is used to value bonds from 1980 to 1997 and compared to the actual market prices the results are very good even with the originally identified outliers.

The first three factors explain more than 99% of the term structure movement. The first factor implies a parallel shift of the term structure, the second factor implied a change in the slope of the term structure and the final factor implies a change in the curvature of the term structure. Only three factors would be needed to explain the stochastic process of Irish interest rates. Heteroscedasticity is a problem and eliminates the use of single factor models to model the stochastic process. There is evidence of autocorrelation up to four lags in the case of the short and long rates. The hypothesis that changes of the short rate, long rate and spread are normally distributed could not be rejected. However, the kurtosis figure is greater than the three we would expect in the case of a normal distribution. The parameters of the stochastic process are estimated.

The conclusion is that there are excess reserve profits earned in the agency system above those required that have not been eroded by movements in the labour market or entry of new firms. The capital requirement in a primary dealing structure would be £25m to have the capacity for turnover that would be required to compete with other European markets. A market maker would have to capture a mean spread of 5 pence per £100 nominal to stay in business in the long run. The normal distribution with a mean of £34,500 and a standard deviation of £302,000 is the most appropriate distribution for modelling a Primary Dealer daily profit distribution. On a daily basis, the probability of making a loss is 38.46%.

The NTMA stated that it would consider the primary dealing system to have failed if the number of primary dealers fell below four. By assuming that the primary dealers would withdraw if they failed to cover the costs over a trading year, then the risk of the primary dealing system failing is 2.8%. The important profit distribution parameters are market share, earned spreads and volatility of the term structure.

While a considerable amount of research has been dedicated to analysing management of either asset or liability portfolios, little work has been done on the interaction of asset/liability management. The duration and present value is estimated for insurance liabilities and those of a matching asset portfolio consisting of the three month money market and the Riada Short bond index. The top three insurance classes are Motor, Liability and Property that accounted for 97% of all insurance underwritten.

The performance of the matched against the mismatched portfolio and the contribution of the mismatch return is examined with very mixed results. The sample period is then subdivided into two and three periods to see if there is a difference in company's performance. An area of concern is the cross subsidisation of underwriting by investment performance and the risks of insolvency due to further increased mismatching.

6.4 Areas for further research

The spot rates could be estimated monthly between 1980 and 1997 rather than on a semi-annual basis. Then a generalised additive model approach could be set up to investigate bond pricing errors in the discount function at each sample point. In chapter three the embedded option of outlier bond could be reverse engineered. The volatility of the term structure of the rest of Europe could be included in the analysis to identify cross currency influences. A Generalised Autocorrelation Conditional Heteroschedasticity (i.e. G-ARCH) model should be used in relation to the modelling of the time series of the volatility of the term structure.

In relation to the microstructure, the building of a database along the lines of the time stamped data series in the CRSP in the US would be very helpful. This would allow a more detailed study of the behaviour of the market on an intra-day basis and for event studies like funding decision by the authorities.

For mismatch reserving, if the data is available on a quarterly basis within the company, this would bring the sample series up to fifty two sample points rather than the thirteen that is used for modelling. Fifty two points are available when identifying the probability distribution of asset returns. A simple linear correlation process between asset classes is assumed, but it may be appropriate to investigate whether there is a need for a GARCH model that can handle changing variance and correlations.

Other methods than the chain ladder to estimate liability run offs should be used and compared to see if the results are superior. A time series model would be interesting to see the changes in frequency and severity of the Irish experience over the past thirteen years. A cross comparison of the individual components of a claim cost across the EC would be helpful to establish benchmarks of the most efficient approach to controlling this element of the cost.

Appendix 1

Data for Term Structure Identification 1980-1997

Trade	17-Apr-80																				
Sett :	21-Apr-80																				
Stock		Coupon	Nominal Issue	Market Price	Market Yield	Volatility	Duration	Life	Clean Market Value (IR£m)	Dirty Market Value (IR£m)	Stock Weight in Index	Weighted Volatility	Weighted Duration	Weighted Life	Ex-Div Date	Accrued Interest	Accrued Interest	First Redemption Date	Last Redemption Date	Redemption Date
IR FUNDING 9 1/2% 1980		9 50%	90 0	99.44	18 617%	0 06	0 067	0.07	89 500	88 939	2.68%	0 00	0 002	0 00	15-May-80	-24	-0 62	15-May-80	15 May-80	15-May-80
IR FINANCE VAR% 1983		17 94%	50 0	100.02	17.777%	0 13	0 140	0 11	50 008	51 261	1 54%	0 00	0 002	0 00	01-Mar-80	51	2 50	01-Sep-83	01 Sep 83	01-Sep-83
IR FINANCE 8 % 1980		8.00%	170 0	96.34	17 201%	0 41	0.447	0 45	163 775	164 520	4 96%	0 02	0 022	0 02	01-Apr-80	20	0 44	01-Oct 80	01 Oct-80	01-Oct-80
IR NATION. 4 1/4% 1975/80		4 25%	61 0	93.98	16 826%	0 49	0.530	0 53	57.329	57 258	1 73%	0 01	0 009	0 01	01-May-80	-10	-0 12	01-Nov-75	01-Nov-80	01-Nov-80
IR SAVING 5 % 1971/81		5 00%	42 0	91.39	17.060%	0 75	0 813	0 82	38 383	38 762	1.17%	0 01	0 009	0 01	15-Feb-80	66	0 90	15-Feb-71	15 Feb-81	15 Feb 81
IR FUNDING 8 1/2% 1981		8 50%	125 0	93.67	17 209%	0 78	0 844	0 86	117 089	118 573	3 57%	0 03	0 030	0 03	01-Mar 80	51	1.19	01-Mar-81	01 Mar 81	01 Mar 81
IR EXCHEQR 10 % 1981		10 00%	120 0	93.58	17 125%	0 99	1 073	1.11	112 298	116 963	3 53%	0 03	0 038	0 04	01-Dec-79	142	3 89	01 Jun 81	01-Jun 81	01 Jun 81
IR FINANCE 11 1/2% 1981		11 50%	160 0	94.74	16 460%	1 19	1 291	1 36	151 580	154 149	4 65%	0 06	0 060	0 06	01 Mar 80	51	1 61	01-Sep-81	01-Sep-81	01 Sep-81
IR EXCHEQR 11 1/2% 1982		11 50%	80 0	93.68	16 314%	1 52	1 642	1.78	74 944	76 959	2 32%	0 04	0 038	0 04	01 Feb 80	80	2 52	01 Feb 82	01 Feb 82	01 Feb 82
IR FINANCE 10 1/2% 1982		10 50%	100 0	91 57	16 361%	1 67	1 810	1 98	91.574	91 746	2 77%	0 05	0 050	0 05	15 Apr 80	6	0 17	15 Apr 82	15 Apr 82	15 Apr-82
IR CONVER 9 % 1980/82		9 00%	151 0	87.65	16 328%	1 99	2 153	2 40	132.348	133 725	4 03%	0 08	0 087	0 10	15-Mar 80	37	0 91	15-Sep-80	15-Sep 82	15 Sep 82
IR FUNDING 11 3/4% 1983		11.75%	80 0	92.05	16 035%	2 31	2 499	2 94	73 641	74 182	2 24%	0 05	0 056	0 07	31-Mar 80	21	0 68	31 Mar 83	31-Mar 83	31 Mar 83
IR FINANCE 12 % 1984		12.00%	80 0	91.50	16 006%	2 80	3 019	3 78	73 202	75 304	2 27%	0 06	0 069	0 09	01-Feb 80	80	2 63	01-Feb-84	01-Feb-84	01 Feb-84
IR NATION. 5 1/4% 1979/84		5 25%	29 0	71.68	15 474%	3 49	3 760	4.57	20 766	20 666	0 62%	0 02	0 023	0 03	15 May-80	-24	-0 34	15-Nov-79	15-Nov 84	15-Nov-84
IR NATION 14 % 1985		14 00%	130 8	93.17	17 128%	3 23	3 505	4 90	121.866	123 721	3 73%	0 12	0.131	0 18	15-Mar 80	37	1 42	15-Mar-85	15 Mar 85	15-Mar 85
IR EXCHEQR 6 % 1980/85		6 00%	71.5	72.89	14 889%	3 97	4 262	5 62	52 154	53 822	1 62%	0 06	0 069	0 09	01-Dec 79	142	2 33	01 Dec 80	01 Dec 85	01 Dec 85
IR NATION 7 1/2% 1981/85		7 50%	59 1	76.58	15 370%	4 03	4 336	6 20	45 256	46 603	1 40%	0 06	0 061	0 09	01-Jan-80	111	2 28	01-Jul 81	01-Jul-86	01-Jul-86
IR NATION 5 3/4% 1982/87		5 75%	21 4	66.64	15 788%	4 47	4 828	7 49	14 273	14 293	0 43%	0 02	0 021	0 03	15-Apr 80	6	0 09	15-Oct-82	15 Oct 87	15-Oct 87
IR CONVER 8 1/2 % 1986/88		8 50%	60 2	78.44	15 737%	4 33	4 672	7 79	47 255	48 377	1 46%	0 06	0 068	0 11	01-Feb-80	80	1 86	01-Feb-86	01 Feb-88	01-Feb-88
IR NATION 9 3/4% 1984/89		9 75%	80 2	83.20	15 731%	4 54	4 896	9 28	66 716	68 429	2 06%	0 09	0 101	0 19	01 Feb 80	80	2 14	01-Aug-84	01 Aug 89	01 Aug 89
IR EXCHEQR 5 3/4% 1984/89		5 75%	26 3	64.80	15 999%	4 68	5 053	9 54	17 072	17 030	0 51%	0 02	0 026	0 05	01-May-80	-10	-0 16	01-Nov-84	01-Nov 89	01 Nov 89
IR NATION. 14 % 1985/90		14 00%	130 8	95.45	16 071%	4 72	5 097	9 90	124 852	126 707	3 82%	0 18	0 195	0 38	15-Mar-80	37	1 42	15-Mar-85	15 Mar-90	15-Mar-90
IR EXCHEQR 6 % 1985/90		6 00%	59.8	65.59	16 280%	4 59	4 965	10.58	39 221	38 985	1.17%	0 05	0 058	0 12	15-May-80	-24	-0 39	15-Nov-85	15-Nov-90	15-Nov-90
IR NATION 6 3/4% 1986/91		6 75%	63 6	69.71	16 390%	4 48	4 849	11 45	44 311	44 546	1 34%	0 06	0 065	0 15	01-Apr-80	20	0 37	01-Oct-86	01-Oct-91	01-Oct-91
IR EXCHEQR 14 % 1990/92		14 00%	25 0	95.12	16.510%	4 84	5 235	11 79	23 781	24 548	0 74%	0 04	0 039	0 09	01-Feb-80	80	3 07	01-Feb-90	01 Feb 92	01-Feb-92
IR NATION. 7 % 1987/92		7 00%	106 2	71.20	16 520%	4 40	4 763	12.16	75 622	78 228	2 36%	0 10	0 112	0 29	15-Dec-79	128	2 45	15-Jun-87	15-Jun-92	15-Jun-92
IR DEVELO 7 1/2% 1988/93		7 50%	176 8	74.38	16 580%	4 32	4 674	13 20	131 499	135 529	4 08%	0 18	0 191	0 54	01-Jan-80	111	2 28	01-Jul-88	01 Jul 93	01-Jul 93
IR NATION 9 1/4% 1989/94		9 25%	36 5	92.07	11 750%	6 45	6 831	14 20	33 617	34 644	1 04%	0 07	0 071	0 15	01-Jan-80	111	2 81	01 Jul 89	01 Jul 94	01-Jul-94
IR CONVER 12 % 1995		12 00%	31 6	92.12	16 476%	4 75	5 137	15 41	29 110	29 494	0 89%	0 04	0 046	0 14	15 Mar 80	37	1 22	15-Sep-95	15 Sep 95	15-Sep-95
IR EXCHEQR 9 1/4% 1991/96		9 25%	191 3	84.54	16 793%	4 17	4 524	16.54	161.687	161.203	4 86%	0 20	0 220	0 80	01 May 80	-10	-0.25	01-Nov 91	01-Nov 96	01-Nov-96
IR NATION 9 3/4% 1992/97		9 75%	223 2	87.16	16 672%	4 25	4 601	17 50	194 539	194 896	5 87%	0 25	0 270	1 03	15-Apr-80	6	0.16	15-Oct 92	15-Oct 97	15-Oct 97
IR NATION 11 % 1993/98		11 00%	233 2	91.36	16.682%	4 43	4 801	18 50	213 022	213 443	6 43%	0 29	0 309	1 19	15-Apr 80	6	0 18	15-Oct-93	15-Oct-98	15-Oct 98
IR DEVELO 11 1/2% 1997/99		11 50%	210 0	92.94	16 944%	4 39	4 761	19 58	195 176	193 589	5 83%	0.26	0 278	1 14	15-May-80	-24	-0 76	15-Nov-97	15-Nov-99	15-Nov 99
IR FINANCE 14 1/2% 1998/00		14 50%	25 0	98.19	16 501%	5 30	5 739	20 42	24 547	24 915	0 75%	0 04	0 043	0 15	15-Mar-80	37	1 47	15-Sep 98	15-Sep-00	15-Sep 00
IR FINANCE 13 % 1997/02		13 00%	255 0	96.72	16 604%	4 87	5 270	21 96	246 634	248 449	7 49%	0 36	0 395	1 64	01 Apr 80	20	0 71	01-Apr 97	01-Apr 02	01 Apr 02
IR DEVELO 14 3/4% 2002/04		14 75%	25 0	99.08	16 194%	5 59	6 038	23 80	24 769	25 577	0 77%	0 04	0 047	0 18	01-Feb-80	80	3 23	01 Feb-02	01-Feb-04	01 Feb 04
IR EXCHEQR 6 1/2% 2000/05		6 50%	128 0	82.29	15 666%	3 52	3 794	25 20	105 325	107 968	3 25%	0 11	0 123	0 82	27 Dec 79	116	2 06	27-Jun-00	27-Jun-05	27-Jun 05
									3278.743	3318 002	100 00%	3.17	3 433	10 12						

Trade : 17-Oct-80
Sett : 21-Oct-80

Stock	Coupon	Nominal Issue	Market Price	Market Yield	Volatility	Duration	Life	Clean Market Value (IR£m)	Dirty Market Value (IR£m)	Stock Weight in Index	Weighted Volatility	Weighted Duration	Weighted Life	Ex-Div Date	Accrued Interest	Accrued Interest	First Redemption Date	Last Redemption Date	Redemption Date
IR NATION 4 1/4% 1975/80	4.25%	61.0	99.70	14.585%	0.03	0.030	0.03	60.819	60.741	1.63%	0.00	0.000	0.00	01-Nov-80	-11	-0.13	01-Nov-75	01-Nov-80	01-Nov-80
IR FINANCE VAR% 1983	16.61%	50.0	100.01	16.537%	0.13	0.137	0.11	50.003	51.140	1.37%	0.00	0.002	0.00	01-Sep-80	50	2.27	01-Sep-83	01-Sep-83	01-Sep-83
IR NATION 5 % 1971/81	5.00%	42.0	97.60	13.051%	0.30	0.322	0.32	40.992	41.377	1.11%	0.00	0.004	0.00	15-Aug-80	67	0.92	15-Feb-71	15-Feb-81	15-Feb-81
IR FUNDING 8 1/2% 1981	8.50%	125.0	98.65	12.611%	0.34	0.361	0.36	123.311	124.766	3.35%	0.01	0.012	0.01	01-Sep-80	50	1.16	01-Mar-81	01-Mar-81	01-Mar-81
IR EXCHEQR 10 % 1981	10.00%	120.0	98.53	12.717%	0.57	0.607	0.61	118.238	122.904	3.30%	0.02	0.020	0.02	01-Jun-80	142	3.89	01-Jun-81	01-Jun-81	01-Jun-81
IR NATION. 9 1/4% 1981	9.25%	98.0	90.77	25.470%	0.61	0.683	0.69	88.950	91.730	2.46%	0.01	0.017	0.02	01-Jul-80	112	2.84	01-Jul-81	01-Jul-81	01-Jul-81
IR FINANCE 11 1/2% 1981	11.50%	160.0	99.21	12.569%	0.80	0.845	0.86	158.741	161.260	4.33%	0.03	0.037	0.04	01-Sep-80	50	1.57	01-Sep-81	01-Sep-81	01-Sep-81
IR EXCHEQR 11 1/2% 1982	11.50%	80.0	98.87	12.585%	1.15	1.226	1.28	79.096	81.136	2.18%	0.03	0.027	0.03	01-Aug-80	81	2.55	01-Feb-82	01-Feb-82	01-Feb-82
IR FINANCE 10 1/2% 1982	10.50%	100.0	97.70	12.437%	1.32	1.406	1.48	97.699	97.871	2.63%	0.03	0.037	0.04	15-Oct-80	6	0.17	15-Apr-82	15-Apr-82	15-Apr-82
IR NATION. 9 1/4% 1982	9.25%	98.0	91.19	16.053%	1.47	1.584	1.69	89.366	92.146	2.47%	0.04	0.039	0.04	01-Jul-80	112	2.84	01-Jul-82	01-Jul-82	01-Jul-82
IR CONVER 9 % 1980/82	9.00%	151.0	94.93	12.427%	1.67	1.775	1.90	143.339	144.678	3.88%	0.06	0.069	0.07	15-Sep-80	36	0.89	15-Sep-80	15-Sep-82	15-Sep-82
IR FUNDING 11 3/4% 1983	11.75%	80.0	98.69	12.506%	2.06	2.184	2.44	78.955	79.470	2.13%	0.04	0.047	0.05	01-Oct-80	20	0.64	31-Mar-83	31-Mar-83	31-Mar-83
IR FUNDING 11 1/2% 1983	11.50%	98.0	98.04	12.475%	2.47	2.625	3.03	96.080	95.740	2.57%	0.06	0.067	0.08	01-Nov-80	-11	-0.35	01-Nov-83	01-Nov-83	01-Nov-83
IR FINANCE 12 % 1984	12.00%	80.0	98.80	12.572%	2.63	2.795	3.28	79.043	81.172	2.18%	0.06	0.061	0.07	01-Aug-80	81	2.66	01-Feb-84	01-Feb-84	01-Feb-84
IR FINANCE 11 3/4% 1984	11.75%	98.0	98.18	12.543%	2.97	3.159	3.82	96.216	99.305	2.67%	0.08	0.084	0.10	15-Jul-80	98	3.15	15-Aug-84	15-Aug-84	15-Aug-84
IR NATION. 5 1/4% 1979/84	5.25%	29.0	80.94	12.129%	3.34	3.547	4.07	23.447	23.343	0.63%	0.02	0.022	0.03	15-Nov-80	-25	-0.36	15-Nov-79	15-Nov-84	15-Nov-84
IR NATION. 14 % 1985	14.00%	130.8	101.64	13.287%	3.25	3.464	4.40	132.950	134.755	3.62%	0.12	0.125	0.16	15-Sep-80	36	1.38	15-Mar-85	15-Mar-85	15-Mar-85
IR NATION. 14 % 1985/90	14.00%	130.8	102.37	12.977%	3.27	3.480	4.40	133.906	135.711	3.64%	0.12	0.127	0.16	15-Sep-80	36	1.38	15-Mar-85	15-Mar-90	15-Mar-85
IR EXCHEQR 12 % 1985	12.00%	130.8	98.82	12.470%	3.41	3.622	4.57	129.261	128.187	3.44%	0.12	0.125	0.16	15-Nov-80	-25	-0.82	15-May-85	15-May-85	15-May-85
IR EXCHEQR 6 % 1980/85	6.00%	71.5	82.11	11.659%	3.97	4.196	5.12	58.746	60.415	1.62%	0.06	0.068	0.08	01-Jun-80	142	2.33	01-Dec-80	01-Dec-85	01-Dec-85
IR NATION. 7 1/2% 1981/85	7.50%	59.1	85.66	12.031%	4.15	4.404	5.70	50.622	51.981	1.40%	0.06	0.061	0.08	01-Jul-80	112	2.30	01-Jul-81	01-Jul-86	01-Jul-86
IR NATION. 5 3/4% 1982/87	5.75%	21.4	75.07	12.680%	4.77	5.075	6.99	16.077	16.098	0.43%	0.02	0.022	0.03	15-Oct-80	6	0.09	15-Oct-82	15-Oct-87	15-Oct-87
IR CONVER 8 1/2 % 1986/88	8.50%	60.2	85.45	12.991%	4.64	4.946	7.28	51.475	52.611	1.41%	0.07	0.070	0.10	01-Aug-80	81	1.89	01-Feb-86	01-Feb-88	01-Feb-88
IR NATION 9 3/4% 1984/89	9.75%	80.2	89.58	13.060%	5.05	5.379	8.78	71.836	73.570	1.97%	0.10	0.106	0.17	01-Aug-80	81	2.16	01-Aug-84	01-Aug-89	01-Aug-89
IR EXCHEQR 5 3/4% 1984/89	5.75%	26.3	71.77	13.132%	5.28	5.625	9.04	18.908	18.862	0.51%	0.03	0.028	0.05	01-Nov-80	-11	-0.17	01-Nov-84	01-Nov-89	01-Nov-89
IR EXCHEQR 14 % 1990/92	14.00%	25.0	101.24	13.510%	5.23	5.588	9.29	25.309	26.086	0.70%	0.04	0.039	0.07	01-Aug-80	81	3.10	01-Feb-90	01-Feb-92	01-Feb-90
IR EXCHEQR 6 % 1985/90	6.00%	59.8	70.77	13.871%	5.22	5.583	10.07	42.319	42.073	1.13%	0.06	0.063	0.11	15-Nov-80	-25	-0.41	15-Nov-85	15-Nov-90	15-Nov-90
IR NATION 6 3/4% 1986/91	6.75%	63.6	74.91	13.778%	5.27	5.628	10.95	47.617	47.852	1.28%	0.07	0.072	0.14	01-Oct-80	20	0.37	01-Oct-86	01-Oct-91	01-Oct-91
IR NATION 7 % 1987/92	7.00%	106.2	76.82	13.561%	5.37	5.735	11.66	81.600	84.206	2.26%	0.12	0.130	0.26	15-Jun-80	128	2.45	15-Jun-87	15-Jun-92	15-Jun-92
IR DEVELO 7 1/2% 1988/93	7.50%	176.8	79.33	13.701%	5.36	5.728	12.70	140.245	144.311	3.87%	0.21	0.222	0.49	01-Jul-80	112	2.30	01-Jul-88	01-Jul-93	01-Jul-93
IR NATION. 9 1/4% 1989/94	9.25%	36.5	95.10	10.669%	6.93	7.295	13.70	34.723	35.759	0.96%	0.07	0.070	0.13	01-Jul-80	112	2.84	01-Jul-89	01-Jul-94	01-Jul-94
IR CONVER 12 % 1995	12.00%	31.6	95.27	14.239%	5.71	6.116	14.91	30.105	30.478	0.82%	0.05	0.050	0.12	15-Sep-80	36	1.18	15-Sep-95	15-Sep-95	15-Sep-95
IR EXCHEQR 9 1/4% 1991/96	9.25%	191.3	86.92	14.640%	5.11	5.480	16.04	166.252	165.719	4.45%	0.23	0.244	0.71	01-Nov-80	-11	-0.28	01-Nov-91	01-Nov-96	01-Nov-96
IR NATION. 9 3/4% 1992/97	9.75%	223.2	89.36	14.548%	5.22	5.598	16.99	199.447	199.805	5.36%	0.28	0.300	0.91	15-Oct-80	6	0.16	15-Oct-92	15-Oct-97	15-Oct-97
IR FINANCE 14 1/2% 1998/00	14.50%	25.0	100.12	14.414%	6.39	6.847	17.91	25.030	25.387	0.68%	0.04	0.047	0.12	15-Sep-80	36	1.43	15-Sep-98	15-Sep-00	15-Sep-98
IR NATION. 11 % 1993/98	11.00%	233.2	93.37	14.589%	5.45	5.843	17.99	217.707	218.128	5.86%	0.32	0.342	1.05	15-Oct-80	6	0.18	15-Oct-93	15-Oct-98	15-Oct-98
IR DEVELO 11 1/2% 1997/99	11.50%	210.0	94.76	14.764%	5.47	5.878	19.08	198.992	197.339	5.30%	0.29	0.311	1.01	15-Nov-80	-25	-0.79	15-Nov-97	15-Nov-99	15-Nov-99
IR DEVELO 14 3/4% 2002/04	14.75%	25.0	100.59	14.166%	6.87	7.353	21.30	25.148	25.966	0.70%	0.05	0.051	0.15	01-Aug-80	81	3.27	01-Feb-02	01-Feb-04	01-Feb-02
IR FINANCE 13 % 1997/02	13.00%	255.0	98.25	14.503%	6.08	6.524	21.46	250.547	252.362	6.77%	0.41	0.442	1.45	01-Oct-80	20	0.71	01-Apr-97	01-Apr-02	01-Apr-02
IR EXCHEQR 6 1/2% 2000/05	6.50%	128.0	83.14	13.763%	4.52	4.833	24.70	106.413	109.055	2.93%	0.13	0.141	0.72	27-Jun-80	116	2.06	27-Jun-00	27-Jun-05	27-Jun-05
								3679.530	3725.493	100.00%	3.56	3.802	9.06						

Trade : 15-Apr-81
Sett : 21-Apr-81

Stock	Coupon	Nominal Issue	Market Price	Market Yield	Volatility	Duration	Life	Clean Market Value (IR£m)	Dirty Market Value (IR£m)	Stock Weight in Index	Weighted Volatility	Weighted Duration	Weighted Life	Ex-Div Date	Accrued Interest	Accrued Interest	First Redemption Date	Last Redemption Date	Redemption Date
IR.FINANCE VAR% 1983	14 16%	50 0	100.05	13 654%	0 14	0 140	0.11	50 026	51.014	1 49%	0 00	0.002	0 00	01-Mar-81	51	1 98	01-Sep-83	01-Sep-83	01-Sep-83
IR.EXCHEQR 10 % 1981	10 00%	120 0	99.42	15 594%	0 11	0 114	0 11	119 301	123 934	3 63%	0 00	0 004	0 00	01-Dec-80	141	3 86	01-Jun-81	01-Jun-81	01-Jun-81
IR FINANCE 11 1/2% 1981	11 50%	160 0	99 05	14 415%	0 34	0 367	0 36	158 475	161 045	4 72%	0 02	0 017	0 02	01-Mar 81	51	1 61	01-Sep-81	01 Sep 81	01 Sep 81
IR EXCHEQR 11 1/2% 1982	11 50%	80 0	98 37	13 934%	0 72	0 770	0 78	78 697	80 687	2 36%	0 02	0 018	0 02	01 Feb 81	79	2 49	01 Feb 82	01 Feb 82	01 Feb 82
IR FINANCE 10 1/2% 1982	10 50%	100 0	97.27	13 810%	0 90	0 957	0 98	97 267	97 440	2 86%	0 03	0 027	0 03	15-Apr 81	6	0 17	15-Apr 82	15-Apr 82	15 Apr 82
IR NATION. 9 1/4% 1982	9 25%	98 0	86.68	23 799%	1 02	1.141	1.19	84 950	87 680	2 57%	0 03	0 029	0 03	01-Jan-81	110	2 79	01-Jul 82	01-Jul 82	01-Jul 82
IR CONVER 9 % 1980/82	9 00%	151 0	94.35	13 979%	1 25	1 340	1 40	142 469	143 846	4 22%	0 05	0 056	0 06	15 Mar 81	37	0 91	15-Sep-80	15-Sep-82	15-Sep-82
IR FUNDING 11 3/4% 1983	11 75%	80 0	96.75	14 022%	1 66	1 780	1 94	77 397	77 938	2 28%	0 04	0 041	0 04	31 Mar 81	21	0 68	31-Mar 83	31 Mar 83	31 Mar 83
IR FUNDING 11 1/2% 1983	11 50%	98.0	95 71	13 960%	2 09	2 240	2 53	93 800	93 492	2 74%	0 06	0 061	0 07	01 May 81	-10	-0 31	01-Nov 83	01-Nov 83	01-Nov 83
IR FINANCE 12 % 1984	12 00%	80 0	95.73	14 331%	2 25	2 413	2 78	76 584	78 661	2 31%	0 05	0 056	0 06	01-Feb-81	79	2 60	01-Feb-84	01-Feb 84	01-Feb-84
IR CONVER 13 % 1984	13 00%	98 0	97.91	14 069%	2 49	2 663	3 15	95 952	98 219	2 88%	0 07	0.077	0 09	15-Feb-81	65	2 31	15-Jun-84	15-Jun 84	15-Jun-84
IR FINANCE 11 3/4% 1984	11 75%	98 0	95.02	14.175%	2 60	2 788	3 32	93 115	95 165	2 79%	0 07	0 078	0 09	15-Feb 81	65	2 09	15-Aug-84	15-Aug 84	15-Aug 84
IR NATION. 5 1/4% 1979/84	5.25%	29 0	82.45	12.179%	3 00	3.185	3.57	23 886	23.786	0.70%	0 02	0 022	0.02	15 May-81	-24	-0 34	15-Nov-79	15-Nov-84	15-Nov 84
IR NATION 14 % 1985	14 00%	130 8	94.47	16.719%	2 80	3.033	3 90	123 563	125 418	3 68%	0 10	0 111	0 14	15 Mar 81	37	1 42	15-Mar 85	15 Mar 85	15-Mar-85
IR EXCHEQR 12 % 1985	12 00%	130 8	95.04	14 173%	3 04	3 251	4 07	124 316	123 285	3 61%	0 11	0 117	0 15	15-May 81	-24	-0 79	15-May-85	15-May 85	15 May-85
IR EXCHEQR 6 % 1980/85	6 00%	71 5	81.60	12 266%	3 64	3 861	4 62	58 385	60 042	1.76%	0 06	0 068	0 08	01-Dec-80	141	2 32	01-Dec-80	01 Dec 85	01-Dec-85
IR NATION. 7 1/2% 1981/85	7.50%	59 1	84.33	12 776%	3 84	4 088	5 20	49 838	51.173	1 50%	0 06	0 061	0 08	01-Jan-81	110	2 26	01-Jul-81	01-Jul-86	01-Jul-86
IR NATION 5 3/4% 1982/87	5.75%	21 4	74.66	13 107%	4 52	4 821	6 49	15 990	16 010	0 47%	0 02	0.023	0 03	15 Apr 81	6	0 09	15-Oct-82	15 Oct 87	15-Oct-87
IR CONVER 8 1/2 % 1986/88	8 50%	60 2	80.91	14 884%	4 22	4 530	6 79	48 741	49 849	1 46%	0 06	0 066	0 10	01 Feb 81	79	1 84	01-Feb-86	01 Feb-88	01 Feb 88
IR NATION. 9 3/4% 1984/89	9 75%	80 2	84 57	15 068%	4 52	4 859	8 28	67 818	69 509	2 04%	0 09	0 099	0 17	01 Feb 81	79	2 11	01-Aug 84	01 Aug 89	01 Aug 89
IR EXCHEQR 5 3/4% 1984/89	5 75%	26 3	69.23	14 256%	4 95	5 298	8 54	18 238	18 196	0 53%	0 03	0 028	0 05	01 May 81	-10	-0 16	01-Nov-84	01 Nov 89	01 Nov 89
IR NATION. 14 % 1985/90	14 00%	130 8	96.97	15 287%	4 71	5 067	8 90	126 831	128 686	3 77%	0 18	0 191	0 34	15-Mar 81	37	1 42	15 Mar-85	15 Mar 90	15 Mar 90
IR EXCHEQR 6 % 1985/90	6 00%	59 8	68.14	15 051%	4 88	5 244	9 58	40 748	40 512	1 19%	0 06	0 062	0 11	15 May 81	-24	-0 39	15-Nov 85	15 Nov 90	15-Nov 90
IR NATION. 6 3/4% 1986/91	6 75%	63 6	70.83	15 606%	4 71	5 082	10 45	45 022	45 257	1 33%	0 06	0 067	0 14	01 Apr 81	20	0 37	01 Oct 86	01 Oct 91	01 Oct 91
IR EXCHEQR 14 % 1990/92	14 00%	25 0	96.48	15 636%	4 98	5 369	10 79	24 120	24 877	0 73%	0 04	0 039	0 08	01 Feb 81	79	3 03	01 Feb 90	01 Feb 92	01 Feb 92
IR NATION 7 % 1987/92	7 00%	106 2	72.77	15 363%	4 78	5 148	11 16	77 292	79 877	2 34%	0 11	0 120	0 26	15-Dec-80	127	2 43	15-Jun-87	15 Jun 92	15-Jun-92
IR DEVELO 7 1/2% 1988/93	7 50%	176 8	75 39	15 538%	4 71	5 074	12 20	133 277	137.271	4 02%	0 19	0 204	0 49	01-Jan 81	110	2 26	01-Jul-88	01 Jul-93	01 Jul-93
IR NATION. 9 1/4% 1989/94	9 25%	36.5	92.88	11 384%	6 49	6 857	13 20	33 911	34 928	1 02%	0 07	0 070	0 14	01-Jan 81	110	2 79	01-Jul-89	01 Jul 94	01-Jul 94
IR CONVER 12 % 1995	12 00%	31 6	91.99	16 171%	4 86	5 248	14 41	29 068	29 452	0 86%	0 04	0 045	0 12	15-Mar 81	37	1 22	15-Sep-95	15-Sep-95	15-Sep-95
IR EXCHEQR 9 1/4% 1991/96	9 25%	191.3	83.98	16 500%	4 34	4 699	15 54	160 627	160 142	4 69%	0 20	0 221	0 73	01 May 81	-10	-0 25	01-Nov-91	01-Nov 96	01-Nov-96
IR NATION. 9 3/4% 1992/97	9 75%	223 2	86.70	16 338%	4 43	4 791	16 50	193 509	193 866	5 68%	0 25	0 272	0 94	15 Apr 81	6	0 16	15-Oct 92	15-Oct 97	15-Oct-97
IR NATION 11 % 1993/98	11 00%	233 2	91.01	16 379%	4 59	4 966	17 50	212 186	212 607	6 23%	0 29	0 309	1 09	15 Apr 81	6	0 18	15-Oct 93	15 Oct 98	15-Oct 98
IR DEVELO 11 1/2% 1997/99	11 50%	210 0	92.64	16 603%	4 56	4 943	18 58	194 545	192 958	5 65%	0 26	0 280	1 05	15 May 81	-24	-0 76	15-Nov-97	15 Nov 99	15-Nov 99
IR FINANCE 14 1/2% 1998/00	14 50%	25 0	98 26	16 193%	5 45	5 888	19 42	24 566	24 933	0 73%	0 04	0 043	0 14	15 Mar 81	37	1 47	15 Sep-98	15 Sep 00	15 Sep 00
IR FINANCE 13 % 1997/02	13 00%	255 0	96.61	16 303%	5 03	5 435	20 96	246 348	248 164	7 27%	0 37	0 395	1 52	01 Apr 81	20	0 71	01 Apr 97	01 Apr 02	01 Apr 02
IR DEVELO. 14 3/4% 2002/04	14 75%	25 0	99.16	15 889%	5 76	6 215	22 80	24 791	25 589	0 75%	0 04	0 047	0 17	01 Feb 81	79	3 19	01-Feb-02	01 Feb-04	01 Feb-04
IR EXCHEQR 6 1/2% 2000/05	6 50%	128 0	81.58	15 253%	3 78	4 066	24 20	104 427	107 047	3 14%	0 12	0 128	0 76	27-Dec 80	115	2 05	27-Jun-00	27-Jun-05	27-Jun-05
								3370 077	3412.553	100 00%	3.30	3.557	9.42						

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Trade: 16-Oct-81
Sett: 20-Oct-81

Stock	Coupon	Nominal Issue	Market Price	Market Yield	Volatility	Duration	Life	Clean Market Value (IR£m)	Dirty Market Value (IR£m)	Stock Weight in Index	Weighted Volatility	Weighted Duration	Weighted Life	Ex-Div Date	Accrued Interest	Accrued Interest	First Redemption Date	Last Redemption Date	Redemption Date
IR FINANCE VAR% 1983	17.93%	150.0	100.07	17.279%	0.13	0.134	0.12	150.101	153.709	3.91%	0.01	0.005	0.00	01-Sep-81	49	2.41	01-Sep-83	01-Sep-83	01-Sep-83
IR FINANCE VAR% 1986	16.90%	120.0	100.04	16.723%	0.03	0.033	0.28	120.053	119.387	3.03%	0.00	0.001	0.01	01-Nov-81	-12	-0.56	01-May-86	01-May-86	01-May-86
IR EXCHEQR 11 1/2% 1982	11.50%	225.0	97.94	19.623%	0.26	0.288	0.28	220.369	226.037	5.74%	0.02	0.017	0.02	01-Aug-81	80	2.52	01-Feb-82	01-Feb-82	01-Feb-82
IR FINANCE 10 1/2% 1982	10.50%	210.0	96.48	18.837%	0.44	0.484	0.48	202.612	202.914	5.16%	0.02	0.025	0.03	15-Oct-81	5	0.14	15-Apr-82	15-Apr-82	15-Apr-82
IR CONVER 9 % 1980/82	9.00%	241.0	92.58	18.912%	0.81	0.883	0.90	223.112	225.191	5.72%	0.05	0.051	0.05	15-Sep-81	35	0.86	15-Sep-80	15-Sep-82	15-Sep-82
IR FUNDING 11 3/4% 1983	11.75%	180.0	92.63	18.521%	1.24	1.353	1.44	166.738	167.838	4.27%	0.05	0.058	0.06	01-Oct-81	19	0.61	31-Mar-83	31-Mar-83	31-Mar-83
IR FUNDING 11 1/2% 1983	11.50%	75.0	90.45	18.248%	1.68	1.828	2.03	67.838	67.554	1.72%	0.03	0.031	0.03	01-Nov-81	-12	-0.38	01-Nov-83	01-Nov-83	01-Nov-83
IR FINANCE 12 % 1984	12.00%	180.0	90.40	18.299%	1.84	2.010	2.28	162.728	167.459	4.26%	0.08	0.086	0.10	01-Aug-81	80	2.63	01-Feb-84	01-Feb-84	01-Feb-84
IR CONVER 13 % 1984	13.00%	25.0	91.78	17.948%	2.07	2.261	2.65	22.946	23.533	0.60%	0.01	0.014	0.02	15-Aug-81	66	2.35	15-Jun-84	15-Jun-84	15-Jun-84
IR FINANCE 11 3/4% 1984	11.75%	100.0	89.33	17.809%	2.19	2.390	2.82	89.335	91.458	2.32%	0.05	0.056	0.07	15-Aug-81	66	2.12	15-Aug-84	15-Aug-84	15-Aug-84
IR NATION. 5 1/4% 1979/84	5.25%	29.0	78.50	15.183%	2.57	2.765	3.07	22.765	22.656	0.58%	0.01	0.016	0.02	15-Nov-81	-26	-0.37	15-Nov-79	15-Nov-84	15-Nov-84
IR NATION. 14 % 1985	14.00%	136.0	88.59	20.365%	2.40	2.649	3.40	120.481	122.306	3.11%	0.07	0.082	0.11	15-Sep-81	35	1.34	15-Mar-85	15-Mar-85	15-Mar-85
IR EXCHEQR 12 % 1985	12.00%	100.0	88.79	17.603%	2.62	2.848	3.57	88.791	87.937	2.23%	0.06	0.064	0.08	15-Nov-81	-26	-0.85	15-May-85	15-May-85	15-May-85
IR EXCHEQR 6 % 1980/85	6.00%	72.0	77.27	14.747%	3.22	3.459	4.12	55.632	57.300	1.46%	0.05	0.050	0.06	01-Jun-81	141	2.32	01-Dec-80	01-Dec-85	01-Dec-85
IR NATION. 7 1/2% 1981/85	7.50%	64.0	78.25	15.773%	3.40	3.663	4.70	50.077	51.536	1.31%	0.04	0.048	0.06	01-Jul-81	111	2.28	01-Jul-81	01-Jul-86	01-Jul-86
IR NATION. 5 3/4% 1982/87	5.75%	21.0	70.75	15.039%	4.13	4.436	5.99	14.857	14.874	0.38%	0.02	0.017	0.02	15-Oct-81	5	0.08	15-Oct-82	15-Oct-87	15-Oct-87
IR CONVER 8 1/2 % 1986/88	8.50%	90.0	76.33	17.128%	3.81	4.131	6.29	68.699	70.375	1.79%	0.07	0.074	0.11	01-Aug-81	80	1.86	01-Feb-86	01-Feb-88	01-Feb-88
IR NATION. 9 3/4% 1984/89	9.75%	110.0	79.82	17.300%	4.04	4.386	7.79	87.805	90.154	2.29%	0.09	0.100	0.18	01-Aug-81	80	2.14	01-Aug-84	01-Aug-89	01-Aug-89
IR EXCHEQR 5 3/4% 1984/89	5.75%	26.0	65.09	16.246%	4.50	4.861	8.04	16.923	16.874	0.43%	0.02	0.021	0.03	01-Nov-81	-12	-0.19	01-Nov-84	01-Nov-89	01-Nov-89
IR NATION. 14 % 1985/90	14.00%	136.0	92.35	17.495%	4.15	4.515	8.41	125.603	127.427	3.24%	0.13	0.146	0.27	15-Sep-81	35	1.34	15-Mar-85	15-Mar-90	15-Mar-90
IR EXCHEQR 6 % 1985/90	6.00%	60.0	63.89	17.199%	4.37	4.745	9.08	38.336	38.080	0.97%	0.04	0.046	0.09	15-Nov-81	-26	-0.43	15-Nov-85	15-Nov-90	15-Nov-90
IR NATION. 6 3/4% 1986/91	6.75%	69.0	67.49	17.321%	4.28	4.651	9.95	46.570	46.813	1.19%	0.05	0.055	0.12	01-Oct-81	19	0.35	01-Oct-86	01-Oct-91	01-Oct-91
IR EXCHEQR 14 % 1990/92	14.00%	70.0	93.34	17.272%	4.46	4.849	10.29	65.335	67.481	1.71%	0.08	0.083	0.18	01-Aug-81	80	3.07	01-Feb-90	01-Feb-92	01-Feb-92
IR NATION. 7 % 1987/92	7.00%	126.0	69.42	17.069%	4.31	4.681	10.66	87.469	90.536	2.30%	0.10	0.108	0.25	15-Jun-81	127	2.43	15-Jun-87	15-Jun-92	15-Jun-92
IR DEVELO. 7 1/2% 1988/93	7.50%	186.0	72.24	17.210%	4.22	4.579	11.70	134.366	138.605	3.52%	0.15	0.161	0.41	01-Jul-81	111	2.28	01-Jul-88	01-Jul-93	01-Jul-93
IR NATION. 9 1/4% 1982	9.25%	37.0	74.04	23.799%	2.62	2.929	12.70	27.396	30.029	0.76%	0.02	0.022	0.10	12-Jan-81	281	7.12	01-Jul-89	01-Jul-94	01-Jul-94
IR NATION. 9 1/4% 1989/94	9.25%	36.5	92.80	11.384%	6.40	6.767	12.70	33.870	34.896	0.89%	0.06	0.060	0.11	01-Jul-81	111	2.81	01-Jul-89	01-Jul-94	01-Jul-94
IR CONVER 12 % 1995	12.00%	86.0	89.47	17.880%	4.24	4.621	13.91	76.942	77.931	1.98%	0.08	0.092	0.28	15-Sep-81	35	1.15	15-Sep-95	15-Sep-95	15-Sep-95
IR EXCHEQR 9 1/4% 1991/96	9.25%	216.0	81.59	18.233%	3.77	4.110	15.04	176.226	175.569	4.46%	0.17	0.183	0.67	01-Nov-81	-12	-0.30	01-Nov-91	01-Nov-96	01-Nov-96
IR NATION. 9 3/4% 1992/97	9.75%	238.0	84.40	18.148%	3.79	4.133	16.00	200.880	201.197	5.11%	0.19	0.211	0.82	15-Oct-81	5	0.13	15-Oct-92	15-Oct-97	15-Oct-97
IR NATION. 11 % 1993/98	11.00%	253.0	89.01	18.153%	3.91	4.269	17.00	225.207	225.588	5.73%	0.22	0.245	0.97	15-Oct-81	5	0.15	15-Oct-93	15-Oct-98	15-Oct-98
IR DEVELO. 11 1/2% 1997/99	11.50%	270.0	90.88	18.444%	3.85	4.204	18.08	245.364	243.154	6.18%	0.24	0.260	1.12	15-Nov-81	-26	-0.82	15-Nov-97	15-Nov-99	15-Nov-99
IR FINANCE 14 1/2% 1998/00	14.50%	45.0	96.83	17.888%	4.63	5.043	18.92	43.575	44.201	1.12%	0.05	0.057	0.21	15-Sep-81	35	1.39	15-Sep-98	15-Sep-00	15-Sep-00
IR FINANCE 13 % 1997/02	13.00%	270.0	95.32	18.034%	4.23	4.613	20.46	257.368	259.194	6.59%	0.28	0.304	1.35	01-Oct-81	19	0.68	01-Apr-97	01-Apr-02	01-Apr-02
IR DEVELO. 14 3/4% 2002/04	14.75%	45.0	98.17	17.544%	4.85	5.270	22.30	44.175	45.629	1.16%	0.06	0.061	0.26	01-Aug-81	80	3.23	01-Feb-02	01-Feb-04	01-Feb-04
IR EXCHEQR 6 1/2% 2000/05	6.50%	133.0	80.19	16.871%	3.15	3.412	23.70	106.659	109.381	2.78%	0.09	0.095	0.66	27-Jun-81	115	2.05	27-Jun-00	27-Jun-05	27-Jun-05
								3887.203	3934.801	100.00%	2.76	3.004	8.91						

Trade	16-Apr-82
Sett	20 Apr 82

Stock	Coupon	Nominal Issue	Market Price	Market Yield	Volatility	Duration	Life	Clean Market Value (IR£m)	Dirty Market Value (IR£m)	Stock Weight in Index	Weighted Volatility	Weighted Duration	Weighted Life	Ex-Div Date	Accrued Interest	Accrued Interest	First Redemption Date	Last Redemption Date	Redemption Date
IR FINANCE VAR% 1983	19.52%	150.0	100.10	18.571%	0.13	0.137	0.11	150.143	154.151	3.68%	0.00	0.005	0.00	01-Mar-82	50	2.67	01-Sep-83	01-Sep-83	01-Sep-83
IR FINANCE VAR% 1985	19.16%	210.0	100.01	19.080%	0.09	0.099	0.15	210.023	213.989	5.11%	0.00	0.005	0.01	15-Mar-82	36	1.89	15-Sep-85	15-Sep-85	15-Sep-85
IR FINANCE VAR% 1986	19.16%	210.0	100.06	18.924%	0.03	0.030	0.28	210.121	208.909	4.98%	0.00	0.002	0.01	01-May-82	-11	-0.58	01-May-86	01-May-86	01-May-86
IR CONVER 9 % 1980/82	9.00%	241.0	96.30	19.323%	0.37	0.407	0.41	232.084	234.221	5.59%	0.02	0.023	0.02	15-Mar-82	36	0.89	15-Sep-80	15-Sep-82	15-Sep-82
IR FUNDING 11 3/4% 1983	11.75%	210.0	94.48	18.979%	0.84	0.916	0.95	198.408	199.759	4.77%	0.04	0.044	0.05	31-Mar-82	20	0.64	31-Mar-83	31-Mar-83	31-Mar-83
IR FUNDING 11 1/2% 1983	11.50%	175.0	91.72	18.754%	1.31	1.429	1.53	160.510	159.904	3.81%	0.05	0.055	0.06	01-May-82	-11	-0.35	01-Nov-83	01-Nov-83	01-Nov-83
IR FINANCE 12 % 1984	12.00%	200.0	91.36	18.778%	1.49	1.630	1.79	182.729	187.855	4.48%	0.07	0.073	0.08	01-Feb-82	78	2.56	01-Feb-84	01-Feb-84	01-Feb-84
IR.CONVER 13 % 1984	13.00%	115.0	91.75	18.731%	1.74	1.903	2.16	105.517	110.674	2.64%	0.05	0.050	0.06	15-Dec-81	126	4.48	15-Jun-84	15-Jun-84	15-Jun-84
IR FINANCE 11 3/4% 1984	11.75%	100.0	89.30	18.711%	1.86	2.036	2.32	89.297	91.356	2.18%	0.04	0.044	0.05	15-Feb-82	64	2.06	15-Aug-84	15-Aug-84	15-Aug-84
IR NATION. 5 1/4% 1979/84	5.25%	29.0	79.39	16.236%	2.19	2.366	2.58	23.023	22.919	0.55%	0.01	0.013	0.01	15-May-82	-25	-0.36	15-Nov-79	15-Nov-84	15-Nov-84
IR NATION 14 % 1985	14.00%	136.0	85.99	22.745%	2.09	2.325	2.90	116.946	118.823	2.83%	0.06	0.066	0.08	15-Mar-82	36	1.38	15-Mar-85	15-Mar-85	15-Mar-85
IR.EXCHEQR 12 % 1985	12.00%	100.0	87.99	18.608%	2.31	2.530	3.07	87.987	87.166	2.08%	0.05	0.053	0.06	15-May-82	-25	-0.82	15-May-85	15-May-85	15-May-85
IR EXCHEQR 6 % 1980/85	6.00%	72.0	76.20	16.185%	2.87	3.101	3.62	54.862	56.517	1.35%	0.04	0.042	0.05	01-Dec-81	140	2.30	01-Dec-80	01-Dec-85	01-Dec-85
IR NATION 7 1/2% 1981/85	7.50%	64.0	77.59	16.699%	3.10	3.361	4.20	49.655	51.088	1.22%	0.04	0.041	0.05	01-Jan-82	109	2.24	01-Jul-81	01-Jul-86	01-Jul-86
IR NATION 5 3/4% 1982/87	5.75%	21.0	68.96	16.340%	3.82	4.130	5.49	14.482	14.499	0.35%	0.01	0.014	0.02	15-Apr-82	5	0.08	15-Oct-82	15-Oct-87	15-Oct-87
IR CONVER 8 1/2 % 1986/88	8.50%	105.0	76.00	17.552%	3.62	3.941	5.79	79.797	81.703	1.95%	0.07	0.077	0.11	01-Feb-82	78	1.82	01-Feb-86	01-Feb-88	01-Feb-88
IR NATION. 9 3/4% 1984/89	9.75%	115.0	79.35	17.566%	3.92	4.260	7.29	91.250	93.645	2.23%	0.09	0.095	0.16	01-Feb-82	78	2.08	01-Aug-84	01-Aug-89	01-Aug-89
IR.EXCHEQR 5 3/4% 1984/89	5.75%	26.0	63.04	17.485%	4.23	4.596	7.54	16.390	16.345	0.39%	0.02	0.018	0.03	01-May-82	-11	-0.17	01-Nov-84	01-Nov-89	01-Nov-89
IR NATION. 14 % 1985/90	14.00%	146.0	91.31	17.990%	3.98	4.333	7.91	133.312	135.326	3.23%	0.13	0.140	0.26	15-Mar-82	36	1.38	15-Mar-85	15-Mar-90	15-Mar-90
IR EXCHEQR 6 % 1985/90	6.00%	60.0	63.20	17.655%	4.26	4.637	8.58	37.922	37.676	0.90%	0.04	0.042	0.08	15-May-82	-25	-0.41	15-Nov-85	15-Nov-90	15-Nov-90
IR NATION. 6 3/4% 1986/91	6.75%	69.0	66.34	17.927%	4.15	4.522	9.45	45.776	46.018	1.10%	0.05	0.050	0.10	01-Apr-82	19	0.35	01-Oct-86	01-Oct-91	01-Oct-91
IR EXCHEQR 14 % 1990/92	14.00%	85.0	92.50	17.654%	4.31	4.695	9.79	78.624	81.165	1.94%	0.08	0.091	0.19	01-Feb-82	78	2.99	01-Feb-90	01-Feb-92	01-Feb-92
IR NATION. 7 % 1987/92	7.00%	126.0	68.56	17.451%	4.23	4.600	10.16	86.391	89.433	2.13%	0.09	0.098	0.22	15-Dec-81	126	2.41	15-Jun-87	15-Jun-92	15-Jun-92
IR DEVELO 7 1/2% 1988/93	7.50%	191.0	71.37	17.543%	4.15	4.515	11.21	136.320	140.595	3.35%	0.14	0.151	0.38	01-Jan-82	109	2.24	01-Jul-88	01-Jul-93	01-Jul-93
IR.NATION. 9 1/4% 1989/94	9.25%	37.0	98.03	9.776%	6.99	7.335	12.21	36.271	37.292	0.89%	0.06	0.065	0.11	01-Jan-82	109	2.76	01-Jul-89	01-Jul-94	01-Jul-94
IR.CONVER 12 % 1995	12.00%	221.0	88.74	18.180%	4.15	4.529	13.41	196.123	198.737	4.74%	0.20	0.215	0.64	15-Mar-82	36	1.18	15-Sep-95	15-Sep-95	15-Sep-95
IR EXCHEQR 9 1/4% 1991/96	9.25%	221.0	80.73	18.554%	3.70	4.046	14.55	178.414	177.798	4.24%	0.16	0.172	0.62	01-May-82	-11	-0.28	01-Nov-91	01-Nov-96	01-Nov-96
IR NATION 9 3/4% 1992/97	9.75%	243.0	83.62	18.452%	3.72	4.065	15.50	203.194	203.518	4.86%	0.18	0.197	0.75	15-Apr-82	5	0.13	15-Oct-92	15-Oct-97	15-Oct-97
IR NATION 11 % 1993/98	11.00%	258.0	88.36	18.440%	3.84	4.191	16.50	227.961	228.349	5.45%	0.21	0.228	0.90	15-Apr-82	5	0.15	15-Oct-93	15-Oct-98	15-Oct-98
IR.DEVELO 11 1/2% 1997/99	11.50%	275.0	90.29	18.732%	3.77	4.122	17.58	248.302	246.138	5.87%	0.22	0.242	1.03	15-May-82	-25	-0.79	15-Nov-97	15-Nov-99	15-Nov-99
IR FINANCE 14 1/2% 1998/00	14.50%	50.0	96.43	18.233%	4.49	4.894	18.42	48.215	48.930	1.17%	0.05	0.057	0.22	15-Mar-82	36	1.43	15-Sep-98	15-Sep-00	15-Sep-00
IR FINANCE 13 % 1997/02	13.00%	270.0	94.90	18.368%	4.11	4.484	19.96	256.238	258.064	6.16%	0.25	0.276	1.23	01-Apr-82	19	0.68	01-Apr-97	01-Apr-02	01-Apr-02
IR DEVELO 14 3/4% 2002/04	14.75%	50.0	97.91	17.861%	4.69	5.114	21.80	48.953	50.528	1.21%	0.06	0.062	0.26	01-Feb-82	78	3.15	01-Feb-02	01-Feb-04	01-Feb-04
IR EXCHEQR 6 1/2% 2000/05	6.50%	133.0	79.54	17.136%	3.09	3.354	23.20	105.782	108.481	2.59%	0.08	0.087	0.60	27-Dec-81	114	2.03	27-Jun-00	27-Jun-05	27-Jun-05
								4141.022	4191.571	100.00%	2.65	2.891	8.50						

Trade: 15-Oct-82
Sett: 19-Oct-82

Stock	Coupon	Nominal Issue	Market Price	Market Yield	Volatility	Duration	Life	Clean Market Value (IR£m)	Dirty Market Value (IR£m)	Stock Weight in Index	Weighted Volatility	Weighted Duration	Weighted Life	Ex-Div Date	Accrued Interest	Accrued Interest	First Redemption Date	Last Redemption Date	Redemption Date
IR.FINANCE VAR% 1985	19.20%	100.0	100.00	19.003%	0.25	0.263	-0.01	99.998	105.044	2.05%	0.01	0.005	0.00	15-Jul-82	96	5.05	15-Jan-85	15-Jan-85	15-Jan-85
IR.FINANCE VAR% 1983	17.65%	135.0	100.08	16.877%	0.13	0.131	0.12	135.111	138.242	2.70%	0.00	0.004	0.00	01-Sep-82	48	2.32	01-Sep-83	01-Sep-83	01-Sep-83
IR.FINANCE VAR% 1985	16.61%	210.0	100.01	16.516%	0.09	0.093	0.16	210.026	213.272	4.16%	0.00	0.004	0.01	15-Sep-82	34	1.55	15-Sep-85	15-Sep-85	15-Sep-85
IR.FINANCE VAR% 1986	18.37%	160.0	100.11	17.916%	0.03	0.036	0.28	160.180	159.134	3.11%	0.00	0.001	0.01	01-Nov-82	-13	-0.65	01-May-86	01-May-86	01-May-86
IR.FUNDING 11 3/4% 1983	11.75%	210.0	99.38	13.298%	0.42	0.448	0.45	208.706	209.922	4.10%	0.02	0.018	0.02	01-Oct-82	18	0.58	31-Mar-83	31-Mar-83	31-Mar-83
IR.EXCHEQR 15 % 1983	15.00%	140.0	100.91	13.529%	0.68	0.725	0.74	141.280	146.799	2.87%	0.02	0.021	0.02	15-Jul-82	96	3.94	15-Jul-83	15-Jul-83	15-Jul-83
IR.FUNDING 11 1/2% 1983	11.50%	225.0	98.39	13.365%	0.94	1.004	1.04	221.388	220.468	4.30%	0.04	0.043	0.04	01-Nov-82	-13	-0.41	01-Nov-83	01-Nov-83	01-Nov-83
IR.FINANCE 12 % 1984	12.00%	220.0	98.33	13.615%	1.15	1.228	1.29	216.336	222.046	4.33%	0.05	0.053	0.06	01-Aug-82	79	2.60	01-Feb-84	01-Feb-84	01-Feb-84
IR.CONVER 13 % 1984	13.00%	115.0	99.26	13.590%	1.44	1.541	1.66	114.148	119.305	2.33%	0.03	0.036	0.04	15-Jun-82	126	4.48	15-Jun-84	15-Jun-84	15-Jun-84
IR.FINANCE 11 3/4% 1984	11.75%	220.0	97.64	13.468%	1.58	1.687	1.82	214.809	219.410	4.28%	0.07	0.072	0.08	15-Aug-82	65	2.09	15-Aug-84	15-Aug-84	15-Aug-84
IR.NATION. 5 1/4% 1979/84	5.25%	29.0	89.26	11.643%	1.86	1.972	2.08	25.885	25.773	0.50%	0.01	0.010	0.01	15-Nov-82	-27	-0.39	15-Nov-79	15-Nov-84	15-Nov-84
IR.NATION 14 % 1985	14.00%	136.0	99.88	14.076%	1.98	2.123	2.41	135.833	137.605	2.69%	0.05	0.057	0.06	15-Sep-82	34	1.30	15-Mar-85	15-Mar-85	15-Mar-85
IR.NATION 14 % 1985/90	14.00%	146.0	100.94	13.425%	2.00	2.130	2.41	147.374	149.277	2.91%	0.06	0.062	0.07	15-Sep-82	34	1.30	15-Mar-85	15-Mar-90	15-Mar-85
IR.EXCHEQR 12 % 1985	12.00%	100.0	96.88	13.780%	2.12	2.267	2.57	96.880	95.993	1.87%	0.04	0.042	0.05	15-Nov-82	-27	-0.89	15-May-85	15-May-85	15-May-85
IR.FINANCE 12 1/4% 1985	12.25%	120.0	97.42	13.587%	2.41	2.569	2.99	116.899	118.268	2.31%	0.06	0.059	0.07	15-Sep-82	34	1.14	15-Oct-85	15-Oct-85	15-Oct-85
IR.EXCHEQR 6 % 1980/85	6.00%	72.0	85.37	12.486%	2.64	2.809	3.12	61.468	63.124	1.23%	0.03	0.035	0.04	01-Jun-82	140	2.30	01-Dec-80	01-Dec-85	01-Dec-85
IR.FUNDING 15 1/2% 1986	15.50%	115.0	103.50	13.695%	2.59	2.769	3.33	119.030	119.908	2.34%	0.06	0.065	0.08	01-Oct-82	18	0.76	15-Feb-86	15-Feb-86	15-Feb-86
IR.NATION 7 1/2% 1981/85	7.50%	64.0	86.18	13.189%	2.97	3.164	3.70	55.157	56.602	1.10%	0.03	0.035	0.04	01-Jul-82	110	2.26	01-Jul-81	01-Jul-86	01-Jul-86
IR.EXCHEQR 12 1/2% 1986	12.50%	120.0	97.55	13.590%	2.99	3.197	3.95	117.055	118.452	2.31%	0.07	0.074	0.09	15-Sep-82	34	1.16	01-Oct-86	01-Oct-86	01-Oct-86
IR.FUNDING 12 3/4% 1986	12.75%	120.0	97.99	13.606%	3.22	3.440	4.37	117.590	119.014	2.32%	0.07	0.080	0.10	15-Sep-82	34	1.19	01-Mar-87	01-Mar-87	01-Mar-87
IR.FINANCE 16 % 1987	16.00%	120.0	104.70	13.891%	3.39	3.625	4.74	125.640	130.686	2.55%	0.09	0.092	0.12	15-Jul-82	96	4.21	15-Jul-87	15-Jul-87	15-Jul-87
IR.NATION 5 3/4% 1982/87	5.75%	21.0	78.75	12.691%	3.84	4.088	4.99	16.538	16.551	0.32%	0.01	0.013	0.02	15-Oct-82	4	0.06	15-Oct-82	15-Oct-87	15-Oct-87
IR.CONVER 8 1/2 % 1986/88	8.50%	105.0	86.74	13.094%	3.82	4.070	5.29	91.078	93.008	1.82%	0.07	0.074	0.10	01-Aug-82	79	1.84	01-Feb-86	01-Feb-88	01-Feb-88
IR.CONVER 15 % 1988	15.00%	50.0	103.35	13.622%	3.97	4.237	5.87	51.677	52.375	1.02%	0.04	0.043	0.06	15-Sep-82	34	1.40	01-Sep-88	01-Sep-88	01-Sep-88
IR.NATION. 9 1/4% 1989/94	9.25%	37.0	100.82	9.018%	4.95	5.169	6.70	37.303	38.334	0.75%	0.04	0.039	0.05	01-Jul-82	110	2.79	01-Jul-89	01-Jul-94	01-Jul-89
IR.NATION 9 3/4% 1984/89	9.75%	115.0	89.36	13.286%	4.39	4.684	6.79	102.763	105.189	2.05%	0.09	0.096	0.14	01-Aug-82	79	2.11	01-Aug-84	01-Aug-89	01-Aug-89
IR.EXCHEQR 5 3/4% 1984/89	5.75%	26.0	73.29	13.303%	4.71	5.021	7.04	19.056	19.002	0.37%	0.02	0.019	0.03	01-Nov-82	-13	-0.20	01-Nov-84	01-Nov-89	01-Nov-89
IR.EXCHEQR 14 % 1990/92	14.00%	85.0	101.36	13.473%	4.57	4.875	7.29	86.160	88.734	1.73%	0.08	0.084	0.13	01-Aug-82	79	3.03	01-Feb-90	01-Feb-92	01-Feb-90
IR.EXCHEQR 6 % 1985/90	6.00%	60.0	72.90	13.453%	4.97	5.303	8.08	43.741	43.475	0.85%	0.04	0.045	0.07	15-Nov-82	-27	-0.44	15-Nov-85	15-Nov-90	15-Nov-90
IR.NATION. 6 3/4% 1986/91	6.75%	69.0	75.27	13.727%	5.03	5.379	8.96	51.936	52.166	1.02%	0.05	0.055	0.09	01-Oct-82	18	0.33	01-Oct-86	01-Oct-91	01-Oct-91
IR.NATION 7 % 1987/92	7.00%	126.0	77.20	13.370%	5.22	5.570	9.66	97.271	100.314	1.96%	0.10	0.109	0.19	15-Jun-82	126	2.41	15-Jun-87	15-Jun-92	15-Jun-92
IR.DEVELO 7 1/2% 1988/93	7.50%	191.0	78.95	13.615%	5.27	5.625	10.71	150.791	155.105	3.03%	0.16	0.170	0.32	01-Jul-82	110	2.26	01-Jul-88	01-Jul-93	01-Jul-93
IR.CONVER 12 % 1995	12.00%	96.0	94.85	14.179%	5.55	5.947	12.92	91.052	92.125	1.80%	0.10	0.107	0.23	15-Sep-82	34	1.12	15-Sep-95	15-Sep-95	15-Sep-95
IR.EXCHEQR 9 1/4% 1991/96	9.25%	221.0	86.02	14.446%	5.20	5.574	14.05	190.098	189.370	3.70%	0.19	0.206	0.52	01-Nov-82	-13	-0.33	01-Nov-91	01-Nov-96	01-Nov-96
IR.NATION 9 3/4% 1992/97	9.75%	243.0	88.51	14.361%	5.31	5.689	15.00	215.076	215.335	4.20%	0.22	0.239	0.63	15-Oct-82	4	0.11	15-Oct-92	15-Oct-97	15-Oct-97
IR.FINANCE 14 1/2% 1998/00	14.50%	50.0	100.47	14.212%	6.31	6.757	15.92	50.236	50.910	0.99%	0.06	0.067	0.16	15-Sep-82	34	1.35	15-Sep-98	15-Sep-00	15-Sep-98
IR.NATION 11 % 1993/98	11.00%	258.0	92.83	14.369%	5.53	5.922	16.00	239.506	239.817	4.68%	0.26	0.277	0.75	15-Oct-82	4	0.12	15-Oct-93	15-Oct-98	15-Oct-98
IR.DEVELO 11 1/2% 1997/99	11.50%	275.0	94.30	14.529%	5.57	5.976	17.08	259.333	256.995	5.02%	0.28	0.300	0.86	15-Nov-82	-27	-0.85	15-Nov-97	15-Nov-99	15-Nov-99
IR.DEVELO 14 3/4% 2002/04	14.75%	50.0	100.93	13.995%	6.84	7.321	19.30	50.467	52.062	1.02%	0.07	0.074	0.20	01-Aug-82	79	3.19	01-Feb-02	01-Feb-04	01-Feb-02
IR.FINANCE 13 % 1997/02	13.00%	270.0	98.17	14.313%	6.14	6.580	19.46	265.050	266.780	5.21%	0.32	0.343	1.01	01-Oct-82	18	0.64	01-Apr-97	01-Apr-02	01-Apr-02
IR.EXCHEQR 6 1/2% 2000/05	6.50%	133.0	78.99	17.136%	3.13	3.397	22.70	105.056	107.754	2.10%	0.07	0.071	0.48	27-Jun-82	114	2.03	27-Jun-00	27-Jun-05	27-Jun-05
								5054.983	5123.747	100.00%	3.09	3.301	7.03						

Trade 15-Apr-83
Sett : 19-Apr-83

Stock	Coupon	Nominal Issue	Market Price	Market Yield	Volatility	Duration	Life	Clean Market Value (IR£m)	Dirty Market Value (IR£m)	Stock Weight in Index	Weighted Volatility	Weighted Duration	Weighted Life	Ex Div Date	Accrued Interest	Accrued Interest	First Redemption Date	Last Redemption Date	Redemption Date
IR FINANCE VAR% 1985	15 59%	100 0	100 00	15 422%	0 25	0 257	-0 01	99 999	104.011	1 91%	0 00	0 005	0 00	15-Jan-83	94	4 01	15-Jan 85	15-Jan 85	15 Jan 85
IR FINANCE VAR% 1983	15 31%	165 0	99 80	17 198%	0 13	0 134	0 12	164 674	168 063	3 08%	0 00	0 004	0 00	01-Mar 83	49	2 05	01-Sep 83	01 Sep 83	01-Sep 83
IR.FINANCE VAR% 1985	15 02%	210 0	99 98	15 202%	0 09	0 096	0 15	209 948	212.971	3 91%	0 00	0 004	0 01	15-Mar 83	35	1 44	15-Sep-85	15-Sep 85	15 Sep 85
IR EXCHEQR 15 % 1983	15 00%	140 0	100 05	14 779%	0 23	0 243	0 24	140 066	145 471	2 67%	0 01	0 006	0 01	15-Jan-83	94	3 86	15-Jul 83	15-Jul 83	15-Jul 83
IR FINANCE VAR% 1986	17 31%	160 0	100 04	17 157%	0 03	0 033	0 28	160 061	159 151	2 92%	0 00	0 001	0 01	01-May 83	-12	-0 57	01-May-86	01-May-86	01-May 86
IR FUNDING 11 1/2% 1983	11 50%	225 0	98 68	14 301%	0 50	0 535	0 54	222 028	221 177	4 06%	0 02	0 022	0 02	01-May 83	-12	-0 38	01 Nov 83	01 Nov 83	01 Nov 83
IR FINANCE 12 % 1984	12 00%	220 0	98 52	14 215%	0 72	0 775	0 79	216 736	222.301	4 08%	0 03	0 032	0 03	01-Feb 83	77	2 53	01-Feb-84	01 Feb 84	01 Feb 84
IR CONVER 13 % 1984	13 00%	200 0	99 24	13 819%	1 04	1 111	1.16	198 470	207 368	3 80%	0 04	0 042	0 04	15-Dec 82	125	4 45	15-Jun-84	15-Jun 84	15 Jun 84
IR FINANCE 11 3/4% 1984	11 75%	220 0	97 98	13 662%	1 18	1 262	1 33	215 545	220.004	4 04%	0 05	0 051	0 05	15-Feb 83	63	2 03	15-Aug 84	15-Aug 84	15-Aug 84
IR NATION. 5 1/4% 1979/84	5 25%	29 0	90 25	12 654%	1 43	1 523	1 58	26 172	26 064	0 48%	0 01	0 007	0 01	15-May 83	-26	-0 37	15-Nov-79	15-Nov 84	15-Nov 84
IR NATION 14 % 1985	14 00%	151 0	102 29	12 367%	1 65	1 748	1 91	154 457	156 483	2 87%	0 05	0 050	0 05	15 Mar 83	35	1 34	15 Mar 85	15-Mar-85	15 Mar 85
IR NATION 14 % 1985/90	14 00%	151 0	102 29	12 367%	1 65	1 748	1 91	154 457	156 483	2 87%	0 05	0 050	0 05	15 Mar 83	35	1 34	15-Mar-85	15 Mar 90	15 Mar 85
IR EXCHEQR 12 % 1985	12 00%	200 0	98 28	13 133%	1 77	1 889	2 07	196 566	194 858	3 57%	0 06	0 068	0 07	15-May-83	-26	-0 85	15-May-85	15-May 85	15 May 85
IR FINANCE 12 1/4% 1985	12 25%	185 0	98 46	13 144%	2 08	2 213	2 49	182 147	182 395	3 35%	0 07	0 074	0 08	15-Apr 83	4	0 13	15-Oct 85	15-Oct 85	15-Oct-85
IR EXCHEQR 6 % 1980/85	6 00%	72 0	86 68	12 748%	2 27	2 412	2 62	62 411	64 055	1 17%	0 03	0 028	0 03	01-Dec 82	139	2 28	01 Dec 80	01-Dec-85	01 Dec 85
IR FUNDING 15 1/2% 1986	15 50%	115 0	103 96	13 280%	2 28	2 434	2 83	119 550	122 625	2 25%	0 05	0 055	0 06	15-Feb-83	63	2 67	15-Feb-86	15 Feb 86	15 Feb 86
IR NATION 7 1/2% 1981/85	7 50%	64 0	88 37	12 724%	2 65	2 822	3.20	56 556	57 976	1 06%	0 03	0 030	0 03	01-Jan-83	108	2 22	01-Jul 81	01-Jul-86	01-Jul-86
IR EXCHEQR 12 1/2% 1986	12 50%	160 0	98 71	13 109%	2 72	2 893	3 45	157 939	158 158	2 90%	0 08	0 084	0 10	15-Apr-83	4	0 14	01-Oct-86	01-Oct-86	01-Oct 86
IR FUNDING 12 3/4% 1987	12 75%	160 0	99 09	13 156%	2 96	3 157	3.87	158 549	161 285	2 96%	0 09	0 093	0 11	01-Mar 83	49	1 71	01 Mar 87	01 Mar 87	01 Mar-87
IR FINANCE 16 % 1987	16 00%	105 0	105 90	13 283%	3 15	3 364	4 24	111 196	115 520	2 12%	0 07	0 071	0 09	15-Jan 83	94	4 12	15-Jul 87	15-Jul 87	15-Jul 87
IR NATION. 5 3/4% 1982/87	5 75%	21.0	80 21	12 611%	3 56	3 785	4 49	16 844	16 857	0 31%	0 01	0 012	0 01	15-Apr-83	4	0 06	15-Oct 82	15-Oct 87	15-Oct 87
IR CONVER 8 1/2 % 1986/88	8 50%	105 0	87 65	12 973%	3 58	3 808	4 79	92 030	93 912	1 72%	0 06	0 066	0 08	01 Feb 83	77	1 79	01-Feb-86	01 Feb 88	01 Feb 88
IR CONVER 15 % 1988	15 00%	50 0	106 17	12 494%	3 83	4 074	5 38	53 086	54 092	0 99%	0 04	0 040	0 05	01-Mar 83	49	2 01	01-Sep-88	01 Sep 88	01 Sep 88
IR NATION. 9 3/4% 1984/89	9 75%	125 0	91.72	12 490%	4 29	4 563	6 29	114 653	117.222	2 15%	0 09	0 098	0 14	01 Feb 83	77	2 06	01-Aug 84	01-Aug 89	01-Aug 89
IR.EXCHEQR 5 3/4% 1984/89	5 75%	26.0	76 52	12 395%	4 63	4 916	6 54	19 895	19 846	0 36%	0 02	0 018	0 02	01-May-83	-12	-0 19	01-Nov 84	01 Nov 89	01-Nov-89
IR EXCHEQR 14 % 1990/92	14 00%	95 0	103 83	12.561%	4 50	4 786	6 79	98 638	101.442	1 86%	0 08	0 089	0 13	01-Feb-83	77	2 95	01-Feb 90	01 Feb 92	01-Feb-90
IR.EXCHEQR 11 1/2% 1990	11 50%	73 0	96 72	12 619%	4 68	4 974	7 33	70 606	72 123	1 32%	0 06	0 066	0 10	12-Feb 83	66	2 08	15-Aug-90	15-Aug 90	15-Aug-90
IR EXCHEQR 6 % 1985/90	6 00%	65 0	75 94	12 524%	4 98	5 292	7 58	49 359	49 081	0 90%	0 04	0 048	0 07	15-May-83	-26	-0 43	15-Nov-85	15-Nov 90	15-Nov-90
IR NATION. 6 3/4% 1986/91	6 75%	69 0	78 55	12 598%	5 16	5 486	8 46	54 198	54 428	1 00%	0 05	0 055	0 08	01-Apr-83	18	0 33	01-Oct 86	01 Oct 91	01-Oct-91
IR NATION 7 % 1987/92	7 00%	126 0	79 16	12 686%	5 30	5 631	9 16	99 747	102.765	1 88%	0 10	0 106	0.17	15-Dec-82	125	2 40	15-Jun-87	15-Jun-92	15-Jun-92
IR DEVELO 7 1/2% 1988/93	7 50%	191 0	80 83	12 871%	5 42	5 768	10 21	154 382	158 618	2 91%	0 16	0 168	0 30	01-Jan-83	108	2 22	01-Jul-88	01 Jul 93	01 Jul 93
IR NATION 9 1/4% 1989/94	9 25%	23 0	88 24	12 936%	5 56	5 921	11.21	20 296	20.925	0 38%	0 02	0 023	0 04	01-Jan-83	108	2 74	01-Jul 89	01-Jul 94	01-Jul 94
IR CONVER 12 % 1995	12 00%	106 0	96 52	13 371%	5 81	6 196	12 42	102 310	103 529	1 90%	0 11	0 118	0 24	15-Mar-83	35	1 15	15-Sep-95	15-Sep-95	15-Sep 95
IR EXCHEQR 9 1/4% 1991/96	9 25%	226 0	87 43	13 609%	5 53	5 910	13 55	197 585	196 898	3 61%	0 20	0 213	0 49	01-May 83	-12	-0 30	01-Nov-91	01 Nov 96	01 Nov 96
IR NATION 9 3/4% 1992/97	9 75%	243 0	89 78	13 559%	5 66	6 044	14 50	218 154	218 413	4 01%	0 23	0 242	0 58	15-Apr-83	4	0 11	15-Oct 92	15 Oct 97	15-Oct 97
IR FINANCE 14 1/2% 1998/00	14 50%	60 0	102 03	13.378%	6 70	7 150	15 42	61 217	62.051	1 14%	0 08	0 081	0 18	15-Mar-83	35	1 39	15 Sep 98	15 Sep 00	15-Sep 98
IR NATION. 11 % 1993/98	11 00%	263 0	94 05	13 567%	5 90	6 306	15 50	247 363	247.679	4 54%	0 27	0 286	0 70	15-Apr-83	4	0 12	15 Oct 93	15-Oct 98	15-Oct 98
IR.DEVELO 11 1/2% 1997/99	11 50%	275 0	95 46	13 696%	6 00	6.409	16 59	262 515	260 264	4 77%	0 29	0 306	0 79	15-May-83	-26	-0 82	15-Nov-97	15-Nov-99	15-Nov 99
IR DEVELO. 14 3/4% 2002/04	14 75%	60 0	102 21	13.164%	7 38	7.866	18 80	61 328	63.193	1.16%	0 09	0 091	0 22	01-Feb-83	77	3 11	01-Feb-02	01-Feb-04	01-Feb-02
IR FINANCE 13 % 1997/02	13 00%	270 0	99 21	13 509%	6 64	7.084	18 96	267.857	269 587	4 94%	0 33	0 350	0 94	01-Apr-83	18	0 64	01-Apr-97	01-Apr-02	01-Apr-02
IR.EXCHEQR 6 1/2% 2000/05	6 50%	133 0	82 66	12 467%	5 54	5.885	22 21	109 933	112 608	2 07%	0 11	0 122	0 46	27-Dec-82	113	2 01	27-Jun-00	27-Jun 05	27-Jun 05
								5379 524	5451 953	100 00%	3.17	3 375	6.67						

Trade 18-Oct-83
Sett. 20-Oct-83

Stock	Coupon	Nominal Issue	Market Price	Market Yield	Volatility	Duration	Life	Clean Market Value (IR£m)	Dirty Market Value (IR£m)	Stock Weight in Index	Weighted Volatility	Weighted Duration	Weighted Life	Ex-Div Date	Accrued Interest	Accrued Interest	First Redemption Date	Last Redemption Date	Redemption Date
IR FINANCE VAR% 1985	13.71%	100.0	99.99	13.303%	0.26	0.266	-0.02	99.994	103.634	1.68%	0.00	0.004	0.00	15-Jul-83	97	3.64	15-Jan-85	15-Jan-85	15-Jan-85
IR FUNDING 11 1/2% 1983	11.50%	225.0	100.01	11.175%	0.03	0.034	0.03	225.023	224.173	3.64%	0.00	0.001	0.00	01-Nov-83	-12	-0.38	01-Nov-83	01-Nov-83	01-Nov-83
IR FINANCE VAR% 1988	13.95%	170.0	100.01	13.846%	0.15	0.153	0.10	170.016	173.652	2.82%	0.00	0.004	0.00	25-Aug-83	56	2.14	01-Jun-88	01-Jun-88	01-Jun-88
IR FINANCE VAR% 1985	13.62%	210.0	100.03	13.408%	0.09	0.096	0.15	210.063	212.805	3.46%	0.00	0.003	0.01	15-Sep-83	35	1.31	15-Sep-85	15-Sep-85	15-Sep-85
IR FINANCE VAR% 1986	14.18%	160.0	100.10	13.792%	0.03	0.033	0.28	160.156	159.411	2.59%	0.00	0.001	0.01	01-Nov-83	-12	-0.47	01-May-86	01-May-86	01-May-86
IR FINANCE 12 % 1984	12.00%	235.0	99.76	12.922%	0.27	0.288	0.28	234.439	240.615	3.91%	0.01	0.011	0.01	01-Aug-83	80	2.63	01-Feb-84	01-Feb-84	01-Feb-84
IR.CONVER 13 % 1984	13.00%	240.0	100.09	12.836%	0.61	0.649	0.65	240.223	251.072	4.08%	0.02	0.026	0.03	15-Jun-83	127	4.52	15-Jun-84	15-Jun-84	15-Jun-84
IR.FINANCE 11 3/4% 1984	11.75%	250.0	99.26	12.806%	0.76	0.807	0.82	248.146	253.454	4.12%	0.03	0.033	0.03	15-Aug-83	66	2.12	15-Aug-84	15-Aug-84	15-Aug-84
IR NATION. 5 1/4% 1979/84	5.25%	29.0	93.33	12.358%	0.99	1.054	1.07	27.066	26.957	0.44%	0.00	0.005	0.00	15-Nov-83	-26	-0.37	15-Nov-79	15-Nov-84	15-Nov-84
IR NATION 14 % 1985	14.00%	151.0	101.93	12.246%	1.25	1.326	1.40	153.918	155.944	2.53%	0.03	0.034	0.04	15-Sep-83	35	1.34	15-Mar-85	15-Mar-85	15-Mar-85
IR.NATION 14 % 1985/90	14.00%	151.0	101.93	12.246%	1.25	1.326	1.40	153.918	155.944	2.53%	0.03	0.034	0.04	15-Sep-83	35	1.34	15-Mar-85	15-Mar-90	15-Mar-85
IR EXCHEQR 12 % 1985	12.00%	240.0	99.07	12.759%	1.39	1.475	1.57	237.769	235.719	3.83%	0.05	0.056	0.06	15-Nov-83	-26	-0.85	15-May-85	15-May-85	15-May-85
IR FINANCE 12 1/4% 1985	12.25%	230.0	99.18	12.806%	1.71	1.821	1.99	228.120	228.506	3.71%	0.06	0.068	0.07	15-Oct-83	5	0.17	15-Oct-85	15-Oct-85	15-Oct-85
IR EXCHEQR 6 % 1980/85	6.00%	72.0	88.82	12.694%	1.87	1.992	2.12	63.952	65.620	1.07%	0.02	0.021	0.02	01-Jun-83	141	2.32	01-Dec-80	01-Dec-85	01-Dec-85
IR FUNDING 15 1/2% 1986	15.50%	115.0	104.12	12.893%	1.94	2.066	2.33	119.734	122.955	2.00%	0.04	0.041	0.05	15-Aug-83	66	2.80	15-Feb-86	15-Feb-86	15-Feb-86
IR EXCHEQR 10 3/4% 1986	10.75%	125.0	96.37	12.827%	2.07	2.197	2.45	120.464	121.163	1.97%	0.04	0.043	0.05	01-Oct-83	19	0.56	01-Apr-86	01-Apr-86	01-Apr-86
IR NATION. 7 1/2% 1981/85	7.50%	64.0	89.73	12.712%	2.29	2.441	2.70	57.425	58.884	0.96%	0.02	0.023	0.03	01-Jul-83	111	2.28	01-Jul-81	01-Jul-86	01-Jul-86
IR EXCHEQR 12 1/2% 1986	12.50%	160.0	99.35	12.834%	2.40	2.551	2.95	158.967	159.241	2.59%	0.06	0.066	0.08	15-Oct-83	5	0.17	01-Oct-86	01-Oct-86	01-Oct-86
IR FUNDING 12 3/4% 1987	12.75%	160.0	99.65	12.919%	2.66	2.834	3.36	159.437	162.174	2.63%	0.07	0.075	0.09	01-Sep-83	49	1.71	01-Mar-87	01-Mar-87	01-Mar-87
IR FINANCE 16 % 1987	16.00%	105.0	106.19	13.004%	2.87	3.057	3.74	111.499	115.961	1.88%	0.05	0.058	0.07	15-Jul-83	97	4.25	15-Jul-87	15-Jul-87	15-Jul-87
IR EXCHEQR 11 % 1987	11.00%	160.0	95.41	12.971%	2.99	3.188	3.87	152.662	155.023	2.52%	0.08	0.080	0.10	01-Sep-83	49	1.48	01-Sep-87	01-Sep-87	01-Sep-87
IR NATION. 5 3/4% 1982/87	5.75%	21.0	81.42	12.705%	3.24	3.447	3.99	17.098	17.115	0.28%	0.01	0.010	0.01	15-Oct-83	5	0.08	15-Oct-82	15-Oct-87	15-Oct-87
IR CONVER 8 1/2 % 1986/88	8.50%	105.0	88.41	12.951%	3.30	3.513	4.29	92.826	94.781	1.54%	0.05	0.054	0.07	01-Aug-83	80	1.86	01-Feb-86	01-Feb-88	01-Feb-88
IR FUNDING 11 1/4% 1988	11.25%	80.0	95.69	12.967%	3.37	3.588	4.53	76.554	76.258	1.24%	0.04	0.044	0.06	01-Nov-83	-12	-0.37	01-May-88	01-May-88	01-May-88
IR.CONVER 15 % 1988	15.00%	50.0	104.71	13.001%	3.52	3.752	4.87	52.354	53.361	0.87%	0.03	0.033	0.04	01-Sep-83	49	2.01	01-Sep-88	01-Sep-88	01-Sep-88
IR.NATION. 9 3/4% 1984/89	9.75%	135.0	91.28	12.744%	4.04	4.302	5.79	123.226	126.109	2.05%	0.08	0.088	0.12	01-Aug-83	80	2.14	01-Aug-84	01-Aug-89	01-Aug-89
IR EXCHEQR 5 3/4% 1984/89	5.75%	26.0	76.01	12.893%	4.35	4.636	6.04	19.763	19.714	0.32%	0.01	0.015	0.02	01-Nov-83	-12	-0.19	01-Nov-84	01-Nov-89	01-Nov-89
IR EXCHEQR 14 % 1990/92	14.00%	115.0	102.80	12.921%	4.23	4.501	6.29	118.222	121.749	1.98%	0.08	0.089	0.12	01-Aug-83	80	3.07	01-Feb-90	01-Feb-92	01-Feb-90
IR EXCHEQR 11 1/2% 1990	11.50%	123.0	95.36	13.129%	4.41	4.698	6.82	117.297	119.853	1.95%	0.09	0.091	0.13	15-Aug-83	66	2.08	15-Aug-90	15-Aug-90	15-Aug-90
IR EXCHEQR 6 % 1985/90	6.00%	65.0	75.13	13.024%	4.73	5.041	7.08	48.836	48.559	0.79%	0.04	0.040	0.06	15-Nov-83	-26	-0.43	15-Nov-85	15-Nov-90	15-Nov-90
IR NATION. 6 3/4% 1986/91	6.75%	69.0	77.58	13.060%	4.94	5.258	7.95	53.532	53.774	0.87%	0.04	0.046	0.07	01-Oct-83	19	0.35	01-Oct-86	01-Oct-91	01-Oct-91
IR NATION 7 % 1987/92	7.00%	126.0	78.59	12.963%	5.12	5.450	8.66	99.020	102.087	1.66%	0.08	0.090	0.14	15-Jun-83	127	2.43	15-Jun-87	15-Jun-92	15-Jun-92
IR FINANCE 11 1/2% 1991/93	11.50%	25.0	94.82	13.306%	5.15	5.488	9.25	23.706	24.139	0.39%	0.02	0.022	0.04	26-Aug-83	55	1.73	15-Jan-91	15-Jan-93	15-Jan-93
IR DEVELO 7 1/2% 1988/93	7.50%	191.0	80.26	13.095%	5.27	5.619	9.70	153.294	157.647	2.56%	0.14	0.144	0.25	01-Jul-83	111	2.28	01-Jul-88	01-Jul-93	01-Jul-93
IR NATION. 9 1/4% 1989/94	9.25%	63.0	87.55	13.167%	5.41	5.765	10.70	55.158	56.929	0.92%	0.05	0.053	0.10	01-Jul-83	111	2.81	01-Jul-89	01-Jul-94	01-Jul-94
IR CONVER 12 % 1995	12.00%	141.0	96.00	13.561%	5.65	6.037	11.91	135.358	136.979	2.23%	0.13	0.134	0.27	15-Sep-83	35	1.15	15-Sep-95	15-Sep-95	15-Sep-95
IR.EXCHEQR 9 1/4% 1991/96	9.25%	246.0	86.77	13.813%	5.42	5.797	13.04	213.450	212.703	3.46%	0.19	0.200	0.45	01-Nov-83	-12	-0.30	01-Nov-91	01-Nov-96	01-Nov-96
IR NATION 9 3/4% 1992/97	9.75%	263.0	89.15	13.756%	5.55	5.927	14.00	234.469	234.820	3.82%	0.21	0.226	0.53	15-Oct-83	5	0.13	15-Oct-92	15-Oct-97	15-Oct-97
IR FINANCE 14 1/2% 1998/00	14.50%	60.0	101.73	13.560%	6.52	6.964	14.92	61.041	61.874	1.01%	0.07	0.070	0.15	15-Sep-83	35	1.39	15-Sep-98	15-Sep-00	15-Sep-98
IR NATION. 11 % 1993/98	11.00%	278.0	93.53	13.754%	5.78	6.177	15.00	260.020	260.439	4.23%	0.24	0.261	0.63	15-Oct-83	5	0.15	15-Oct-93	15-Oct-98	15-Oct-98
IR DEVELO 11 1/2% 1997/99	11.50%	290.0	94.92	13.922%	5.85	6.257	16.08	275.273	272.899	4.43%	0.26	0.277	0.71	15-Nov-83	-26	-0.82	15-Nov-97	15-Nov-99	15-Nov-99
IR DEVELO 14 3/4% 2002/04	14.75%	70.0	102.03	13.330%	7.20	7.680	18.30	71.423	73.685	1.20%	0.09	0.092	0.22	01-Aug-83	80	3.23	01-Feb-02	01-Feb-04	01-Feb-02
IR FINANCE 13 % 1997/02	13.00%	290.0	98.92	13.674%	6.49	6.936	18.46	286.878	288.839	4.69%	0.30	0.325	0.87	01-Oct-83	19	0.68	01-Apr-97	01-Apr-02	01-Apr-02
IR DEVELO 12 1/4% 2003	12.25%	45.0	98.60	13.099%	6.74	7.185	19.67	44.369	46.361	0.75%	0.05	0.054	0.15	10-Jun-83	132	4.43	15-Jun-03	15-Jun-03	15-Jun-03
IR EXCHEQR 6 1/2% 2000/05	6.50%	133.0	81.75	12.849%	5.32	5.661	21.70	108.728	111.450	1.81%	0.10	0.103	0.39	27-Jun-83	115	2.05	27-Jun-00	27-Jun-05	27-Jun-05
								6074.889	6155.030	100.00%	3.05	3.251	6.37						

Trade : 17-Apr-84
Sett : 19-Apr-84

Stock	Coupon	Nominal Issue	Market Price	Market Yield	Volatility	Duration	Life	Clean Market Value (IR£m)	Dirty Market Value (IR£m)	Stock Weight in Index	Weighted Volatility	Weighted Duration	Weighted Life	Ex-Div Date	Accrued Interest	Accrued Interest	First Redemption Date	Last Redemption Date	Redemption Date
IR.FINANCE VAR% 1988	12.56%	170.0	100.02	12.700%	0.37	0.383	-0.13	170.031	178.213	2.82%	0.01	0.011	0.00	01-Dec-83	140	4.81	01-Jun-88	01-Jun-88	01-Jun-88
IR.FINANCE VAR% 1985	12.54%	100.0	100.00	12.688%	0.25	0.260	-0.01	100.002	103.264	1.64%	0.00	0.004	0.00	15-Jan-84	95	3.26	15-Jan-85	15-Jan-85	15-Jan-85
IR.FINANCE VAR% 1985	12.93%	210.0	100.00	12.930%	0.09	0.096	0.15	210.000	212.602	3.37%	0.00	0.003	0.01	15-Mar-84	35	1.24	15-Sep-85	15-Sep-85	15-Sep-85
IR.CONVER 13 % 1984	13.00%	240.0	100.21	11.534%	0.15	0.160	0.16	240.508	251.271	3.98%	0.01	0.006	0.01	15-Dec-83	126	4.48	15-Jun-84	15-Jun-84	15-Jun-84
IR.FINANCE VAR% 1986	12.73%	160.0	100.05	12.525%	0.03	0.033	0.28	160.082	159.413	2.52%	0.00	0.001	0.01	01-May-84	-12	-0.42	01-May-86	01-May-86	01-May-86
IR.FINANCE 11 3/4% 1984	11.75%	270.0	99.88	12.171%	0.31	0.327	0.32	269.666	275.225	4.36%	0.01	0.014	0.01	15-Feb-84	64	2.06	15-Aug-84	15-Aug-84	15-Aug-84
IR.NATION. 5 1/4% 1979/84	5.25%	29.0	96.16	12.580%	0.54	0.574	0.58	27.886	27.778	0.44%	0.00	0.003	0.00	15-May-84	-26	-0.37	15-Nov-79	15-Nov-84	15-Nov-84
IR.FUNDING 11 1/2% 1985	11.50%	155.0	98.79	13.210%	0.76	0.812	0.83	153.130	156.253	2.47%	0.02	0.020	0.02	15-Feb-84	64	2.02	15-Feb-85	15-Feb-85	15-Feb-85
IR.NATION. 14 % 1985	14.00%	151.0	101.32	12.257%	0.83	0.881	0.90	152.990	155.016	2.46%	0.02	0.022	0.02	15-Mar-84	35	1.34	15-Mar-85	15-Mar-85	15-Mar-85
IR.NATION 14 % 1985/90	14.00%	151.0	101.32	12.257%	0.83	0.881	0.90	152.990	155.016	2.46%	0.02	0.022	0.02	15-Mar-84	35	1.34	15-Mar-85	15-Mar-90	15-Mar-85
IR.EXCHEQR 12 % 1985	12.00%	290.0	99.00	13.133%	0.97	1.035	1.07	287.093	284.615	4.51%	0.04	0.047	0.05	15-May-84	-26	-0.85	15-May-85	15-May-85	15-May-85
IR.FINANCE 12 1/4% 1985	12.25%	280.0	98.89	13.201%	1.32	1.404	1.49	276.895	277.270	4.39%	0.06	0.062	0.07	15-Apr-84	4	0.13	15-Oct-85	15-Oct-85	15-Oct-85
IR.EXCHEQR 6 % 1980/85	6.00%	102.0	91.93	12.001%	1.47	1.555	1.62	93.769	96.115	1.52%	0.02	0.024	0.02	01-Dec-83	140	2.30	01-Dec-80	01-Dec-85	01-Dec-85
IR.FUNDING 15 1/2% 1986	15.50%	115.0	102.81	13.373%	1.57	1.671	1.83	118.231	121.355	1.92%	0.03	0.032	0.04	15-Feb-84	64	2.72	15-Feb-86	15-Feb-86	15-Feb-86
IR.EXCHEQR 10 3/4% 1986	10.75%	180.0	96.40	13.202%	1.69	1.798	1.95	173.524	174.477	2.76%	0.05	0.050	0.05	01-Apr-84	18	0.53	01-Apr-86	01-Apr-86	01-Apr-86
IR.NATION. 7 1/2% 1981/85	7.50%	119.0	91.46	12.548%	1.92	2.040	2.20	108.843	111.506	1.77%	0.03	0.036	0.04	01-Jan-84	109	2.24	01-Jul-81	01-Jul-86	01-Jul-86
IR.EXCHEQR 12 1/2% 1986	12.50%	180.0	98.79	13.211%	2.04	2.179	2.45	177.826	178.935	2.83%	0.06	0.062	0.07	01-Apr-84	18	0.62	01-Oct-86	01-Oct-86	01-Oct-86
IR.FUNDING 12 3/4% 1987	12.75%	180.0	99.03	13.267%	2.33	2.480	2.87	178.255	181.334	2.87%	0.07	0.071	0.08	01-Mar-84	49	1.71	01-Mar-87	01-Mar-87	01-Mar-87
IR.FINANCE 16 % 1987	16.00%	105.0	104.95	13.402%	2.54	2.713	3.24	110.201	114.570	1.81%	0.05	0.049	0.06	15-Jan-84	95	4.16	15-Jul-87	15-Jul-87	15-Jul-87
IR.EXCHEQR 11 % 1987	11.00%	45.0	95.12	13.285%	2.68	2.853	3.37	42.803	43.467	0.69%	0.02	0.020	0.02	01-Mar-84	49	1.48	01-Sep-87	01-Sep-87	01-Sep-87
IR.NATION. 5 3/4% 1982/87	5.75%	21.0	83.70	12.384%	2.92	3.098	3.49	17.576	17.590	0.28%	0.01	0.009	0.01	15-Apr-84	4	0.06	15-Oct-82	15-Oct-87	15-Oct-87
IR.CONVER 8 1/2 % 1986/88	8.50%	160.0	89.17	12.968%	3.00	3.196	3.79	142.676	145.581	2.31%	0.07	0.074	0.09	01-Feb-84	78	1.82	01-Feb-86	01-Feb-88	01-Feb-88
IR.FUNDING 11 1/4% 1988	11.25%	100.0	95.18	13.301%	3.07	3.277	4.04	95.176	94.807	1.50%	0.05	0.049	0.06	01-May-84	-12	-0.37	01-May-88	01-May-88	01-May-88
IR.CONVER 15 % 1988	15.00%	50.0	103.47	13.450%	3.22	3.436	4.37	51.735	52.741	0.84%	0.03	0.029	0.04	01-Mar-84	49	2.01	01-Sep-88	01-Sep-88	01-Sep-88
IR.NATION. 9 3/4% 1984/89	9.75%	180.0	90.90	13.013%	3.79	4.032	5.29	163.612	167.360	2.65%	0.10	0.107	0.14	01-Feb-84	78	2.08	01-Aug-84	01-Aug-89	01-Aug-89
IR.EXCHEQR 5 3/4% 1984/89	5.75%	26.0	78.99	12.144%	4.18	4.432	5.54	20.538	20.489	0.32%	0.01	0.014	0.02	01-May-84	-12	-0.19	01-Nov-84	01-Nov-89	01-Nov-89
IR.EXCHEQR 14 % 1990/92	14.00%	125.0	101.69	13.329%	3.95	4.215	5.79	127.115	130.852	2.07%	0.08	0.087	0.12	01-Feb-84	78	2.99	01-Feb-90	01-Feb-92	01-Feb-90
IR.EXCHEQR 11 1/2% 1990	11.50%	143.0	94.65	13.429%	4.17	4.452	6.33	135.352	138.234	2.19%	0.09	0.097	0.14	15-Feb-84	64	2.02	15-Aug-90	15-Aug-90	15-Aug-90
IR.EXCHEQR 6 % 1985/90	6.00%	100.0	77.01	12.591%	4.60	4.887	6.58	77.008	76.581	1.21%	0.06	0.059	0.08	15-May-84	-26	-0.43	15-Nov-85	15-Nov-90	15-Nov-90
IR.NATION. 6 3/4% 1986/91	6.75%	84.0	78.78	12.768%	4.83	5.142	7.45	66.177	66.456	1.05%	0.05	0.054	0.08	01-Apr-84	18	0.33	01-Oct-86	01-Oct-91	01-Oct-91
IR.NATION. 7 % 1987/92	7.00%	141.0	79.65	12.675%	5.05	5.367	8.16	112.300	115.705	1.83%	0.09	0.098	0.15	15-Dec-83	126	2.41	15-Jun-87	15-Jun-92	15-Jun-92
IR.FINANCE 11 1/2% 1991/93	11.50%	35.0	94.48	13.428%	4.98	5.319	8.75	33.068	34.115	0.54%	0.03	0.029	0.05	15-Jan-84	95	2.99	15-Jan-91	15-Jan-93	15-Jan-93
IR.DEVELO. 7 1/2% 1988/93	7.50%	226.0	80.26	13.123%	5.17	5.513	9.21	181.389	186.447	2.95%	0.15	0.163	0.27	01-Jan-84	109	2.24	01-Jul-88	01-Jul-93	01-Jul-93
IR.NATION. 9 1/4% 1989/94	9.25%	73.0	86.50	13.548%	5.22	5.570	10.21	63.146	65.162	1.03%	0.05	0.057	0.11	01-Jan-84	109	2.76	01-Jul-89	01-Jul-94	01-Jul-94
IR.CONVER 12 % 1995	12.00%	151.0	94.96	13.973%	5.43	5.806	11.41	143.388	145.124	2.30%	0.12	0.133	0.26	15-Mar-84	35	1.15	15-Sep-95	15-Sep-95	15-Sep-95
IR.EXCHEQR 9 1/4% 1991/96	9.25%	246.0	85.69	14.217%	5.24	5.612	12.55	210.800	210.053	3.33%	0.17	0.187	0.42	01-May-84	-12	-0.30	01-Nov-91	01-Nov-96	01-Nov-96
IR.NATION. 9 3/4% 1992/97	9.75%	263.0	88.12	14.153%	5.35	5.733	13.50	231.766	232.047	3.68%	0.20	0.211	0.50	15-Apr-84	4	0.11	15-Oct-92	15-Oct-97	15-Oct-97
IR.FINANCE 14 1/2% 1998/00	14.50%	80.0	100.95	13.986%	6.23	6.663	14.42	80.761	81.873	1.30%	0.08	0.086	0.19	15-Mar-84	35	1.39	15-Sep-98	15-Sep-00	15-Sep-98
IR.NATION. 11 % 1993/98	11.00%	278.0	92.49	14.209%	5.54	5.930	14.50	257.136	257.471	4.08%	0.23	0.242	0.59	15-Apr-84	4	0.12	15-Oct-93	15-Oct-98	15-Oct-98
IR.DEVELO. 11 1/2% 1997/99	11.50%	290.0	93.95	14.394%	5.59	5.989	15.58	272.469	270.095	4.28%	0.24	0.256	0.67	15-May-84	-26	-0.82	15-Nov-97	15-Nov-99	15-Nov-99
IR.DEVELO. 14 3/4% 2002/04	14.75%	80.0	101.47	13.727%	6.87	7.345	17.80	81.177	83.697	1.33%	0.09	0.097	0.24	01-Feb-84	78	3.15	01-Feb-02	01-Feb-04	01-Feb-02
IR.FINANCE 13 % 1997/02	13.00%	290.0	98.27	14.079%	6.21	6.645	17.96	284.987	286.845	4.54%	0.28	0.302	0.82	01-Apr-84	18	0.64	01-Apr-97	01-Apr-02	01-Apr-02
IR.DEVELO. 12 1/4% 2003	12.25%	65.0	97.95	13.492%	6.45	6.881	19.17	63.666	66.413	1.05%	0.07	0.072	0.20	15-Dec-83	126	4.23	15-Jun-03	15-Jun-03	15-Jun-03
IR.EXCHEQR 6 1/2% 2000/05	6.50%	133.0	81.12	13.026%	5.24	5.585	21.20	107.895	110.593	1.75%	0.09	0.098	0.37	27-Dec-83	114	2.03	27-Jun-00	27-Jun-05	27-Jun-05
								6225.640	6314.026	100.00%	2.97	3.169	6.18						

Trade 17 Oct 84
Sett 19 Oct 84

Stock		Coupon	Nominal Issue	Market Price	Market Yield	Volatility	Duration	Life	Clean Market Value (IR£m)	Dirty Market Value (IR£m)	Stock Weight in Index	Weighted Volatility	Weighted Duration	Weighted Life	Ex Div Date	Accrued Interest	Accrued Interest	First Redemption Date	Last Redemption Date	Redemption Date
IR NATION 5 1/4%	1979/84	5 25%	29 0	99 72	9 134%	0 07	0 075	0 07	28 920	28 807	0 42%	0 00	0 000	0 00	15 Nov 84	27	-0 39	15-Nov-79	15-Nov-84	15 Nov 84
IR FINANCE VAR%	1985	13 55%	210 0	100 03	13 311%	0 09	0 093	0 16	210 073	212 722	3 11%	0 00	0 003	0 00	15 Sep 84	34	1 26	15 Sep 85	15 Sep 85	15 Sep 85
IR FINANCE VAR%	1988	13 12%	200 0	99 97	13 294%	0 05	0 049	0 20	199 935	201 227	2 95%	0 00	0 001	0 01	01 Oct 84	18	0 65	01 Jun 88	01 Jun 88	01 Jun 88
IR FINANCE VAR%	1985	12 99%	140 0	99 95	13 203%	0 01	0 011	0 24	139 934	140 133	2 05%	0 00	0 000	0 00	15 Oct 84	4	0 14	15 Jan 85	15 Jan 85	15 Jan 85
IR FINANCE VAR%	1986	13 79%	160 0	100 04	13 643%	0 03	0 036	0 28	160 061	159 276	2 33%	0 00	0 001	0 01	01 Nov 84	13	-0 49	01 May 86	01 May 86	01 May 86
IR FUNDING 11 1/2%	1985	11 50%	240 0	99 33	13 768%	0 31	0 329	0 33	238 396	243 308	3 56%	0 01	0 012	0 01	15 Aug 84	65	2 05	15 Feb 85	15 Feb 85	15 Feb 85
IR NATION 14 %	1985	14 00%	151 0	99 01	16 804%	0 37	0 405	0 40	149 508	151 476	2 22%	0 01	0 009	0 01	15 Sep 84	34	1 30	15 Mar 85	15 Mar 85	15 Mar 85
IR NATION 14 %	1985/90	14 00%	151 0	100 63	12 257%	0 38	0 406	0 40	151 945	164 562	2 41%	0 01	0 010	0 01	15 Mar 84	218	8 36	15 Mar 85	15 Mar 90	15 Mar 85
IR EXCHEQR 12 %	1985	12 00%	300 0	99 25	13 505%	0 53	0 567	0 57	297 746	295 085	4 32%	0 02	0 025	0 02	15 Nov 84	-27	-0 89	15 May 85	15 May 85	15 May 85
IR FINANCE 12 1/4%	1985	12 25%	300 0	98 77	13 756%	0 90	0 960	0 99	296 295	296 698	4 34%	0 04	0 042	0 04	15 Oct 84	4	0 13	15-Oct 85	15-Oct 85	15 Oct 85
IR EXCHEQR 6 %	1980/85	6 00%	126 0	93 19	13 082%	1 03	1 093	1 12	117 416	120 314	1 76%	0 02	0 019	0 02	01 Jun 84	140	2 30	01 Dec 80	01-Dec 85	01 Dec 85
IR FUNDING 10 %	1986	10 00%	105 0	95 92	14 031%	1 11	1 192	1 24	100 712	103 472	1 51%	0 02	0 018	0 02	15 Jul 84	96	2 63	15 Jan 86	15-Jan 86	15 Jan 86
IR FUNDING 15 1/2%	1986	15 50%	180 0	101 53	14 008%	1 17	1 252	1 33	182 746	187 711	2 75%	0 03	0 034	0 04	15 Aug 84	65	2 76	15 Feb 86	15 Feb 86	15 Feb 86
IR EXCHEQR 10 3/4%	1986	10 75%	215 0	96 17	14 094%	1 28	1 373	1 45	206 760	207 899	3 04%	0 04	0 042	0 04	01-Oct-84	18	0 53	01 Apr 86	01 Apr 86	01 Apr 86
IR NATION 7 1/2%	1981/85	7 50%	159 0	91 57	13 721%	1 51	1 609	1 70	145 604	149 195	2 18%	0 03	0 035	0 04	01-Jul-84	110	2 26	01-Jul-81	01-Jul 86	01 Jul 86
IR EXCHEQR 12 1/2%	1986	12 50%	180 0	97 77	14 070%	1 66	1 781	1 95	175 977	177 086	2 59%	0 04	0 046	0 05	01 Oct 84	18	0 62	01 Oct 86	01-Oct 86	01 Oct 86
IR FUNDING 12 3/4%	1987	12 75%	180 0	97 71	14 159%	1 96	2 100	2 36	175 870	178 886	2 62%	0 05	0 055	0 06	01 Sep 84	48	1 68	01 Mar 87	01 Mar 87	01 Mar 87
IR EXCHEQR 9 %	1987	9 00%	50 0	90 17	14 286%	2 21	2 363	2 65	45 084	46 994	0 69%	0 02	0 016	0 02	17 May 84	155	3 82	15 Jun 87	15 Jun 87	15 Jun 87
IR FINANCE 16 %	1987	16 00%	140 0	102 95	14 274%	2 19	2 348	2 74	144 124	150 011	2 20%	0 05	0 052	0 06	15 Jul 84	96	4 21	15-Jul 87	15-Jul 87	15 Jul 87
IR EXCHEQR 11 %	1987	11 00%	45 0	93 78	14 277%	2 32	2 487	2 87	42 199	42 849	0 63%	0 01	0 016	0 02	01-Sep-84	48	1 45	01 Sep 87	01-Sep 87	01 Sep 87
IR NATION 5 3/4%	1982/87	5 75%	46 0	84 48	12 862%	2 55	2 710	2 99	38 861	38 890	0 57%	0 01	0 015	0 02	15 Oct 84	4	0 06	15-Oct 82	15-Oct 87	15 Oct 87
IR CONVER 8 1/2 %	1986/88	8 50%	175 0	87 32	14 364%	2 64	2 826	3 29	152 811	156 029	2 28%	0 06	0 065	0 08	01 Aug 84	79	1 84	01 Feb 86	01-Feb 88	01 Feb 88
IR FUNDING 11 1/4%	1988	11 25%	100 0	93 29	14 383%	2 73	2 929	3 53	93 288	92 887	1 36%	0 04	0 040	0 05	01 Nov 84	13	-0 40	01 May 88	01 May 88	01 May 88
IR CONVER 15 %	1988	15 00%	80 0	101 23	14 412%	2 89	3 095	3 87	80 980	82 557	1 21%	0 03	0 037	0 05	01 Sep 84	48	1 97	01 Sep 88	01 Sep 88	01 Sep 88
IR FINANCE 9 %	1989	9 00%	75 0	86 33	14 490%	3 20	3 436	4 29	64 745	66 205	0 97%	0 03	0 033	0 04	01 Aug 84	79	1 95	01 Feb 89	01 Feb 89	01 Feb 89
IR DEVELO 2 1/2%	1989	2 50%	25 0	72 02	11 063%	3 93	4 147	4 53	18 006	17 984	0 26%	0 01	0 011	0 01	01 Nov 84	13	-0 09	01 May 89	01 May 89	01 May 89
IR NATION 9 3/4%	1984/89	9 75%	210 0	87 76	14 501%	3 43	3 681	4 79	184 303	188 732	2 76%	0 09	0 102	0 13	01 Aug 84	79	2 11	01 Aug 84	01 Aug 89	01 Aug 89
IR EXCHEQR 5 3/4%	1984/89	5 75%	26 0	77 53	13 133%	3 84	4 093	5 04	20 157	20 104	0 29%	0 01	0 012	0 01	01 Nov 84	13	-0 20	01 Nov 84	01 Nov 89	01 Nov 89
IR EXCHEQR 11 1/2%	1990	11 50%	197 0	93 19	14 058%	3 90	4 170	5 82	183 576	187 608	2 75%	0 11	0 115	0 16	15 Aug 84	65	2 05	15 Aug 90	15 Aug 90	15 Aug 90
IR EXCHEQR 6 %	1985/90	6 00%	100 0	75 62	13 411%	4 30	4 586	6 08	75 619	75 176	1 10%	0 05	0 050	0 07	15 Nov 84	27	-0 44	15 Nov 85	15 Nov 90	15 Nov 90
IR NATION 6 3/4%	1986/91	6 75%	84 0	76 95	13 631%	4 54	4 851	6 95	64 637	64 916	0 95%	0 04	0 046	0 07	01 Oct 84	18	0 33	01-Oct 86	01-Oct 91	01-Oct 91
IR EXCHEQR 14 %	1990/92	14 00%	155 0	99 89	14 045%	4 47	4 786	7 29	154 825	159 518	2 34%	0 10	0 112	0 17	01 Aug 84	79	3 03	01 Feb 90	01 Feb 92	01 Feb 92
IR NATION 7 %	1987/92	7 00%	141 0	76 94	13 801%	4 71	5 034	7 66	108 488	111 893	1 64%	0 08	0 082	0 13	15 Jun 84	126	2 41	15 Jun 87	15 Jun 92	15 Jun 92
IR FINANCE 11 1/2%	1991/93	11 50%	75 0	92 85	14 055%	4 72	5 048	8 25	69 641	71 908	1 05%	0 05	0 053	0 09	15 Jul 84	96	3 02	15 Jan 91	15 Jan 93	15 Jan 93
IR DEVELO 7 1/2%	1988/93	7 50%	261 0	78 10	14 005%	4 88	5 220	8 70	203 838	209 733	3 07%	0 15	0 160	0 27	01 Jul 84	110	2 26	01 Jul 88	01-Jul 93	01 Jul 93
IR NATION 9 1/4%	1989/94	9 25%	88 0	85 12	14 081%	4 99	5 345	9 70	74 903	77 355	1 13%	0 06	0 061	0 11	01 Jul 84	110	2 79	01 Jul 89	01 Jul 94	01 Jul 94
IR CONVER 12 %	1995	12 00%	202 0	93 63	14 521%	5 17	5 546	10 91	189 123	191 380	2 80%	0 14	0 155	0 31	15 Sep 84	34	1 12	15-Sep 95	15-Sep 95	15 Sep 95
IR EXCHEQR 9 1/4%	1991/96	9 25%	276 0	84 23	14 816%	5 00	5 373	12 04	232 469	231 561	3 39%	0 17	0 182	0 41	01 Nov 84	13	-0 33	01 Nov 91	01 Nov 96	01 Nov 96
IR NATION 9 3/4%	1992/97	9 75%	278 0	86 81	14 701%	5 12	5 494	13 00	241 320	241 617	3 54%	0 18	0 194	0 46	15 Oct 84	4	0 11	15-Oct 92	15-Oct 97	15 Oct 97
IR NATION 11 %	1993/98	11 00%	278 0	91 36	14 718%	5 29	5 680	14 00	253 984	254 319	3 72%	0 20	0 211	0 52	15 Oct 84	4	0 12	15 Oct 93	15-Oct 98	15-Oct 98
IR DEVELO 11 1/2%	1997/99	11 50%	300 0	92 90	14 919%	5 32	5 719	15 08	278 696	276 145	4 04%	0 22	0 231	0 61	15 Nov 84	27	-0 85	15 Nov 97	15 Nov 99	15 Nov 99
IR FINANCE 14 1/2%	1998/00	14 50%	105 0	99 96	14 524%	6 14	6 587	15 92	104 959	106 376	1 56%	0 10	0 103	0 25	15 Sep 84	34	1 35	15 Sep 98	15-Sep-00	15 Sep 00
IR DEVELO 14 3/4%	2002/04	14 75%	120 0	100 61	14 324%	6 45	6 911	17 30	120 727	124 555	1 82%	0 12	0 126	0 32	01 Aug 84	79	3 19	01 Feb 02	01 Feb 04	01 Feb 02
IR FINANCE 13 %	1997/02	13 00%	310 0	97 38	14 648%	5 85	6 282	17 46	301 886	303 872	4 45%	0 26	0 279	0 78	01 Oct 84	18	0 64	01-Apr 97	01 Apr 02	01 Apr 02
IR DEVELO 12 1/4%	2003	12 25%	110 0	97 07	14 042%	6 07	6 500	18 67	106 779	111 427	1 63%	0 10	0 106	0 30	15 Jun 84	126	4 23	15 Jun 03	15-Jun-03	15 Jun 03
IR EXCHEQR 6 1/2%	2000/05	6 50%	133 0	80 44	13 234%	5 15	5 495	20 70	106 989	109 688	1 61%	0 08	0 088	0 33	27 Jun 84	114	2 03	27 Jun 00	27-Jun-05	27 Jun 05
									6734 917	6830 147	100 00%	2 90	3 107	6 21						

Table A 1 11 Irish Government Treasury Data - April 1985

Trade 17 Apr 85
Sett 19 Apr-85

Stock	Coupon	Nominal Issue	Market Price	Market Yield	Volatility	Duration	Life	Clean Market Value (IR£m)	Dirty Market Value (IR£m)	Stock Weight in Index	Weighted Volatility	Weighted Duration	Weighted Life	Ex Div Date	Accrued Interest	Accrued Interest	First Redemption Date	Last Redemption Date	Redemption Date
IR EXCHEQR 12 % 1985	12 00%	300 0	100 20	8 974%	0 07	0 073	0 07	300 610	298 047	3 93%	0 00	0 003	0 00	15 May 85	26	-0 85	15 May-85	15 May 85	15 May 85
IR FINANCE VAR% 1988	14 64%	220 0	100 02	14 495%	0 13	0 134	0 12	220 033	224 354	2 96%	0 00	0 004	0 00	01 Mar 85	49	1 96	01 Jun 88	01-Jun 88	01 Jun 88
IR FINANCE VAR% 1989	14 64%	25 0	100 03	14 392%	0 10	0 099	0 15	25 009	25 369	0 33%	0 00	0 000	0 00	14 Mar 85	36	1 44	15 Sep 89	15 Sep 89	15 Sep 89
IR FINANCE VAR% 1985	14 76%	210 0	100 15	13 721%	0 09	0 096	0 15	210 306	213 277	2 81%	0 00	0 003	0 00	15 Mar 85	35	1 41	15 Sep 85	15 Sep 85	15 Sep 85
IR NATION 14 % 1985/90	14 00%	151 0	100 62	11 288%	0 24	0 254	0 25	151 934	153 960	2 03%	0 00	0 005	0 01	15 Mar-85	35	1 34	15 Mar 85	15 Mar 90	19 Jul 85
IR FINANCE VAR% 1986	15 26%	175 0	100 15	14 663%	0 03	0 033	0 28	175 262	174 385	2 30%	0 00	0 001	0 01	01 May-85	12	-0 50	01 May-86	01 May 86	01-May-86
IR FINANCE 12 1/4% 1985	12 25%	300 0	99 91	12 467%	0 46	0 491	0 49	299 717	300 120	3 95%	0 02	0 019	0 02	15 Apr-85	4	0 13	15-Oct-85	15 Oct 85	15 Oct 85
IR EXCHEQR 6 % 1980/85	6 00%	136 0	96 13	12 929%	0 58	0 616	0 62	130 737	133 843	1 76%	0 01	0 011	0 01	01 Dec-84	139	2 28	01 Dec-80	01 Dec 85	01 Dec-85
IR FUNDING 10 % 1986	10 00%	145 0	98 17	12 837%	0 69	0 733	0 74	142 339	146 071	1 92%	0 01	0 014	0 01	15 Jan-85	94	2 57	15-Jan-86	15 Jan 86	15 Jan-86
IR FUNDING 15 1/2% 1986	15 50%	180 0	101 77	12 939%	0 76	0 809	0 83	183 178	187 990	2 48%	0 02	0 020	0 02	15 Feb-85	63	2 67	15 Feb-86	15 Feb 86	15 Feb 86
IR CAPITAL 9 1/2% 1986	9 50%	85 0	97 42	12 818%	0 83	0 886	0 90	82 811	83 584	1 10%	0 01	0 010	0 01	15 Mar 85	35	0 91	15 Mar-86	15 Mar 86	15 Mar 86
IR EXCHEQR 10 3/4% 1986	10 75%	225 0	98 33	12 821%	0 87	0 927	0 95	221 248	222 440	2 93%	0 03	0 027	0 03	01 Apr-85	18	0 53	01-Apr-86	01 Apr 86	01 Apr 86
IR NATION 7 1/2% 1981/85	7 50%	159 0	94 60	12 821%	1 09	1 164	1 20	150 418	153 944	2 03%	0 02	0 024	0 02	01 Jan-85	108	2 22	01-Jul-81	01-Jul 86	01 Jul 86
IR EXCHEQR 12 1/2% 1986	12 50%	180 0	99 60	12 850%	1 29	1 371	1 45	179 281	180 390	2 38%	0 03	0 033	0 03	01 Apr-85	18	0 62	01-Oct 86	01-Oct 86	01 Oct-86
IR FUNDING 12 3/4% 1987	12 75%	180 0	99 74	12 936%	1 61	1 717	1 87	179 534	182 613	2 41%	0 04	0 041	0 04	01 Mar-85	49	1 71	01 Mar 87	01 Mar-87	01 Mar-87
IR CAPITAL 14 % 1987	14 00%	50 0	101 59	12 946%	1 80	1 912	2 12	50 793	53 381	0 70%	0 01	0 013	0 01	05 Dec-84	135	5 17	01-Jun-87	01 Jun 87	01 Jun-87
IR EXCHEQR 9 % 1987	9 00%	90 0	93 61	12 933%	1 86	1 984	2 16	84 250	87 022	1 15%	0 02	0 023	0 02	15 Dec-84	125	3 08	15 Jun-87	15-Jun 87	15 Jun-87
IR FINANCE 16 % 1987	16 00%	150 0	104 60	12 985%	1 87	1 996	2 24	156 904	163 081	2 15%	0 04	0 043	0 05	15-Jan-85	94	4 12	15 Jul-87	15-Jul 87	15 Jul-87
IR EXCHEQR 11 % 1987	11 00%	75 0	96 62	12 990%	2 00	2 132	2 37	72 468	73 575	0 97%	0 02	0 021	0 02	01 Mar-85	49	1 48	01-Sep 87	01-Sep 87	01 Sep 87
IR NATION 5 3/4% 1982/87	5 75%	46 0	86 99	12 566%	2 17	2 311	2 49	40 015	40 044	0 53%	0 01	0 012	0 01	15 Apr 85	4	0 06	15 Oct 82	15 Oct 87	15 Oct-87
IR CONVER 8 1/2 % 1986/88	8 50%	230 0	91 14	12 975%	2 34	2 488	2 79	209 631	213 752	2 82%	0 07	0 070	0 08	01 Feb-85	77	1 79	01 Feb 86	01 Feb 88	01 Feb 88
IR FUNDING 11 1/4% 1988	11 25%	100 0	96 52	12 989%	2 46	2 624	3 04	96 518	96 148	1 27%	0 03	0 033	0 04	01 May 85	12	-0 37	01 May 88	01 May 88	01 May-88
IR CAPITAL 11 % 1988	11 00%	55 0	95 67	13 103%	2 55	2 712	3 16	52 619	54 855	0 72%	0 02	0 020	0 02	05 Dec-84	135	4 07	15 Jun-88	15-Jun-88	15 Jun 88
IR CONVER 15 % 1988	15 00%	90 0	103 68	13 155%	2 64	2 815	3 37	93 308	95 119	1 25%	0 03	0 035	0 04	01 Mar 85	49	2 01	01 Sep-88	01 Sep-88	01 Sep-88
IR FINANCE 9 % 1989	9 00%	130 0	90 27	13 062%	2 99	3 181	3 79	117 355	119 822	1 58%	0 05	0 050	0 06	01 Feb-85	77	1 90	01 Feb 89	01 Feb 89	01 Feb 89
IR DEVELO 2 1/2% 1989	2 50%	25 0	74 04	11 166%	3 55	3 744	4 04	18 511	18 490	0 24%	0 01	0 009	0 01	01 May-85	12	-0 08	01 May 89	01 May 89	01 May 89
IR CAPITAL 10 % 1989	10 00%	60 0	92 56	13 047%	3 13	3 335	4 07	55 534	55 107	0 73%	0 02	0 024	0 03	15 May-85	26	-0 71	15 May 89	15 May 89	15 May 89
IR NATION 9 3/4% 1984/89	9 75%	245 0	91 58	13 090%	3 26	3 470	4 29	224 363	229 399	3 02%	0 10	0 105	0 13	01 Feb 85	77	2 06	01 Aug 84	01 Aug 89	01 Aug 89
IR EXCHEQR 5 3/4% 1984/89	5 75%	41 0	80 07	12 619%	3 59	3 814	4 54	32 828	32 751	0 43%	0 02	0 016	0 02	01 May 85	12	-0 19	01 Nov 84	01 Nov 89	01 Nov 89
IR EXCHEQR 14 % 1990/92	14 00%	155 0	102 79	12 842%	3 49	3 717	4 79	159 325	163 900	2 16%	0 08	0 080	0 10	01 Feb 85	77	2 95	01 Feb 90	01 Feb 92	01 Feb 90
IR EXCHEQR 11 1/2% 1990	11 50%	197 0	95 92	13 031%	3 77	4 014	5 33	188 970	192 878	2 54%	0 10	0 102	0 14	15 Feb 85	63	1 98	15 Aug 90	15 Aug 90	15 Aug 90
IR CAPITAL 13 % 1990	13 00%	60 0	99 83	13 065%	3 84	4 086	5 49	59 899	59 985	0 79%	0 03	0 032	0 04	15 Apr 85	4	0 14	15 Oct 90	15-Oct 90	15 Oct 90
IR EXCHEQR 6 % 1985/90	6 00%	100 0	78 09	12 821%	4 12	4 387	5 58	78 090	77 663	1 02%	0 04	0 045	0 06	15-May-85	26	-0 43	15-Nov-85	15-Nov 90	15-Nov 90
IR FINANCE 12 1/2% 1991	12 50%	25 0	98 52	13 050%	4 09	4 356	6 04	24 630	24 528	0 32%	0 01	0 014	0 02	01 May 85	12	-0 41	01 May 91	01 May 91	01 May 91
IR NATION 6 3/4% 1986/91	6 75%	109 0	79 67	12 829%	4 46	4 744	6 45	86 837	87 199	1 15%	0 05	0 054	0 07	01 Apr 85	18	0 33	01-Oct-86	01-Oct 91	01-Oct 91
IR NATION 7 % 1987/92	7 00%	141 0	79 39	13 033%	4 68	4 981	7 16	111 940	115 318	1 52%	0 07	0 076	0 11	15 Dec-84	125	2 40	15 Jun-87	15 Jun 92	15 Jun 92
IR FINANCE 11 1/2% 1991/93	11 50%	85 0	95 42	13 079%	4 75	5 061	7 75	81 109	83 624	1 10%	0 05	0 056	0 09	15 Jan-85	94	2 96	15 Jan 91	15-Jan-93	15 Jan 93
IR DEVELO 7 1/2% 1988/93	7 50%	271 0	81 34	12 850%	4 99	5 316	8 21	220 422	226 432	2 98%	0 15	0 159	0 24	01 Jan-85	108	2 22	01 Jul-88	01 Jul 93	01 Jul-93
IR CAPITAL 8 % 1993	8 00%	90 0	83 39	12 834%	5 06	5 390	8 54	75 050	74 814	0 99%	0 05	0 053	0 08	01 May-85	-12	-0 26	01-Nov 93	01-Nov 93	01 Nov-93
IR NATION 9 1/4% 1989/94	9 25%	98 0	87 63	13 089%	5 14	5 481	9 21	85 874	88 554	1 17%	0 06	0 064	0 11	01 Jan 85	108	2 74	01 Jul 89	01-Jul 94	01-Jul 94
IR EXCHEQR 13 % 1994	13 00%	25 0	99 77	13 084%	5 34	5 693	9 50	24 944	24 979	0 33%	0 02	0 019	0 03	15 Apr 85	4	0 14	15 Oct 94	15-Oct 94	15 Oct 94
IR CAPITAL 12 1/4% 1995	12 25%	60 0	97 57	13 139%	5 45	5 807	10 12	58 539	61 256	0 81%	0 04	0 047	0 08	05 Dec-84	135	4 53	01 Jun 95	01 Jun 95	01 Jun 95
IR CONVER 12 % 1995	12 00%	202 0	96 89	13 127%	5 51	5 867	10 41	195 726	198 049	2 61%	0 14	0 153	0 27	15 Mar-85	35	1 15	15 Sep 95	15 Sep 95	15 Sep 95
IR EXCHEQR 9 1/4% 1991/96	9 25%	286 0	88 26	12 958%	5 60	5 965	11 55	252 428	251 559	3 31%	0 19	0 198	0 38	01 May-85	12	-0 30	01-Nov 91	01 Nov 96	01 Nov 96
IR NATION 9 3/4% 1992/97	9 75%	288 0	90 37	12 967%	5 75	6 125	12 50	260 267	260 575	3 43%	0 20	0 210	0 43	15 Apr-85	4	0 11	15-Oct-92	15-Oct 97	15 Oct 97
IR FINANCE 14 1/2% 1998/00	14 50%	105 0	102 89	13 121%	6 46	6 888	13 42	108 033	109 492	1 44%	0 09	0 099	0 19	15 Mar 85	35	1 39	15-Sep 98	15-Sep-00	15 Sep 98
IR NATION 11 % 1993/98	11 00%	288 0	94 71	12 996%	6 00	6 385	13 50	272 770	273 117	3 60%	0 22	0 230	0 49	15 Apr 85	4	0 12	15 Oct 93	15-Oct 98	15 Oct 98
IR DEVELO 11 1/2% 1997/99	11 50%	300 0	96 10	13 118%	6 14	6 542	14 58	288 292	285 836	3 77%	0 23	0 246	0 55	15 May-85	26	-0 82	15-Nov 97	15 Nov 99	15 Nov 99
IR CAPITAL 11 3/4% 2000	11 75%	140 0	97 10	12 990%	6 30	6 704	15 00	135 942	136 123	1 79%	0 11	0 120	0 27	15 Apr-85	4	0 13	15-Apr-00	15-Apr-00	15 Apr-00
IR DEVELO 14 3/4% 2002/04	14 75%	120 0	102 58	13 169%	7 10	7 570	16 80	123 097	126 828	1 67%	0 12	0 126	0 28	01 Feb-85	77	3 11	01 Feb-02	01 Feb 04	01 Feb-02
IR FINANCE 13 % 1997/02	13 00%	310 0	99 67	13 179%	6 67	7 113	16 96	308 973	310 959	4 10%	0 27	0 291	0 69	01 Apr-85	18	0 64	01-Apr 97	01 Apr-02	01 Apr-02
IR DEVELO 12 1/4% 2003	12 25%	110 0	98 28	13 194%	6 58	7 013	18 17	108 112	112 723	1 49%	0 10	0 104	0 27	15 Dec 84	125	4 19	15-Jun-03	15 Jun-03	15 Jun-03
IR EXCHEQR 6 1/2% 2000/05	6 50%	153 0	80 98	12 619%	5 58	5 927	20 20	123 892	126 969	1 67%	0 09	0 099	0 34	27 Dec 84	113	2 01	27-Jun-00	27 Jun-05	27 Jun-05
IR CAPITAL 12 1/2% 2005	12 50%	100 0	98 96	13 204%	6 80	7 254	20 67	98 958	103 578	1 36%	0 09	0 099	0 28	05 Dec 84	135	4 62	15 Dec-05	15 Dec 05	15 Dec-05
								7489 634	7589 868	100 00%	3 26	3 467	6 41						

Table A 1 12 Irish Government Treasury Data - October 1986

Trade 17 Oct 85
Sett 18 Oct 85

Stock	Coupon	Nominal Issue	Market Price	Market Yield	Volatility	Duration	Life	Clean Market Value (IR£m)	Dirty Market Value (IR£m)	Stock Weight in Index	Weighted Volatility	Weighted Duration	Weighted Life	Ex Div Date	Accrued Interest	Accrued Interest	First Redemption Date	Last Redemption Date	Redemption Date
IR EXCHEQR 6 % 1980/85	6 00%	136 0	99 81	7 613%	0 12	0 122	0 12	135 746	138 852	1 68%	0 00	0 002	0 00	01 Jun 85	139	2 28	01 Dec-80	01 Dec-85	01 Dec 85
IR FINANCE VAR% 1988	12 73%	220 0	100 02	12 526%	0 12	0 129	0 12	220 051	223 655	2 71%	0 00	0 003	0 00	01 Sep-85	47	1 64	01 Jun-88	01 Jun-88	01 Jun 88
IR FINANCE VAR% 1990	10 78%	450 0	100 01	10 712%	0 10	0 101	0 15	450 044	454 959	5 51%	0 01	0 006	0 01	11 Sep-85	37	1 09	15-May 90	15-May 90	15 May 90
IR FINANCE VAR% 1989	10 64%	25 0	100 03	10 413%	0 09	0 090	0 16	25 008	25 248	0 31%	0 00	0 000	0 00	15 Sep-85	33	0 96	15 Sep-89	15 Sep-89	15 Sep 89
IR FUNDING 10 % 1986	10 00%	145 0	100 21	9 068%	0 24	0 247	0 24	145 308	149 079	1 81%	0 00	0 004	0 00	15 Jul-85	95	2 60	15-Jan-86	15-Jan 86	15 Jan 86
IR NATION 14 % 1985/90	14 00%	151 0	102 23	4 444%	0 25	0 255	0 25	154 372	156 282	1 89%	0 00	0 005	0 00	15 Sep-85	33	1 26	15 Mar 85	15-Mar 90	17 Jan 86
IR FINANCE VAR% 1986	10 76%	175 0	100 08	10 469%	0 04	0 038	0 29	175 137	174 415	2 11%	0 00	0 001	0 01	01 Nov-85	14	-0 41	01 May-86	01-May-86	01 May-86
IR FUNDING 15 1/2% 1986	15 50%	180 0	101 80	9 433%	0 32	0 333	0 33	183 249	188 137	2 28%	0 01	0 008	0 01	15 Aug-85	64	2 72	15 Feb-86	15-Feb 86	15 Feb 86
IR CAPITAL 9 1/2% 1986	9 50%	95 0	100 05	9 372%	0 39	0 407	0 41	95 045	95 861	1 16%	0 00	0 005	0 00	15 Sep 85	33	0 86	15 Mar 86	15 Mar 86	15 Mar 86
IR EXCHEQR 10 3/4% 1986	10 75%	245 0	100 52	9 479%	0 43	0 453	0 45	246 282	247 508	3 00%	0 01	0 014	0 01	01 Oct-85	17	0 50	01 Apr 86	01 Apr 86	01 Apr 86
IR NATION 7 1/2% 1981/85	7 50%	159 0	98 37	10 071%	0 66	0 696	0 70	156 414	159 973	1 94%	0 01	0 013	0 01	01-Jul-85	109	2 24	01-Jul-81	01-Jul 86	01 Jul 86
IR EXCHEQR 12 1/2% 1986	12 50%	180 0	101 83	10 245%	0 88	0 930	0 95	183 295	184 342	2 23%	0 02	0 021	0 02	01 Oct-85	17	0 58	01-Oct-86	01 Oct-86	01 Oct-86
IR FUNDING 12 3/4% 1987	12 75%	180 0	102 80	10 223%	1 24	1 303	1 37	185 048	188 001	2 28%	0 03	0 030	0 03	01 Sep-85	47	1 64	01 Mar-87	01 Mar-87	01 Mar-87
IR CAPITAL 14 % 1987	14 00%	50 0	104 67	10 295%	1 44	1 517	1 62	52 337	55 001	0 67%	0 01	0 010	0 01	01-Jun-85	139	5 33	01-Jun-87	01 Jun-87	01 Jun 87
IR EXCHEQR 9 % 1987	9 00%	180 0	98 27	10 276%	1 50	1 573	1 66	176 892	182 436	2 21%	0 03	0 035	0 04	15 Jun 85	125	3 08	15-Jun-87	15 Jun-87	15 Jun-87
IR FINANCE 16 % 1987	16 00%	150 0	107 36	10 374%	1 53	1 613	1 74	161 037	167 279	2 03%	0 03	0 033	0 04	15 Jul-85	95	4 16	15-Jul-87	15-Jul-87	15 Jul 87
IR EXCHEQR 11 % 1987	11 00%	115 0	101 05	10 279%	1 66	1 745	1 87	116 213	117 841	1 43%	0 02	0 025	0 03	01-Sep-85	47	1 42	01-Sep-87	01-Sep-87	01 Sep-87
IR NATION 5 3/4% 1982/87	5 75%	56 0	92 97	10 026%	1 81	1 896	1 99	52 065	52 091	0 63%	0 01	0 012	0 01	15-Oct-85	3	0 05	15-Oct-82	15-Oct-87	15 Oct 87
IR CONVER 8 1/2 % 1986/88	8 50%	300 0	96 62	10 407%	2 01	2 116	2 29	289 871	295 317	3 58%	0 07	0 076	0 08	01 Aug-85	78	1 82	01 Feb-86	01 Feb 88	01 Feb-88
IR FUNDING 11 1/4% 1988	11 25%	175 0	101 52	10 424%	2 17	2 285	2 54	177 661	176 906	2 14%	0 05	0 049	0 05	01 Nov-85	-14	-0 43	01 May-88	01 May-88	01 May-88
IR CAPITAL 11 % 1988	11 00%	120 0	101 09	10 428%	2 27	2 384	2 66	121 313	125 831	1 52%	0 03	0 036	0 04	15-Jun-85	125	3 76	15-Jun-88	15-Jun-88	15 Jun-88
IR CONVER 15 % 1988	15 00%	90 0	108 59	10 469%	2 39	2 517	2 87	97 734	99 471	1 21%	0 03	0 030	0 03	01 Sep-85	47	1 93	01 Sep-88	01 Sep-88	01 Sep-88
IR FINANCE 9 % 1989	9 00%	150 0	96 55	10 505%	2 75	2 893	3 29	144 819	147 702	1 79%	0 05	0 052	0 06	01 Aug-85	78	1 92	01 Feb-89	01 Feb-89	01 Feb 89
IR DEVELO 2 1/2% 1989	2 50%	25 0	79 93	9 707%	3 19	3 341	3 54	19 982	19 958	0 24%	0 01	0 008	0 01	01 Nov-85	14	-0 10	01 May-89	01 May-89	01 May-89
IR CAPITAL 10 % 1989	10 00%	165 0	98 61	10 583%	2 92	3 078	3 58	162 713	169 761	2 06%	0 06	0 063	0 07	15 May 85	156	4 27	15 May-89	15 May-89	15 May-89
IR NATION 9 3/4% 1984/89	9 75%	265 0	97 89	10 601%	3 07	3 233	3 79	259 417	264 935	3 21%	0 10	0 104	0 12	01 Aug 85	78	2 08	01 Aug 84	01 Aug 89	01 Aug 89
IR EXCHEQR 5 3/4% 1984/89	5 75%	56 0	87 41	10 186%	3 38	3 551	4 04	48 948	48 825	0 59%	0 02	0 021	0 02	01 Nov 85	14	-0 22	01 Nov-84	01 Nov-89	01 Nov-89
IR EXCHEQR 14 % 1990/92	14 00%	155 0	108 22	10 611%	3 35	3 524	4 29	167 739	172 373	2 09%	0 07	0 074	0 09	01 Aug 85	78	2 99	01 Feb 90	01 Feb-92	01 Feb 90
IR EXCHEQR 11 1/2% 1990	11 50%	197 0	102 46	10 596%	3 69	3 888	4 83	201 850	205 820	2 49%	0 09	0 097	0 12	15 Aug 85	64	2 02	15 Aug-90	15 Aug 90	15 Aug 90
IR CAPITAL 13 % 1990	13 00%	60 0	106 41	10 594%	3 78	3 981	4 99	63 844	63 908	0 77%	0 03	0 031	0 04	15 Oct-85	3	0 11	15-Oct 90	15-Oct 90	15 Oct 90
IR EXCHEQR 6 % 1985/90	6 00%	100 0	85 17	10 581%	4 02	4 230	5 08	85 171	84 711	1 03%	0 04	0 043	0 05	15 Nov-85	28	-0 46	15-Nov-85	15-Nov 90	15-Nov 90
IR FINANCE 11 1/2% 1991/93	11 50%	105 0	101 25	11 052%	3 90	4 113	5 25	106 315	109 456	1 33%	0 05	0 055	0 07	15 Jul-85	95	2 99	15-Jan-91	15 Jan 93	15 Jan-91
IR FINANCE 12 1/2% 1991	12 50%	25 0	105 34	10 602%	4 09	4 311	5 54	26 335	26 215	0 32%	0 01	0 014	0 02	01-Nov-85	14	-0 48	01 May 91	01-May 91	01 May 91
IR NATION 6 3/4% 1986/91	6 75%	109 0	86 11	10 798%	4 44	4 684	5 96	93 861	94 204	1 14%	0 05	0 053	0 07	01 Oct-85	17	0 31	01-Oct-86	01-Oct 91	01-Oct 91
IR NATION 7 % 1987/92	7 00%	141 0	85 20	11 186%	4 73	4 994	6 66	120 125	123 503	1 50%	0 07	0 075	0 10	15 Jun-85	125	2 40	15-Jun-87	15-Jun-92	15-Jun-92
IR DEVELO 7 1/2% 1988/93	7 50%	286 0	86 25	11 274%	5 12	5 408	7 71	246 665	253 066	3 07%	0 16	0 166	0 24	01 Jul-85	109	2 24	01-Jul-88	01 Jul 93	01 Jul 93
IR CAPITAL 8 % 1993	8 00%	125 0	88 12	11 291%	5 22	5 513	8 04	110 156	109 773	1 33%	0 07	0 073	0 11	01-Nov-85	-14	-0 31	01 Nov 93	01-Nov 93	01 Nov 93
IR NATION 9 1/4% 1989/94	9 25%	123 0	92 75	11 345%	5 41	5 719	8 71	114 086	117 482	1 42%	0 08	0 081	0 12	01 Jul-85	109	2 76	01-Jul-89	01 Jul 94	01-Jul 94
IR EXCHEQR 13 % 1994	13 00%	30 0	104 91	11 325%	5 63	5 949	9 00	31 474	31 507	0 38%	0 02	0 023	0 03	15 Oct-85	3	0 11	15-Oct 94	15-Oct 94	15 Oct 94
IR CAPITAL 12 1/4% 1995	12 25%	75 0	102 25	11 500%	5 77	6 105	9 62	76 684	80 181	0 97%	0 06	0 059	0 09	01 Jun 85	139	4 66	01 Jun-95	01-Jun-95	01 Jun 95
IR CONVER 12 % 1995	12 00%	222 0	101 50	11 502%	5 86	6 193	9 92	225 336	227 743	2 76%	0 16	0 171	0 27	15 Sep 85	33	1 08	15 Sep 95	15 Sep 95	15 Sep 95
IR EXCHEQR 9 1/4% 1991/96	9 25%	286 0	92 02	11 577%	5 99	6 342	11 05	263 170	262 156	3 18%	0 19	0 201	0 35	01 Nov-85	14	-0 35	01 Nov 91	01 Nov 96	01 Nov 96
IR FINANCE 13 % 1997/02	13 00%	310 0	103 78	11 623%	6 39	6 765	11 46	321 729	323 605	3 92%	0 25	0 265	0 45	01 Oct 85	17	0 61	01-Apr 97	01-Apr-02	01 Apr 97
IR NATION 9 3/4% 1992/97	9 75%	288 0	94 00	11 578%	6 23	6 587	12 00	270 722	270 953	3 28%	0 20	0 216	0 39	15 Oct-85	3	0 08	15-Oct 92	15-Oct 97	15-Oct 97
IR FINANCE 14 1/2% 1998/00	14 50%	105 0	106 73	11 663%	7 03	7 445	12 92	112 067	113 442	1 37%	0 10	0 102	0 18	15 Sep-85	33	1 31	15 Sep 98	15-Sep-00	15 Sep 98
IR NATION 11 % 1993/98	11 00%	288 0	98 18	11 619%	6 54	6 921	13 00	282 751	283 011	3 43%	0 22	0 237	0 45	15 Oct-85	3	0 09	15-Oct 93	15-Oct 98	15 Oct 98
IR DEVELO 11 1/2% 1997/99	11 50%	300 0	99 64	11 631%	6 83	7 223	14 08	298 923	296 278	3 59%	0 25	0 259	0 51	15 Nov-85	28	-0 88	15-Nov 97	15-Nov 99	15 Nov 99
IR CAPITAL 11 3/4% 2000	11 75%	190 0	100 11	11 707%	6 91	7 314	14 50	190 217	190 400	2 31%	0 16	0 169	0 33	15 Oct 85	3	0 10	15-Apr-00	15-Apr-00	15 Apr 00
IR DEVELO 14 3/4% 2002/04	14 75%	120 0	105 82	11 710%	7 98	8 452	16 30	126 979	130 759	1 58%	0 13	0 134	0 26	01 Aug-85	78	3 15	01-Feb-02	01 Feb-04	01 Feb-02
IR DEVELO 12 1/4% 2003	12 25%	110 0	101 01	11 775%	7 50	7 942	17 67	111 109	115 721	1 40%	0 11	0 111	0 25	15 Jun-85	125	4 19	15-Jun-03	15-Jun-03	15-Jun-03
IR EXCHEQR 6 1/2% 2000/05	6 50%	153 0	82 92	11 391%	6 45	6 816	19 70	126 862	129 939	1 57%	0 10	0 107	0 31	27 Jun-85	113	2 01	27 Jun-00	27 Jun-05	27 Jun-05
IR CAPITAL 12 1/2% 2005	12 50%	120 0	101 41	11 706%	7 96	8 426	20 17	121 695	126 829	1 54%	0 12	0 129	0 31	15 Jun 85	125	4 28	15-Dec-05	15-Dec-05	15 Dec-05
								8131 868	8252 699	100 00%	3 42	3 613	5 95						

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Trade 16 Apr 86
Sett 18 Apr 86

Stock		Coupon	Nominal Issue	Market Price	Market Yield	Volatility	Duration	Life	Clean Market Value (IR£m)	Dirty Market Value (IR£m)	Stock Weight in Index	Weighted Volatility	Weighted Duration	Weighted Life	Ex Div Date	Accrued Interest (days)	Accrued Interest (IR£m)	First Redemption Date	Last Redemption Date	Redemption Date
IR FINANCE VAR%	1988	10.75%	220.0	99.96	11.128%	0.11	0.118	0.12	219.908	223.016	2.41%	0.00	0.003	0.00	01 Mar 86	48	1.41	01 Jun 88	01 Jun 88	01 Jun 88
IR FINANCE VAR%	1989	15.10%	75.0	100.08	14.561%	0.09	0.093	0.16	75.057	76.111	0.82%	0.00	0.001	0.00	15 Mar 86	34	1.41	15 Sep 89	15 Sep 89	15 Sep 89
IR NATION 7 1/2%	1981/85	7.50%	159.0	99.25	11.449%	0.19	0.205	0.20	157.807	161.301	1.75%	0.00	0.004	0.00	01 Jan 86	107	2.20	01 Jul 81	01 Jul 86	01 Jul 86
IR NATION 9 3/4%	1984/89	9.75%	270.0	101.74	2.483%	0.25	0.253	0.25	274.689	280.167	3.03%	0.01	0.008	0.01	01 Feb 86	76	2.03	01 Aug 84	01 Aug 89	18 Jul 86
IR FINANCE VAR%	1990	10.40%	450.0	99.98	10.472%	0.07	0.074	0.32	449.897	446.439	4.83%	0.00	0.004	0.02	15 May 86	27	-0.77	15 May 90	15 May 90	15 May 90
IR EXCHEQR 12 1/2%	1986	12.50%	180.0	100.85	10.423%	0.43	0.456	0.45	181.529	182.576	1.98%	0.01	0.009	0.01	01 Apr 86	17	0.58	01 Oct 86	01 Oct 86	01 Oct 86
IR FUNDING 12 3/4%	1987	12.75%	180.0	102.07	9.981%	0.81	0.851	0.87	183.721	186.737	2.02%	0.02	0.017	0.02	01 Mar 86	48	1.68	01 Mar 87	01 Mar 87	01 Mar 87
IR CAPITAL 14 %	1987	14.00%	50.0	104.12	9.573%	1.03	1.081	1.12	52.061	54.705	0.59%	0.01	0.006	0.01	01 Dec 85	138	5.29	01 Jun 87	01 Jun 87	01 Jun 87
IR EXCHEQR 9 %	1987	9.00%	235.0	99.54	9.466%	1.07	1.126	1.16	233.908	241.088	2.61%	0.03	0.029	0.03	15 Dec 85	124	3.06	15 Jun 87	15 Jun 87	15 Jun 87
IR FINANCE 16 %	1987	16.00%	150.0	106.73	9.289%	1.13	1.187	1.24	160.099	166.210	1.80%	0.02	0.021	0.02	15 Jan 86	93	4.07	15 Jul 87	15 Jul 87	15 Jul 87
IR EXCHEQR 11 %	1987	11.00%	140.0	101.90	9.335%	1.26	1.314	1.37	142.658	144.682	1.57%	0.02	0.021	0.02	01 Mar 86	48	1.45	01 Sep 87	01 Sep 87	01 Sep 87
IR NATION 5 3/4%	1982/87	5.75%	91.0	95.51	9.228%	1.38	1.447	1.49	86.917	86.960	0.94%	0.01	0.014	0.01	15 Apr 86	3	0.05	15 Oct 82	15 Oct 87	15 Oct 87
IR CONVER 8 1/2 %	1986/88	8.50%	315.0	98.91	9.242%	1.62	1.697	1.79	311.568	317.140	3.43%	0.06	0.058	0.06	01 Feb 86	76	1.77	01 Feb 86	01 Feb 88	01 Feb 88
IR FUNDING 11 1/4%	1988	11.25%	185.0	103.22	9.218%	1.81	1.889	2.04	190.950	190.209	2.06%	0.04	0.039	0.04	01 May 86	-13	-0.40	01 May 88	01 May 88	01 May 88
IR CAPITAL 11 %	1988	11.00%	160.0	103.03	9.178%	1.91	1.994	2.16	164.849	170.824	1.85%	0.04	0.037	0.04	15 Dec 85	124	3.73	15 Jun 88	15 Jun 88	15 Jun 88
IR CONVER 15 %	1988	15.00%	120.0	109.82	9.212%	2.05	2.145	2.38	131.780	134.146	1.45%	0.03	0.031	0.03	01 Mar 86	48	1.97	01 Sep 88	01 Sep 88	01 Sep 88
IR FINANCE 9 %	1989	9.00%	285.0	99.70	9.145%	2.42	2.530	2.79	284.139	289.476	3.13%	0.08	0.079	0.09	01 Feb 86	76	1.87	01 Feb 89	01 Feb 89	01 Feb 89
IR DEVELO 2 1/2%	1989	2.50%	25.0	87.72	7.291%	2.82	2.918	3.04	21.929	21.907	0.24%	0.01	0.007	0.01	01 May 86	13	-0.09	01 May 89	01 May 89	01 May 89
IR CAPITAL 10 %	1989	10.00%	195.0	101.93	9.126%	2.62	2.738	3.08	198.755	197.314	2.14%	0.06	0.058	0.07	15 May 86	27	-0.74	15 May 89	15 May 89	15 May 89
IR NATIONL 9 1/4%	1989/94	9.25%	294.0	100.00	9.250%	2.72	2.846	3.21	294.001	301.968	3.27%	0.09	0.093	0.10	01 Jan 86	107	2.71	01 Jul 89	01 Jul 94	01 Jul 89
IR NATION 9 1/4%	1989/94	9.25%	294.0	100.00	9.250%	2.72	2.846	3.21	294.000	301.967	3.27%	0.09	0.093	0.10	01 Jan 86	107	2.71	01 Jul 89	01 Jul 94	01 Jul 89
IR EXCHEQR 5 3/4%	1984/89	5.75%	101.0	91.65	8.902%	3.06	3.201	3.54	92.563	92.356	1.00%	0.03	0.032	0.04	01 May 86	-13	-0.20	01 Nov 84	01 Nov 89	01 Nov 89
IR EXCHEQR 14 %	1990/92	14.00%	155.0	110.99	9.298%	3.09	3.229	3.79	172.034	176.550	1.91%	0.06	0.062	0.07	01 Feb 86	76	2.91	01 Feb 90	01 Feb 92	01 Feb 90
IR EXCHEQR 14 %	1990/92	14.00%	151.0	101.18	13.448%	2.89	3.088	3.79	152.789	157.188	1.70%	0.05	0.053	0.06	01 Feb 86	76	2.91	01 Feb 90	01 Feb 92	01 Feb 90
IR EXCHEQR 11 1/2%	1990	11.50%	207.0	106.45	9.082%	3.48	3.633	4.33	220.356	224.397	2.43%	0.08	0.088	0.11	15 Feb 86	62	1.95	15 Aug 90	15 Aug 90	15 Aug 90
IR CAPITAL 13 %	1990	13.00%	70.0	110.31	9.083%	3.58	3.738	4.50	77.218	77.292	0.84%	0.03	0.031	0.04	15 Apr 86	3	0.11	15 Oct 90	15 Oct 90	15 Oct 90
IR EXCHEQR 6 %	1985/90	6.00%	185.0	90.85	8.895%	3.80	3.968	4.58	168.064	167.243	1.81%	0.07	0.072	0.08	15 May 86	27	-0.44	15 Nov 85	15 Nov 90	15 Nov 90
IR FINANCE 11 1/2%	1991/93	11.50%	130.0	106.63	9.135%	3.75	3.917	4.75	138.617	142.423	1.54%	0.06	0.060	0.07	15 Jan 86	93	2.93	15 Jan 91	15 Jan 93	15 Jan 91
IR FINANCE 12 1/2%	1991	12.50%	25.0	109.58	9.100%	3.93	4.107	5.04	27.395	27.284	0.30%	0.01	0.012	0.01	01 May 86	13	-0.44	01 May 91	01 May 91	01 May 91
IR NATION 6 3/4%	1986/91	6.75%	154.0	91.87	9.116%	4.31	4.509	5.46	141.478	141.962	1.54%	0.07	0.069	0.08	01 Apr 86	17	0.31	01 Oct 86	01 Oct 91	01 Oct 91
IR EXCHEQR 9 1/4%	1991/96	9.25%	301.0	100.30	9.156%	4.27	4.465	5.54	301.907	300.916	3.26%	0.14	0.145	0.18	01 May 86	13	-0.33	01 Nov 91	01 Nov 96	01 Nov 91
IR NATION 7 %	1987/92	7.00%	196.0	92.18	9.147%	4.71	4.927	6.16	180.677	185.335	2.01%	0.09	0.099	0.12	15 Dec 85	124	2.38	15 Jun 87	15 Jun 92	15 Jun 92
IR NATION 9 3/4%	1992/97	9.75%	298.0	102.30	9.077%	4.82	5.036	6.50	304.847	305.086	3.30%	0.16	0.166	0.21	15 Apr 86	3	0.08	15 Oct 92	15 Oct 97	15 Oct 92
IR DEVELO 7 1/2%	1988/93	7.50%	296.0	93.71	9.136%	5.24	5.484	7.21	277.368	283.871	3.07%	0.16	0.168	0.22	01 Jan 86	107	2.20	01 Jul 88	01 Jul 93	01 Jul 93
IR NATION 11 %	1993/98	11.00%	303.0	105.89	9.271%	5.32	5.568	7.50	320.833	321.107	3.48%	0.18	0.193	0.26	15 Apr 86	3	0.09	15 Oct 93	15 Oct 98	15 Oct 93
IR CAPITAL 8 %	1993	8.00%	280.0	95.67	9.127%	5.39	5.640	7.55	267.870	267.073	2.89%	0.16	0.163	0.22	01 May 86	-13	-0.28	01 Nov 93	01 Nov 93	01 Nov 93
IR EXCHEQR 13 %	1994	13.00%	30.0	112.49	9.143%	5.93	6.203	8.50	33.746	33.778	0.37%	0.02	0.023	0.03	15 Apr 86	3	0.11	15 Oct 94	15 Oct 94	15 Oct 94
IR CAPITAL 12 1/4%	1995	12.25%	85.0	110.41	9.151%	6.21	6.495	9.13	93.845	97.779	1.06%	0.07	0.069	0.10	01 Dec 85	138	4.63	01 Jun 95	01 Jun 95	01 Jun 95
IR CONVER 12 %	1995	12.00%	242.0	109.67	9.155%	6.34	6.627	9.42	265.403	268.106	2.90%	0.18	0.192	0.27	15 Mar 86	34	1.12	15 Sep 95	15 Sep 95	15 Sep 95
IR FINANCE 13 %	1997/02	13.00%	310.0	111.95	9.256%	7.12	7.453	10.96	347.041	348.917	3.78%	0.27	0.281	0.41	01 Apr 86	17	0.61	01 Apr 97	01 Apr 02	01 Apr 97
IR DEVELO 11 1/2%	1997/99	11.50%	300.0	107.68	9.256%	7.22	7.557	11.59	323.034	320.484	3.47%	0.25	0.262	0.40	15 May 86	27	-0.85	15 Nov 97	15 Nov 99	15 Nov 97
IR FINANCE 14 1/2%	1998/00	14.50%	105.0	114.89	9.266%	8.03	8.404	12.42	120.636	122.053	1.32%	0.11	0.111	0.16	15 Mar 86	34	1.35	15 Sep 98	15 Sep 00	15 Sep 98
IR CAPITAL 11 3/4%	2000	11.75%	300.0	107.87	9.279%	8.17	8.550	14.00	323.598	323.888	3.51%	0.29	0.300	0.49	15 Apr 86	3	0.10	15 Apr 00	15 Apr 00	15 Apr 00
IR DEVELO 14 3/4%	2002/04	14.75%	120.0	113.32	9.274%	9.64	10.090	15.80	135.981	139.664	1.51%	0.15	0.153	0.24	01 Feb 86	76	3.07	01 Feb 02	01 Feb 04	01 Feb 02
IR DEVELO 12 1/4%	2003	12.25%	110.0	107.45	9.466%	9.21	9.642	17.17	118.193	122.768	1.33%	0.12	0.128	0.23	15 Dec 85	124	4.16	15 Jun 03	15 Jun 03	15 Jun 03
IR EXCHEQR 6 1/2%	2000/05	6.50%	248.0	89.51	8.900%	8.49	8.864	19.21	221.980	226.924	2.46%	0.21	0.218	0.47	27 Dec 85	112	1.99	27 Jun 00	27 Jun 05	27 Jun 05
IR CAPITAL 12 1/2%	2005	12.50%	170.0	107.66	9.255%	10.24	10.710	19.67	183.022	190.237	2.06%	0.21	0.221	0.41	15 Dec 85	124	4.24	15 Dec 05	15 Dec 05	15 Dec 05
									9120.719	9239.621	100.00%	3.83	4.004	5.70						

Table A1.14 Irish Government Treasury Data - October 1986

Trade 16 Oct 86
Sett 17 Oct 86

Stock		Coupon	Nominal Issue	Market Price	Market Yield	Volatility	Duration	Life	Clean Market Value (IR£m)	Dirty Market Value (IR£m)	Stock Weight in Index	Weighted Volatility	Weighted Duration	Weighted Life	Ex Div Date	Accrued Interest	Accrued Interest	First Redemption Date	Last Redemption Date	Redemption Date
IR FINANCE VAR%	1988	8.86%	220.0	99.92	9.535%	0.12	0.126	0.12	219.826	222.280	2.54%	0.00	0.003	0.00	01-Sep-86	46	1.12	01-Jun-88	01-Jun-88	01-Jun-88
IR FINANCE VAR%	1989	10.93%	120.0	99.89	11.675%	0.09	0.088	0.16	119.865	121.014	1.38%	0.00	0.001	0.00	15-Sep-86	32	0.96	15-Sep-89	15-Sep-89	15-Sep-89
IR FINANCE VAR%	1990	10.47%	451.0	99.93	10.692%	0.08	0.079	0.33	450.696	446.947	5.10%	0.00	0.004	0.02	15-Nov-86	29	-0.83	15-May-90	15-May-90	15-May-90
IR FUNDING 12 3/4%	1987	12.75%	180.0	99.86	13.178%	0.35	0.373	0.37	179.745	182.635	2.09%	0.01	0.008	0.01	01-Sep-86	46	1.61	01-Mar-87	01-Mar-87	01-Mar-87
IR CAPITAL 14 %	1987	14.00%	50.0	100.23	13.567%	0.58	0.617	0.62	50.116	52.761	0.60%	0.00	0.004	0.00	01-Jun-86	138	5.29	01-Jun-87	01-Jun-87	01-Jun-87
IR EXCHEQR 9 %	1987	9.00%	270.0	97.24	13.743%	0.61	0.655	0.66	262.561	270.811	3.09%	0.02	0.020	0.02	15-Jun-86	124	3.06	15-Jun-87	15-Jun-87	15-Jun-87
IR FINANCE 16 %	1987	16.00%	150.0	101.41	13.733%	0.68	0.730	0.74	152.113	158.289	1.81%	0.01	0.013	0.01	15-Jul-86	94	4.12	15-Jul-87	15-Jul-87	15-Jul-87
IR EXCHEQR 11 %	1987	11.00%	140.0	97.96	13.757%	0.80	0.855	0.87	137.140	139.079	1.59%	0.01	0.014	0.01	01-Sep-86	46	1.39	01-Sep-87	01-Sep-87	01-Sep-87
IR NATION 5 3/4%	1982/87	5.75%	176.0	93.20	13.623%	0.91	0.977	0.99	164.027	164.083	1.87%	0.02	0.018	0.02	15-Oct-86	2	0.03	15-Oct-82	15-Oct-87	15-Oct-87
IR CONVER 8 1/2 %	1986/88	8.50%	315.0	94.25	13.902%	1.16	1.244	1.29	296.894	302.538	3.45%	0.04	0.043	0.04	01-Aug-86	77	1.79	01-Feb-86	01-Feb-88	01-Feb-88
IR FUNDING 11 1/4%	1988	11.25%	185.0	96.83	13.890%	1.35	1.449	1.54	179.135	178.280	2.04%	0.03	0.029	0.03	01-Nov-86	15	-0.46	01-May-88	01-May-88	01-May-88
IR CAPITAL 11 %	1988	11.00%	160.0	96.35	13.844%	1.45	1.555	1.66	154.168	160.143	1.83%	0.03	0.028	0.03	15-Jun-86	124	3.73	15-Jun-88	15-Jun-88	15-Jun-88
IR CAPITAL 7 1/4 %	1988	7.25%	25.0	90.54	13.810%	1.61	1.725	1.83	22.634	22.753	0.26%	0.00	0.004	0.00	23-Sep-86	24	0.48	15-Aug-88	15-Aug-88	15-Aug-88
IR CONVER 15 %	1988	15.00%	120.0	101.55	13.847%	1.60	1.710	1.88	121.865	124.132	1.42%	0.02	0.024	0.03	01-Sep-86	46	1.89	01-Sep-88	01-Sep-88	01-Sep-88
IR FINANCE 9 %	1989	9.00%	285.0	91.67	13.951%	1.95	2.089	2.30	261.266	266.673	3.04%	0.06	0.064	0.07	01-Aug-86	77	1.90	01-Feb-89	01-Feb-89	01-Feb-89
IR DEVELO 2 1/2%	1989	2.50%	25.0	80.77	11.848%	2.31	2.444	2.54	20.192	20.166	0.23%	0.01	0.006	0.01	01-Nov-86	15	-0.10	01-May-89	01-May-89	01-May-89
IR CAPITAL 10 %	1989	10.00%	215.0	93.06	13.842%	2.15	2.294	2.58	200.080	198.373	2.26%	0.05	0.052	0.06	15-Nov-86	-29	-0.79	15-May-89	15-May-89	15-May-89
IR NATION 9 3/4%	1984/89	9.75%	270.0	92.09	13.881%	2.30	2.456	2.79	248.642	254.192	2.90%	0.07	0.071	0.08	01-Aug-86	77	2.06	01-Aug-84	01-Aug-89	01-Aug-89
IR EXCHEQR 5 3/4%	1984/89	5.75%	156.0	82.44	13.813%	2.56	2.741	3.04	128.610	128.242	1.46%	0.04	0.040	0.04	01-Nov-86	15	-0.24	01-Nov-84	01-Nov-89	01-Nov-89
IR EXCHEQR 14 %	1990/92	14.00%	155.0	100.73	13.632%	2.58	2.759	3.30	156.131	160.705	1.83%	0.05	0.051	0.06	01-Aug-86	77	2.95	01-Feb-90	01-Feb-92	01-Feb-90
IR EXCHEQR 11 1/2%	1990	11.50%	207.0	95.72	13.382%	2.95	3.142	3.83	198.151	202.257	2.31%	0.07	0.073	0.09	15-Aug-86	63	1.98	15-Aug-90	15-Aug-90	15-Aug-90
IR CAPITAL 13 %	1990	13.00%	71.0	99.29	13.314%	3.03	3.229	4.00	70.497	70.548	0.81%	0.02	0.026	0.03	15-Oct-86	2	0.07	15-Oct-90	15-Oct-90	15-Oct-90
IR EXCHEQR 6 %	1985/90	6.00%	254.0	80.12	13.495%	3.25	3.474	4.08	203.504	202.294	2.31%	0.08	0.080	0.09	15-Nov-86	-29	-0.48	15-Nov-85	15-Nov-90	15-Nov-90
IR FINANCE 12 1/2%	1991	12.50%	25.0	97.89	13.373%	3.33	3.553	4.54	24.473	24.345	0.28%	0.01	0.010	0.01	01-Nov-86	-15	-0.51	01-May-91	01-May-91	01-May-91
IR NATION 6 3/4%	1986/91	6.75%	201.0	80.40	13.486%	3.71	3.960	4.96	161.608	162.202	1.85%	0.07	0.073	0.09	01-Oct-86	16	0.30	01-Oct-86	01-Oct-91	01-Oct-91
IR NATION 7 %	1987/92	7.00%	269.0	79.77	13.584%	4.03	4.301	5.67	214.591	220.984	2.52%	0.10	0.109	0.14	15-Jun-86	124	2.38	15-Jun-87	15-Jun-92	15-Jun-92
IR FINANCE 11 1/2%	1991/93	11.50%	130.0	94.20	13.611%	4.12	4.401	6.25	122.455	126.302	1.44%	0.06	0.063	0.09	15-Jul-86	94	2.96	15-Jan-91	15-Jan-93	15-Jan-93
IR DEVELO 7 1/2%	1988/93	7.50%	296.0	80.35	13.600%	4.41	4.710	6.71	237.822	244.386	2.79%	0.12	0.131	0.19	01-Jul-86	108	2.22	01-Jul-88	01-Jul-93	01-Jul-93
IR CAPITAL 8 %	1993	8.00%	310.0	82.02	13.604%	4.50	4.802	7.05	254.261	253.242	2.89%	0.13	0.139	0.20	01-Nov-86	-15	-0.33	01-Nov-93	01-Nov-93	01-Nov-93
IR NATION 9 1/4%	1989/94	9.25%	300.0	86.23	13.690%	4.64	4.957	7.71	258.676	266.881	3.05%	0.14	0.151	0.23	01-Jul-86	108	2.74	01-Jul-89	01-Jul-94	01-Jul-94
IR EXCHEQR 13 %	1994	13.00%	30.0	98.46	13.574%	4.77	5.096	8.00	29.538	29.560	0.34%	0.02	0.017	0.03	15-Oct-86	2	0.07	15-Oct-94	15-Oct-94	15-Oct-94
IR CAPITAL 12 1/4%	1995	12.25%	85.0	96.25	13.613%	4.93	5.268	8.63	81.813	85.747	0.98%	0.05	0.052	0.08	01-Jun-86	138	4.63	01-Jun-95	01-Jun-95	01-Jun-95
IR CONVER 12 %	1995	12.00%	241.0	95.55	13.605%	5.01	5.347	8.92	230.270	232.804	2.66%	0.13	0.142	0.24	15-Sep-86	32	1.05	15-Sep-95	15-Sep-95	15-Sep-95
IR EXCHEQR 9 1/4%	1991/96	9.25%	301.0	86.13	13.687%	5.15	5.506	10.05	259.254	258.111	2.95%	0.15	0.162	0.30	01-Nov-86	-15	-0.38	01-Nov-91	01-Nov-96	01-Nov-96
IR CAPITAL 7 3/4 %	1997	7.75%	140.0	79.89	13.705%	5.24	5.598	10.75	111.851	114.643	1.31%	0.07	0.073	0.14	15-Jul-86	94	1.99	15-Jul-97	15-Jul-97	15-Jul-97
IR NATION 9 3/4%	1992/97	9.75%	298.0	88.15	13.717%	5.30	5.661	11.00	262.679	262.838	3.00%	0.16	0.170	0.33	15-Oct-86	2	0.05	15-Oct-92	15-Oct-97	15-Oct-97
IR FINANCE 14 1/2%	1998/00	14.50%	105.0	101.61	13.765%	5.87	6.275	11.92	106.689	108.023	1.23%	0.07	0.077	0.15	15-Sep-86	32	1.27	15-Sep-98	15-Sep-00	15-Sep-98
IR NATION 11 %	1993/98	11.00%	303.0	92.70	13.712%	5.51	5.893	12.00	280.876	281.059	3.21%	0.18	0.189	0.39	15-Oct-86	2	0.06	15-Oct-93	15-Oct-98	15-Oct-98
IR DEVELO 11 1/2%	1997/99	11.50%	300.0	94.48	13.714%	5.70	6.091	13.09	283.433	280.694	3.20%	0.18	0.195	0.42	15-Nov-86	29	-0.91	15-Nov-97	15-Nov-99	15-Nov-99
IR CAPITAL 11 3/4%	2000	11.75%	300.0	95.25	13.726%	5.78	6.172	13.50	285.756	285.949	3.26%	0.19	0.201	0.44	15-Oct-86	2	0.06	15-Apr-00	15-Apr-00	15-Apr-00
IR CAPITAL 8 %	2001	8.00%	205.0	82.96	13.653%	5.43	5.797	15.01	170.074	170.164	1.94%	0.11	0.113	0.29	15-Oct-86	2	0.04	15-Oct-01	15-Oct-01	15-Oct-01
IR DEVELO 14 3/4%	2002/04	14.75%	121.0	101.72	13.761%	6.53	6.976	15.30	123.080	126.843	1.45%	0.09	0.101	0.22	01-Aug-86	77	3.11	01-Feb-02	01-Feb-04	01-Feb-02
IR FINANCE 13 %	1997/02	13.00%	310.0	98.55	13.741%	6.19	6.619	15.47	305.500	307.266	3.51%	0.22	0.232	0.54	01-Oct-86	16	0.57	01-Apr-97	01-Apr-02	01-Apr-02
IR DEVELO 12 1/4%	2000/03	12.25%	110.0	97.11	13.755%	6.13	6.555	16.67	106.819	111.394	1.27%	0.08	0.083	0.21	15-Jun-86	124	4.16	15-Jun-00	15-Jun-03	15-Jun-03
IR EXCHEQR 6 1/2%	2000/05	6.50%	305.0	78.14	13.713%	5.04	5.385	18.71	238.336	244.415	2.79%	0.14	0.150	0.52	27-Jun-86	112	1.99	27-Jun-00	27-Jun-05	27-Jun-05
IR CAPITAL 12 1/2%	2005	12.50%	170.0	98.04	13.745%	6.35	6.787	19.18	166.663	173.878	1.99%	0.13	0.135	0.38	15-Jun-86	124	4.24	15-Dec-05	15-Dec-05	15-Dec-05
IR CAPITAL 8 1/4%	2008	8.25%	70.0	88.43	13.675%	5.22	5.579	21.80	61.901	62.439	0.71%	0.04	0.040	0.16	13-Sep-86	34	0.77	30-Jul-08	30-Jul-08	30-Jul-08
IR CAPITAL 8 1/2%	2010	8.25%	305.0	90.11	13.355%	5.33	5.688	23.97	274.836	275.939	3.15%	0.17	0.179	0.76	01-Oct-86	16	0.36	01-Oct-10	01-Oct-10	01-Oct-10
									8651.110	8759.299	100.00%	3.43	3.666	7.32						

Trade	16 Apr-87
Sett	21-Apr-87

Stock		Coupon	Nominal Issue	Market Price	Market Yield	Volatility	Duration	Life	Clean Market Value (IR£m)	Dirty Market Value (IR£m)	Stock Weight in Index	Weighted Volatility	Weighted Duration	Weighted Life	Ex-Div Date	Accrued Interest	Accrued Interest	First Redemption Date	Last Redemption Date	Redemption Date
IR FINANCE VAR%	1988	8 853%	220 0	100 01	8 757%	0 14	0 140	0 11	220 022	222 742	1 96%	0 00	0 003	0 00	01 Mar 87	51	1 24	01-Jun-88	01-Jun 88	01-Jun 88
IR CAPITAL 14 %	1987	14 000%	50 0	100 36	10 509%	0 11	0 115	0 11	50 182	52 885	0 47%	0 00	0 001	0 00	01-Dec-86	141	5 40	01-Jun-87	01-Jun-87	01-Jun-87
IR FINANCE VAR%	1989	15 093%	120 0	100 01	14 991%	0 10	0 101	0 15	120 016	121 851	1 07%	0 00	0 001	0 00	15-Mar-87	37	1 53	15-Sep-89	15-Sep-89	15-Sep-89
IR EXCHEQR 9 %	1987	9 000%	270 0	99 67	11 333%	0 14	0 153	0 15	269 110	277 559	2 45%	0 00	0 004	0 00	15-Dec-86	127	3 13	15-Jun-87	15-Jun-87	15-Jun-87
IR FINANCE 16 %	1987	16 000%	150 0	101 04	11 086%	0 23	0 238	0 23	151 560	157 868	1 39%	0 00	0 003	0 00	15-Jan-87	96	4 21	15-Jul-87	15-Jul-87	15-Jul-87
IR NATION 14 %	1985/90	14 000%	150 0	100 53	11 662%	0 24	0 254	0 25	150 799	152 926	1 35%	0 00	0 003	0 00	15-Mar-87	37	1 42	15-Mar-85	15-Mar-90	21-Jul-87
IR FINANCE VAR%	1990	10 342%	451 0	100 00	10 342%	0 06	0 066	0 32	451 000	447 935	3 95%	0 00	0 003	0 01	15-May-87	24	-0 68	15-May-90	15-May-90	15-May-90
IR EXCHEQR 11 %	1987	11 000%	140 0	99 76	11 721%	0 35	0 367	0 36	139 666	141 816	1 25%	0 00	0 005	0 00	01-Mar-87	51	1 54	01-Sep-87	01-Sep-87	01-Sep-87
IR NATION 5 3/4%	1982/87	5 750%	191 0	97 47	11 413%	0 46	0 485	0 48	186 171	186 351	1 64%	0 01	0 008	0 01	15-Apr-87	6	0 09	15-Oct-82	15-Oct-87	15-Oct-87
IR CONVER 8 1/2 %	1986/88	8 500%	320 0	97 91	11 516%	0 73	0 773	0 78	313 327	319 210	2 81%	0 02	0 022	0 02	01-Feb-87	79	1 84	01-Feb-86	01-Feb-88	01-Feb-88
IR FUNDING 11 1/4%	1988	11 250%	185 0	99 77	11 514%	0 95	1 001	1 03	184 575	184 005	1 62%	0 02	0 016	0 02	01-May-87	10	-0 31	01-May-88	01-May-88	01-May-88
IR CAPITAL 11 %	1988	11 000%	165 0	99 50	11 523%	1 05	1 114	1 15	164 170	170 481	1 50%	0 02	0 017	0 02	15-Dec-86	127	3 82	15-Jun-88	15-Jun-88	15-Jun-88
IR CAPITAL 7 1/4 %	1988	7 250%	250 0	95 60	11 177%	1 21	1 278	1 32	238 994	242 220	2 14%	0 03	0 027	0 03	15-Feb-87	65	1 29	15-Aug-88	15-Aug-88	15-Aug-88
IR CONVER 15 %	1988	15 000%	120 0	103 71	11 551%	1 22	1 294	1 37	124 452	126 966	1 12%	0 01	0 014	0 02	01-Mar-87	51	2 09	01-Sep-88	01-Sep-88	01-Sep-88
IR FINANCE 9 %	1989	9 000%	290 0	96 48	11 477%	1 59	1 681	1 79	279 787	285 432	2 52%	0 04	0 042	0 04	01-Feb-87	79	1 95	01-Feb-89	01-Feb-89	01-Feb-89
IR DEVELO 2 1/2%	1989	2 500%	25 0	84 85	11 346%	1 87	1 977	2 03	21 212	21 194	0 19%	0 00	0 004	0 00	01 May-87	10	-0 07	01 May-89	01 May-89	01 May-89
IR CAPITAL 10 %	1989	10 000%	260 0	97 71	11 447%	1 81	1 911	2 07	254 047	252 339	2 22%	0 04	0 043	0 05	15 May 87	24	-0 66	15 May 89	15 May 89	15 May 89
IR NATION 9 3/4%	1984/89	9 750%	309 0	97 16	11 408%	1 98	2 088	2 28	300 223	306 739	2 70%	0 05	0 056	0 06	01-Feb 87	79	2 11	01-Aug-84	01-Aug 89	01 Aug 89
IR EXCHEQR 5 3/4%	1984/89	5 750%	305 0	89 56	11 028%	2 24	2 358	2 53	273 169	272 689	2 40%	0 05	0 057	0 06	01-May-87	10	-0 16	01-Nov-84	01-Nov-89	01-Nov-89
IR EXCHEQR 14 %	1990/92	14 000%	115 0	104 11	11 778%	2 30	2 436	2 79	119 723	123 205	1 09%	0 02	0 026	0 03	01-Feb-87	79	3 03	01-Feb-90	01-Feb-92	01-Feb-90
IR EXCHEQR 11 1/2%	1990	11 500%	207 0	100 12	11 445%	2 70	2 853	3 32	207 249	211 485	1 86%	0 05	0 053	0 06	15-Feb-87	65	2 05	15-Aug-90	15-Aug-90	15-Aug-90
IR CAPITAL 13 %	1990	13 000%	71 0	103 44	11 418%	2 80	2 955	3 49	73 443	73 595	0 65%	0 02	0 019	0 02	15-Apr-87	6	0 21	15-Oct-90	15-Oct-90	15-Oct-90
IR EXCHEQR 6 %	1985/90	6 000%	311 0	86 28	11 423%	3 00	3 167	3 57	268 337	267 111	2 36%	0 07	0 075	0 08	15-May-87	24	-0 39	15-Nov-85	15-Nov-90	15-Nov-90
IR FINANCE 11 1/2%	1991/93	11 500%	130 0	100 20	11 416%	2 98	3 145	3 74	130 255	134 184	1 18%	0 04	0 037	0 04	15-Jan-87	96	3 02	15-Jan-91	15-Jan-93	15-Jan-91
IR FINANCE 12 1/2%	1991	12 500%	25 0	102 56	11 424%	3 15	3 327	4 03	25 641	25 555	0 23%	0 01	0 007	0 01	01-May-87	10	-0 34	01-May-91	01-May-91	01-May-91
IR CAPITAL 8 1/2%	1991	8 500%	135 0	93 85	10 767%	3 38	3 562	4 24	126 695	128 360	1 13%	0 04	0 040	0 05	27-Feb-87	53	1 23	15-Jul-91	15-Jul-91	15-Jul-91
IR NATION 6 3/4%	1986/91	6 750%	307 0	86 54	11 438%	3 54	3 745	4 45	265 669	268 803	2 35%	0 08	0 088	0 10	01-Apr-87	20	0 37	01-Oct-86	01-Oct-91	01-Oct-91
IR NATION 7 %	1987/92	7 000%	311 0	87 06	11 136%	3 97	4 188	5 16	270 745	278 315	2 45%	0 10	0 103	0 13	15-Dec-86	127	2 43	15-Jun-87	15-Jun-92	15-Jun 92
IR DEVELO 7 1/2%	1988/93	7 500%	309 0	87 48	11 219%	4 48	4 732	6 20	270 301	277 281	2 44%	0 11	0 116	0 15	01-Jan-87	110	2 26	01-Jul-88	01-Jul-93	01-Jul-93
IR CAPITAL 8 %	1993	8 000%	310 0	89 06	11 235%	4 61	4 872	6 54	276 084	275 405	2 43%	0 11	0 118	0 16	01-May-87	-10	-0 22	01-Nov-93	01-Nov-93	01-Nov-93
IR CAPITAL 7 %	1994	7 000%	317 0	85 26	11 096%	4 85	5 117	6 90	270 269	272 517	2 40%	0 12	0 123	0 17	15-Mar-87	37	0 71	15-Mar-94	15-Mar-94	15-Mar-94
IR NATION 9 1/4%	1989/94	9 250%	300 0	93 15	11 307%	4 85	5 126	7 20	279 447	287 804	2 54%	0 12	0 130	0 18	01-Jan-87	110	2 79	01-Jul-89	01-Jul-94	01-Jul-94
IR EXCHEQR 13 %	1994	13 000%	19 0	105 48	11 137%	5 02	5 305	7 49	20 040	20 081	0 18%	0 01	0 009	0 01	15-Apr-87	6	0 21	15-Oct-94	15-Oct-94	15-Oct-94
IR CAPITAL 12 1/4%	1995	12 250%	85 0	103 37	11 146%	5 28	5 573	8 12	87 862	91 881	0 81%	0 04	0 045	0 07	01-Dec-86	141	4 73	01-Jun-95	01-Jun-95	01-Jun-95
IR CONVER 12 %	1995	12 000%	209 0	102 65	11 143%	5 39	5 693	8 41	214 529	217 070	1 91%	0 10	0 109	0 16	15-Mar-87	37	1 22	15-Sep-95	15-Sep-95	15-Sep-95
IR EXCHEQR 9 1/4%	1991/96	9 250%	301 0	92 95	11 265%	5 70	6 017	9 54	279 770	279 008	2 46%	0 14	0 148	0 23	01-May-87	10	-0 25	01-Nov-91	01-Nov-96	01-Nov-96
IR FINANCE 13 %	1997/02	13 000%	274 0	105 28	11 190%	6 03	6 372	9 95	288 480	290 430	2 56%	0 15	0 163	0 25	01-Apr-87	20	0 71	01-Apr-97	01-Apr-02	01-Apr-97
IR CAPITAL 7 3/4 %	1997	7 750%	325 0	87 39	11 033%	5 96	6 289	10 24	284 023	290 643	2 56%	0 15	0 161	0 26	15-Jan-87	96	2 04	15-Jul-97	15-Jul-97	15-Jul-97
IR NATION 9 3/4%	1992/97	9 750%	298 0	94 78	11 284%	5 98	6 313	10 49	282 434	282 911	2 49%	0 15	0 157	0 26	15-Apr-87	6	0 16	15-Oct-92	15-Oct-97	15-Oct-97
IR DEVELO 11 1/2%	1997/99	11 500%	257 0	100 87	11 221%	6 12	6 467	10 58	259 226	257 284	2 27%	0 14	0 147	0 24	15-May-87	24	-0 76	15-Nov-97	15-Nov-99	15-Nov-97
IR FINANCE 14 1/2%	1998/00	14 500%	80 0	108 50	11 230%	6 72	7 095	11 41	86 801	87 976	0 78%	0 05	0 055	0 09	15-Mar-87	37	1 47	15-Sep-98	15-Sep-00	15-Sep-98
IR NATION 11 %	1993/98	11 000%	303 0	99 26	11 236%	6 34	6 701	11 49	300 758	301 306	2 66%	0 17	0 178	0 31	15-Apr-87	6	0 18	15-Oct-93	15-Oct-98	15-Oct-98
IR CAPITAL 7 1/2 %	1999	7 500%	315 0	86 04	11 102%	6 35	6 706	12 24	271 022	277 231	2 44%	0 16	0 164	0 30	15-Jan-87	96	1 97	15-Jul-99	15-Jul-99	15-Jul-99
IR CAPITAL 11 3/4%	2000	11 750%	211 0	101 92	11 088%	6 89	7 274	12 99	215 055	215 463	1 90%	0 13	0 138	0 25	15-Apr-87	6	0 19	15-Apr-00	15-Apr-00	15-Apr-00
IR DEVELO 12 1/4%	2000/03	12 250%	105 0	102 88	11 213%	6 95	7 341	13 16	108 022	112 495	0 99%	0 07	0 073	0 13	15-Dec-86	127	4 26	15-Jun-00	15-Jun-03	15-Jun-00
IR CAPITAL 8 %	2001	8 000%	335 0	88 91	11 067%	6 70	7 074	14 50	297 837	298 277	2 63%	0 18	0 186	0 38	15-Apr-87	6	0 13	15-Oct-01	15-Oct-01	15-Oct-01
IR DEVELO 14 3/4%	2002/04	14 750%	108 0	107 61	11 256%	7 88	8 322	14 79	116 218	119 664	1 06%	0 08	0 088	0 16	01-Feb-87	79	3 19	01-Feb-02	01-Feb-04	01-Feb-02
IR EXCHEQR 6 1/2%	2000/05	6 500%	305 0	82 80	11 093%	6 69	7 065	18 20	252 532	258 774	2 28%	0 15	0 161	0 42	27-Dec-86	115	2 05	27-Jun-00	27-Jun-05	27-Jun-05
IR CAPITAL 12 1/2%	2005	12 500%	160 0	102 90	11 104%	8 25	8 712	18 67	164 643	171 597	1 51%	0 12	0 132	0 28	15-Dec-86	127	4 35	15-Dec-05	15-Dec-05	15-Dec-05
IR CAPITAL 9 %	2006	9 000%	260 0	94 96	10 759%	7 53	7 934	19 38	246 907	250 303	2 21%	0 17	0 175	0 43	27-Feb-87	53	1 31	01-Sep-06	01-Sep-06	01-Sep-06
IR CAPITAL 8 1/4%	2008	8 250%	352 0	92 30	11 024%	7 17	7 562	21 29	324 883	331 323	2 92%	0 21	0 221	0 62	30-Jan-87	81	1 83	30-Jul-08	30-Jul-08	30-Jul-08
IR CAPITAL 8 1/2%	2010	8 500%	320 0	93 95	10 988%	7 32	7 723	23 46	300 623	302 118	2 66%	0 20	0 206	0 63	01-Apr-87	20	0 47	01-Oct-10	01-Oct-10	01-Oct-10
IR CAPITAL 8 3/4%	2012	8 750%	335 0	95 27	10 984%	7 45	7 860	25 46	319 165	320 931	2 83%	0 21	0 222	0 72	30-Mar-87	22	0 53	30-Sep-12	30-Sep-12	30-Sep-12
									11197 175	11341 592	100 00%	3 98	4 204	7 74						

Trade 16-Oct-87
Sett 19-Oct-87

Stock		Coupon	Nominal Issue	Market Price	Market Yield	Volatility	Duration	Life	Clean Market Value (IR£m)	Dirty Market Value (IR£m)	Stock Weight in Index	Weighted Volatility	Weighted Duration	Weighted Life	Ex-Div Date	Accrued Interest	Accrued Interest	First Redemption Date	Last Redemption Date	Redemption Date
IR FINANCE VAR%	1988	10 770%	220 0	100 03	10 513%	0 13	0 131	0 12	220 064	223 178	1 90%	0 00	0 003	0 00	01-Sep-87	48	1 42	01-Jun-88	01-Jun-88	01-Jun-88
IR FINANCE VAR%	1989	14 171%	120 0	99 99	14 232%	0 09	0 093	0 16	119 989	121 572	1 04%	0 00	0 001	0 00	15-Sep-87	34	1 32	15-Sep-89	15-Sep-89	15-Sep-89
IR CONVER 8 1/2 %	1986/88	8 500%	320 0	99 71	9 582%	0 28	0 290	0 29	319 071	324 954	2 77%	0 01	0 008	0 01	01-Aug-87	79	1 84	01-Feb-86	01-Feb-88	01-Feb-88
IR FINANCE VAR%	1990	10 815%	451 0	100 01	10 792%	0 07	0 074	0 32	451 031	447 426	3 82%	0 00	0 003	0 01	15-Nov-87	27	-0 80	15-May-90	15-May-90	15-May-90
IR FUNDING 11 1/4%	1988	11 250%	185 0	100 80	9 580%	0 51	0 534	0 53	186 486	185 745	1 58%	0 01	0 008	0 01	01-Nov-87	13	-0 40	01-May-88	01-May-88	01-May-88
IR CAPITAL 11 %	1988	11 000%	165 0	100 70	9 795%	0 62	0 652	0 66	166 163	172 424	1 47%	0 01	0 010	0 01	15-Jun-87	126	3 79	15-Jun-88	15-Jun-88	15-Jun-88
IR CAPITAL 7 1/4 %	1988	7 250%	250 0	98 38	9 441%	0 78	0 815	0 82	245 946	249 172	2 12%	0 02	0 017	0 02	15-Aug-87	65	1 29	15-Aug-88	15-Aug-88	15-Aug-88
IR CONVER 15 %	1988	15 000%	120 0	103 89	9 733%	0 81	0 852	0 87	124 672	127 038	1 08%	0 01	0 009	0 01	01-Sep-87	48	1 97	01-Sep-88	01-Sep-88	01-Sep-88
IR FINANCE 9 %	1989	9 000%	290 0	98 66	10 228%	1 18	1 245	1 29	285 116	291 761	2 49%	0 03	0 031	0 03	01-Aug-87	79	1 95	01-Feb-89	01-Feb-89	01-Feb-89
IR DEVELO 2 1/2%	1989	2 500%	25 0	89 47	10 289%	1 44	1 509	1 53	22 368	22 346	0 19%	0 00	0 003	0 00	01-Nov-87	13	-0 09	01-May-89	01-May-89	01-May-89
IR CAPITAL 10 %	1989	10 000%	260 0	99 55	10 353%	1 42	1 493	1 57	258 826	256 904	2 19%	0 03	0 033	0 03	15-Nov-87	27	-0 74	15-May-89	15-May-89	15-May-89
IR NATION 9 3/4%	1984/89	9 750%	310 0	99 01	10 441%	1 60	1 679	1 79	306 945	313 482	2 67%	0 04	0 045	0 05	01-Aug-87	79	2 11	01-Aug-84	01-Aug-89	01-Aug-89
IR EXCHEQR 5 3/4%	1984/89	5 750%	305 0	93 12	9 845%	1 85	1 938	2 04	284 022	283 398	2 42%	0 04	0 047	0 05	01-Nov-87	13	-0 20	01-Nov-84	01-Nov-89	01-Nov-89
IR EXCHEQR 14 %	1990/92	14 000%	115 0	105 20	10 821%	1 96	2 067	2 29	120 986	124 468	1 06%	0 02	0 022	0 02	01-Aug-87	79	3 03	01-Feb-90	01-Feb-92	01-Feb-90
IR EXCHEQR 11 1/2%	1990	11 500%	207 0	101 74	10 620%	2 38	2 503	2 82	210 597	214 833	1 83%	0 04	0 046	0 05	15-Aug-87	65	2 05	15-Aug-90	15-Aug-90	15-Aug-90
IR CAPITAL 13 %	1990	13 000%	71 0	104 88	10 569%	2 48	2 616	2 99	74 463	74 564	0 64%	0 02	0 017	0 02	15-Oct-87	4	0 14	15-Oct-90	15-Oct-90	15-Oct-90
IR EXCHEQR 6 %	1985/90	6 000%	311 0	89 78	10 426%	2 66	2 801	3 08	279 206	277 826	2 37%	0 06	0 066	0 07	15-Nov-87	27	-0 44	15-Nov-85	15-Nov-90	15-Nov-90
IR FINANCE 11 1/2%	1991/93	11 500%	109 0	101 17	10 957%	2 66	2 809	3 24	110 276	113 570	0 97%	0 03	0 027	0 03	15-Jul-87	96	3 02	15-Jan-91	15-Jan-93	15-Jan-91
IR CAPITAL 7 1/2%	1991	7 500%	330 0	92 12	10 868%	2 76	2 915	3 28	303 992	310 497	2 65%	0 07	0 077	0 09	15-Jul-87	96	1 97	30-Jan-91	30-Jan-91	30-Jan-91
IR FINANCE 12 1/2%	1991	12 500%	25 0	103 74	10 829%	2 85	3 008	3 53	25 934	25 823	0 22%	0 01	0 007	0 01	01-Nov-87	-13	-0 44	01-May-91	01-May-91	01-May-91
IR CAPITAL 8 1/2%	1991	8 500%	320 0	93 88	10 947%	3 05	3 217	3 74	300 408	304 355	2 60%	0 08	0 084	0 10	27-Aug-87	53	1 23	15-Jul-91	15-Jul-91	15-Jul-91
IR NATION 6 3/4%	1986/91	6 750%	323 0	88 86	10 884%	3 25	3 426	3 95	287 003	288 077	2 46%	0 08	0 084	0 10	01-Oct-87	18	0 33	01-Oct-86	01-Oct-91	01-Oct-91
IR CAPITAL 8 3/4%	1992	8 750%	320 0	93 97	10 904%	3 55	3 746	4 54	300 705	299 708	2 56%	0 09	0 096	0 12	01-Nov-87	13	-0 31	01-May-92	01-May-92	01-May-92
IR NATION 7 %	1987/92	7 000%	326 0	88 42	10 897%	3 69	3 892	4 66	288 254	296 126	2 53%	0 09	0 098	0 12	15-Jun-87	126	2 41	15-Jun-87	15-Jun-92	15-Jun-92
IR DEVELO 7 1/2%	1988/93	7 500%	310 0	88 81	10 922%	4 26	4 492	5 70	275 324	282 326	2 41%	0 10	0 108	0 14	01-Jul-87	110	2 26	01-Jul-88	01-Jul-93	01-Jul-93
IR CAPITAL 8 %	1993	8 000%	322 0	90 40	10 902%	4 41	4 653	6 04	291 101	290 184	2 47%	0 11	0 115	0 15	01-Nov-87	-13	-0 28	01-Nov-93	01-Nov-93	01-Nov-93
IR CAPITAL 7 %	1994	7 000%	317 0	86 28	10 911%	4 64	4 897	6 41	273 494	275 559	2 35%	0 11	0 115	0 15	15-Sep-87	34	0 65	15-Mar-94	15-Mar-94	15-Mar-94
IR NATION 9 1/4%	1989/94	9 250%	300 0	93 92	11 103%	4 66	4 924	6 70	281 760	290 118	2 47%	0 12	0 122	0 17	01-Jul-87	110	2 79	01-Jul-89	01-Jul-94	01-Jul-94
IR EXCHEQR 13 %	1994	13 000%	19 0	106 04	10 938%	4 82	5 085	6 99	20 148	20 175	0 17%	0 01	0 009	0 01	15-Oct-87	4	0 14	15-Oct-94	15-Oct-94	15-Oct-94
IR CAPITAL 12 1/4%	1995	12 250%	85 0	103 93	10 960%	5 10	5 378	7 62	88 344	92 335	0 79%	0 04	0 042	0 06	01-Jun-87	140	4 70	01-Jun-95	01-Jun-95	01-Jun-95
IR CONVER 12 %	1995	12 000%	209 0	103 21	10 962%	5 22	5 507	7 91	215 714	218 049	1 86%	0 10	0 102	0 15	15-Sep-87	34	1 12	15-Sep-95	15-Sep-95	15-Sep-95
IR CAPITAL 9 %	1996	9 000%	75 0	93 07	10 944%	5 53	5 834	8 79	69 803	71 688	0 61%	0 03	0 036	0 05	09-Jul-87	102	2 51	30-Jul-96	30-Jul-96	30-Jul-96
IR EXCHEQR 9 1/4%	1991/96	9 250%	301 0	93 22	11 188%	5 56	5 871	9 04	280 593	279 602	2 38%	0 13	0 140	0 22	01-Nov-87	-13	-0 33	01-Nov-91	01-Nov-96	01-Nov-96
IR FINANCE 13 %	1997/02	13 000%	274 0	105 40	11 166%	5 85	6 180	9 46	288 799	290 555	2 48%	0 15	0 153	0 23	01-Oct-87	18	0 64	01-Apr-97	01-Apr-02	01-Apr-97
IR CAPITAL 7 3/4 %	1997	7 750%	325 0	87 58	10 992%	5 84	6 160	9 75	284 639	291 259	2 48%	0 15	0 153	0 24	15-Jul-87	96	2 04	15-Jul-97	15-Jul-97	15-Jul-97
IR NATION 9 3/4%	1992/97	9 750%	298 0	95 03	11 202%	5 86	6 189	10 00	283 179	283 498	2 42%	0 14	0 150	0 24	15-Oct-87	4	0 11	15-Oct-92	15-Oct-97	15-Oct-97
IR DEVELO 11 1/2%	1997/99	11 500%	257 0	101 05	11 165%	5 98	6 316	10 08	259 707	257 522	2 20%	0 13	0 139	0 22	15-Nov-87	27	-0 85	15-Nov-97	15-Nov-99	15-Nov-97
IR CAPITAL 9 3/4 %	1998	9 750%	110 0	95 84	10 954%	6 12	6 456	10 62	105 419	107 357	0 92%	0 06	0 059	0 10	14-Aug-87	66	1 76	01-Jun-98	01-Jun-98	01-Jun-98
IR FINANCE 14 1/2%	1998/00	14 500%	80 0	108 79	11 186%	6 55	6 914	10 92	87 028	88 108	0 75%	0 05	0 052	0 08	15-Sep-87	34	1 35	15-Sep-98	15-Sep-00	15-Sep-98
IR NATION 11 %	1993/98	11 000%	187 0	99 34	11 209%	6 22	6 565	11 00	185 761	185 986	1 59%	0 10	0 104	0 17	15-Oct-87	4	0 12	15-Oct-93	15-Oct-98	15-Oct-98
IR CAPITAL 7 1/2 %	1999	7 500%	316 0	86 27	11 015%	6 30	6 648	11 75	272 614	278 843	2 38%	0 15	0 158	0 28	15-Jul-87	96	1 97	15-Jul-99	15-Jul-99	15-Jul-99
IR CAPITAL 11 3/4%	2000	11 750%	211 0	102 03	11 062%	6 77	7 147	12 50	215 291	215 563	1 84%	0 12	0 131	0 23	15-Oct-87	4	0 13	15-Apr-00	15-Apr-00	15-Apr-00
IR DEVELO 12 1/4%	2000/03	12 250%	105 0	103 24	11 110%	6 87	7 247	12 67	108 403	112 840	0 96%	0 07	0 070	0 12	15-Jun-87	126	4 23	15-Jun-00	15-Jun-03	15-Jun-00
IR CAPITAL 8 %	2001	8 000%	335 0	88 79	11 067%	6 64	7 012	14 00	297 432	297 725	2 54%	0 17	0 178	0 36	15-Oct-87	4	0 09	15-Oct-01	15-Oct-01	15-Oct-01
IR DEVELO 14 3/4%	2002/04	14 750%	108 0	108 16	11 137%	7 80	8 232	14 30	116 814	120 259	1 03%	0 08	0 084	0 15	01-Aug-87	79	3 19	01-Feb-02	01-Feb-04	01-Feb-02
IR CAPITAL 9 1/4%	2003	9 250%	337 0	94 43	11 006%	7 06	7 444	15 74	318 216	329 397	2 81%	0 20	0 209	0 44	10-Jun-87	131	3 32	11-Jul-03	11-Jul-03	11-Jul-03
IR EXCHEQR 6 1/2%	2000/05	6 500%	305 0	82 87	10 971%	6 78	7 151	17 70	252 749	258 937	2 21%	0 15	0 158	0 39	27-Jun-87	114	2 03	27-Jun-00	27-Jun-05	27-Jun-05
IR CAPITAL 12 1/2%	2005	12 500%	160 0	103 19	11 022%	8 23	8 687	18 17	165 102	172 002	1 47%	0 12	0 127	0 27	15-Jun-87	126	4 31	15-Dec-05	15-Dec-05	15-Dec-05
IR CAPITAL 9 %	2006	9 000%	316 0	94 33	10 975%	7 32	7 724	18 88	298 081	302 207	2 58%	0 19	0 199	0 49	27-Aug-87	53	1 31	01-Sep-06	01-Sep-06	01-Sep-06
IR CAPITAL 8 1/4%	2008	8 250%	352 0	92 22	10 977%	7 20	7 590	20 79	324 617	331 057	2 82%	0 20	0 214	0 59	30-Jul-87	81	1 83	30-Jul-08	30-Jul-08	30-Jul-08
IR CAPITAL 8 1/2%	2010	8 500%	331 0	93 83	10 966%	7 33	7 736	22 97	310 584	311 970	2 66%	0 20	0 206	0 61	01-Oct-87	18	0 42	01-Oct-10	01-Oct-10	01-Oct-10
IR CAPITAL 8 3/4%	2012	8 750%	336 0	95 19	10 952%	7 48	7 887	24 97	319 850	321 379	2 74%	0 20	0 216	0 68	30-Sep-87	19	0 46	30-Sep-12	30-Sep-12	30-Sep-12
									11584 091	11725 750	100 00%	4 16	4 391	7 94						

Table A 1 17 Irish Government Treasury Data - April 1987

Trade 16 Oct-89
Sett 17-Oct-89

Stock	Coupon	Nominal Issue	Market Price	Market Yield	Volatility	Duration	Life	Clean Market Value (IR£m)	Dirty Market Value (IR£m)	Stock Weight in Index	Weighted Volatility	Weighted Duration	Weighted Life	Ex Div Date	Accrued Interest	Accrued Interest	First Redemption Date	Last Redemption Date	Redemption Date
IR EXCHEQR 5 3/4% 1984/89	5 750%	302 0	99 95	6 989%	0 04	0 042	0 04	301 851	301 138	2 47%	0 00	0 001	0 00	01 Nov-89	15	-0 24	01-Nov-84	01-Nov-89	01 Nov-89
IR FINANCE VAR% 1990	9 998%	442 0	100 00	9 979%	0 17	0 172	0 08	442 006	449 628	3 69%	0 01	0 006	0 00	15 Aug-89	63	1 72	15 May 90	15 May 90	15 May 90
IR FINANCE VAR% 1991	10 157%	259 0	100 00	10 151%	0 13	0 137	0 11	259 002	262 603	2 16%	0 00	0 003	0 00	28 Aug-89	50	1 39	28 Nov 91	28 Nov 91	28 Nov 91
IR FINANCE VAR% 1992	10 629%	332 0	100 00	10 610%	0 05	0 047	0 20	332 012	333 655	2 74%	0 00	0 001	0 01	30 Sep 89	17	0 49	30 Mar 92	30 Mar 92	30 Mar 92
IR FINANCE VAR% 1993	9 919%	629 0	100 01	9 900%	0 04	0 041	0 29	629 032	626 470	5 14%	0 00	0 002	0 01	01 Nov-89	15	-0 41	01 Feb-93	01 Feb 93	01 Feb 93
IR EXCHEQR 14 % 1990/92	14 000%	51 0	100 86	10 764%	0 28	0 297	0 29	51 440	52 945	0 43%	0 00	0 001	0 00	01 Aug-89	77	2 95	01 Feb 90	01 Feb 92	01 Feb-90
IR CAPITAL 7 % 1990	7 000%	299 0	98 81	10 152%	0 39	0 409	0 41	295 435	297 269	2 44%	0 01	0 010	0 01	15 Sep-89	32	0 61	15 Mar 90	15-Mar 90	15 Mar 90
IR EXCHEQR 11 1/2% 1990	11 500%	193 0	100 79	10 401%	0 77	0 813	0 83	194 523	198 351	1 63%	0 01	0 013	0 01	15 Aug-89	63	1 98	15-Aug-90	15-Aug-90	15 Aug-90
IR CAPITAL 13 % 1990	13 000%	59 0	102 26	10 313%	0 92	0 967	0 99	60 331	60 373	0 50%	0 00	0 005	0 00	15-Oct-89	2	0 07	15-Oct-90	15-Oct 90	15-Oct-90
IR EXCHEQR 6 % 1985/90	6 000%	333 0	96 37	9 795%	1 01	1 059	1 08	320 927	319 340	2 62%	0 03	0 028	0 03	15-Nov-89	29	-0 48	15-Nov-85	15-Nov 90	15 Nov 90
IR FINANCE 11 1/2% 1991/93	11 500%	105 0	101 13	10 405%	1 14	1 198	1 25	106 190	109 297	0 90%	0 01	0 011	0 01	15-Jul-89	94	2 96	15-Jan-91	15-Jan-93	15-Jan-91
IR CAPITAL 7 1/2% 1991	7 500%	327 0	96 87	10 345%	1 19	1 248	1 29	316 749	322 054	2 64%	0 03	0 033	0 03	30-Jul-89	79	1 62	30 Jan 91	30-Jan 91	30 Jan 91
IR CAPITAL 8 % 1991	8 000%	384 0	97 13	10 424%	1 29	1 356	1 41	372 962	375 654	3 08%	0 04	0 042	0 04	15-Sep-89	32	0 70	15 Mar 91	15-Mar-91	15 Mar 91
IR FINANCE 12 1/2% 1991	12 500%	6 0	102 74	10 268%	1 38	1 452	1 54	6 164	6 133	0 05%	0 00	0 001	0 00	01 Nov-89	15	-0 51	01 May 91	01 May 91	01 May 91
IR CAPITAL 8 1/2% 1991	8 500%	330 0	97 41	10 329%	1 57	1 650	1 74	321 443	328 662	2 70%	0 04	0 045	0 05	15-Jul-89	94	2 19	15-Jul-91	15-Jul-91	15-Jul-91
IR NATION 6 3/4% 1986/91	6 750%	329 0	94 75	10 031%	1 76	1 853	1 96	311 737	312 710	2 57%	0 05	0 048	0 05	01 Oct-89	16	0 30	01-Oct-86	01-Oct 91	01 Oct 91
IR CAPITAL 8 3/4% 1992	8 750%	346 0	97 44	10 082%	2 21	2 319	2 54	337 152	335 908	2 76%	0 06	0 064	0 07	01 Nov-89	15	-0 36	01 May 92	01-May 92	01 May 92
IR NATION 7 % 1987/92	7 000%	321 0	93 65	10 107%	2 33	2 447	2 66	300 610	308 239	2 53%	0 08	0 062	0 07	15-Jun-89	124	2 38	15 Jun-87	15-Jun 92	15-Jun 92
IR EXCHEQR 7 1/4% 1992	7 250%	139 0	93 83	10 107%	2 49	2 615	2 88	130 423	131 692	1 08%	0 03	0 028	0 03	01 Sep-89	46	0 91	01 Sep 92	01 Sep-92	01 Sep 92
IR CAPITAL 8 1/2% 1992	8 500%	313 0	96 59	10 045%	2 59	2 718	3 04	302 340	301 393	2 47%	0 06	0 067	0 08	30-Oct 89	13	-0 30	30-Oct 92	30-Oct 92	30 Oct 92
IR DEVELO 7 1/2% 1988/93	7 500%	472 0	93 74	9 918%	3 09	3 248	3 71	442 436	452 903	3 72%	0 12	0 121	0 14	01-Jul 89	108	2 22	01-Jul-88	01-Jul-93	01-Jul-93
IR NATION 11 % 1993/98	11 000%	184 0	102 38	10 054%	3 21	3 373	4 00	188 385	188 495	1 55%	0 05	0 052	0 06	15-Oct-89	2	0 06	15-Oct 93	15-Oct 98	15 Oct 93
IR CAPITAL 8 % 1993	8 000%	482 0	94 93	9 865%	3 31	3 476	4 04	457 549	455 965	3 74%	0 12	0 130	0 15	01 Nov-89	-15	-0 33	01 Nov 93	01 Nov 93	01 Nov 93
IR CAPITAL 7 % 1994	7 000%	498 0	91 70	9 819%	3 59	3 769	4 41	456 646	459 700	3 77%	0 14	0 142	0 17	15-Sep-89	32	0 61	15-Mar 94	15 Mar 94	15-Mar 94
IR NATION 9 1/4% 1989/94	9 250%	113 0	97 61	10 080%	3 69	3 880	4 71	110 300	113 391	0 93%	0 03	0 038	0 04	01-Jul-89	108	2 74	01-Jul-89	01-Jul 94	01-Jul 94
IR EXCHEQR 13 % 1994	13 000%	19 0	109 12	9 659%	3 86	4 043	5 00	20 733	20 747	0 17%	0 01	0 007	0 01	15 Oct-89	2	0 07	15-Oct 94	15-Oct 94	15-Oct 94
IR CAPITAL 12 1/4% 1995	12 250%	52 0	107 80	9 592%	4 24	4 448	5 62	56 058	58 464	0 48%	0 02	0 021	0 03	01 Jun 89	138	4 63	01 Jun-95	01 Jun-95	01 Jun-95
IR CONVER 12 % 1995	12 000%	181 0	107 38	9 556%	4 42	4 629	5 92	194 356	196 258	1 61%	0 07	0 075	0 10	15-Sep-89	32	1 05	15-Sep-95	15-Sep 95	15-Sep 95
IR CAPITAL 9 % 1996	9 000%	378 0	98 32	9 477%	4 93	5 167	6 79	371 661	379 019	3 11%	0 15	0 161	0 21	30-Jul-89	79	1 95	30-Jul-96	30-Jul-96	30-Jul-96
IR EXCHEQR 8 1/2 % 1996	8 500%	97 0	96 61	9 436%	5 04	5 276	6 98	93 714	94 098	0 77%	0 04	0 041	0 05	30-Sep-89	17	0 40	30 Sep 96	30-Sep-96	30-Sep-96
IR EXCHEQR 9 1/4% 1991/96	9 250%	171 0	97 59	9 943%	4 99	5 239	7 05	166 886	166 236	1 36%	0 07	0 071	0 10	01 Nov-89	15	-0 38	01 Nov 91	01 Nov 96	01 Nov 96
IR FINANCE 13 % 1997/02	13 000%	248 0	110 59	9 604%	5 28	5 538	7 46	274 268	275 680	2 26%	0 12	0 125	0 17	01 Oct 89	16	0 57	01 Apr 97	01-Apr-02	01 Apr 97
IR CAPITAL 7 3/4 % 1997	7 750%	301 0	93 38	9 461%	5 44	5 699	7 75	281 067	287 070	2 36%	0 13	0 134	0 18	15 Jul-89	94	1 99	15-Jul-97	15-Jul-97	15-Jul-97
IR NATION 9 3/4% 1992/97	9 750%	195 0	99 35	9 934%	5 43	5 701	8 00	193 731	193 835	1 59%	0 09	0 091	0 13	15-Oct 89	2	0 05	15-Oct-92	15-Oct-97	15-Oct 97
IR DEVELO 11 1/2% 1997/99	11 500%	230 0	106 50	9 561%	5 57	5 837	8 08	244 958	242 858	1 99%	0 11	0 116	0 16	15 Nov-89	29	-0 91	15-Nov-97	15-Nov-99	15-Nov 97
IR CAPITAL 9 3/4 % 1998	9 750%	268 0	101 29	9 398%	5 83	6 099	8 63	271 468	281 340	2 31%	0 13	0 141	0 20	01-Jun-89	138	3 68	01-Jun-98	01-Jun-98	01-Jun-98
IR FINANCE 14 1/2% 1998/00	14 500%	73 0	114 94	9 518%	6 16	6 450	8 92	83 907	84 834	0 70%	0 04	0 045	0 06	15 Sep 89	32	1 27	15 Sep 98	15-Sep-00	15 Sep 98
IR CAPITAL 7 1/2 % 1999	7 500%	283 0	92 19	9 364%	6 30	6 594	9 75	260 908	266 370	2 19%	0 14	0 144	0 21	15-Jul-89	94	1 93	15-Jul-99	15-Jul-99	15-Jul-99
IR CAPITAL 11 3/4% 2000	11 750%	133 0	107 82	9 437%	6 72	7 042	10 50	143 402	143 487	1 18%	0 08	0 083	0 12	15-Oct-89	2	0 06	15-Apr-00	15-Apr-00	15-Apr-00
IR DEVELO 12 1/4% 2000/03	12 250%	105 0	109 28	9 432%	6 84	7 167	10 67	114 746	119 113	0 98%	0 07	0 070	0 10	15-Jun-89	124	4 16	15-Jun-00	15-Jun-03	15 Jun-00
IR CAPITAL 8 % 2001	8 000%	172 0	95 32	9 110%	7 15	7 471	12 00	163 956	164 031	1 35%	0 10	0 101	0 16	15 Oct-89	2	0 04	15 Oct-01	15 Oct-01	15-Oct-01
IR DEVELO 14 3/4% 2002/04	14 750%	71 0	115 07	9 365%	7 97	8 343	12 30	81 701	83 909	0 69%	0 05	0 057	0 08	01 Aug-89	77	3 11	01 Feb-02	01-Feb-04	01 Feb-02
IR CAPITAL 9 1/4% 2003	9 250%	335 0	100 69	9 070%	7 79	8 143	13 74	337 319	345 633	2 84%	0 22	0 231	0 39	11-Jul-89	98	2 48	11-Jul-03	11-Jul-03	11-Jul-03
IR EXCHEQR 8 1/4% 2003	8 250%	195 0	96 79	9 032%	7 77	8 126	14 04	188 743	188 170	1 54%	0 12	0 126	0 22	30-Oct-89	13	-0 29	30-Oct-03	30-Oct-03	30 Oct-03
IR EXCHEQR 6 1/2% 2000/05	6 500%	262 0	88 99	8 866%	8 07	8 426	15 70	233 142	238 364	1 96%	0 16	0 165	0 31	27 Jun-89	112	1 99	27 Jun-00	27 Jun-05	27 Jun 05
IR CAPITAL 12 1/2% 2005	12 500%	63 0	109 60	9 110%	9 25	9 666	16 17	69 049	71 722	0 59%	0 05	0 057	0 10	15 Jun 89	124	4 24	15 Dec-05	15-Dec-05	15 Dec 05
IR CAPITAL 9 % 2006	9 000%	290 0	100 70	8 810%	8 75	9 133	16 88	292 041	295 328	2 42%	0 21	0 221	0 41	01 Sep-89	46	1 13	01 Sep-06	01 Sep-06	01 Sep-06
IR CAPITAL 8 1/4% 2008	8 250%	319 0	97 94	8 799%	8 95	9 346	18 80	312 427	318 119	2 61%	0 23	0 244	0 49	30-Jul-89	79	1 78	30-Jul-08	30-Jul-08	30-Jul-08
IR CAPITAL 8 1/2% 2010	8 500%	303 0	99 17	8 741%	9 44	9 858	20 97	300 497	301 626	2 48%	0 23	0 244	0 52	01 Oct 89	16	0 37	01-Oct 10	01-Oct 10	01 Oct 10
IR CAPITAL 8 3/4% 2012	8 750%	260 0	99 92	8 775%	9 80	10 229	22 97	259 797	260 856	2 14%	0 21	0 219	0 49	30-Sep-89	17	0 41	30-Sep 12	30 Sep 12	30 Sep 12
								12058 178	12181 140	100 00%	3 77	3 943	6 08						

Table A 1 18 Irish Government Treasury Data - October 1988

Trade 18 Oct 88
Sett 20 Oct 88

Stock		Coupon	Nominal Issue	Market Price	Market Yield	Volatility	Duration	Life	Clean Market Value (IR£m)	Dirty Market Value (IR£m)	Stock Weight in Index	Weighted Volatility	Weighted Duration	Weighted Life	Ex-Div Date	Accrued Interest	Accrued Interest	First Redemption Date	Last Redemption Date	Redemption Date
IR FINANCE VAR%	1989	7 900%	99 0	99 98	8 017%	0 09	0 096	0 15	98 983	99 732	0 77%	0 00	0 001	0 00	15 Sep 88	35	0 76	15 Sep 89	15 Sep 89	15 Sep 89
IR FINANCE VAR%	1992	7 840%	332 0	100 00	7 824%	0 05	0 055	0 19	332 010	333 435	2 58%	0 00	0 001	0 01	30 Sep 88	20	0 43	30 Mar 93	30 Mar 93	30 Mar 93
IR FINANCE VAR%	1993	8 040%	441 0	100 01	8 021%	0 03	0 033	0 28	441 023	439 858	3 41%	0 00	0 001	0 01	01 Nov 88	-12	-0 26	01 Feb 93	01 Feb 93	01 Feb 93
IR FINANCE 9 %	1989	9 000%	232 0	100 43	7 374%	0 28	0 288	0 28	233 009	237 582	1 84%	0 01	0 005	0 01	01 Aug 88	80	1 97	01 Feb 89	01 Feb 89	01 Feb 89
IR FINANCE VAR%	1990	8 840%	442 0	100 00	8 840%	0 07	0 071	0 32	442 000	439 218	3 40%	0 00	0 002	0 01	15 Nov 88	-26	-0 63	15 May 90	15 May 90	15 May 90
IR DEVELO 2 1/2%	1989	2 500%	25 0	98 13	6 188%	0 51	0 528	0 53	24 534	24 513	0 19%	0 00	0 001	0 00	01 Nov 88	-12	-0 08	01 May 89	01 May 89	01 May 89
IR CAPITAL 10 %	1989	10 000%	246 0	101 35	7 396%	0 55	0 566	0 57	249 317	247 566	1 92%	0 01	0 011	0 01	15 Nov 88	-26	-0 71	15 May 89	15 May 89	15 May 89
IR NATION 9 1/4%	1989/94	9 250%	300 0	100 66	8 195%	0 66	0 690	0 70	301 989	310 423	2 40%	0 02	0 017	0 02	01 Jul 88	111	2 81	01 Jul 89	01 Jul 94	01 Jul 89
IR EXCHEQR 5 3/4%	1984/89	5 750%	305 0	98 18	7 699%	0 98	1 017	1 03	299 453	298 877	2 32%	0 02	0 024	0 02	01 Nov 88	-12	-0 19	01 Nov 84	01 Nov 89	01 Nov 89
IR EXCHEQR 14 %	1990/92	14 000%	95 0	106 51	7 874%	1 19	1 232	1 28	101 187	104 100	0 81%	0 01	0 010	0 01	01 Aug 88	80	3 07	01 Feb 90	01 Feb 92	01 Feb 90
IR CAPITAL 7 %	1990	7 000%	299 0	98 69	8 078%	1 30	1 356	1 40	295 081	297 086	2 30%	0 03	0 031	0 03	15 Sep 88	35	0 67	15 Mar 90	15 Mar 90	15 Mar 90
IR EXCHEQR 11 1/2%	1990	11 500%	195 0	104 78	8 214%	1 64	1 707	1 82	204 329	208 381	1 61%	0 03	0 028	0 03	15 Aug 88	66	2 08	15 Aug 90	15 Aug 90	15 Aug 90
IR CAPITAL 13 %	1990	13 000%	61 0	107 39	8 193%	1 77	1 842	1 99	65 509	65 617	0 51%	0 01	0 009	0 01	15 Oct 88	5	0 18	15 Oct 90	15 Oct 90	15 Oct 90
IR EXCHEQR 6 %	1985/90	6 000%	336 0	96 67	7 919%	1 90	1 971	2 07	324 800	323 365	2 51%	0 05	0 049	0 05	15 Nov 88	26	-0 43	15 Nov 85	15 Nov 90	15 Nov 90
IR FINANCE 11 1/2%	1991/93	11 500%	109 0	105 49	8 308%	1 98	2 061	2 24	114 979	118 308	0 92%	0 02	0 019	0 02	15 Jul 88	97	3 05	15 Jan 91	15 Jan 93	15 Jan 91
IR CAPITAL 7 1/2%	1991	7 500%	328 0	98 51	8 309%	2 05	2 132	2 28	323 121	328 644	2 55%	0 05	0 054	0 06	30 Jul 88	82	1 68	30 Jan 91	30 Jan 91	30 Jan 91
IR CAPITAL 8 %	1991	8 000%	385 0	99 42	8 304%	2 14	2 229	2 40	382 770	385 721	2 99%	0 06	0 067	0 07	15 Sep 88	35	0 77	15 Mar 91	15 Mar 91	15 Mar 91
IR FINANCE 12 1/2%	1991	12 500%	7 0	107 65	8 387%	2 20	2 291	2 53	7 535	7 507	0 06%	0 00	0 001	0 00	01 Nov 88	-12	-0 41	01 May 91	01 May 91	01 May 91
IR CAPITAL 8 1/2%	1991	8 500%	331 0	100 35	8 333%	2 40	2 498	2 73	332 155	339 627	2 63%	0 06	0 066	0 07	15 Jul 88	97	2 26	15 Jul 91	15 Jul 91	15 Jul 91
IR NATION 6 3/4%	1986/91	6 750%	331 0	96 40	8 328%	2 60	2 704	2 95	319 071	320 233	2 48%	0 06	0 067	0 07	01 Oct 88	19	0 35	01 Oct 86	01 Oct 91	01 Oct 91
IR EXCHEQR 9 1/4%	1991/96	9 250%	262 0	101 32	8 658%	2 61	2 722	3 03	265 454	264 658	2 05%	0 05	0 056	0 06	01 Nov 88	-12	-0 30	01 Nov 91	01 Nov 96	01 Nov 91
IR CAPITAL 8 3/4%	1992	8 750%	349 0	100 96	8 367%	3 00	3 122	3 53	352 365	351 362	2 72%	0 08	0 085	0 10	01 Nov 88	-12	-0 29	01 May 92	01 May 92	01 May 92
IR NATION 7 %	1987/92	7 000%	323 0	96 29	8 391%	3 13	3 258	3 65	311 004	318 865	2 47%	0 08	0 080	0 09	15 Jun 88	127	2 43	15 Jun 87	15 Jun 92	15 Jun 92
IR EXCHEQR 7 1/4%	1992	7 250%	139 0	96 89	8 374%	3 28	3 413	3 87	134 675	136 027	1 05%	0 03	0 036	0 04	01 Sep 88	49	0 97	01 Sep 92	01 Sep 92	01 Sep 92
IR NATION 9 3/4%	1992/97	9 750%	257 0	102 85	8 678%	3 29	3 434	3 99	264 333	264 676	2 05%	0 07	0 070	0 08	15 Oct 88	5	0 13	15 Oct 92	15 Oct 97	15 Oct 92
IR CAPITAL 8 1/2%	1992	8 500%	314 0	100 29	8 396%	3 36	3 499	4 03	314 906	314 175	2 43%	0 08	0 085	0 10	30 Oct 88	10	-0 23	30 Oct 92	30 Oct 92	30 Oct 92
IR DEVELO 7 1/2%	1988/93	7 500%	335 0	97 04	8 444%	3 84	4 004	4 70	325 100	332 736	2 58%	0 10	0 103	0 12	01 Jul 88	111	2 28	01 Jul 88	01 Jul 93	01 Jul 93
IR NATION 11 %	1993/98	11 000%	187 0	107 18	8 570%	3 95	4 116	4 99	200 430	200 712	1 55%	0 06	0 064	0 08	15 Oct 88	5	0 15	15 Oct 93	15 Oct 98	15 Oct 93
IR CAPITAL 8 %	1993	8 000%	483 0	98 48	8 471%	4 05	4 217	5 04	475 665	474 396	3 68%	0 15	0 155	0 19	01 Nov 88	-12	-0 26	01 Nov 93	01 Nov 93	01 Nov 93
IR CAPITAL 7 %	1994	7 000%	362 0	94 82	8 502%	4 32	4 499	5 40	343 241	345 669	2 68%	0 12	0 120	0 14	15 Sep 88	35	0 67	15 Mar 94	15 Mar 94	15 Mar 94
IR EXCHEQR 13 %	1994	13 000%	19 0	113 48	8 564%	4 58	4 776	5 99	21 562	21 596	0 17%	0 01	0 008	0 01	15 Oct 88	5	0 18	15 Oct 94	15 Oct 94	15 Oct 94
IR CAPITAL 12 1/4%	1995	12 250%	53 0	111 80	8 587%	4 95	5 165	6 62	59 252	61 758	0 48%	0 02	0 025	0 03	01 Jun 88	141	4 73	01 Jun 95	01 Jun 95	01 Jun 95
IR CONVER 12 %	1995	12 000%	182 0	111 26	8 580%	5 12	5 341	6 91	202 501	204 594	1 58%	0 08	0 085	0 11	15 Sep 88	35	1 15	15 Sep 95	15 Sep 95	15 Sep 95
IR CAPITAL 9 %	1996	9 000%	345 0	101 67	8 562%	5 59	5 830	7 78	350 769	357 739	2 77%	0 15	0 162	0 22	30 Jul 88	82	2 02	30 Jul 96	30 Jul 96	30 Jul 98
IR FINANCE 13 %	1997/02	13 000%	250 0	113 96	8 760%	6 00	6 260	8 45	284 900	286 591	2 22%	0 13	0 139	0 19	01 Oct 88	19	0 68	01 Apr 97	01 Apr 02	01 Apr 97
IR CAPITAL 7 3/4 %	1997	7 750%	325 0	96 59	8 566%	6 08	6 339	8 74	313 924	320 613	2 48%	0 15	0 157	0 22	15 Jul 88	97	2 06	15 Jul 97	15 Jul 97	15 Jul 97
IR DEVELO 11 1/2%	1997/99	11 500%	257 0	109 73	8 748%	6 25	6 527	9 08	282 005	279 902	2 17%	0 14	0 142	0 20	15 Nov 88	26	-0 82	15 Nov 97	15 Nov 99	15 Nov 97
IR CAPITAL 9 3/4 %	1998	9 750%	271 0	104 81	8 515%	6 50	6 782	9 62	284 048	294 249	2 28%	0 15	0 155	0 22	01 Jun 88	141	3 76	01 Jun 98	01 Jun 98	01 Jun 98
IR FINANCE 14 1/2%	1998/00	14 500%	73 0	117 78	8 761%	6 92	7 228	9 91	85 977	86 991	0 67%	0 05	0 049	0 07	15 Sep 88	35	1 39	15 Sep 98	15 Sep 00	15 Sep 98
IR CAPITAL 7 1/2 %	1999	7 500%	316 0	95 58	8 492%	6 94	7 237	10 74	302 046	308 340	2 39%	0 17	0 173	0 26	15 Jul 88	97	1 99	15 Jul 99	15 Jul 99	15 Jul 99
IR CAPITAL 11 3/4%	2000	11 750%	135 0	111 57	8 482%	7 54	7 858	11 49	150 621	150 838	1 17%	0 09	0 092	0 13	15 Oct 88	5	0 16	15 Apr 00	15 Apr 00	15 Apr 00
IR DEVELO 12 1/4%	2000/03	12 250%	106 0	112 52	8 587%	7 64	7 963	11 66	119 268	123 783	0 96%	0 07	0 076	0 11	15 Jun 88	127	4 26	15 Jun 00	15 Jun 03	15 Jun 00
IR CAPITAL 8 %	2001	8 000%	335 0	98 29	8 390%	7 79	8 119	12 99	329 257	329 624	2 55%	0 20	0 207	0 33	15 Oct 88	5	0 11	15 Oct 01	15 Oct 01	15 Oct 01
IR DEVELO 14 3/4%	2002/04	14 750%	75 0	117 64	8 582%	8 90	9 286	13 29	88 234	90 657	0 70%	0 06	0 065	0 09	01 Aug 88	80	3 23	01 Feb 02	01 Feb 04	01 Feb 02
IR CAPITAL 9 1/4%	2003	9 250%	337 0	103 53	8 361%	8 52	8 879	14 73	348 885	357 504	2 77%	0 24	0 246	0 41	11 Jul 88	101	2 56	11 Jul 03	11 Jul 03	11 Jul 03
IR EXCHEQR 6 1/2%	2000/05	6 500%	305 0	91 49	8 267%	8 68	9 034	16 70	279 037	285 279	2 21%	0 19	0 200	0 37	27 Jun 88	115	2 05	27 Jun 00	27 Jun 05	27 Jun 05
IR CAPITAL 12 1/2%	2005	12 500%	70 0	112 26	8 306%	10 31	10 742	17 16	78 580	81 623	0 63%	0 07	0 068	0 11	15 Jun 88	127	4 35	15 Dec 05	15 Dec 05	15 Dec 05
IR CAPITAL 9 %	2006	9 000%	316 0	102 97	8 219%	9 50	9 888	17 88	325 380	329 195	2 55%	0 24	0 252	0 46	01 Sep 88	49	1 21	01 Sep 06	01 Sep 06	01 Sep 06
IR CAPITAL 8 1/4%	2008	8 250%	350 0	100 20	8 199%	9 73	10 126	19 79	350 695	357 178	2 77%	0 27	0 280	0 55	30 Jul 88	82	1 85	30 Jul 08	30 Jul 08	30 Jul 08
IR CAPITAL 8 1/2%	2010	8 500%	331 0	101 23	8 150%	10 30	10 719	21 96	335 072	336 536	2 61%	0 27	0 279	0 57	01 Oct 88	19	0 44	01 Oct 10	01 Oct 10	01 Oct 10
IR CAPITAL 8 3/4%	2012	8 750%	304 0	101 80	8 180%	10 73	11 173	23 96	309 470	310 927	2 41%	0 26	0 269	0 58	30 Sep 88	20	0 48	30 Sep 12	30 Sep 12	30 Sep 12
									12781 509	12908 584	100 00%	4 27	4 448	6 73						

Table A 1 19 Irish Government Treasury Data - April 1989

Trade 17-Apr 89
Sett 18 Apr 89

Stock		Coupon	Nominal Issue	Market Price	Market Yield	Volatility	Duration	Life	Clean Market Value (IR£m)	Dirty Market Value (IR£m)	Stock Weight in Index	Weighted Volatility	Weighted Duration	Weighted Life	Ex-Div Date	Accrued Interest	Accrued Interest	First Redemption Date	Last Redemption Date	Redemption Date
IR DEVELO 2 1/2%	1989	2 500%	25 0	99 88	5 922%	0 03	0 036	0 04	24 970	24 948	0 21%	0 00	0 000	0 00	01 May 89	-13	-0 09	01 May 89	01-May-89	01 May 89
IR CAPITAL 10 %	1989	10 000%	155 0	100 25	6 420%	0 07	0 076	0 07	155 392	154 246	1 28%	0 00	0 001	0 00	15 May 89	-27	-0 74	15 May 89	15 May 89	15 May 89
IR FINANCE VAR%	1990	8 440%	442 0	100 00	8 390%	0 17	0 170	0 08	442 017	448 349	3 73%	0 01	0 006	0 00	15-Feb-89	62	1 43	15 May 90	15-May 90	15 May 90
IR FINANCE VAR%	1991	8 400%	259 0	100 00	8 378%	0 13	0 134	0 12	259 006	261 925	2 18%	0 00	0 003	0 00	28-Feb-89	49	1 13	28 Nov 91	28-Nov 91	28-Nov 91
IR FINANCE VAR%	1989	8 480%	94 0	100 00	8 479%	0 09	0 093	0 16	94 000	94 742	0 79%	0 00	0 001	0 00	15 Mar 89	34	0 79	15 Sep-89	15 Sep 89	15 Sep 89
IR FINANCE VAR%	1992	8 360%	332 0	100 00	8 337%	0 05	0 052	0 20	332 015	333 459	2 77%	0 00	0 001	0 01	30 Mar-89	19	0 43	30 Mar 92	30-Mar 92	30 Mar 92
IR NATION 9 1/4%	1989/94	9 250%	114 0	100 22	8 083%	0 20	0 205	0 20	114 254	117 343	0 98%	0 00	0 002	0 00	01-Jan-89	107	2 71	01-Jul-89	01-Jul-94	01-Jul-89
IR FINANCE VAR%	1993	8 440%	259 0	100 01	8 415%	0 03	0 036	0 28	259 018	258 240	2 15%	0 00	0 001	0 01	01-May-89	-13	-0 30	01-Feb-93	01-Feb 93	01 Feb 93
IR EXCHEQR 5 3/4%	1984/89	5 750%	302 0	98 84	8 066%	0 52	0 539	0 54	298 482	297 864	2 48%	0 01	0 013	0 01	01-May-89	-13	-0 20	01-Nov-84	01 Nov-89	01 Nov-89
IR EXCHEQR 14 %	1990/92	14 000%	58 0	103 71	8 600%	0 75	0 779	0 79	60 152	61 842	0 51%	0 00	0 004	0 00	01 Feb-89	76	2 91	01 Feb-90	01 Feb 92	01-Feb 90
IR CAPITAL 7 %	1990	7 000%	299 0	98 76	8 519%	0 86	0 894	0 91	295 300	297 248	2 47%	0 02	0 022	0 02	15 Mar-89	34	0 65	15 Mar 90	15 Mar 90	15 Mar 90
IR EXCHEQR 11 1/2%	1990	11 500%	195 0	103 25	8 570%	1 22	1 273	1 33	201 336	205 143	1 71%	0 02	0 022	0 02	15 Feb-89	62	1 95	15 Aug-90	15-Aug-90	15 Aug-90
IR CAPITAL 13 %	1990	13 000%	60 0	105 33	8 596%	1 36	1 417	1 49	63 200	63 264	0 53%	0 01	0 007	0 01	15-Apr-89	3	0 11	15-Oct 90	15-Oct 90	15-Oct-90
IR EXCHEQR 6 %	1985/90	6 000%	333 0	96 80	8 344%	1 46	1 525	1 58	322 359	320 882	2 67%	0 04	0 041	0 04	15 May-89	27	-0 44	15-Nov-85	15-Nov 90	15-Nov 90
IR FINANCE 11 1/2%	1991/93	11 500%	109 0	103 75	8 819%	1 57	1 641	1 75	113 083	116 274	0 97%	0 02	0 016	0 02	15-Jan-89	93	2 93	15-Jan-91	15-Jan-93	15-Jan-91
IR CAPITAL 7 1/2%	1991	7 500%	327 0	98 12	8 765%	1 63	1 701	1 79	320 843	326 080	2 71%	0 04	0 046	0 05	30-Jan-89	78	1 60	30 Jan 91	30-Jan 91	30-Jan 91
IR CAPITAL 8 %	1991	8 000%	385 0	98 73	8 814%	1 73	1 803	1 91	380 101	382 968	3 18%	0 05	0 057	0 06	15 Mar-89	34	0 74	15 Mar 91	15 Mar 91	15 Mar 91
IR FINANCE 12 1/2%	1991	12 500%	6 0	105 83	8 779%	1 80	1 883	2 04	6 350	6 323	0 05%	0 00	0 001	0 00	01-May-89	13	-0 44	01 May 91	01 May 91	01 May 91
IR CAPITAL 8 1/2%	1991	8 500%	330 0	99 47	8 801%	2 00	2 085	2 24	328 236	335 378	2 79%	0 06	0 058	0 06	15 Jan-89	93	2 16	15-Jul 91	15-Jul 91	15-Jul-91
IR NATION 6 3/4%	1986/91	6 750%	329 0	95 93	8 829%	2 19	2 289	2 45	315 601	316 635	2 63%	0 06	0 060	0 06	01 Apr 89	17	0 31	01-Oct-86	01-Oct 91	01-Oct-91
IR EXCHEQR 9 1/4%	1991/96	9 250%	171 0	100 22	9 137%	2 22	2 322	2 54	171 372	170 809	1 42%	0 03	0 033	0 04	01 May-89	-13	-0 33	01 Nov 91	01-Nov-96	01 Nov 91
IR CAPITAL 8 3/4%	1992	8 750%	348 0	99 74	8 865%	2 62	2 731	3 04	347 105	346 022	2 88%	0 08	0 079	0 09	01 May 89	13	-0 31	01 May 92	01 May 92	01 May 92
IR NATION 7 %	1987/92	7 000%	321 0	95 47	8 905%	2 74	2 863	3 18	306 468	314 097	2 61%	0 07	0 075	0 08	15 Dec 88	124	2 38	15 Jun 87	15-Jun-92	15-Jun-92
IR EXCHEQR 7 1/4%	1992	7 250%	139 0	95 79	8 946%	2 89	3 024	3 38	133 148	134 472	1 12%	0 03	0 034	0 04	01 Mar 89	48	0 95	01 Sep 92	01-Sep-92	01 Sep 92
IR NATION 9 3/4%	1992/97	9 750%	196 0	101 32	9 204%	2 92	3 058	3 50	198 583	198 740	1 65%	0 05	0 051	0 06	15 Apr 89	3	0 08	15 Oct 92	15-Oct 97	15-Oct 92
IR CAPITAL 8 1/2%	1992	8 500%	314 0	98 99	8 903%	2 99	3 119	3 54	310 827	309 950	2 58%	0 08	0 080	0 09	30 Apr-89	-12	-0 28	30 Oct 92	30-Oct-92	30 Oct 92
IR DEVELO 7 1/2%	1988/93	7 500%	477 0	95 82	8 953%	3 48	3 636	4 21	457 052	467 533	3 89%	0 14	0 141	0 16	01 Jan-89	107	2 20	01-Jul-88	01-Jul-93	01 Jul-93
IR NATION 11 %	1993/98	11 000%	184 0	104 90	9 215%	3 58	3 748	4 50	193 024	193 191	1 61%	0 06	0 060	0 07	15-Apr-89	3	0 09	15-Oct 93	15-Oct-98	15 Oct 93
IR CAPITAL 8 %	1993	8 000%	483 0	97 31	8 899%	3 70	3 860	4 54	470 004	468 629	3 90%	0 14	0 150	0 18	01 May-89	-13	-0 28	01 Nov 93	01-Nov 93	01 Nov 93
IR CAPITAL 7 %	1994	7 000%	498 0	93 82	8 920%	3 97	4 148	4 91	467 216	470 461	3 91%	0 16	0 162	0 19	15-Mar-89	34	0 65	15 Mar 94	15 Mar 94	15 Mar 94
IR EXCHEQR 13 %	1994	13 000%	19 0	111 70	8 968%	4 23	4 418	5 50	21 223	21 243	0 18%	0 01	0 008	0 01	15 Apr 89	3	0 11	15 Oct 94	15-Oct 94	15-Oct 94
IR CAPITAL 12 1/4%	1995	12 250%	52 0	110 08	8 990%	4 61	4 813	6 12	57 241	59 648	0 50%	0 02	0 024	0 03	01 Dec-88	138	4 63	01 Jun 95	01-Jun-95	01 Jun 95
IR CONVER 12 %	1995	12 000%	182 0	109 48	9 006%	4 77	4 989	6 41	199 252	201 285	1 67%	0 08	0 084	0 11	15 Mar-89	34	1 12	15 Sep-95	15-Sep-95	15-Sep-95
IR CAPITAL 9 %	1996	9 000%	378 0	100 35	8 905%	5 28	5 512	7 29	379 320	386 585	3 21%	0 17	0 177	0 23	30 Jan-89	78	1 92	30-Jul 96	30-Jul 96	30 Jul 96
IR FINANCE 13 %	1997/02	13 000%	248 0	112 40	9 139%	5 64	5 901	7 96	278 761	280 261	2 33%	0 13	0 138	0 19	01 Apr-89	17	0 61	01 Apr 97	01-Apr-02	01 Apr 97
IR CAPITAL 7 3/4 %	1997	7 750%	302 0	95 26	8 924%	5 77	6 032	8 25	287 687	293 646	2 44%	0 14	0 147	0 20	15 Jan-89	93	1 97	15-Jul 97	15-Jul-97	15-Jul 97
IR DEVELO 11 1/2%	1997/99	11 500%	232 0	108 33	9 090%	5 92	6 190	8 58	251 317	249 345	2 07%	0 12	0 128	0 18	15 May 89	27	-0 85	15 Nov 97	15-Nov 99	15-Nov 97
IR CAPITAL 9 3/4 %	1998	9 750%	268 0	103 08	8 937%	6 16	6 438	9 13	276 257	286 130	2 38%	0 15	0 153	0 22	01 Dec 88	138	3 68	01 Jun 98	01-Jun 98	01 Jun 98
IR FINANCE 14 1/2%	1998/00	14 500%	73 0	116 51	9 096%	6 55	6 843	9 42	85 053	86 038	0 72%	0 05	0 049	0 07	15 Mar-89	34	1 35	15 Sep 98	15 Sep 00	15 Sep 98
IR CAPITAL 7 1/2 %	1999	7 500%	306 0	93 87	8 918%	6 62	6 911	10 25	287 249	293 093	2 44%	0 16	0 168	0 25	15 Jan 89	93	1 91	15-Jul 99	15-Jul 99	15-Jul-99
IR CAPITAL 11 3/4%	2000	11 750%	133 0	109 44	9 013%	7 10	7 418	11 00	145 551	145 679	1 21%	0 09	0 090	0 13	15 Apr 89	3	0 10	15-Apr 00	15-Apr 00	15-Apr 00
IR DEVELO 12 1/4%	2000/03	12 250%	105 0	110 63	9 069%	7 20	7 531	11 17	116 165	120 532	1 00%	0 07	0 075	0 11	15-Dec-88	124	4 16	15 Jun-00	15-Jun-03	15-Jun-00
IR CAPITAL 8 %	2001	8 000%	171 0	96 02	8 934%	7 37	7 704	12 50	164 202	164 314	1 37%	0 10	0 105	0 17	15-Apr-89	3	0 07	15-Oct-01	15-Oct-01	15-Oct-01
IR DEVELO 14 3/4%	2002/04	14 750%	74 0	116 05	9 045%	8 38	8 763	12 80	85 879	88 150	0 73%	0 06	0 064	0 09	01-Feb-89	76	3 07	01 Feb-02	01-Feb-04	01 Feb-02
IR CAPITAL 9 1/4%	2003	9 250%	336 0	101 47	8 869%	8 05	8 410	14 24	340 944	349 198	2 90%	0 23	0 244	0 41	11-Jan-89	97	2 46	11-Jul-03	11-Jul-03	11-Jul-03
IR EXCHEQR 6 1/2%	2000/05	6 500%	262 0	89 33	8 792%	8 20	8 562	16 20	234 056	239 278	1 99%	0 16	0 170	0 32	27 Dec-88	112	1 99	27-Jun-00	27-Jun-05	27 Jun-05
IR CAPITAL 12 1/2%	2005	12 500%	63 0	110 07	8 926%	9 58	10 003	16 67	69 346	72 019	0 60%	0 06	0 060	0 10	15 Dec-88	124	4 24	15-Dec-05	15-Dec-05	15 Dec-05
IR CAPITAL 9 %	2006	9 000%	294 0	100 87	8 763%	8 90	9 293	17 38	296 566	300 043	2 50%	0 22	0 232	0 43	01 Mar-89	48	1 18	01 Sep-06	01-Sep-06	01 Sep-06
IR CAPITAL 8 1/4%	2008	8 250%	319 0	98 31	8 703%	9 13	9 525	19 30	313 607	319 227	2 65%	0 24	0 253	0 51	30 Jan-89	78	1 76	30-Jul-08	30-Jul-08	30-Jul-08
IR CAPITAL 8 1/2%	2010	8 500%	303 0	99 54	8 634%	9 64	10 057	21 47	301 619	302 817	2 52%	0 24	0 253	0 54	01 Apr-89	17	0 40	01-Oct 10	01-Oct 10	01-Oct 10
IR CAPITAL 8 3/4%	2012	8 750%	268 0	100 20	8 685%	9 98	10 414	23 47	268 532	269 751	2 24%	0 22	0 234	0 53	30 Mar 89	19	0 46	30 Sep-12	30-Sep 12	30 Sep-12
									11900 340	12025 340	100 00%	3 91	4 086	6 22						

Table A 1 20 Irish Government Treasury Data - October 1989

Trade 16 Oct 89
Sett 17 Oct 89

Stock		Coupon	Nominal Issue	Market Price	Market Yield	Volatility	Duration	Life	Clean Market Value (IR£m)	Dirty Market Value (IR£m)	Stock Weight in Index	Weighted Volatility	Weighted Duration	Weighted Life	Ex Div Date	Accrued Interest	Accrued Interest	First Redemption Date	Last Redemption Date	Redemption Date
IR EXCHEQR 5 3/4%	1984/89	5 750%	302 0	99 95	6 989%	0 04	0 042	0 04	301 851	301 138	2 47%	0 00	0 001	0 00	01 Nov-89	-15	-0 24	01 Nov-84	01-Nov-89	01 Nov 89
IR FINANCE VAR%	1990	9 998%	442 0	100 00	9 979%	0 17	0 172	0 08	442 006	449 628	3 69%	0 01	0 006	0 00	15-Aug-89	63	1 72	15 May-90	15-May 90	15 May 90
IR FINANCE VAR%	1991	10 157%	259 0	100 00	10 151%	0 13	0 137	0 11	259 002	262 603	2 16%	0 00	0 003	0 00	28 Aug-89	50	1 39	28-Nov 91	28-Nov 91	28 Nov 91
IR FINANCE VAR%	1992	10 629%	332 0	100 00	10 610%	0 05	0 047	0 20	332 012	333 655	2 74%	0 00	0 001	0 01	30 Sep 89	17	0 49	30-Mar 92	30 Mar 92	30 Mar 92
IR FINANCE VAR%	1993	9 919%	629 0	100 01	9 900%	0 04	0 041	0 29	629 032	626 470	5 14%	0 00	0 002	0 01	01 Nov-89	-15	-0 41	01-Feb-93	01-Feb 93	01 Feb 93
IR EXCHEQR 14 %	1990/92	14 000%	51 0	100 86	10 764%	0 28	0 297	0 29	51 440	52 945	0 43%	0 00	0 001	0 00	01 Aug-89	77	2 95	01 Feb 90	01-Feb 92	01 Feb 90
IR CAPITAL 7 %	1990	7 000%	299 0	98 81	10 152%	0 39	0 409	0 41	295 435	297 269	2 44%	0 01	0 010	0 01	15 Sep-89	32	0 61	15 Mar 90	15 Mar 90	15 Mar 90
IR EXCHEQR 11 1/2%	1990	11 500%	193 0	100 79	10 401%	0 77	0 813	0 83	194 523	198 351	1 63%	0 01	0 013	0 01	15 Aug-89	63	1 98	15 Aug 90	15 Aug 90	15-Aug 90
IR CAPITAL 13 %	1990	13 000%	59 0	102 26	10 313%	0 92	0 967	0 99	60 331	60 373	0 50%	0 00	0 005	0 00	15-Oct 89	2	0 07	15-Oct 90	15-Oct 90	15 Oct 90
IR EXCHEQR 6 %	1985/90	6 000%	333 0	96 37	9 795%	1 01	1 059	1 08	320 927	319 340	2 62%	0 03	0 028	0 03	15-Nov-89	29	-0 48	15-Nov-85	15-Nov 90	15 Nov 90
IR FINANCE 11 1/2%	1991/93	11 500%	105 0	101 13	10 405%	1 14	1 198	1 25	106 190	109 297	0 90%	0 01	0 011	0 01	15-Jul-89	94	2 96	15-Jan-91	15-Jan 93	15-Jan-91
IR CAPITAL 7 1/2%	1991	7 500%	327 0	96 87	10 345%	1 19	1 248	1 29	316 749	322 054	2 64%	0 03	0 033	0 03	30-Jul-89	79	1 62	30 Jan 91	30 Jan 91	30 Jan 91
IR CAPITAL 8 %	1991	8 000%	384 0	97 13	10 424%	1 29	1 356	1 41	372 962	375 654	3 08%	0 04	0 042	0 04	15-Sep-89	32	0 70	15 Mar 91	15 Mar 91	15 Mar 91
IR FINANCE 12 1/2%	1991	12 500%	6 0	102 74	10 268%	1 38	1 452	1 54	6 164	6 133	0 05%	0 00	0 001	0 00	01 Nov-89	-15	-0 51	01 May-91	01-May 91	01 May 91
IR CAPITAL 8 1/2%	1991	8 500%	330 0	97 41	10 329%	1 57	1 650	1 74	321 443	328 662	2 70%	0 04	0 045	0 05	15-Jul-89	94	2 19	15-Jul-91	15-Jul 91	15-Jul 91
IR NATION 6 3/4%	1986/91	6 750%	329 0	94 75	10 031%	1 76	1 853	1 96	311 737	312 710	2 57%	0 05	0 048	0 05	01-Oct-89	16	0 30	01-Oct-86	01-Oct 91	01-Oct 91
IR CAPITAL 8 3/4%	1992	8 750%	346 0	97 44	10 082%	2 21	2 319	2 54	337 152	335 908	2 76%	0 06	0 064	0 07	01-Nov-89	-15	-0 36	01-May 92	01-May 92	01 May 92
IR NATION 7 %	1987/92	7 000%	321 0	93 65	10 107%	2 33	2 447	2 66	300 610	308 239	2 53%	0 06	0 062	0 07	15 Jun-89	124	2 38	15-Jun-87	15-Jun 92	15-Jun 92
IR EXCHEQR 7 1/4%	1992	7 250%	139 0	93 83	10 107%	2 49	2 615	2 88	130 423	131 692	1 08%	0 03	0 028	0 03	01 Sep-89	46	0 91	01 Sep-92	01 Sep 92	01 Sep 92
IR CAPITAL 8 1/2%	1992	8 500%	313 0	96 59	10 045%	2 59	2 718	3 04	302 340	301 393	2 47%	0 06	0 067	0 08	30 Oct-89	-13	-0 30	30-Oct 92	30-Oct 92	30-Oct 92
IR DEVELO 7 1/2%	1988/93	7 500%	472 0	93 74	9 918%	3 09	3 248	3 71	442 436	452 903	3 72%	0 12	0 121	0 14	01 Jul-89	108	2 22	01-Jul-88	01-Jul-93	01-Jul 93
IR NATION 11 %	1993/98	11 000%	184 0	102 38	10 054%	3 21	3 373	4 00	188 385	188 495	1 55%	0 05	0 052	0 06	15-Oct-89	2	0 06	15-Oct-93	15-Oct 98	15-Oct 93
IR CAPITAL 8 %	1993	8 000%	482 0	94 93	9 865%	3 31	3 476	4 04	457 549	455 965	3 74%	0 12	0 130	0 15	01 Nov-89	-15	-0 33	01-Nov-93	01-Nov 93	01-Nov 93
IR CAPITAL 7 %	1994	7 000%	498 0	91 70	9 819%	3 59	3 769	4 41	456 646	459 700	3 77%	0 14	0 142	0 17	15 Sep 89	32	0 61	15-Mar 94	15 Mar 94	15-Mar 94
IR NATION 9 1/4%	1989/94	9 250%	113 0	97 61	10 080%	3 69	3 880	4 71	110 300	113 391	0 93%	0 03	0 036	0 04	01 Jul-89	108	2 74	01 Jul 89	01-Jul-94	01-Jul 94
IR EXCHEQR 13 %	1994	13 000%	19 0	109 12	9 659%	3 86	4 043	5 00	20 733	20 747	0 17%	0 01	0 007	0 01	15 Oct-89	2	0 07	15-Oct 94	15-Oct 94	15-Oct 94
IR CAPITAL 12 1/4%	1995	12 250%	52 0	107 80	9 592%	4 24	4 448	5 62	56 058	58 464	0 48%	0 02	0 021	0 03	01 Jun-89	138	4 63	01 Jun-95	01 Jun-95	01 Jun-95
IR CONVER 12 %	1995	12 000%	181 0	107 38	9 556%	4 42	4 629	5 92	194 356	196 258	1 61%	0 07	0 075	0 10	15 Sep 89	32	1 05	15-Sep-95	15 Sep 95	15-Sep 95
IR CAPITAL 9 %	1996	9 000%	378 0	98 32	9 477%	4 93	5 167	6 79	371 661	379 019	3 11%	0 15	0 161	0 21	30 Jul-89	79	1 95	30-Jul-96	30-Jul 96	30-Jul-96
IR EXCHEQR 8 1/2 %	1996	8 500%	97 0	96 61	9 436%	5 04	5 276	6 98	83 714	84 098	0 77%	0 04	0 041	0 05	30 Sep-89	17	0 40	30-Sep 96	30-Sep-96	30-Sep 96
IR EXCHEQR 9 1/4%	1991/96	9 250%	171 0	97 59	9 943%	4 99	5 239	7 05	166 886	166 236	1 36%	0 07	0 071	0 10	01 Nov-89	15	-0 38	01 Nov 91	01-Nov 96	01-Nov 96
IR FINANCE 13 %	1997/02	13 000%	248 0	110 59	9 604%	5 28	5 538	7 46	274 268	275 680	2 26%	0 12	0 125	0 17	01-Oct-89	16	0 57	01 Apr 97	01-Apr-02	01-Apr 97
IR CAPITAL 7 3/4 %	1997	7 750%	301 0	93 38	9 461%	5 44	5 699	7 75	281 067	287 070	2 36%	0 13	0 134	0 18	15-Jul-89	94	1 99	15-Jul-97	15-Jul-97	15-Jul-97
IR NATION 9 3/4%	1992/97	9 750%	195 0	99 35	9 934%	5 43	5 701	8 00	193 731	193 835	1 59%	0 09	0 091	0 13	15-Oct-89	2	0 05	15-Oct-92	15-Oct-97	15-Oct 97
IR DEVELO 11 1/2%	1997/99	11 500%	230 0	106 50	9 561%	5 57	5 837	8 08	244 958	242 858	1 99%	0 11	0 116	0 16	15 Nov 89	29	-0 91	15-Nov 97	15-Nov 99	15-Nov 97
IR CAPITAL 9 3/4 %	1998	9 750%	268 0	101 29	9 398%	5 83	6 099	8 63	271 468	281 340	2 31%	0 13	0 141	0 20	01 Jun-89	138	3 68	01-Jun 98	01-Jun 98	01-Jun-98
IR FINANCE 14 1/2%	1998/00	14 500%	73 0	114 94	9 518%	6 16	6 450	8 92	83 907	84 834	0 70%	0 04	0 045	0 06	15 Sep 89	32	1 27	15-Sep 98	15-Sep-00	15 Sep 98
IR CAPITAL 7 1/2 %	1999	7 500%	283 0	92 19	9 364%	6 30	6 594	9 75	260 908	266 370	2 19%	0 14	0 144	0 21	15 Jul 89	94	1 93	15-Jul-99	15-Jul-99	15-Jul-99
IR CAPITAL 11 3/4%	2000	11 750%	133 0	107 82	9 437%	6 72	7 042	10 50	143 402	143 487	1 18%	0 08	0 083	0 12	15 Oct 89	2	0 06	15-Apr-00	15-Apr-00	15-Apr-00
IR DEVELO 12 1/4%	2000/03	12 250%	105 0	109 28	9 432%	6 84	7 167	10 67	114 746	119 113	0 98%	0 07	0 070	0 10	15-Jun-89	124	4 16	15-Jun-00	15-Jun-03	15-Jun-00
IR CAPITAL 8 %	2001	8 000%	172 0	95 32	9 110%	7 15	7 471	12 00	163 956	164 031	1 35%	0 10	0 101	0 16	15 Oct 89	2	0 04	15-Oct-01	15-Oct-01	15-Oct-01
IR DEVELO 14 3/4%	2002/04	14 750%	71 0	115 07	9 365%	7 97	8 343	12 30	81 701	83 909	0 69%	0 05	0 057	0 08	01 Aug 89	77	3 11	01-Feb-02	01-Feb-04	01-Feb-02
IR CAPITAL 9 1/4%	2003	9 250%	335 0	100 69	9 070%	7 79	8 143	13 74	337 319	345 633	2 84%	0 22	0 231	0 39	11-Jul-89	98	2 48	11-Jul-03	11-Jul-03	11-Jul-03
IR EXCHEQR 8 1/4%	2003	8 250%	195 0	96 79	9 032%	7 77	8 126	14 04	188 743	188 170	1 54%	0 12	0 126	0 22	30 Oct-89	-13	-0 29	30-Oct-03	30-Oct-03	30-Oct-03
IR EXCHEQR 6 1/2%	2000/05	6 500%	262 0	88 99	8 866%	8 07	8 426	15 70	233 142	238 364	1 96%	0 16	0 165	0 31	27 Jun-89	112	1 99	27-Jun-00	27-Jun-05	27 Jun-05
IR CAPITAL 12 1/2%	2005	12 500%	63 0	109 60	9 110%	9 25	9 666	16 17	69 049	71 722	0 59%	0 05	0 057	0 10	15 Jun-89	124	4 24	15-Dec-05	15-Dec-05	15-Dec-05
IR CAPITAL 9 %	2006	9 000%	290 0	100 70	8 810%	8 75	9 133	16 88	292 041	295 328	2 42%	0 21	0 221	0 41	01 Sep-89	46	1 13	01 Sep-06	01 Sep 06	01 Sep-06
IR CAPITAL 8 1/4%	2008	8 250%	319 0	97 94	8 799%	8 95	9 346	18 80	312 427	318 119	2 61%	0 23	0 244	0 49	30 Jul-89	79	1 78	30-Jul-08	30-Jul-08	30-Jul-08
IR CAPITAL 8 1/2%	2010	8 500%	303 0	99 17	8 741%	9 44	9 858	20 97	300 497	301 626	2 48%	0 23	0 244	0 52	01 Oct 89	16	0 37	01-Oct-10	01-Oct-10	01-Oct-10
IR CAPITAL 8 3/4%	2012	8 750%	260 0	99 92	8 775%	9 80	10 229	22 97	259 797	260 856	2 14%	0 21	0 219	0 49	30 Sep-89	17	0 41	30-Sep-12	30-Sep-12	30 Sep 12
									12058 178	12181 140	100 00%	3 77	3 943	6 08						

Table A.1.21 Irish Government Treasury Data - April 1990

Trade 17-Apr-90
Sett 18-Apr-90

Stock		Coupon	Nominal Issue	Market Price	Market Yield	Volatility	Duration	Life	Clean Market Value (IR£m)	Dirty Market Value (IR£m)	Stock Weight in Index	Weighted Volatility	Weighted Duration	Weighted Life	Ex-Div Date	Accrued Interest	Accrued Interest	First Redemption Date	Last Redemption Date	Redemption Date
IR.FINANCE VAR%	1990	11.770%	442.0	100.04	11.212%	0.17	0.170	0.08	442.184	451.015	3.61%	0.01	0.006	0.00	15-Feb-90	62	2.00	15-May-90	15-May-90	15-May-90
IR.FINANCE VAR%	1991	12.590%	259.0	100.02	12.358%	0.13	0.134	0.12	259.064	263.439	2.11%	0.00	0.003	0.00	28-Feb-90	49	1.69	28-Nov-91	28-Nov-91	28-Nov-91
IR.FINANCE VAR%	1994	12.635%	630.0	100.02	12.486%	0.09	0.093	0.16	630.136	637.546	5.10%	0.00	0.005	0.01	15-Mar-90	34	1.18	01-Jun-94	01-Jun-94	01-Jun-94
IR.FINANCE VAR%	1992	12.815%	631.0	100.05	12.548%	0.05	0.052	0.20	631.305	635.512	5.08%	0.00	0.003	0.01	30-Mar-90	19	0.67	30-Mar-92	30-Mar-92	30-Mar-92
IR.FINANCE VAR%	1993	12.508%	639.0	100.05	12.313%	0.03	0.036	0.28	639.323	636.479	5.09%	0.00	0.002	0.01	01-May-90	13	-0.45	01-Feb-93	01-Feb-93	01-Feb-93
IR.EXCHEQR 11 1/2%	1990	11.500%	193.1	99.95	11.660%	0.31	0.329	0.33	193.008	196.778	1.57%	0.00	0.005	0.01	15-Feb-90	62	1.95	15-Aug-90	15-Aug-90	15-Aug-90
IR.CAPITAL 13 %	1990	13.000%	59.2	100.56	11.711%	0.47	0.494	0.49	59.534	59.597	0.48%	0.00	0.002	0.00	15-Apr-90	3	0.11	15-Oct-90	15-Oct-90	15-Oct-90
IR.EXCHEQR 6 %	1985/90	6.000%	333.8	97.87	10.011%	0.55	0.576	0.58	326.687	325.207	2.60%	0.01	0.015	0.02	15-May-90	-27	-0.44	15-Nov-85	15-Nov-90	15-Nov-90
IR.FINANCE 11 1/2%	1991/93	11.500%	105.5	100.14	11.284%	0.70	0.735	0.75	105.648	108.737	0.87%	0.01	0.006	0.01	15-Jan-90	93	2.93	15-Jan-91	15-Jan-93	15-Jan-91
IR.CAPITAL 7 1/2%	1991	7.500%	327.5	97.57	10.973%	0.74	0.777	0.79	319.536	324.782	2.60%	0.02	0.020	0.02	30-Jan-90	78	1.60	30-Jan-91	30-Jan-91	30-Jan-91
IR.CAPITAL 8 %	1991	8.000%	384.1	97.54	11.092%	0.84	0.891	0.91	374.652	377.512	3.02%	0.03	0.027	0.03	15-Mar-90	34	0.74	15-Mar-91	15-Mar-91	15-Mar-91
IR.FINANCE 12 1/2%	1991	12.500%	6.4	101.18	11.136%	0.95	1.004	1.04	6.476	6.447	0.05%	0.00	0.001	0.00	01-May-90	-13	-0.44	01-May-91	01-May-91	01-May-91
IR.CAPITAL 8 1/2%	1991	8.500%	330.5	97.26	11.110%	1.14	1.201	1.24	321.437	328.590	2.63%	0.03	0.032	0.03	15-Jan-90	93	2.16	15-Jul-91	15-Jul-91	15-Jul-91
IR.NATION. 6 3/4%	1986/91	6.750%	397.0	95.04	10.783%	1.33	1.404	1.45	377.296	378.543	3.03%	0.04	0.042	0.04	01-Apr-90	17	0.31	01-Oct-86	01-Oct-91	01-Oct-91
IR.CAPITAL 8 3/4%	1992	8.750%	366.0	96.24	11.109%	1.80	1.899	2.04	352.237	351.097	2.81%	0.05	0.053	0.06	01-May-90	-13	-0.31	01-May-92	01-May-92	01-May-92
IR.NATION. 7 %	1987/92	7.000%	321.2	93.03	11.076%	1.92	2.023	2.16	298.820	306.454	2.45%	0.05	0.050	0.05	15-Dec-89	124	2.38	15-Jun-87	15-Jun-92	15-Jun-92
IR.EXCHEQR 7 1/4%	1992	7.250%	139.0	93.02	11.048%	2.08	2.199	2.38	129.299	130.623	1.04%	0.02	0.023	0.02	01-Mar-90	48	0.95	01-Sep-92	01-Sep-92	01-Sep-92
IR.CAPITAL 8 1/2%	1992	8.500%	313.9	95.25	10.997%	2.19	2.312	2.54	299.005	298.128	2.38%	0.05	0.055	0.06	30-Apr-90	-12	-0.28	30-Oct-92	30-Oct-92	30-Oct-92
IR.DEVELO. 7 1/2%	1988/93	7.500%	472.3	91.92	11.022%	2.70	2.852	3.21	434.146	444.523	3.56%	0.10	0.101	0.11	01-Jan-90	107	2.20	01-Jul-88	01-Jul-93	01-Jul-93
IR.CAPITAL 8 %	1993	8.000%	482.2	92.79	10.959%	2.93	3.090	3.54	447.415	446.042	3.57%	0.10	0.110	0.13	01-May-90	-13	-0.28	01-Nov-93	01-Nov-93	01-Nov-93
IR.CAPITAL 7 %	1994	7.000%	598.0	89.58	10.917%	3.21	3.385	3.91	535.699	539.596	4.32%	0.14	0.146	0.17	15-Mar-90	34	0.65	15-Mar-94	15-Mar-94	15-Mar-94
IR.NATION. 9 1/4%	1989/94	9.250%	113.7	94.95	11.168%	3.32	3.507	4.21	107.958	111.039	0.89%	0.03	0.031	0.04	01-Jan-90	107	2.71	01-Jul-89	01-Jul-94	01-Jul-94
IR.EXCHEQR 13 %	1994	13.000%	19.6	105.50	10.821%	3.46	3.652	4.50	20.625	20.646	0.17%	0.01	0.006	0.01	15-Apr-90	3	0.11	15-Oct-94	15-Oct-94	15-Oct-94
IR.CAPITAL 12 1/4%	1995	12.250%	52.9	104.17	10.723%	3.85	4.055	5.12	56.109	57.557	0.46%	0.02	0.019	0.02	01-Dec-89	138	4.63	01-Jun-95	01-Jun-95	01-Jun-95
IR.CONVER 12 %	1995	12.000%	181.2	103.74	10.673%	4.02	4.235	5.41	187.981	190.005	1.52%	0.06	0.064	0.08	15-Mar-90	34	1.12	15-Sep-95	15-Sep-95	15-Sep-95
IR.CAPITAL 9 %	1996	9.000%	378.0	95.15	10.470%	4.56	4.789	6.29	359.663	366.928	2.93%	0.13	0.141	0.18	30-Jan-90	78	1.92	30-Jul-96	30-Jul-96	30-Jul-96
IR.EXCHEQR 8 1/2 %	1996	8.500%	132.0	93.34	10.463%	4.65	4.895	6.46	123.211	123.794	0.99%	0.05	0.048	0.06	30-Mar-90	19	0.44	30-Sep-96	30-Sep-96	30-Sep-96
IR.EXCHEQR 9 1/4%	1991/96	9.250%	171.2	97.46	10.002%	4.73	4.969	6.55	166.853	166.290	1.33%	0.06	0.066	0.09	01-May-90	-13	-0.33	01-Nov-91	01-Nov-96	01-Nov-96
IR.FINANCE 13 %	1997/02	13.000%	248.0	107.08	10.611%	4.85	5.113	6.96	265.547	267.047	2.14%	0.10	0.109	0.15	01-Apr-90	17	0.61	01-Apr-97	01-Apr-02	01-Apr-97
IR.CAPITAL 7 3/4 %	1997	7.750%	301.6	90.55	10.333%	5.07	5.332	7.25	273.102	279.053	2.23%	0.11	0.119	0.16	15-Jan-90	93	1.97	15-Jul-97	15-Jul-97	15-Jul-97
IR.NATION. 9 3/4%	1992/97	9.750%	195.9	96.27	10.861%	5.04	5.317	7.50	188.593	188.750	1.51%	0.08	0.080	0.11	15-Apr-90	3	0.08	15-Oct-92	15-Oct-97	15-Oct-97
IR.DEVELO. 11 1/2%	1997/99	11.500%	230.9	101.95	10.879%	5.08	5.359	7.58	235.408	233.445	1.87%	0.09	0.100	0.14	15-May-90	-27	-0.85	15-Nov-97	15-Nov-99	15-Nov-97
IR.CAPITAL 9 3/4 %	1998	9.750%	268.0	98.06	10.304%	5.41	5.692	8.13	262.812	272.684	2.18%	0.12	0.124	0.18	01-Dec-89	138	3.68	01-Jun-98	01-Jun-98	01-Jun-98
IR.FINANCE 14 1/2%	1998/00	14.500%	73.2	111.21	10.579%	5.64	5.937	8.42	81.407	82.395	0.66%	0.04	0.039	0.06	15-Mar-90	34	1.35	15-Sep-98	15-Sep-00	15-Sep-98
IR.NATION. 11 %	1993/98	11.000%	184.1	99.64	11.111%	5.41	5.708	8.50	183.441	183.607	1.47%	0.08	0.084	0.12	15-Apr-90	3	0.09	15-Oct-93	15-Oct-98	15-Oct-98
IR.CAPITAL 7 1/2 %	1999	7.500%	283.3	89.02	10.263%	5.88	6.185	9.25	252.182	257.592	2.06%	0.12	0.127	0.19	15-Jan-90	93	1.91	15-Jul-99	15-Jul-99	15-Jul-99
IR.CAPITAL 11 3/4%	2000	11.750%	133.6	104.11	10.473%	6.18	6.505	10.00	139.085	139.214	1.11%	0.07	0.072	0.11	15-Apr-90	3	0.10	15-Apr-00	15-Apr-00	15-Apr-00
IR.DEVELO. 12 1/4%	2000/03	12.250%	105.2	105.36	10.535%	6.26	6.592	10.17	110.835	115.210	0.92%	0.06	0.061	0.09	15-Dec-89	124	4.16	15-Jun-00	15-Jun-03	15-Jun-00
IR.CAPITAL 8 %	2001	8.000%	172.2	91.13	10.242%	6.55	6.884	11.50	156.933	157.046	1.26%	0.08	0.086	0.14	15-Apr-90	3	0.07	15-Oct-01	15-Oct-01	15-Oct-01
IR.DEVELO. 14 3/4%	2002/04	14.750%	71.4	111.44	10.441%	7.24	7.616	11.80	79.568	81.759	0.65%	0.05	0.050	0.08	01-Feb-90	76	3.07	01-Feb-02	01-Feb-04	01-Feb-02
IR.CAPITAL 9 1/4%	2003	9.250%	335.1	96.57	10.205%	7.06	7.422	13.24	323.607	331.839	2.65%	0.19	0.197	0.35	11-Jan-90	97	2.46	11-Jul-03	11-Jul-03	11-Jul-03
IR.EXCHEQR 8 1/4%	2003	8.250%	220.0	92.61	10.177%	7.05	7.404	13.54	203.746	203.149	1.62%	0.11	0.120	0.22	30-Apr-90	-12	-0.27	30-Oct-03	30-Oct-03	30-Oct-03
IR.EXCHEQR 6 1/2%	2000/05	6.500%	262.9	84.42	10.137%	7.19	7.558	15.20	221.950	227.190	1.82%	0.13	0.137	0.28	27-Dec-89	112	1.99	27-Jun-00	27-Jun-05	27-Jun-05
IR.CAPITAL 12 1/2%	2005	12.500%	63.4	105.93	10.246%	8.24	8.667	15.67	67.162	69.853	0.56%	0.05	0.048	0.09	15-Dec-89	124	4.24	15-Dec-05	15-Dec-05	15-Dec-05
IR.CAPITAL 9 %	2006	9.000%	290.7	96.11	10.151%	7.66	8.045	16.38	279.383	282.821	2.26%	0.17	0.182	0.37	01-Mar-90	48	1.18	01-Sep-06	01-Sep-06	01-Sep-06
IR.CAPITAL 8 1/4%	2008	8.250%	319.6	93.64	10.121%	7.75	8.145	18.30	299.275	304.906	2.44%	0.19	0.199	0.45	30-Jan-90	78	1.76	30-Jul-08	30-Jul-08	30-Jul-08
IR.CAPITAL 8 1/2%	2010	8.500%	303.5	95.41	9.985%	8.13	8.539	20.47	289.573	290.773	2.33%	0.19	0.199	0.48	01-Apr-90	17	0.40	01-Oct-10	01-Oct-10	01-Oct-10
IR.CAPITAL 8 3/4%	2012	8.750%	260.4	96.36	10.087%	8.27	8.686	22.47	250.920	252.105	2.02%	0.17	0.175	0.45	30-Mar-90	19	0.46	30-Sep-12	30-Sep-12	30-Sep-12
									12368.835	12503.344	100.00%	3.22	3.393	5.50						

Trade : 17 Oct 90
Sett : 19-Oct 90

Stock		Coupon	Nominal Issue	Market Price	Market Yield	Volatility	Duration	Life	Clean Market Value (IR£m)	Dirty Market Value (IR£m)	Stock Weight in Index	Weighted Volatility	Weighted Duration	Weighted Life	Ex Div Date	Accrued Interest	Accrued Interest	First Redemption Date	Last Redemption Date	Redemption Date
IR EXCHEQR 6 %	1985/90	6 000%	334 0	99 90	7 370%	0 07	0 075	0 07	333 674	332 193	2 55%	0 00	0 002	0 00	15-Nov-90	-27	-0 44	15-Nov-85	15-Nov-90	15-Nov-90
IR FINANCE VAR%	1991	11 190%	259 0	100 04	10 798%	0 14	0 142	0 11	259 102	263 228	2 02%	0 00	0 003	0 00	28-Aug-90	52	1 59	28-Nov-91	28-Nov-91	28-Nov-91
IR FINANCE VAR%	1994	11 390%	630 0	100 03	11 150%	0 09	0 093	0 16	630 220	636 900	4 89%	0 00	0 005	0 01	15-Sep-90	34	1 06	01-Jun-94	01-Jun-94	01-Jun-94
IR FINANCE VAR%	1992	11 310%	631 0	100 07	10 912%	0 05	0 052	0 20	631 460	635 172	4 87%	0 00	0 003	0 01	30-Sep-90	19	0 59	30-Mar-92	30-Mar-92	30-Mar-92
IR FINANCE 11 1/2%	1991/93	11 500%	106 0	100 24	10 421%	0 23	0 245	0 24	106 255	109 459	0 84%	0 00	0 002	0 00	15-Jul-90	96	3 02	15-Jan-91	15-Jan-93	15-Jan 91
IR FUNDING VAR%	1995	10 430%	270 0	100 03	10 292%	0 01	0 008	0 24	270 083	270 314	2 07%	0 00	0 000	0 00	16-Oct 90	3	0 09	16 Jun-95	16-Jun-95	16-Jun-95
IR CAPITAL 7 1/2%	1991	7 500%	328 0	99 47	9 520%	0 27	0 284	0 28	326 248	331 704	2 54%	0 01	0 007	0 01	30 Jul 90	81	1 66	30-Jan-91	30-Jan 91	30-Jan 91
IR FINANCE VAR%	1993	10 590%	639 0	100 08	10 289%	0 03	0 036	0 28	639 505	637 097	4 89%	0 00	0 002	0 01	01-Nov-90	-13	-0 38	01 Feb-93	01-Feb-93	01-Feb-93
IR CAPITAL 8 %	1991	8 000%	384 0	99 38	9 657%	0 39	0 404	0 40	381 630	384 489	2 95%	0 01	0 012	0 01	15-Sep-90	34	0 74	15 Mar 91	15-Mar 91	15-Mar 91
IR FINANCE 12 1/2%	1991	12 500%	6 0	101 16	10 046%	0 51	0 531	0 53	6 070	6 043	0 05%	0 00	0 000	0 00	01-Nov 90	-13	-0 44	01 May 91	01 May 91	01 May 91
IR CAPITAL 8 1/2%	1991	8 500%	331 0	98 96	10 086%	0 69	0 729	0 74	327 542	334 937	2 57%	0 02	0 019	0 02	15-Jul 90	96	2 23	15-Jul-91	15-Jul 91	15-Jul 91
IR NATION 6 3/4%	1986/91	6 750%	470 0	97 45	9 770%	0 89	0 935	0 95	457 999	459 562	3 53%	0 03	0 033	0 03	01-Oct 90	18	0 33	01 Oct 86	01 Oct 91	01-Oct 91
IR CAPITAL 8 3/4%	1992	8 750%	366 0	97 99	10 337%	1 39	1 465	1 53	358 626	357 486	2 74%	0 04	0 040	0 04	01 Nov 90	-13	-0 31	01 May 92	01 May 92	01 May 92
IR NATION 7 %	1987/92	7 000%	321 0	95 50	10 256%	1 51	1 586	1 66	306 559	314 310	2 41%	0 04	0 038	0 04	15-Jun-90	126	2 41	15-Jun-87	15-Jun 92	15-Jun 92
IR EXCHEQR 7 1/4%	1992	7 250%	139 0	95 50	10 192%	1 69	1 773	1 87	132 748	134 072	1 03%	0 02	0 018	0 02	01 Sep 90	48	0 95	01 Sep 92	01-Sep-92	01 Sep 92
IR CAPITAL 8 1/2%	1992	8 500%	314 0	97 03	10 341%	1 81	1 900	2 03	304 689	303 886	2 33%	0 04	0 044	0 05	30 Oct 90	-11	-0 26	30-Oct 92	30-Oct 92	30 Oct 92
IR DEVELO 7 1/2%	1988/93	7 500%	472 0	94 11	10 386%	2 34	2 467	2.70	444 179	454 840	3 49%	0 08	0 086	0 09	01 Jul 90	110	2 26	01 Jul 88	01-Jul 93	01-Jul 93
IR NATION 11 %	1993/98	11 000%	184 0	100 74	10 641%	2 50	2 635	2 99	185 368	185 590	1 42%	0 04	0 038	0 04	15-Oct 90	4	0 12	15-Oct 93	15-Oct 98	15-Oct 93
IR CAPITAL 8 %	1993	8 000%	656 0	94 80	10 352%	2 59	2 723	3 04	621 863	619 996	4 76%	0 12	0 130	0 14	01-Nov-90	-13	-0 28	01 Nov 93	01-Nov-93	01-Nov 93
IR CAPITAL 7 %	1994	7 000%	598 0	91 82	10 345%	2 88	3 029	3 41	549 066	552 963	4 24%	0 12	0 128	0 14	15-Sep-90	34	0 65	15 Mar 94	15-Mar 94	15 Mar 94
IR NATION 9 1/4%	1989/94	9 250%	114 0	96 71	10 584%	3 02	3 182	3 70	110 251	113 427	0 87%	0 03	0 028	0 03	01-Jul 90	110	2 79	01-Jul-89	01-Jul-94	01-Jul 94
IR EXCHEQR 13 %	1994	13 000%	20 0	105 62	10 645%	3 16	3 326	3 99	21 123	21 151	0 16%	0 01	0 005	0 01	15-Oct-90	4	0 14	15-Oct-94	15-Oct 94	15-Oct 94
IR CAPITAL 12 1/4%	1995	12 250%	53 0	104 39	10 575%	3 56	3 749	4 62	55 325	57 813	0 44%	0 02	0 017	0 02	01 Jun 90	140	4 70	01 Jun-95	01-Jun 95	01-Jun 95
IR CONVER 12 %	1995	12 000%	181 0	103 94	10 549%	3 74	3 936	4 91	188 124	190 146	1 46%	0 05	0 057	0 07	15-Sep-90	34	1 12	15-Sep-95	15-Sep 95	15-Sep 95
IR CAPITAL 9 %	1996	9 000%	891 0	95 62	10 370%	4 30	4 521	5 78	852 015	869 798	6 67%	0 29	0 302	0 39	30 Jul 90	81	2 00	30 Jul 96	30-Jul-96	30-Jul-96
IR EXCHEQR 8 1/2 %	1996	8 500%	132 0	93 67	10 429%	4 40	4 627	5 95	123 646	124 230	0 95%	0 04	0 044	0 06	30-Sep-90	19	0 44	30-Sep-96	30-Sep-96	30-Sep-96
IR EXCHEQR 9 1/4%	1991/96	9 250%	55 0	95 46	10 668%	4 40	4 631	6 04	52 504	52 322	0 40%	0 02	0 019	0 02	01 Nov 90	-13	-0 33	01 Nov 91	01 Nov 96	01-Nov 96
IR FINANCE 13 %	1997/02	13 000%	248 0	106 78	10 665%	4 59	4 832	6 45	264 823	266 412	2 04%	0 09	0 099	0 13	01-Oct 90	18	0 64	01-Apr 97	01-Apr-02	01 Apr 97
IR CAPITAL 7 3/4 %	1997	7 750%	302 0	90 60	10 396%	4 83	5 078	6 74	273 623	279 775	2 15%	0 10	0 109	0 14	15-Jul-90	96	2 04	15-Jul 97	15-Jul 97	15-Jul 97
IR NATION 9 3/4%	1992/97	9 750%	196 0	96 95	10 669%	4 85	5 108	6 99	190 026	190 235	1 46%	0 07	0 075	0 10	15-Oct 90	4	0 11	15-Oct-92	15-Oct 97	15-Oct 97
IR DEVELO 11 1/2%	1997/99	11 500%	231 0	102 79	10 611%	4 89	5 154	7 08	237 435	235 471	1 81%	0 09	0 093	0 13	15-Nov 90	27	-0 85	15-Nov-97	15-Nov 99	15-Nov-97
IR CAPITAL 9 3/4 %	1998	9 750%	489 0	97 91	10 358%	5 18	5 453	7 62	478 786	497 061	3 81%	0 20	0 208	0 29	01-Jun-90	140	3 74	01-Jun-98	01-Jun-98	01-Jun-98
IR FINANCE 14 1/2%	1998/00	14 500%	73 0	111 86	10 383%	5 43	5 711	7 91	81 655	82 640	0 63%	0 03	0 036	0 05	15 Sep 90	34	1 35	15 Sep-98	15-Sep-00	15-Sep-98
IR CAPITAL 7 1/2 %	1999	7 500%	283 0	88 84	10 352%	5 68	5 979	8 74	251 430	257 009	1 97%	0 11	0 118	0 17	15-Jul 90	96	1 97	15-Jul-99	15-Jul 99	15-Jul 99
IR CAPITAL 11 3/4%	2000	11 750%	134 0	104 16	10 460%	5 99	6 302	9 50	139 577	139 749	1 07%	0 06	0 068	0 10	15-Oct 90	4	0 13	15-Apr-00	15-Apr-00	15-Apr-00
IR DEVELO 12 1/4%	2000/03	12 250%	105 0	105 22	10 581%	6 05	6 371	9 66	110 486	114 923	0 88%	0 05	0 056	0 09	15-Jun-90	126	4 23	15-Jun-00	15-Jun-03	15-Jun-00
IR CAPITAL 8 %	2001	8 000%	172 0	90 86	10 321%	6 39	6 718	11 00	156 281	156 432	1 20%	0 08	0 081	0 13	15-Oct-90	4	0 09	15-Oct-01	15-Oct-01	15-Oct-01
IR DEVELO 14 3/4%	2002/04	14 750%	71 0	110 30	10 843%	6 86	7 233	11 30	78 313	80 578	0 62%	0 04	0 045	0 07	01 Aug-90	79	3 19	01-Feb-02	01-Feb-04	01-Feb-02
IR CAPITAL 9 1/4%	2003	9 250%	335 0	96 09	10 337%	6 88	7 236	12 73	321 910	330 394	2 53%	0 17	0 183	0 32	11-Jul-90	100	2 53	11-Jul-03	11-Jul-03	11-Jul-03
IR EXCHEQR 8 1/4%	2003	8 250%	250 0	92 13	10 303%	6 88	7 237	13 04	230 333	229 711	1 76%	0 12	0 128	0 23	30-Oct 90	-11	-0 25	30-Oct-03	30-Oct-03	30-Oct-03
IR EXCHEQR 6 1/2%	2000/05	6 500%	259 0	84 10	10 205%	7 10	7 463	14 70	217 817	223 072	1 71%	0 12	0 128	0 25	27-Jun-90	114	2 03	27-Jun-00	27-Jun-05	27-Jun-05
IR CAPITAL 12 1/2%	2005	12 500%	63 0	105 50	10 430%	7 98	8 398	15 17	66 463	69 179	0 53%	0 04	0 045	0 08	15-Jun-90	126	4 31	15 Dec-05	15-Dec-05	15-Dec-05
IR CAPITAL 9 %	2006	9 000%	291 0	95 82	10 222%	7 53	7 915	15 88	278 845	282 286	2 17%	0 16	0 171	0 34	01-Sep-90	48	1 18	01-Sep-06	01-Sep-06	01-Sep-06
IR CAPITAL 8 1/4%	2008	8 250%	320 0	93 33	10 191%	7 65	8 038	17 79	298 644	304 499	2 34%	0 18	0 188	0 42	30-Jul 90	81	1 83	30-Jul-08	30-Jul-08	30-Jul-08
IR CAPITAL 8 1/2%	2010	8 500%	304 0	95 33	9 979%	8 10	8 499	19 96	289 813	291 086	2 23%	0 18	0 190	0 45	01-Oct 90	18	0 42	01-Oct 10	01-Oct-10	01-Oct 10
IR CAPITAL 8 3/4%	2012	8 750%	260 0	96 20	10 115%	8 21	8 623	21 96	250 133	251 316	1 93%	0 16	0 166	0 42	30-Sep-90	19	0 46	30-Sep-12	30-Sep-12	30 Sep 12
									12892 265	13034 956	100 00%	3 11	3 266	5 21						

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Trade 17-Apr-91
Sett 19 Apr 91

Stock	Coupon	Nominal Issue	Market Price	Market Yield	Volatility	Duration	Life	Clean Market Value (IR£m)	Dirty Market Value (IR£m)	Stock Weight in Index	Weighted Volatility	Weighted Duration	Weighted Life	Ex Div Date	Accrued Interest	Accrued Interest	First Redemption Date	Last Redemption Date	Redemption Date
IR FINANCE 12 1/2% 1991	12 500%	6 0	100 15	7 843%	0 03	0 034	0 03	6 009	5 984	0 05%	0 00	0 000	0 00	01-May 91	-12	-0 41	01-May 91	01 May 91	01 May 91
IR FINANCE VAR% 1991	11 520%	259 0	100 05	10 999%	0 13	0 137	0 11	259 142	263 226	1 99%	0 00	0 003	0 00	28-Feb-91	50	1 58	28-Nov-91	28-Nov 91	28-Nov 91
IR FINANCE VAR% 1994	11.110%	630 0	100 05	10 774%	0 09	0 096	0 15	630 303	637 010	4 82%	0 00	0 005	0 01	15-Mar-91	35	1 06	01-Jun-94	01-Jun-94	01-Jun-94
IR FINANCE VAR% 1992	10 670%	630 0	100 09	10 160%	0 05	0 055	0 19	630 582	634 263	4 80%	0 00	0 003	0 01	30-Mar-91	20	0 58	30-Mar 92	30-Mar 92	30 Mar 92
IR CAPITAL 8 1/2% 1991	8 500%	330 0	99 80	9 410%	0 23	0 241	0 24	329 329	336 548	2 55%	0 01	0 006	0 01	15-Jan-91	94	2 19	15-Jul-91	15-Jul 91	15-Jul 91
IR FUNDING VAR% 1995	10 590%	267 0	100 06	10 316%	0 01	0 008	0 24	267 164	267 396	2 02%	0 00	0 000	0 00	16 Apr 91	3	0 09	16-Jun-95	16-Jun 95	16-Jun 95
IR FINANCE VAR% 1993	11 730%	638 0	100 11	11 288%	0 03	0 033	0 28	638 730	636 271	4 81%	0 00	0 002	0 01	01-May 91	-12	-0 39	01 Feb-93	01-Feb-93	01 Feb-93
IR NATION. 6 3/4% 1986/91	6 750%	469 0	98 94	9 267%	0 43	0 453	0 45	464 049	465 609	3 52%	0 02	0 016	0 02	01-Apr-91	18	0 33	01-Oct-86	01-Oct 91	01-Oct 91
IR CAPITAL 8 3/4% 1992	8 750%	360 0	99 20	9 632%	0 97	1 012	1 04	357 136	356 101	2 69%	0 03	0 027	0 03	01 May-91	-12	-0 29	01 May-92	01-May 92	01 May 92
IR NATION 7 % 1987/92	7 000%	318 0	97 45	9 516%	1 08	1 131	1 16	309 893	317 511	2 40%	0 03	0 027	0 03	15-Dec 90	125	2 40	15-Jun-87	15-Jun-92	15-Jun-92
IR EXCHEQR 7 1/4% 1992	7 250%	139 0	97 38	9 473%	1 27	1 328	1 37	135 361	136 713	1 03%	0 01	0 014	0 01	01 Mar 91	49	0 97	01 Sep 92	01 Sep 92	01-Sep-92
IR NATION 9 3/4% 1992/97	9 750%	154 0	100 00	9 750%	1 36	1 425	1 49	154 000	154 164	1 17%	0 02	0 017	0 02	15-Apr 91	4	0 11	15-Oct 92	15-Oct 97	15-Oct 92
IR CAPITAL 8 1/2% 1992	8 500%	313 0	98 58	9 611%	1 40	1 468	1 53	308 546	307 744	2 33%	0 03	0 034	0 04	30-Apr-91	11	-0 26	30-Oct 92	30-Oct 92	30-Oct 92
IR DEVELO 7 1/2% 1988/93	7 500%	469 0	96 38	9 557%	1 97	2 060	2 20	452 043	462 444	3 50%	0 07	0 072	0 08	01-Jan-91	108	2 22	01-Jul 88	01-Jul 93	01 Jul 93
IR NATION. 11 % 1993/98	11 000%	184 0	102 51	9 641%	2 16	2 261	2 49	188 614	188 835	1 43%	0 03	0 032	0 04	15-Apr 91	4	0 12	15-Oct 93	15-Oct 98	15-Oct 93
IR CAPITAL 8 % 1993	8 000%	651 0	96 86	9 608%	2 23	2 334	2 54	630 531	628 820	4 76%	0 11	0 111	0 12	01-May 91	-12	-0 26	01-Nov-93	01 Nov 93	01-Nov 93
IR CAPITAL 7 % 1994	7 000%	544 0	94 68	9 407%	2 53	2 653	2 91	515 046	518 695	3 93%	0 10	0 104	0 11	15-Mar-91	35	0 67	15-Mar 94	15-Mar 94	15-Mar 94
IR NATION 9 1/4% 1989/94	9 250%	112 0	98 86	9 751%	2 70	2 835	3 20	110 726	113 789	0 86%	0 02	0 024	0 03	01 Jan-91	108	2 74	01-Jul 89	01-Jul 94	01-Jul-94
IR EXCHEQR 13 % 1994	13 000%	19 0	107 09	9 841%	2 86	3 001	3 49	20 346	20 373	0 15%	0 00	0 005	0 01	15 Apr 91	4	0 14	15-Oct 94	15-Oct 94	15-Oct 94
IR CONV 9 1/2% 1995	9 500%	254 0	100 12	9 454%	3 29	3 444	4 03	254 307	253 580	1 92%	0 06	0 066	0 08	30 Apr 91	11	-0 29	30-Apr 95	30 Apr 95	30-Apr 95
IR CAPITAL 12 1/4% 1995	12 250%	53 0	106 12	9 813%	3 29	3 452	4 12	56 242	58 713	0 44%	0 01	0 015	0 02	01-Dec-90	139	4 66	01 Jun-95	01 Jun-95	01 Jun-95
IR.CONVER 12 % 1995	12 000%	180 0	105 97	9 727%	3 49	3 656	4 41	190 742	192 812	1 46%	0 05	0 053	0 06	15-Mar-91	35	1 15	15-Sep-95	15-Sep-95	15-Sep-95
IR CAPITAL 9 % 1996	9 000%	911 0	98 85	9 366%	4 10	4 296	5 28	900 508	918 242	6 95%	0 29	0 299	0 37	30-Jan-91	79	1 95	30-Jul-96	30-Jul 96	30-Jul-96
IR EXCHEQR 8 1/2 % 1996	8 500%	132 0	96 87	9 468%	4 21	4 410	5 45	127 871	128 485	0 97%	0 04	0 043	0 05	30 Mar 91	20	0 47	30-Sep-96	30-Sep-96	30-Sep-96
IR EXCHEQR 9 1/4% 1991/96	9 250%	55 0	98 38	9 761%	4 22	4 421	5 54	54 110	53 943	0 41%	0 02	0 018	0 02	01-May-91	12	-0 30	01 Nov 91	01-Nov 96	01-Nov 96
IR FINANCE 13 % 1997/02	13 000%	248 0	110 07	9 571%	4 44	4 658	5 96	272 985	274 574	2 08%	0 09	0 097	0 12	01-Apr 91	18	0 64	01 Apr 97	01-Apr-02	01-Apr 97
IR CAPITAL 7 3/4 % 1997	7 750%	302 0	94 23	9 375%	4 70	4 916	6 24	284 586	290 609	2 20%	0 10	0 108	0 14	15-Jan-91	94	1 99	15-Jul-97	15-Jul 97	15-Jul 97
IR DEVELO 11 1/2% 1997/99	11 500%	231 0	105 90	9 642%	4 78	5 011	6 58	244 628	242 737	1 84%	0 09	0 092	0 12	15-May-91	26	-0 82	15-Nov-97	15-Nov-99	15-Nov-97
IR CAPITAL 9 3/4 % 1998	9 750%	942 0	101 26	9 388%	5 11	5 346	7 12	953 912	988 865	7 48%	0 38	0 400	0 53	01 Dec 90	139	3 71	01-Jun-98	01-Jun-98	01-Jun 98
IR FINANCE 14 1/2% 1998/00	14 500%	73 0	114 20	9 678%	5 30	5 554	7 41	83 368	84 382	0 64%	0 03	0 035	0 05	15-Mar 91	35	1 39	15 Sep 98	15-Sep-00	15 Sep 98
IR CAPITAL 7 1/2 % 1999	7 500%	283 0	92 63	9 337%	5 70	5 965	8 24	262 143	267 606	2 03%	0 12	0 121	0 17	15-Jan-91	94	1 93	15-Jul-99	15-Jul 99	15-Jul 99
IR CAPITAL 11 3/4% 2000	11 750%	134 0	107 87	9 425%	6 05	6 335	9 00	144 545	144 717	1 10%	0 07	0 069	0 10	15-Apr-91	4	0 13	15-Apr-00	15-Apr-00	15-Apr-00
IR DEVELO 12 1/4% 2000/03	12 250%	105 0	108 79	9 580%	6 11	6 408	9 16	114 224	118 626	0 90%	0 05	0 058	0 08	15-Dec 90	125	4 19	15-Jun-00	15-Jun-03	15-Jun-00
IR CAPITAL 8 % 2001	8 000%	172 0	94 80	9 253%	6 60	6 903	10 50	163 059	163 210	1 24%	0 08	0 085	0 13	15 Apr 91	4	0 09	15-Oct-01	15-Oct-01	15-Oct-01
IR DEVELO 14 3/4% 2002/04	14 750%	71 0	115 00	9 552%	7 14	7 485	10 80	81 653	83 860	0 63%	0 05	0 047	0 07	01-Feb-91	77	3 11	01-Feb-02	01 Feb-04	01-Feb-02
IR CAPITAL 9 1/4% 2003	9 250%	600 0	100 37	9 154%	7 28	7 612	12 24	602 248	617 139	4 67%	0 34	0 355	0 57	11 Jan 91	98	2 48	11-Jul-03	11-Jul-03	11-Jul-03
IR EXCHEQR 8 1/4% 2003	8 250%	220 0	96 35	9 131%	7 31	7 643	12 54	211 979	211 433	1 60%	0 12	0 122	0 20	30-Apr 91	-11	-0 25	30-Oct-03	30-Oct-03	30-Oct-03
IR EXCHEQR 6 1/2% 2000/05	6 500%	258 0	88 23	9 027%	7 69	8 039	14 20	227 621	232 809	1 76%	0 14	0 142	0 25	27-Dec 90	113	2 01	27-Jun-00	27-Jun-05	27 Jun-05
IR CAPITAL 12 1/2% 2005	12 500%	63 0	109 67	9 246%	8 60	8 994	14 67	69 093	71 788	0 54%	0 05	0 049	0 08	15-Dec 90	125	4 28	15-Dec-05	15 Dec-05	15-Dec-05
IR CAPITAL 9 % 2006	9 000%	466 0	99 88	9 030%	8 22	8 593	15 38	465 463	471 089	3 56%	0 29	0 306	0 55	01 Mar 91	49	1 21	01-Sep-06	01-Sep-06	01-Sep-06
IR CAPITAL 8 1/4% 2008	8 250%	320 0	97 25	8 962%	8 54	8 923	17 29	311 196	316 906	2 40%	0 20	0 214	0 41	30-Jan-91	79	1 78	30-Jul-08	30-Jul-08	30-Jul-08
IR CAPITAL 8 1/2% 2010	8 500%	320 0	98 68	8 870%	9 07	9 475	19 47	315 779	317 120	2 40%	0 22	0 227	0 47	01 Apr 91	18	0 42	01-Oct-10	01-Oct 10	01-Oct 10
IR CAPITAL 8 3/4% 2012	8 750%	260 0	99 56	8 887%	9 46	9 877	21 47	258 853	260 099	1 97%	0 19	0 194	0 42	30-Mar-91	20	0 48	30-Sep-12	30-Sep-12	30-Sep-12
								13058 663	13214 841	100 00%	3 55	3 719	5 63						

Table A 1 24 Irish Government Treasury Data - October 1991

Trade 16-Oct-91
Sett 18-Oct-91

Stock		Coupon	Nominal Issue	Market Price	Market Yield	Volatility	Duration	Life	Clean Market Value (IR£m)	Dirty Market Value (IR£m)	Stock Weight in Index	Weighted Volatility	Weighted Duration	Weighted Life	Ex-Div Date	Accrued Interest	Accrued Interest	First Redemption Date	Last Redemption Date	Redemption Date
IR FINANCE VAR%	1991	10.160%	220.0	100.11	9.058%	0.14	0.140	0.11	220.251	223.372	1.67%	0.00	0.002	0.00	28-Aug-91	51	1.42	28-Nov-91	28-Nov-91	28-Nov-91
IR FINANCE VAR%	1994	10.230%	610.0	100.03	9.951%	0.13	0.129	0.12	610.193	618.223	4.63%	0.01	0.006	0.01	01-Sep-91	47	1.32	01-Jun-94	01-Jun-94	01-Jun-94
IR FINANCE VAR%	1992	10.150%	518.0	100.08	9.730%	0.05	0.049	0.20	518.406	520.997	3.90%	0.00	0.002	0.01	30-Sep-91	18	0.50	30-Mar-92	30-Mar-92	30-Mar-92
IR FUNDING VAR%	1995	10.160%	453.0	100.05	9.954%	0.01	0.005	0.24	453.212	453.464	3.40%	0.00	0.000	0.01	16-Oct-91	2	0.06	16-Jun-95	16-Jun-95	16-Jun-95
IR FINANCE VAR%	1993	10.160%	742.0	100.08	9.857%	0.04	0.038	0.29	742.599	739.710	5.54%	0.00	0.002	0.02	01-Nov-91	-14	-0.38	01-Feb-93	01-Feb-93	01-Feb-93
IR CAPITAL 8 3/4%	1992	8.750%	338.0	99.58	9.610%	0.51	0.536	0.54	336.577	335.444	2.51%	0.01	0.013	0.01	01-Nov-91	-14	-0.34	01-May-92	01-May-92	01-May-92
IR NATION 7 %	1987/92	7.000%	331.0	98.66	9.234%	0.63	0.656	0.66	326.548	334.478	2.50%	0.02	0.016	0.02	15-Jun-91	125	2.40	15-Jun-87	15-Jun-92	15-Jun-92
IR EXCHEQR 7 1/4%	1992	7.250%	139.0	98.35	9.357%	0.82	0.862	0.87	136.711	138.007	1.03%	0.01	0.009	0.01	01-Sep-91	47	0.93	01-Sep-92	01-Sep-92	01-Sep-92
IR NATION 9 3/4%	1992/97	9.750%	80.0	100.13	9.599%	0.93	0.972	0.99	80.104	80.168	0.60%	0.01	0.006	0.01	15-Oct-91	3	0.08	15-Oct-92	15-Oct-97	15-Oct-92
IR CAPITAL 8 1/2%	1992	8.500%	312.0	98.97	9.641%	0.97	1.012	1.04	308.781	307.910	2.31%	0.02	0.023	0.02	30-Oct-91	-12	-0.28	30-Oct-92	30-Oct-92	30-Oct-92
IR DEVELO 7 1/2%	1988/93	7.500%	469.0	97.33	9.381%	1.55	1.626	1.70	456.471	466.968	3.50%	0.05	0.057	0.06	01-Jul-91	109	2.24	01-Jul-88	01-Jul-93	01-Jul-93
IR NATION. 11 %	1993/98	11.000%	165.0	102.23	9.565%	1.77	1.852	1.99	168.677	168.826	1.26%	0.02	0.023	0.03	15-Oct-91	3	0.09	15-Oct-93	15-Oct-98	15-Oct-93
IR CAPITAL 8 %	1993	8.000%	682.0	97.56	9.486%	1.83	1.916	2.04	665.356	663.265	4.97%	0.09	0.095	0.10	01-Nov-91	-14	-0.31	01-Nov-93	01-Nov-93	01-Nov-93
IR CAPITAL 7 %	1994	7.000%	544.0	95.76	9.221%	2.14	2.243	2.41	520.910	524.350	3.93%	0.08	0.088	0.09	15-Sep-91	33	0.63	15-Mar-94	15-Mar-94	15-Mar-94
IR NATION 9 1/4%	1989/94	9.250%	95.0	99.22	9.636%	2.34	2.449	2.70	94.262	96.885	0.73%	0.02	0.018	0.02	01-Jul-91	109	2.76	01-Jul-89	01-Jul-94	01-Jul-94
IR EXCHEQR 13 %	1994	13.000%	19.0	106.96	9.589%	2.51	2.635	2.99	20.323	20.343	0.15%	0.00	0.004	0.00	15-Oct-91	3	0.11	15-Oct-94	15-Oct-94	15-Oct-94
IR CAPITAL 12 1/4%	1995	12.250%	53.0	106.43	9.505%	2.97	3.110	3.62	56.408	58.879	0.44%	0.01	0.014	0.02	01-Jun-91	139	4.66	01-Jun-95	01-Jun-95	01-Jun-95
IR CONVER 12 %	1995	12.000%	180.0	106.23	9.474%	3.17	3.321	3.91	191.218	193.170	1.45%	0.05	0.048	0.06	15-Sep-91	33	1.08	15-Sep-95	15-Sep-95	15-Sep-95
IR CONV. 9 1/2%	1995	9.500%	270.0	100.20	9.424%	3.29	3.445	4.03	270.544	269.771	2.02%	0.07	0.070	0.08	30-Apr-91	-11	-0.29	30-Apr-95	30-Apr-95	30-Apr-95
IR CAPITAL 9 %	1996	9.000%	993.0	98.78	9.409%	3.79	3.972	4.79	980.922	1000.497	7.49%	0.28	0.298	0.36	30-Jul-91	80	1.97	30-Jul-96	30-Jul-96	30-Jul-96
IR EXCHEQR 8 1/2 %	1996	8.500%	100.0	97.23	9.400%	3.91	4.098	4.96	97.234	97.653	0.73%	0.03	0.030	0.04	30-Sep-91	18	0.42	30-Sep-96	30-Sep-96	30-Sep-96
IR EXCHEQR 9 1/4%	1991/96	9.250%	63.0	99.00	9.581%	3.93	4.123	5.04	62.368	62.145	0.47%	0.02	0.019	0.02	01-Nov-91	-14	-0.35	01-Nov-91	01-Nov-96	01-Nov-96
IR FINANCE 13 %	1997/02	13.000%	228.0	109.80	9.553%	4.15	4.347	5.46	250.350	251.730	1.88%	0.08	0.082	0.10	01-Oct-91	17	0.61	01-Apr-97	01-Apr-02	01-Apr-97
IR CAPITAL 7 3/4 %	1997	7.750%	291.0	94.70	9.305%	4.42	4.627	5.75	275.564	281.430	2.11%	0.09	0.097	0.12	15-Jul-91	95	2.02	15-Jul-97	15-Jul-97	15-Jul-97
IR DEVELO 11 1/2%	1997/99	11.500%	208.0	106.01	9.559%	4.51	4.730	6.08	220.507	218.674	1.64%	0.07	0.077	0.10	15-Nov-91	28	-0.88	15-Nov-97	15-Nov-99	15-Nov-97
IR CAPITAL 9 3/4 %	1998	9.750%	1006.0	101.33	9.359%	4.85	5.077	6.62	1019.410	1056.737	7.91%	0.38	0.402	0.52	01-Jun-91	139	3.71	01-Jun-98	01-Jun-98	01-Jun-98
IR FINANCE 14 1/2%	1998/00	14.500%	73.0	114.33	9.592%	5.03	5.269	6.92	83.462	84.419	0.63%	0.03	0.033	0.04	15-Sep-91	33	1.31	15-Sep-98	15-Sep-00	15-Sep-98
IR CAPITAL 7 1/2 %	1999	7.500%	282.0	93.16	9.235%	5.49	5.744	7.75	262.708	268.209	2.01%	0.11	0.115	0.16	15-Jul-91	95	1.95	15-Jul-99	15-Jul-99	15-Jul-99
IR CAPITAL 11 3/4%	2000	11.750%	134.0	107.77	9.440%	5.81	6.081	8.50	144.410	144.539	1.08%	0.06	0.066	0.09	15-Oct-91	3	0.10	15-Apr-00	15-Apr-00	15-Apr-00
IR DEVELO 12 1/4%	2000/03	12.250%	104.0	109.08	9.492%	5.90	6.177	8.67	113.445	117.805	0.88%	0.05	0.054	0.08	15-Jun-91	125	4.19	15-Jun-00	15-Jun-03	15-Jun-00
IR GOVER 9 %	2001	9.000%	603.0	99.35	9.165%	6.35	6.644	9.75	599.092	613.207	4.59%	0.29	0.305	0.45	15-Jul-91	95	2.34	15-Jul-01	15-Jul-01	15-Jul-01
IR CAPITAL 8 %	2001	8.000%	172.0	95.16	9.169%	6.44	6.738	10.00	163.674	163.787	1.23%	0.08	0.083	0.12	15-Oct-91	3	0.07	15-Oct-01	15-Oct-01	15-Oct-01
IR DEVELO 14 3/4%	2002/04	14.750%	71.0	115.14	9.559%	6.89	7.218	10.30	81.746	83.982	0.63%	0.04	0.045	0.06	01-Aug-91	78	3.15	01-Feb-02	01-Feb-04	01-Feb-02
IR CAPITAL 9 1/4%	2003	9.250%	689.0	100.33	9.166%	7.11	7.431	11.74	691.270	708.545	5.30%	0.38	0.394	0.62	11-Jul-91	99	2.51	11-Jul-03	11-Jul-03	11-Jul-03
IR EXCHEQR 8 1/4%	2003	8.250%	210.0	96.27	9.152%	7.15	7.477	12.04	202.158	201.589	1.51%	0.11	0.113	0.18	30-Oct-91	12	-0.27	30-Oct-03	30-Oct-03	30-Oct-03
IR EXCHEQR 6 1/2%	2000/05	6.500%	257.0	88.05	9.065%	7.57	7.910	13.70	226.291	231.459	1.73%	0.13	0.137	0.24	27-Jun-91	113	2.01	27-Jun-00	27-Jun-05	27-Jun-05
IR CAPITAL 12 1/2%	2005	12.500%	63.0	109.61	9.308%	8.37	8.759	14.17	69.055	71.750	0.54%	0.04	0.047	0.08	15-Jun-91	125	4.28	15-Dec-05	15-Dec-05	15-Dec-05
IR CAPITAL 9 %	2006	9.000%	586.0	99.62	9.099%	8.05	8.417	14.88	583.781	590.568	4.42%	0.36	0.372	0.66	01-Sep-91	47	1.16	01-Sep-06	01-Sep-06	01-Sep-06
IR CAPITAL 8 1/4%	2008	8.250%	320.0	96.87	9.057%	8.37	8.750	16.79	309.968	315.750	2.36%	0.20	0.207	0.40	30-Jul-91	80	1.81	30-Jul-08	30-Jul-08	30-Jul-08
IR CAPITAL 8 1/2%	2010	8.500%	324.0	98.11	9.028%	8.84	9.240	18.97	317.892	319.173	2.39%	0.21	0.221	0.45	01-Oct-91	17	0.40	01-Oct-10	01-Oct-10	01-Oct-10
IR CAPITAL 8 3/4%	2012	8.750%	260.0	99.03	9.050%	9.21	9.623	20.97	257.474	258.595	1.94%	0.18	0.186	0.41	30-Sep-91	18	0.43	30-Sep-12	30-Sep-12	30-Sep-12
									13190.334	13356.473	100.00%	3.71	3.882	5.87						

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Trade 14 Apr 92
Sett 16 Apr 92

Stock		Coupon	Nominal Issue	Market Price	Market Yield	Volatility	Duration	Life
IR FUNDING VAR%	1995	10 590%	547 0	99 99	10 495%	0 33	0 334	-0 08
IR CAPITAL 8 3/4%	1992	8 750%	266 0	100 00	8 748%	0 04	0 042	0 04
IR FINANCE VAR%	1994	10 470%	695 0	100 01	10 341%	0 12	0 126	0 12
IR NATION 7 %	1987/92	7 000%	286 0	99 44	10 587%	0 16	0 166	0 16
IR FINANCE VAR%	1993	10 790%	683 0	100 07	10 535%	0 04	0 041	0 29
IR EXCHEQR 7 1/4%	1992	7 250%	139 0	98 90	10 403%	0 36	0 380	0 38
IR CAPITAL 8 1/2%	1992	8 500%	308 0	99 22	10 079%	0 51	0 539	0 54
IR DEVELO 7 1/2%	1988/93	7 500%	468 0	97 56	9 835%	1 12	1 175	1 21
IR NATION 11 %	1993/98	11 000%	150 0	101 53	9 753%	1 36	1 425	1 50
IR CAPITAL 8 %	1993	8 000%	732 0	97 56	9 891%	1 41	1 480	1 55
IR CAPITAL 7 %	1994	7 000%	719 0	95 73	9 723%	1 73	1 813	1 91
IR NATION 9 1/4%	1989/94	9 250%	74 0	98 63	10 050%	1 94	2 042	2 21
IR EXCHEQR 13 %	1994	13 000%	19 0	105 99	9 665%	2 15	2 249	2 50
IR CONV 9 1/2%	1995	9 500%	360 0	100 38	9 327%	2 59	2 712	3 04
IR CAPITAL 12 1/4%	1995	12 250%	52 0	106 19	9 352%	2 62	2 746	3 13
IR CONVER 12 %	1995	12 000%	180 0	106 03	9 350%	2 83	2 966	3 42
IR CAPITAL 9 %	1996	9 000%	1058 0	99 40	9 216%	3 48	3 644	4 29
IR EXCHEQR 8 1/2 %	1996	8 500%	99 0	97 86	9 238%	3 61	3 774	4 46
IR EXCHEQR 9 1/4%	1991/96	9 250%	32 0	99 41	9 457%	3 63	3 804	4 55
IR FINANCE 13 %	1997/02	13 000%	218 0	110 46	9 205%	3 87	4 048	4 96
IR CAPITAL 7 3/4 %	1997	7 750%	344 0	95 62	9 091%	4 14	4 331	5 25
IR NATION 9 3/4%	1992/97	9 750%	43 0	99 99	9 752%	4 18	4 385	5 50
IR DEVELO 11 1/2%	1997/99	11 500%	170 0	106 87	9 227%	4 26	4 456	5 59
IR CAPITAL 9 3/4 %	1998	9 750%	1017 0	102 16	9 101%	4 61	4 817	6 13
IR FINANCE 14 1/2%	1998/00	14 500%	73 0	115 22	9 258%	4 78	5 004	6 42
IR CAPITAL 7 1/2 %	1999	7 500%	269 0	94 71	8 858%	5 31	5 543	7 25
IR CAPITAL 11 3/4%	2000	11 750%	131 0	108 57	9 204%	5 61	5 867	8 00
IR DEVELO 12 1/4%	2000/03	12 250%	103 0	110 07	9 208%	5 71	5 974	8 17
IR GOVER 9 %	2001	9 000%	908 0	100 25	8 936%	6 21	6 485	9 25
IR CAPITAL 8 %	2001	8 000%	110 0	96 06	8 951%	6 31	6 592	9 50
IR DEVELO 14 3/4%	2002/04	14 750%	71 0	116 77	9 162%	6 76	7 070	9 80
IR CAPITAL 9 1/4%	2003	9 250%	802 0	101 33	8 915%	7 03	7 341	11 24
IR EXCHEQR 8 1/4%	2003	8 250%	210 0	97 20	8 917%	7 09	7 402	11 55
IR EXCHEQR 6 1/2%	2000/05	6 500%	245 0	89 22	8 770%	7 60	7 938	13 21
IR CAPITAL 12 1/2%	2005	12 500%	41 0	111 20	8 938%	8 40	8 771	13 67
IR CAPITAL 9 %	2006	9 000%	654 0	100 88	8 777%	8 11	8 471	14 39
IR CAPITAL 8 1/4%	2008	8 250%	320 0	98 03	8 738%	8 51	8 880	16 30
IR CAPITAL 8 1/2%	2010	8 500%	324 0	99 28	8 692%	9 06	9 454	18 47
IR CAPITAL 8 3/4%	2012	8 750%	566 0	100 32	8 655%	9 55	9 963	20 47

Stock		Clean Market Value (IR£m)	Dirty Market Value (IR£m)	Stock Weight in Index	Weighted Volatility	Weighted Duration	Weighted Life	Ex-Div Date	Accrued Interest	Accrued Interest	First Redemption Date	Last Redemption Date	Redemption Date
IR FUNDING VAR%	1995	546 958	566 307	4 14%	0 01	0 014	0 00	16 Dec 91	122	3 54	16-Jun-95	16-Jun-95	16-Jun-95
IR CAPITAL 8 3/4%	1992	266 000	265 044	1 94%	0 00	0 001	0 00	01 May 92	-15	-0 36	01-May 92	01 May 92	01 May 92
IR FINANCE VAR%	1994	695 103	704 268	5 15%	0 01	0 006	0 01	01 Mar 92	46	1 32	01-Jun-94	01-Jun-94	01 Jun-94
IR NATION 7 %	1987/92	284 407	291 149	2 13%	0 00	0 004	0 00	15-Dec 91	123	2 36	15-Jun-87	15-Jun-92	15-Jun 92
IR FINANCE VAR%	1993	683 465	680 439	4 98%	0 00	0 002	0 01	01 May 92	-15	-0 44	01 Feb-93	01-Feb-93	01 Feb 93
IR EXCHEQR 7 1/4%	1992	137 464	138 733	1 01%	0 00	0 004	0 00	01-Mar 92	46	0 91	01 Sep-92	01 Sep-92	01 Sep-92
IR CAPITAL 8 1/2%	1992	305 612	304 609	2 23%	0 01	0 012	0 01	30-Apr 92	-14	-0 33	30 Oct 92	30-Oct 92	30-Oct 92
IR DEVELO 7 1/2%	1988/93	456 579	466 765	3 41%	0 04	0 040	0 04	01 Jan-92	106	2 18	01 Jul-88	01 Jul-93	01-Jul-93
IR NATION 11 %	1993/98	152 290	152 335	1 11%	0 02	0 016	0 02	15-Apr 92	1	0 03	15-Oct-93	15-Oct 98	15-Oct 93
IR CAPITAL 8 %	1993	714 112	711 707	5 21%	0 07	0 077	0 08	01-May 92	-15	-0 33	01 Nov 93	01-Nov 93	01 Nov 93
IR CAPITAL 7 %	1994	688 266	692 675	5 07%	0 09	0 092	0 10	15-Mar 92	32	0 61	15 Mar 94	15 Mar 94	15 Mar 94
IR NATION 9 1/4%	1989/94	72 987	74 974	0 55%	0 01	0 011	0 01	01 Jan 92	106	2 68	01-Jul-89	01-Jul-94	01-Jul 94
IR EXCHEQR 13 %	1994	20 138	20 145	0 15%	0 00	0 003	0 00	15-Apr 92	1	0 04	15-Oct 94	15-Oct 94	15-Oct 94
IR CONV 9 1/2%	1995	361 370	360 060	2 63%	0 07	0 071	0 08	30 Apr 92	-14	-0 36	30-Apr 95	30-Apr 95	30 Apr 95
IR CAPITAL 12 1/4%	1995	55 218	57 607	0 42%	0 01	0 012	0 01	01 Dec 91	137	4 59	01 Jun-95	01-Jun-95	01 Jun-95
IR CONVER 12 %	1995	190 849	192 742	1 41%	0 04	0 042	0 05	15 Mar 92	32	1 05	15-Sep-95	15-Sep-95	15-Sep-95
IR CAPITAL 9 %	1996	1051 613	1071 687	7 84%	0 27	0 286	0 34	30 Jan 92	77	1 90	30-Jul-96	30-Jul 96	30-Jul-96
IR EXCHEQR 8 1/2 %	1996	96 881	97 272	0 71%	0 03	0 027	0 03	30 Mar 92	17	0 40	30-Sep-96	30-Sep-96	30-Sep-96
IR EXCHEQR 9 1/4%	1991/96	31 810	31 689	0 23%	0 01	0 009	0 01	01 May 92	-15	-0 38	01 Nov 91	01 Nov 96	01 Nov-96
IR FINANCE 13 %	1997/02	240 794	241 957	1 77%	0 07	0 072	0 09	01 Apr 92	15	0 53	01 Apr 97	01-Apr-02	01-Apr 97
IR CAPITAL 7 3/4 %	1997	328 928	335 643	2 46%	0 10	0 106	0 13	15 Jan 92	92	1 95	15-Jul 97	15-Jul 97	15-Jul 97
IR NATION 9 3/4%	1992/97	42 997	43 009	0 31%	0 01	0 014	0 02	15 Apr 92	1	0 03	15-Oct 92	15-Oct 97	15-Oct 97
IR DEVELO 11 1/2%	1997/99	181 678	180 126	1 32%	0 06	0 059	0 07	15-May 92	-29	-0 91	15-Nov-97	15-Nov 99	15-Nov-97
IR CAPITAL 9 3/4 %	1998	1038 984	1076 176	7 87%	0 36	0 379	0 48	01-Dec 91	137	3 66	01-Jun-98	01-Jun 98	01-Jun-98
IR FINANCE 14 1/2%	1998/00	84 113	85 040	0 62%	0 03	0 031	0 04	15-Mar 92	32	1 27	15 Sep 98	15 Sep-00	15-Sep-98
IR CAPITAL 7 1/2 %	1999	254 769	259 850	1 90%	0 10	0 105	0 14	15-Jan-92	92	1 89	15-Jul 99	15-Jul-99	15-Jul-99
IR CAPITAL 11 3/4%	2000	142 223	142 265	1 04%	0 06	0 061	0 08	15-Apr 92	1	0 03	15-Apr-00	15-Apr-00	15-Apr-00
IR DEVELO 12 1/4%	2000/03	113 371	117 620	0 86%	0 05	0 051	0 07	15-Dec 91	123	4 13	15-Jun-00	15-Jun-03	15-Jun-00
IR GOVER 9 %	2001	910 301	930 885	6 81%	0 42	0 442	0 63	15 Jan 92	92	2 27	15-Jul-01	15-Jul-01	15 Jul-01
IR CAPITAL 8 %	2001	105 666	105 690	0 77%	0 05	0 051	0 07	15-Apr 92	1	0 02	15-Oct-01	15-Oct-01	15-Oct-01
IR DEVELO 14 3/4%	2002/04	82 910	85 060	0 62%	0 04	0 044	0 06	01 Feb-92	75	3 03	01-Feb-02	01 Feb-04	01 Feb-02
IR CAPITAL 9 1/4%	2003	812 653	832 152	6 09%	0 43	0 447	0 68	11-Jan 92	96	2 43	11-Jul-03	11-Jul-03	11 Jul-03
IR EXCHEQR 8 1/4%	2003	204 120	203 456	1 49%	0 11	0 110	0 17	30 Apr 92	-14	-0 32	30 Oct-03	30 Oct-03	30 Oct-03
IR EXCHEQR 6 1/2%	2000/05	218 599	223 439	1 63%	0 12	0 130	0 22	27 Dec 91	111	1 98	27 Jun-00	27 Jun-05	27 Jun-05
IR CAPITAL 12 1/2%	2005	45 592	47 317	0 35%	0 03	0 030	0 05	15-Dec 91	123	4 21	15-Dec-05	15-Dec-05	15-Dec-05
IR CAPITAL 9 %	2006	659 740	667 153	4 88%	0 40	0 413	0 70	01 Mar 92	46	1 13	01 Sep-06	01 Sep-06	01 Sep-06
IR CAPITAL 8 1/4%	2008	313 704	319 269	2 34%	0 20	0 207	0 38	30-Jan 92	77	1 74	30-Jul-08	30 Jul-08	30-Jul-08
IR CAPITAL 8 1/2%	2010	321 671	322 802	2 36%	0 21	0 223	0 44	01-Apr 92	15	0 35	01-Oct-10	01-Oct-10	01-Oct-10
IR CAPITAL 8 3/4%	2012	567 836	570 141	4 17%	0 40	0 416	0 85	30 Mar 92	17	0 41	30-Sep-12	30 Sep-12	30-Sep-12
		13481 771	13669 257	100 00%	3 94	4 120	6 19						

Trade 15-Oct 92
Sett 19 Oct 92

Stock		Coupon	Nominal Issue	Market Price	Market Yield	Volatility	Duration	Life
IR CAPITAL 8 1/2%	1992	8 500%	166 0	99 85	13 648%	0 03	0 031	0 03
IR FINANCE VAR%	1994	10 830%	562 0	99 96	11 177%	0 13	0 131	0 12
IR FUNDING VAR%	1996	13 040%	271 0	99 99	13 106%	0 05	0 052	0 20
IR FUNDING VAR%	1995	17 180%	562 0	100 05	16 939%	0 01	0 008	0 24
IR FINANCE VAR%	1993	10 390%	274 0	99 72	11 477%	0 03	0 036	0 28
IR DEVELO 7 1/2%	1988/93	7 500%	421 0	97 25	11 902%	0 65	0 693	0 70
IR CAPITAL 8 %	1993	8 000%	659 0	96 65	11 751%	0 96	1 012	1 04
IR CAPITAL 7 %	1994	7 000%	806 0	94 71	11 475%	1 28	1 354	1 40
IR NATION 9 1/4%	1989/94	9 250%	74 0	97 78	10 868%	1 52	1 605	1 70
IR EXCHEQR 13 %	1994	13 000%	19 0	102 22	11 500%	1 73	1 825	1 99
IR CONV 9 1/2%	1995	9 500%	340 0	96 84	11 197%	2 17	2 290	2 53
IR CAPITAL 12 1/4%	1995	12 250%	52 0	101 74	11 300%	2 20	2 328	2 62
IR CONVER 12 %	1995	12 000%	180 0	101 39	11 297%	2 41	2 550	2 91
IR CAPITAL 9 %	1996	9 000%	1058 0	95 35	10 862%	3 07	3 236	3 78
IR EXCHEQR 8 1/2 %	1996	8 500%	99 0	93 77	10 903%	3 19	3 365	3 95
IR EXCHEQR 9 1/4%	1991/96	9 250%	31 0	95 31	11 070%	3 22	3 400	4 04
IR FINANCE 13 %	1997/02	13 000%	142 0	104 50	11 194%	3 41	3 605	4 45
IR CAPITAL 7 3/4 %	1997	7 750%	338 0	91 60	10 583%	3 73	3 925	4 74
IR EXCHEQR 8 3/4%	1997	8 750%	755 0	94 82	10 531%	3 72	3 913	4 77
IR NATION 9 3/4%	1992/97	9 750%	41 0	96 76	10 876%	3 80	4 003	4 99
IR DEVELO 11 1/2%	1997/99	11 500%	170 0	102 75	10 515%	3 84	4 047	5 08
IR CAPITAL 9 3/4 %	1998	9 750%	981 0	98 12	10 360%	4 19	4 409	5 62
IR FINANCE 14 1/2%	1998/00	14 500%	73 0	111 80	10 208%	4 36	4 584	5 91
IR NATION. 11 %	1993/98	11 000%	150 0	99 55	11 152%	4 29	4 527	5 99
IR CAPITAL 7 1/2 %	1999	7 500%	269 0	90 06	10 261%	4 86	5 105	6 74
IR CAPITAL 11 3/4%	2000	11 750%	131 0	104 61	10 299%	5 15	5 413	7 49
IR DEVELO 12 1/4%	2000/03	12 250%	103 0	106 44	10 203%	5 26	5 524	7 66
IR GOVER 9 %	2001	9 000%	1113 0	96 38	9 975%	5 74	6 025	8 74
IR CAPITAL 8 %	2001	8 000%	110 0	91 95	10 068%	5 83	6 120	8 99
IR DEVELO 14 3/4%	2002/04	14 750%	71 0	113 73	10 003%	6 24	6 551	9 29
IR CAPITAL 9 1/4%	2003	9 250%	840 0	97 81	9 831%	6 51	6 832	10 73
IR EXCHEQR 8 1/4%	2003	8 250%	210 0	93 61	9 855%	6 57	6 892	11 04
IR EXCHEQR 6 1/2%	2000/05	6 500%	245 0	85 67	9 695%	7 05	7 387	12 70
IR CAPITAL 12 1/2%	2005	12 500%	41 0	107 59	9 949%	7 64	8 016	13 16
IR CAPITAL 9 %	2006	9 000%	711 0	97 62	9 634%	7 48	7 843	13 88
IR CAPITAL 8 1/4%	2008	8 250%	320 0	94 81	9 612%	7 79	8 165	15 79
IR CAPITAL 8 1/2%	2010	8 500%	324 0	96 23	9 571%	8 22	8 609	17 96
IR CAPITAL 8 3/4%	2012	8 750%	625 0	97 64	9 481%	8 64	9 046	19 96

Stock		Clean Market Value (IR£m)	Dirty Market Value (IR£m)	Stock Weight in Index	Weighted Volatility	Weighted Duration	Weighted Life	Ex-Div Date	Accrued Interest	Accrued Interest	First Redemption Date	Last Redemption Date	Redemption Date
IR CAPITAL 8 1/2%	1992	165 757	165 332	1 26%	0 00	0 000	0 00	30-Oct-92	11	-0 26	30-Oct 92	30-Oct 92	30 Oct 92
IR FINANCE VAR%	1994	561 785	569 784	4 33%	0 01	0 006	0 01	01-Sep-92	48	1 42	01 Jun 94	01 Jun 94	01 Jun 94
IR FUNDING VAR%	1996	270 967	272 806	2 07%	0 00	0 001	0 00	30-Sep-92	19	0 68	30 Sep 96	30 Sep 96	30-Sep-96
IR FUNDING VAR%	1995	562 290	563 083	4 28%	0 00	0 000	0 01	16 Oct 92	3	0 14	16-Jun 95	16 Jun 95	16-Jun 95
IR FINANCE VAR%	1993	273 220	272 206	2 07%	0 00	0 001	0 01	01-Nov 92	13	-0 37	01 Feb 93	01 Feb 93	01-Feb-93
IR DEVELO 7 1/2%	1988/93	409 441	418 950	3 19%	0 02	0 022	0 02	01-Jul 92	110	2 26	01 Jul-88	01 Jul-93	01-Jul-93
IR CAPITAL 8 %	1993	636 921	635 044	4 83%	0 05	0 049	0 05	01-Nov-92	-13	-0 28	01 Nov-93	01-Nov-93	01-Nov-93
IR CAPITAL 7 %	1994	763 381	768 633	5 84%	0 07	0 079	0 08	15-Sep-92	34	0 65	15-Mar 94	15-Mar 94	15-Mar 94
IR NATION 9 1/4%	1989/94	72 361	74 422	0 57%	0 01	0 009	0 01	01-Jul-92	110	2 79	01 Jul-89	01-Jul 94	01-Jul 94
IR EXCHEQR 13 %	1994	19 422	19 449	0 15%	0 00	0 003	0 00	15-Oct 92	4	0 14	15-Oct 94	15-Oct 94	15-Oct 94
IR CONV 9 1/2%	1995	329 250	328 278	2 50%	0 05	0 057	0 06	30 Oct 92	-11	-0 29	30 Apr 95	30 Apr 95	30 Apr 95
IR CAPITAL 12 1/4%	1995	52 905	55 346	0 42%	0 01	0 010	0 01	01 Jun-92	140	4 70	01-Jun-95	01-Jun-95	01 Jun 95
IR CONVER 12 %	1995	182 500	184 510	1 40%	0 03	0 036	0 04	15-Sep-92	34	1 12	15-Sep-95	15-Sep-95	15-Sep-95
IR CAPITAL 9 %	1996	1008 805	1029 921	7 83%	0 24	0 253	0 30	30-Jul 92	81	2 00	30 Jul 96	30-Jul-96	30 Jul 96
IR EXCHEQR 8 1/2 %	1996	92 832	93 270	0 71%	0 02	0 024	0 03	30-Sep-92	19	0 44	30-Sep-96	30-Sep-96	30-Sep 96
IR EXCHEQR 9 1/4%	1991/96	29 547	29 445	0 22%	0 01	0 008	0 01	01 Nov 92	-13	-0 33	01 Nov 91	01 Nov 96	01 Nov 96
IR FINANCE 13 %	1997/02	148 386	149 296	1 14%	0 04	0 041	0 05	01-Oct 92	18	0 64	01-Apr 97	01-Apr-02	01-Apr 97
IR CAPITAL 7 3/4 %	1997	309 597	316 482	2 41%	0 09	0 094	0 11	15-Jul 92	96	2 04	15-Jul 97	15-Jul-97	15-Jul-97
IR EXCHEQR 8 3/4%	1997	715 918	731 111	5 56%	0 21	0 218	0 27	27 Jul 92	84	2 01	27 Jul 97	27 Jul 97	27 Jul 97
IR NATION 9 3/4%	1992/97	39 674	39 717	0 30%	0 01	0 012	0 02	15-Oct 92	4	0 11	15-Oct 92	15 Oct 97	15-Oct 97
IR DEVELO 11 1/2%	1997/99	174 678	183 081	1 39%	0 05	0 056	0 07	15-May 92	157	4 94	15-Nov 97	15-Nov 99	15-Nov 97
IR CAPITAL 9 3/4 %	1998	962 551	999 213	7 60%	0 32	0 335	0 43	01 Jun 92	140	3 74	01 Jun 98	01 Jun 98	01 Jun 98
IR FINANCE 14 1/2%	1998/00	81 613	82 599	0 63%	0 03	0 029	0 04	15-Sep 92	34	1 35	15-Sep 98	15-Sep-00	15-Sep 98
IR NATION. 11 %	1993/98	149 323	149 504	1 14%	0 05	0 051	0 07	15 Oct 92	4	0 12	15-Oct 93	15-Oct 98	15-Oct 98
IR CAPITAL 7 1/2 %	1999	242 270	247 573	1 88%	0 09	0 096	0 13	15-Jul-92	96	1 97	15-Jul 99	15-Jul 99	15-Jul-99
IR CAPITAL 11 3/4%	2000	137 043	137 212	1 04%	0 05	0 056	0 08	15-Oct 92	4	0 13	15-Apr-00	15-Apr-00	15-Apr-00
IR DEVELO 12 1/4%	2000/03	109 630	113 983	0 87%	0 05	0 048	0 07	15-Jun-92	126	4 23	15-Jun-00	15-Jun-03	15-Jun-00
IR GOVER 9 %	2001	1072 716	1099 044	8 36%	0 48	0 503	0 73	15-Jul 92	96	2 37	15-Jul-01	15-Jul-01	15-Jul-01
IR CAPITAL 8 %	2001	101 144	101 240	0 77%	0 04	0 047	0 07	15-Oct 92	4	0 09	15-Oct-01	15-Oct-01	15-Oct-01
IR DEVELO 14 3/4%	2002/04	80 745	83 010	0 63%	0 04	0 041	0 06	01 Aug 92	79	3 19	01-Feb-02	01-Feb-04	01 Feb-02
IR CAPITAL 9 1/4%	2003	821 609	842 882	6 41%	0 42	0 438	0 69	11-Jul-92	100	2 53	11-Jul-03	11 Jul-03	11-Jul-03
IR EXCHEQR 8 1/4%	2003	196 590	196 069	1 49%	0 10	0 103	0 16	30 Oct 92	-11	-0 25	30-Oct-03	30-Oct-03	30-Oct-03
IR EXCHEQR 6 1/2%	2000/05	209 885	214 855	1 63%	0 12	0 121	0 21	27 Jun 92	114	2 03	27 Jun-00	27 Jun 05	27 Jun-05
IR CAPITAL 12 1/2%	2005	44 111	45 879	0 35%	0 03	0 028	0 05	15-Jun-92	126	4 31	15-Dec-05	15-Dec-05	15-Dec-05
IR CAPITAL 9 %	2006	694 095	702 504	5 34%	0 40	0 419	0 74	01 Sep-92	48	1 18	01 Sep-06	01 Sep-06	01 Sep-06
IR CAPITAL 8 1/4%	2008	303 390	309 245	2 35%	0 18	0 192	0 37	30-Jul-92	81	1 83	30-Jul-08	30-Jul-08	30-Jul-08
IR CAPITAL 8 1/2%	2010	311 792	313 149	2 38%	0 20	0 205	0 43	01-Oct-92	18	0 42	01-Oct 10	01-Oct 10	01-Oct 10
IR CAPITAL 8 3/4%	2012	610 261	613 106	4 66%	0 40	0 422	0 93	30 Sep-92	19	0 46	30-Sep 12	30 Sep 12	30-Sep-12
		12948 402	13151 231	100 00%	3 92	4 114	6 39						

Table A 1 27 Irish Government Treasury Data - April 1993

Trade 16-Apr 93
Sett 19 Apr 93

Stock		Coupon	Nominal Issue	Market Price	Market Yield	Volatility	Duration	Life	Clean Market Value (IR£m)	Dirty Market Value (IR£m)	Stock Weight in Index	Weighted Volatility	Weighted Duration	Weighted Life	Ex Div Date	Accrued Interest	Accrued Interest	First Redemption Date	Last Redemption Date	Redemption Date
IR FINANCE VAR%	1994	7 240%	661 1	100 08	6 533%	0 13	0 134	0 12	661 616	668 037	4 69%	0 01	0 006	0 01	01 Mar 93	49	0 97	01 Jun 94	01 Jun 94	01 Jun 94
IR FUNDING VAR%	1996	10 680%	317 0	100 04	10 486%	0 05	0 056	0 19	317 111	318 965	2 24%	0 00	0 001	0 00	30 Mar 93	20	0 58	30 Sep 96	30-Sep-96	30 Sep 96
IR DEVELO. 7 1/2%	1988/93	7 500%	407 8	99 87	8 168%	0 19	0 202	0 20	407 284	416 327	2 92%	0 01	0 006	0 01	01 Jan-93	108	2 22	01 Jul-88	01-Jul 93	01-Jul 93
IR FUNDING VAR%	1995	25 120%	503 8	100 03	24 963%	0 01	0 008	0 24	503 960	504 999	3 55%	0 00	0 000	0 01	16-Apr 93	3	0 21	16-Jun-95	16-Jun-95	16 Jun 95
IR NATION 9 1/4%	1989/94	9 250%	73 9	101 40	3 377%	0 25	0 253	0 25	74 936	76 957	0 54%	0 00	0 001	0 00	01-Jan 93	108	2 74	01 Jul-89	01 Jul 94	19 Jul 93
IR EXCHEQR 9 1/4%	1991/96	9 250%	30 7	100 26	8 150%	0 24	0 253	0 25	30 779	30 686	0 22%	0 00	0 001	0 00	01-May 93	-12	-0 30	01 Nov 91	01-Nov-96	19 Jul 93
IR NATION 9 3/4%	1992/97	9 750%	40 6	100 27	8 592%	0 24	0 253	0 25	40 710	40 753	0 29%	0 00	0 001	0 00	15-Apr 93	4	0 11	15-Oct 92	15-Oct 97	19 Jul 93
IR NATION 11 %	1993/98	11 000%	79 3	101 23	8 239%	0 47	0 491	0 49	80 278	80 374	0 56%	0 00	0 003	0 00	15-Apr 93	4	0 12	15-Oct 93	15-Oct 98	15-Oct 93
IR CAPITAL 8 %	1993	8 000%	537 2	100 03	7 942%	0 52	0 536	0 54	537 355	535 943	3 76%	0 02	0 020	0 02	01 May 93	-12	-0 26	01 Nov 93	01 Nov 93	01 Nov 93
IR CAPITAL 7 %	1994	7 000%	805 6	99 29	7 876%	0 86	0 891	0 90	799 844	805 247	5 65%	0 05	0 050	0 05	15 Mar 93	35	0 67	15 Mar 94	15-Mar 94	15 Mar 94
IR EXCHEQR 13 %	1994	13 000%	19 3	106 13	7 963%	1 36	1 416	1 49	20 483	20 510	0 14%	0 00	0 002	0 00	15-Apr 93	4	0 14	15-Oct 94	15-Oct 94	15-Oct 94
IR CONV 9 1/2%	1995	9 500%	370 4	102 40	8 032%	1 83	1 901	2 03	379 284	378 224	2 66%	0 05	0 050	0 05	30 Apr 93	-11	-0 29	30 Apr 95	30 Apr 95	30 Apr 95
IR CAPITAL 12 1/4%	1995	12 250%	40 7	106 80	8 090%	1 88	1 957	2 12	43 467	45 364	0 32%	0 01	0 006	0 01	01 Dec 92	139	4 66	01 Jun 95	01 Jun 95	01-Jun 95
IR CONVER 12 %	1995	12 000%	149 0	107 08	8 091%	2 11	2 199	2 41	159 553	161 266	1 13%	0 02	0 025	0 03	15 Mar 93	35	1 15	15 Sep 95	15 Sep 95	15 Sep 95
IR CAPITAL 9 %	1996	9 000%	1058 0	102 28	8 048%	2 82	2 931	3 28	1082 119	1102 714	7 74%	0 22	0 227	0 25	30 Jan 93	79	1 95	30 Jul 96	30 Jul 96	30-Jul 96
IR EXCHEQR 8 1/2 %	1996	8 500%	98 7	101 01	8 095%	2 95	3 072	3 45	99 702	100 161	0 70%	0 02	0 022	0 02	30 Mar 93	20	0 47	30-Sep-96	30-Sep-96	30-Sep-96
IR FINANCE 13 %	1997/02	13 000%	142 9	111 98	8 209%	3 25	3 387	3 95	160 016	160 931	1 13%	0 04	0 038	0 04	01 Apr 93	18	0 64	01 Apr 97	01 Apr-02	01 Apr 97
IR CAPITAL 7 3/4 %	1997	7 750%	338 0	99 00	8 090%	3 54	3 683	4 24	334 628	341 370	2 40%	0 08	0 088	0 10	15 Jan 93	94	1 99	15-Jul 97	15-Jul 97	15-Jul 97
IR EXCHEQR 8 3/4%	1997	8 750%	1176 3	102 03	8 047%	3 54	3 682	4 27	1200 160	1223 267	8 59%	0 30	0 316	0 37	27 Jan 93	82	1 96	27 Jul 97	27-Jul-97	27 Jul 97
IR DEVELO 11 1/2%	1997/99	11 500%	170 1	109 33	8 185%	3 70	3 849	4 58	185 968	194 270	1 36%	0 05	0 052	0 06	15-Nov-92	155	4 88	15-Nov-97	15-Nov-99	15-Nov-97
IR CAPITAL 9 3/4 %	1998	9 750%	981 2	105 40	8 032%	4 09	4 255	5 12	1034 170	1070 577	7 52%	0 31	0 320	0 38	01 Dec 92	139	3 71	01 Jun-98	01-Jun-98	01-Jun-98
IR FINANCE 14 1/2%	1998/00	14 500%	73 2	117 59	8 278%	4 25	4 427	5 41	86 074	87 091	0 61%	0 03	0 027	0 03	15 Mar 93	35	1 39	15 Sep-98	15-Sep-00	15-Sep-98
IR CAPITAL 7 1/2 %	1999	7 500%	269 1	97 99	8 038%	4 85	5 048	6 24	263 695	268 889	1 89%	0 09	0 095	0 12	15-Jan-93	94	1 93	15-Jul 99	15-Jul-99	15-Jul 99
IR CAPITAL 11 3/4%	2000	11 750%	130 9	111 77	8 263%	5 22	5 434	6 99	146 303	146 471	1 03%	0 05	0 056	0 07	15 Apr 93	4	0 13	15-Apr-00	15-Apr-00	15-Apr-00
IR DEVELO 12 1/4%	2000/03	12 250%	103 5	113 01	8 343%	5 31	5 535	7 16	116 967	121 306	0 85%	0 05	0 047	0 06	15-Dec 92	125	4 19	15-Jun-00	15-Jun-03	15-Jun-00
IR GOVER 9 %	2001	9 000%	1133 4	103 71	8 065%	5 93	6 167	8 24	1175 471	1201 723	8 44%	0 50	0 520	0 70	15-Jan 93	94	2 32	15-Jul-01	15-Jul-01	15-Jul-01
IR CAPITAL 8 %	2001	8 000%	110 4	99 62	8 091%	6 06	6 306	8 50	109 981	110 078	0 77%	0 05	0 049	0 07	15-Apr 93	4	0 09	15-Oct-01	15-Oct-01	15-Oct-01
IR DEVELO 14 3/4%	2002/04	14 750%	71 4	120 44	8 268%	6 43	6 699	8 79	85 991	88 212	0 62%	0 04	0 041	0 05	01-Feb 93	77	3 11	01 Feb-02	01 Feb-04	01 Feb-02
IR CAPITAL 9 1/4%	2003	9 250%	1187 4	104 89	8 065%	6 91	7 186	10 23	1245 410	1274 879	8 95%	0 62	0 643	0 92	11 Jan 93	98	2 48	11-Jul-03	11-Jul-03	11-Jul-03
IR EXCHEQR 8 1/4%	2003	8 250%	210 0	100 65	8 100%	7 00	7 284	10 54	211 370	210 849	1 48%	0 10	0 108	0 16	30 Apr 93	11	-0 25	30 Oct-03	30 Oct-03	30-Oct-03
IR EXCHEQR 6 1/2%	2000/05	6 500%	243 3	92 26	8 071%	7 64	7 946	12 20	224 477	229 370	1 61%	0 12	0 128	0 20	27 Dec 92	113	2 01	27 Jun-00	27 Jun-05	27 Jun-05
IR CAPITAL 12 1/2%	2005	12 500%	41 4	114 29	8 272%	8 31	8 653	12 67	47 316	49 087	0 34%	0 03	0 030	0 04	15 Dec 92	125	4 28	15 Dec-05	15 Dec-05	15 Dec 05
IR CAPITAL 9 %	2006	9 000%	771 2	103 89	8 073%	8 19	8 519	13 38	801 199	810 510	5 69%	0 47	0 485	0 76	01 Mar 93	49	1 21	01 Sep-06	01 Sep-06	01 Sep-06
IR CAPITAL 8 1/4%	2008	8 250%	319 6	100 77	8 072%	8 72	9 074	15 29	322 063	327 766	2 30%	0 20	0 209	0 35	30 Jan 93	79	1 78	30-Jul-08	30-Jul-08	30-Jul-08
IR CAPITAL 8 1/2%	2010	8 500%	323 5	101 66	8 090%	9 37	9 746	17 46	328 880	330 235	2 32%	0 22	0 226	0 40	01 Apr 93	18	0 42	01-Oct-10	01-Oct 10	01 Oct 10
IR CAPITAL 8 3/4%	2012	8 750%	689 8	102 51	8 082%	9 95	10 352	19 46	707 116	710 421	4 99%	0 50	0 516	0 97	30 Mar 93	20	0 48	30 Sep-12	30 Sep-12	30 Sep 12
									14025 735	14243 831	100 00%	4 25	4 417	6 33						

Table A 1 28 Irish Government Treasury Data - October 1993

Trade : 18-Oct-93
Sett : 21-Oct-93

Stock		Coupon	Nominal Issue	Market Price	Market Yield	Volatility	Duration	Life	Clean Market Value (IR£m)	Dirty Market Value (IR£m)	Stock Weight in Index	Weighted Volatility	Weighted Duration	Weighted Life	Ex-Div Date	Accrued Interest	Accrued Interest	First Redemption Date	Last Redemption Date	Redemption Date
IR CAPITAL 8 %	1993	8 00%	368 0	100 03	6 810%	0 03	0 031	0 03	368 127	367 240	2 46%	0 00	0 00	0 00	01-Nov-93	-11	-0 24	01-Nov-93	01-Nov-93	01-Nov-93
IR FINANCE VAR%	1994	6 78%	661 0	100 00	6 780%	0 11	0 112	0 11	661 000	667 135	4 47%	0 00	0 01	0 01	01-Sep-93	50	0 93	01-Jun-94	01-Jun-94	01-Jun-94
IR FUNDING VAR%	1996	6 86%	317 0	100 00	6 850%	0 19	0 192	0 19	317 006	318 256	2 13%	0 00	0 00	0 00	30-Sep-93	21	0 39	30-Sep-96	30-Sep-96	30-Sep-96
IR FUNDING VAR%	1995	6 78%	503 8	100 00	6 780%	0 23	0 236	0 24	503 800	504 268	3 38%	0 01	0 01	0 01	16-Oct-93	5	0 09	16-Jun-95	16-Jun-95	16-Jun-95
IR CAPITAL 7 %	1994	7 00%	607 0	100.29	6 220%	0 39	0 399	0 40	608 774	612 962	4 11%	0 02	0 02	0 02	15-Sep-93	36	0 69	15-Mar-94	15-Mar-94	15-Mar-94
IR EXCHEQR 13 %	1994	13 00%	19 3	105 82	6 200%	0 93	0 961	0 98	20 424	20 465	0 14%	0 00	0 00	0 00	15-Oct-93	6	0 21	15-Oct-94	15-Oct-94	15-Oct-94
IR CONV 9 1/2%	1995	9 50%	370 4	104.53	6 030%	1 42	1 462	1 52	387 186	386 319	2 59%	0 04	0 04	0 04	30-Oct-93	-9	-0 23	30-Apr-95	30-Apr-95	30-Apr-95
IR CAPITAL 12 1/4%	1995	12 25%	40 7	108.22	6 090%	1 48	1 530	1 61	44 045	45 983	0 31%	0 00	0 00	0 00	01-Jun-93	142	4 76	01-Jun-95	01-Jun-95	01-Jun-95
IR CONVER 12 %	1995	12 00%	149 0	109 09	6 090%	1 73	1 785	1 90	162 551	164 314	1 10%	0 02	0 02	0 02	15-Sep-93	36	1 18	15-Sep-95	15-Sep-95	15-Sep-95
IR CAPITAL 9 %	1996	9 00%	1058 0	105 95	6 260%	2 47	2 549	2 78	1120 979	1142 617	7 66%	0 19	0 20	0 21	30-Jul-93	83	2 05	30-Jul-96	30-Jul-96	30-Jul-96
IR EXCHEQR 8 1/2 %	1996	8 50%	98 7	105 02	6 310%	2 61	2 696	2 95	103 657	104 139	0 70%	0 02	0 02	0 02	30-Sep-93	21	0 49	30-Sep-96	30-Sep-96	30-Sep-96
IR.FINANCE 13 %	1997/02	13 00%	140 0	115 56	6 450%	2 96	3 052	3 45	161 789	162 786	1 09%	0 03	0 03	0 04	01-Oct-93	20	0 71	01-Apr-97	01-Apr-02	01-Apr-97
IR CAPITAL 7 3/4 %	1997	7 75%	338 0	103 76	6 400%	3 24	3 345	3 73	350 696	357 724	2 40%	0 08	0 08	0 09	15-Jul-93	98	2 08	15-Jul-97	15-Jul-97	15-Jul-97
IR EXCHEQR 8 3/4%	1997	8 75%	1301 0	106 51	6 380%	3 25	3 351	3 77	1385 649	1412 452	9 47%	0 31	0 32	0 36	27-Jul-93	86	2 06	27-Jul-97	27-Jul-97	27-Jul-97
IR DEVELO 11 1/2%	1997/99	11 50%	145 0	113 55	6 530%	3 43	3 545	4 07	164 649	171 908	1.15%	0 04	0 04	0 05	15-May-93	159	5 01	15-Nov-97	15-Nov-99	15-Nov-97
IR CAPITAL 9 3/4 %	1998	9 75%	981 2	110 39	6 380%	3 86	3 980	4 61	1083 150	1120 343	7 51%	0 29	0 30	0 35	01-Jun-93	142	3 79	01-Jun-98	01-Jun-98	01-Jun-98
IR FINANCE 14 1/2%	1998/00	14 50%	73 2	122 39	6 600%	4 04	4 174	4 90	89 593	90 639	0 61%	0 02	0 03	0 03	15-Sep-93	36	1 43	15-Sep-98	15-Sep-00	15-Sep-98
IR TREASU 6 1/4%	1999	6 25%	773 0	99 19	6 470%	4 54	4 686	5 45	766 776	793 627	5 32%	0 24	0 25	0 29	01-Apr-93	203	3 47	01-Apr-99	01-Apr-99	01-Apr-99
IR CAPITAL 7 1/2 %	1999	7 50%	227 0	104.28	6 360%	4 70	4 846	5 73	236 706	241 274	1 62%	0 08	0 08	0 09	15-Jul-93	98	2 01	15-Jul-99	15-Jul-99	15-Jul-99
IR CAPITAL 11 3/4%	2000	11 75%	130 9	118 36	6 500%	5 15	5 317	6 49	154 932	155 185	1 04%	0 05	0 06	0 07	15-Oct-93	6	0 19	15-Apr-00	15-Apr-00	15-Apr-00
IR DEVELO 12 1/4%	2000/03	12 25%	103 5	119 00	6 740%	5 24	5 414	6 65	123 166	127 609	0 86%	0 04	0 05	0 06	15-Jun-93	128	4 29	15-Jun-00	15-Jun-03	15-Jun-00
IR GOVER 9 %	2001	9 00%	1133 4	109.68	6 650%	5 92	6 112	7 74	1243 074	1270 443	8 52%	0 50	0 52	0 66	15-Jul-93	98	2 41	15-Jul-01	15-Jul-01	15-Jul-01
IR CAPITAL 8 %	2001	8 00%	50 0	105 63	6 700%	6 07	6 270	7 99	52 815	52 881	0 35%	0 02	0 02	0 03	15-Oct-93	6	0 13	15-Oct-01	15-Oct-01	15-Oct-01
IR DEVELO 14 3/4%	2002/04	14 75%	71 4	126.94	6 750%	6 47	6 692	8 29	90 635	92 970	0 62%	0 04	0 04	0 05	01-Aug-93	81	3 27	01-Feb-02	01-Feb-04	01-Feb-02
IR CAPITAL 9 1/4%	2003	9 25%	1332 0	111.18	6 700%	7 07	7 311	9 73	1480 893	1515 301	10 16%	0 72	0 74	0 99	11-Jul-93	102	2 58	11-Jul-03	11-Jul-03	11-Jul-03
IR EXCHEQR 8 1/4%	2003	8 25%	53 0	106.94	6 750%	7 20	7 439	10 03	56 676	56 568	0 38%	0 03	0 03	0 04	30-Oct-93	-9	-0 20	30-Oct-03	30-Oct-03	30-Oct-03
IR TREASU 6 1/4%	2004	6 25%	238 0	97.47	6 740%	7 69	7 950	11 00	231 971	232 093	1 56%	0 12	0 12	0 17	18-Oct-93	3	0 05	18-Oct-04	18-Oct-04	18-Oct-04
IR EXCHEQR 6 1/2%	2000/05	6 50%	236 0	98.73	6 740%	8 00	8 273	11 69	233 007	237 878	1 59%	0 13	0 13	0 19	27-Jun-93	116	2 06	27-Jun-00	27-Jun-05	27-Jun-05
IR CAPITAL 12 1/2%	2005	12 50%	41 4	121.20	6 850%	8 76	9 062	12 16	50 175	51 988	0 35%	0 03	0 03	0 04	15-Jun-93	128	4 38	15-Dec-05	15-Dec-05	15-Dec-05
IR CAPITAL 9 %	2006	9 00%	771 2	109.82	6 850%	8 63	8 926	12 87	846 942	856 443	5 74%	0 50	0 51	0 74	01-Sep-93	50	1 23	01-Sep-06	01-Sep-06	01-Sep-06
IR CAPITAL 8 1/4%	2008	8 25%	319 6	106 00	6 980%	9 29	9 616	14 78	338 777	344 769	2 31%	0 21	0 22	0 34	30-Jul-93	83	1 87	30-Jul-08	30-Jul-08	30-Jul-08
IR CAPITAL 8 1/2%	2010	8 50%	323 5	106.81	6 990%	10 17	10 529	16 96	345 545	347 050	2 33%	0 24	0 24	0 39	01-Oct-93	20	0 47	01-Oct-10	01-Oct-10	01-Oct-10
IR CAPITAL 8 3/4%	2012	8 75%	825 0	107 27	7 030%	10 92	11 308	18 96	884 950	889 100	5 96%	0 65	0 67	1 13	30-Sep-93	21	0 50	30-Sep-12	30-Sep-12	30-Sep-12
									14670 112	14914 730	100 00%	4 68	4 834	6 52						

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Trade 18-Apr-94
Sett 20-Apr-94

Stock	Coupon	Nominal Issue	Market Price	Market Yield	Volatility	Duration	Life	Clean Market Value (IR£m)	Dirty Market Value (IR£m)	Stock Weight in Index	Weighted Volatility	Weighted Duration	Weighted Life	Ex-Div Date	Accrued Interest	Accrued Interest	First Redemption Date	Last Redemption Date	Redemption Date
IR FINANCE VAR% 1994	6 070%	661 0	100 00	6 070%	0 13	0 137	0 11	661 000	666 492	4 52%	0 01	0 006	0 01	01-Mar-94	50	0 83	01-Jun-94	01-Jun-94	01-Jun-94
IR FUNDING VAR% 1996	6 030%	466 0	100 00	6 030%	0 06	0 057	0 19	466 000	467 616	3 17%	0 00	0 002	0 01	30-Mar-94	21	0 35	30-Sep 96	30-Sep-96	30-Sep 96
IR FUNDING VAR% 1995	6 780%	503 8	100 10	6 330%	0 01	0 011	0 24	504 315	504 689	3 43%	0 00	0 000	0 01	16-Apr 94	4	0 07	16 Jun-95	16-Jun 95	16-Jun 95
IR EXCHEQR 13 % 1994	13 000%	17 0	102 98	6 300%	0 47	0 489	0 49	17 506	17 536	0 12%	0 00	0 001	0 00	15-Apr 94	5	0 18	15-Oct 94	15-Oct 94	15 Oct 94
IR CONV 9 1/2% 1995	9 500%	370 4	103 06	6 150%	0 98	1 005	1 03	381 740	380 776	2 58%	0 03	0 026	0 03	30 Apr 94	-10	-0 26	30 Apr 95	30 Apr 95	30 Apr 95
IR CAPITAL 12 1/4% 1995	12 250%	40 7	105 72	6 310%	1 05	1 083	1 12	43 029	44 940	0 31%	0 00	0 003	0 00	01-Dec 93	140	4 70	01-Jun 95	01-Jun 95	01-Jun 95
IR CONVER 12 % 1995	12 000%	149 0	106 77	6 290%	1 31	1 347	1 41	159 090	160 852	1 09%	0 01	0 015	0 02	15-Mar 94	36	1 18	15 Sep 95	15 Sep 95	15 Sep 95
IR CAPITAL 9 % 1996	9 000%	1058 0	103 97	6 840%	2 06	2 126	2 28	1099 984	1120 840	7 61%	0 16	0 162	0 17	30-Jan 94	80	1 97	30-Jul 96	30-Jul 96	30-Jul 96
IR EXCHEQR 8 1/2 % 1996	8 500%	98 7	103 10	6 920%	2 20	2 275	2 45	101 756	102 238	0 69%	0 02	0 016	0 02	30 Mar 94	21	0 49	30-Sep-96	30-Sep 96	30-Sep 96
IR FINANCE 13 % 1997/02	13 000%	103 0	111 95	7 310%	2 55	2 640	2 95	115 307	116 003	0 79%	0 02	0 021	0 02	01-Apr-94	19	0 68	01-Apr-97	01 Apr-02	01 Apr 97
IR CAPITAL 7 3/4 % 1997	7 750%	246 0	101 25	7 240%	2 83	2 934	3 24	249 086	254 045	1 72%	0 05	0 051	0 06	15-Jan-94	95	2 02	15-Jul-97	15-Jul 97	15-Jul 97
IR EXCHEQR 8 3/4% 1997	8 750%	1301 0	103 90	7 150%	2 84	2 943	3 27	1351 757	1377 625	9 35%	0 27	0 275	0 31	27-Jan 94	83	1 99	27-Jul 97	27-Jul 97	27-Jul 97
IR DEVELO 11 1/2% 1997/99	11 500%	115 0	110 34	7 300%	3 03	3 141	3 58	126 891	132 540	0 90%	0 03	0 028	0 03	15 Nov 93	156	4 91	15-Nov-97	15-Nov-99	15-Nov-97
IR CAPITAL 9 3/4 % 1998	9 750%	981 2	107 40	7 120%	3 46	3 580	4 12	1053 804	1090 473	7 40%	0 26	0 265	0 30	01-Dec 93	140	3 74	01-Jun 98	01-Jun-98	01-Jun 98
IR FINANCE 14 1/2% 1998/00	14 500%	29 0	118 95	7 300%	3 63	3 760	4 41	34 495	34 910	0 24%	0 01	0 009	0 01	15-Mar 94	36	1 43	15-Sep-98	15-Sep-00	15-Sep 98
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
IR CAPITAL 7 1/2 % 1999	7 500%	205 0	101 32	7 120%	4 30	4 449	5 24	207 703	211 702	1 44%	0 08	0 064	0 08	15-Jan-94	95	1 95	15-Jul-99	15-Jul 99	15-Jul 99
IR CAPITAL 11 3/4% 2000	11 750%	47 0	114 62	7 300%	4 72	4 889	5 99	53 873	53 949	0 37%	0 02	0 018	0 02	15 Apr 94	5	0 16	15-Apr-00	15-Apr-00	15-Apr-00
IR DEVELO 12 1/4% 2000/03	12 250%	40 0	116 03	7 350%	4 83	5 003	6 16	46 411	48 102	0 33%	0 02	0 016	0 02	15-Dec 93	126	4 23	15-Jun-00	15-Jun-03	15-Jun-00
IR GOVER 9 % 2001	9 000%	1029 0	106 06	7 440%	5 48	5 688	7 24	1091 342	1115 430	7 57%	0 42	0 431	0 55	15-Jan 94	95	2 34	15-Jul-01	15-Jul-01	15-Jul-01
IR CAPITAL 8 % 2001	8 000%	24 0	101 30	7 680%	5 61	5 824	7 49	24 311	24 338	0 17%	0 01	0 010	0 01	15-Apr-94	5	0 11	15-Oct-01	15-Oct-01	15-Oct-01
IR DEVELO 14 3/4% 2002/04	14 750%	44 0	123 14	7 550%	5 95	6 179	7 79	54 182	55 568	0 38%	0 02	0 023	0 03	01-Feb-94	78	3 15	01-Feb-02	01-Feb-04	01-Feb-02
IR CAPITAL 9 1/4% 2003	9 250%	1332 0	107 01	7 560%	6 56	6 811	9 23	1425 360	1458 755	9 90%	0 65	0 674	0 91	11-Jan 94	99	2 51	11-Jul-03	11-Jul-03	11-Jul-03
IR EXCHEQR 8 1/4% 2003	8 250%	40 0	102 57	7 660%	6 68	6 932	9 53	41 029	40 938	0 28%	0 02	0 019	0 03	30-Apr 94	-10	-0 23	30-Oct-03	30 Oct-03	30 Oct-03
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
IR EXCHEQR 6 1/2% 2000/05	6 500%	161 0	94 38	7 630%	7 45	7 730	11 19	151 951	155 218	1.05%	0 08	0 081	0 12	27-Dec-93	114	2 03	27-Jun-00	27-Jun-05	27-Jun-05
IR CAPITAL 12 1/2% 2005	12 500%	41 4	117 12	7 700%	8 07	8 378	11 66	48 486	50 271	0 34%	0 03	0 029	0 04	15-Dec 93	126	4 31	15 Dec-05	15-Dec-05	15 Dec-05
IR CAPITAL 9 % 2006	9 000%	941 0	106 28	7 560%	8 05	8 353	12 38	1000 080	1011 673	6 87%	0 55	0 574	0 85	01-Mar 94	50	1 23	01 Sep-06	01 Sep-06	01 Sep 06
IR CAPITAL 8 1/4% 2008	8 250%	314 0	102 94	7 600%	8 70	9 032	14 29	323 243	328 917	2 23%	0 19	0 202	0 32	30-Jan-94	80	1 81	30-Jul-08	30-Jul-08	30-Jul-08
IR CAPITAL 8 1/2% 2010	8 500%	323 5	103 84	7 610%	9 48	9 839	16 46	335 928	337 359	2 29%	0 22	0 225	0 38	01 Apr 94	19	0 44	01-Oct 10	01-Oct 10	01-Oct-10
IR CAPITAL 8 3/4% 2012	8 750%	925 0	104 57	7 620%	10 15	10 541	18 46	967 237	971 890	6 60%	0 67	0 695	1 22	30-Mar 94	21	0 50	30 Sep-12	30-Sep-12	30-Sep-12
								14488 907	14731 048	100 00%	3 84	3 987	6 82						

Trade 18 Oct 94
Sett 21 Oct 94

Stock	Coupon	Nominal Issue	Market Price	Market Yield	Volatility	Duration	Life	Clean Market Value (IR£m)	Dirty Market Value (IR£m)	Stock Weight in Index	Weighted Volatility	Weighted Duration	Weighted Life	Ex-Div Date	Accrued Interest	Accrued Interest	First Redemption Date	Last Redemption Date	Redemption Date
IR FUNDING VAR% 1998	5.950%	466.0	100.00	5.940%	0.15	0.156	0.09	466.004	470.331	3.30%	0.01	0.005	0.00	25-Aug-94	57	0.93	25-Nov-98	25-Nov-98	25-Nov-98
IR FUNDING VAR% 1996	5.940%	466.0	100.00	5.940%	0.06	0.057	0.19	466.000	467.591	3.28%	0.00	0.002	0.01	30-Sep-94	21	0.34	30-Sep-96	30-Sep-96	30-Sep-96
IR FUNDING VAR% 1995	5.710%	503.8	100.00	5.710%	0.01	0.014	0.24	503.800	504.194	3.54%	0.00	0.000	0.01	16-Oct-94	5	0.08	16-Jun-95	16-Jun-95	16-Jun-95
IR CONV 9 1/2% 1995	9.500%	370.4	101.50	6.400%	0.51	0.523	0.52	375.948	375.081	2.63%	0.01	0.014	0.01	30-Oct-94	-9	-0.23	30-Apr-95	30-Apr-95	30-Apr-95
IR CAPITAL 12 1/4% 1995	12.250%	40.7	103.13	6.580%	0.59	0.608	0.61	41.973	43.912	0.31%	0.00	0.002	0.00	01-Jun-94	142	4.76	01-Jun-95	01-Jun-95	01-Jun-95
IR CONVER 12% 1995	12.000%	149.0	103.99	6.960%	0.85	0.884	0.90	154.946	156.709	1.10%	0.01	0.010	0.01	15-Sep-94	36	1.18	15-Sep-95	15-Sep-95	15-Sep-95
IR CAPITAL 9% 1996	9.000%	1019.0	101.60	7.910%	1.62	1.684	1.78	1035.333	1056.173	7.42%	0.12	0.125	0.13	30-Jul-94	83	2.05	30-Jul-96	30-Jul-96	30-Jul-96
IR EXCHEQR 8 1/2% 1996	8.500%	98.7	100.81	7.990%	1.77	1.836	1.95	99.504	99.986	0.70%	0.01	0.013	0.01	30-Sep-94	21	0.49	30-Sep-96	30-Sep-96	30-Sep-96
IR FINANCE 13% 1997/02	13.000%	95.0	108.27	8.410%	2.13	2.221	2.45	102.852	103.529	0.73%	0.02	0.016	0.02	01-Oct-94	20	0.71	01-Apr-97	01-Apr-02	01-Apr-97
IR CAPITAL 7 3/4% 1997	7.750%	246.0	98.65	8.390%	2.41	2.509	2.73	242.667	247.782	1.74%	0.04	0.044	0.05	15-Jul-94	98	2.08	15-Jul-97	15-Jul-97	15-Jul-97
IR EXCHEQR 8 3/4% 1997	8.750%	1301.0	100.97	8.290%	2.42	2.522	2.77	1313.609	1340.413	9.42%	0.23	0.237	0.26	27-Jul-94	86	2.06	27-Jul-97	27-Jul-97	27-Jul-97
IR DEVELO 11 1/2% 1997/99	11.500%	99.0	106.71	8.410%	2.62	2.728	3.07	105.644	110.600	0.78%	0.02	0.021	0.02	15-May-94	159	5.01	15-Nov-97	15-Nov-99	15-Nov-97
IR CAPITAL 9 3/4% 1998	9.750%	981.2	103.34	8.420%	3.04	3.164	3.61	1013.926	1051.118	7.38%	0.22	0.234	0.27	01-Jun-94	142	3.79	01-Jun-98	01-Jun-98	01-Jun-98
IR FINANCE 14 1/2% 1998/00	14.500%	28.0	114.19	8.560%	3.20	3.333	3.90	31.975	32.375	0.23%	0.01	0.008	0.01	15-Sep-94	36	1.43	15-Sep-98	15-Sep-00	15-Sep-98
IR TREASU [illegible]	8.250%	1412.0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
IR CAPITAL 7 1/2% 1999	7.500%	30.0	97.01	8.450%	3.87	4.029	4.73	29.104	29.708	0.21%	0.01	0.008	0.01	15-Jul-94	98	2.01	15-Jul-99	15-Jul-99	15-Jul-99
IR CAPITAL 11 3/4% 2000	11.750%	40.0	110.22	8.400%	4.28	4.456	5.49	44.089	44.166	0.31%	0.01	0.014	0.02	15-Oct-94	6	0.19	15-Apr-00	15-Apr-00	15-Apr-00
IR DEVELO 12 1/4% 2000/03	12.250%	34.0	111.50	8.470%	4.38	4.561	5.65	37.912	39.371	0.28%	0.01	0.013	0.02	15-Jun-94	128	4.29	15-Jun-00	15-Jun-03	15-Jun-00
IR GOVER 9% 2001	9.000%	1029.0	101.37	8.620%	5.02	5.233	6.74	1043.116	1067.964	7.50%	0.38	0.393	0.51	15-Jul-94	98	2.41	15-Jul-01	15-Jul-01	15-Jul-01
IR CAPITAL 8% 2001	8.000%	22.0	97.24	8.730%	5.17	5.397	6.99	21.392	21.421	0.15%	0.01	0.008	0.01	15-Oct-94	6	0.13	15-Oct-01	15-Oct-01	15-Oct-01
IR DEVELO 14 3/4% 2002/04	14.750%	21.0	117.94	8.800%	5.39	5.629	7.29	24.767	25.454	0.18%	0.01	0.010	0.01	01-Aug-94	81	3.27	01-Feb-02	01-Feb-04	01-Feb-02
IR CAPITAL 9 1/4% 2003	9.250%	1164.0	102.10	8.710%	6.03	6.288	8.73	1188.392	1218.460	8.56%	0.52	0.538	0.75	11-Jul-94	102	2.58	11-Jul-03	11-Jul-03	11-Jul-03
IR EXCHEQR 8 1/4% 2003	8.250%	34.0	97.76	8.800%	6.14	6.415	9.03	33.238	33.169	0.23%	0.01	0.015	0.02	30-Oct-94	-9	-0.20	30-Oct-03	30-Oct-03	30-Oct-03
[illegible]	6.250%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
IR EXCHEQR 6 1/2% 2000/05	6.500%	161.0	90.02	8.640%	6.90	7.197	10.69	144.926	148.249	1.04%	0.07	0.075	0.11	27-Jun-94	116	2.06	27-Jun-00	27-Jun-05	27-Jun-05
IR CAPITAL 12 1/2% 2005	12.500%	41.4	112.73	8.720%	7.37	7.692	11.16	46.672	48.485	0.34%	0.03	0.026	0.04	15-Jun-94	128	4.38	15-Dec-05	15-Dec-05	15-Dec-05
IR CAPITAL 9% 2006	9.000%	1053.0	101.47	8.640%	7.36	7.675	11.87	1068.472	1081.445	7.60%	0.56	0.583	0.90	01-Sep-94	50	1.23	01-Sep-06	01-Sep-06	01-Sep-06
IR CAPITAL 8 1/4% 2008	8.250%	4.0	98.52	8.600%	7.95	8.288	13.78	3.941	4.016	0.03%	0.00	0.002	0.00	30-Jul-94	83	1.87	30-Jul-08	30-Jul-08	30-Jul-08
IR CAPITAL 8 1/2% 2010	8.500%	18.0	99.60	8.600%	8.57	8.944	15.96	17.928	18.011	0.13%	0.01	0.011	0.02	01-Oct-94	20	0.47	01-Oct-10	01-Oct-10	01-Oct-10
IR CAPITAL 8 3/4% 2012	8.750%	975.0	100.75	8.550%	9.15	9.540	17.96	982.337	987.242	6.93%	0.63	0.662	1.25	30-Sep-94	21	0.50	30-Sep-12	30-Sep-12	30-Sep-12
IR TRE [illegible]	8.250%	706.0	98.75	8.600%	0.17	0.176	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
								13990.277	14236.823	100.00%	3.02	3.152	6.88						

Table A 1 31 Irish Government Treasury Data - April 1995

Trade : 18-Apr-95
Sett : 19-Apr-95

Stock		Coupon	Nominal Issue	Market Price	Market Yield	Volatility	Duration	Life	Clean Market Value (IR£m)	Dirty Market Value (IR£m)	Stock Weight in Index	Weighted Volatility	Weighted Duration	Weighted Life	Ex-Div Date	Accrued Interest	Accrued Interest	First Redemption Date	Last Redemption Date	Redemption Date
IR CONV. 9 1/2%	1995	9.500%	370.4	100.09	6.240%	0.03	0.031	0.03	370.749	369.690	2.58%	0.00	0.001	0.00	30-Apr-95	-11	-0.29	30-Apr-95	30-Apr-95	30-Apr-95
IR FUNDING VAR%	1998	6.400%	466.0	100.00	6.390%	0.14	0.145	0.10	466.005	470.332	3.28%	0.00	0.005	0.00	25-Feb-95	53	0.93	25-Nov-98	25-Nov-98	25-Nov-98
IR CAPITAL 12 1/4%	1995	12.250%	40.7	100.65	6.430%	0.12	0.121	0.12	40.964	42.861	0.30%	0.00	0.000	0.00	01-Dec-94	139	4.66	01-Jun-95	01-Jun-95	01-Jun-95
IR FUNDING VAR%	1996	7.100%	466.0	100.00	7.100%	0.05	0.055	0.19	466.000	467.812	3.26%	0.00	0.002	0.01	30-Mar-95	20	0.39	30-Sep-96	30-Sep-96	30-Sep-96
IR CONVER 12 %	1995	12.000%	149.0	102.10	6.420%	0.40	0.411	0.41	152.128	153.841	1.07%	0.00	0.004	0.00	15-Mar-95	35	1.15	15-Sep-95	15-Sep-95	15-Sep-95
IR CAPITAL 9 %	1996	9.000%	1019.0	101.21	7.910%	1.19	1.241	1.28	1031.288	1051.124	7.32%	0.09	0.091	0.09	30-Jan-95	79	1.95	30-Jul-96	30-Jul-96	30-Jul-96
IR EXCHEQR 8 1/2 %	1996	8.500%	98.7	100.92	7.760%	1.35	1.398	1.45	99.608	100.067	0.70%	0.01	0.010	0.01	30-Mar-95	20	0.47	30-Sep-96	30-Sep-96	30-Sep-96
IR FINANCE 13 %	1997/02	13.000%	95.0	107.15	8.280%	1.74	1.814	1.95	101.796	102.405	0.71%	0.01	0.013	0.01	01-Apr-95	18	0.64	01-Apr-97	01-Apr-02	01-Apr-97
IR CAPITAL 7 3/4 %	1997	7.750%	246.0	98.92	8.350%	2.01	2.096	2.24	243.336	248.242	1.73%	0.03	0.036	0.04	15-Jan-95	94	1.99	15-Jul-97	15-Jul-97	15-Jul-97
IR EXCHEQR 8 3/4%	1997	8.750%	1166.0	100.92	8.240%	2.03	2.114	2.27	1176.736	1199.641	8.36%	0.17	0.177	0.19	27-Jan-95	82	1.96	27-Jul-97	27-Jul-97	27-Jul-97
IR DEVELO. 11 1/2%	1997/99	11.500%	99.0	105.99	8.370%	2.24	2.338	2.58	104.930	109.761	0.76%	0.02	0.018	0.02	15-Nov-94	155	4.88	15-Nov-97	15-Nov-99	15-Nov-97
IR CAPITAL 9 3/4 %	1998	9.750%	954.0	102.69	8.560%	2.67	2.785	3.12	979.622	1015.020	7.07%	0.19	0.197	0.22	01-Dec-94	139	3.71	01-Jun-98	01-Jun-98	01-Jun-98
IR FINANCE 14 1/2%	1998/00	14.500%	28.0	112.93	8.630%	2.84	2.963	3.41	31.620	32.009	0.22%	0.01	0.007	0.01	15-Mar-95	35	1.39	15-Sep-98	15-Sep-00	15-Sep-98
IR TREASU 6 1/4%	1999	6.250%	1781.0	93.04	8.770%	0.05	0.049	3.95	1656.963	1662.449	11.58%	0.01	0.006	0.46	[illegible]	18	[illegible]	[illegible]	[illegible]	[illegible]
IR CAPITAL 7 1/2 %	1999	7.500%	30.0	96.54	8.690%	3.52	3.671	4.24	28.961	29.540	0.21%	0.01	0.008	0.01	15-Jan-95	94	1.93	15-Jul-99	15-Jul-99	15-Jul-99
IR CAPITAL 11 3/4%	2000	11.750%	40.0	108.57	8.780%	3.93	4.101	4.99	43.427	43.478	0.30%	0.01	0.012	0.02	15-Apr-95	4	0.13	15-Apr-00	15-Apr-00	15-Apr-00
IR DEVELO. 12 1/4%	2000/03	12.250%	34.0	110.04	8.780%	4.03	4.210	5.16	37.414	38.840	0.27%	0.01	0.011	0.01	15-Dec-94	125	4.19	15-Jun-00	15-Jun-03	15-Jun-00
IR TREASU 8 %	2000	8.000%	200.0	97.62	8.730%	0.49	0.501	5.50	195.234	203.250	[illegible]	0.01	0.007	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
IR GOVER 9 %	2001	9.000%	1029.0	101.11	8.680%	4.74	4.941	6.24	1040.473	1064.307	7.42%	0.35	0.366	0.46	15-Jan-95	94	2.32	15-Jul-01	15-Jul-01	15-Jul-01
IR CAPITAL 8 %	2001	8.000%	22.0	97.15	8.780%	4.89	5.110	6.50	21.373	21.392	0.15%	0.01	0.008	0.01	15-Apr-95	4	0.09	15-Oct-01	15-Oct-01	15-Oct-01
IR DEVELO. 14 3/4%	2002/04	14.750%	21.0	117.32	8.900%	5.07	5.297	6.79	24.637	25.290	0.18%	0.01	0.009	0.01	01-Feb-95	77	3.11	01-Feb-02	01-Feb-04	01-Feb-02
IR CAPITAL 9 1/4%	2003	9.250%	1164.0	101.91	8.750%	5.78	6.032	8.23	1186.214	1215.103	8.47%	0.49	0.511	0.70	11-Jan-95	98	2.48	11-Jul-03	11-Jul-03	11-Jul-03
IR EXCHEQR 8 1/4%	2003	8.250%	34.0	97.56	8.860%	5.91	6.170	8.54	33.169	33.085	0.23%	0.01	0.014	0.02	30-Apr-95	-11	-0.25	30-Oct-03	30-Oct-03	30-Oct-03
IR TREASU 8 1/4%	2004	8.250%	1642.0	88.58	8.820%	0.49	0.501	9.61	1454.456	1505.874	[illegible]	[illegible]	0.053	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
IR EXCHEQR 6 1/2%	2000/05	6.500%	161.0	89.96	8.680%	6.71	6.996	10.20	144.833	148.070	1.03%	0.07	0.072	0.11	27-Dec-94	113	2.01	27-Jun-00	27-Jun-05	27-Jun-05
IR CAPITAL 12 1/2%	2005	12.500%	19.0	111.87	8.950%	7.04	7.359	10.67	21.254	22.067	0.15%	0.01	0.011	0.02	15-Dec-94	125	4.28	15-Dec-05	15-Dec-05	15-Dec-05
IR CAPITAL 9 %	2006	9.000%	1053.0	101.47	8.640%	7.17	7.482	11.38	1068.474	1081.187	7.53%	0.54	0.564	0.86	01-Mar-95	49	1.21	01-Sep-06	01-Sep-06	01-Sep-06
IR CAPITAL 8 1/4%	2008	8.250%	4.0	98.76	8.540%	7.83	8.163	13.29	3.950	4.022	0.03%	0.00	0.002	0.00	30-Jan-95	79	1.78	30-Jul-08	30-Jul-08	30-Jul-08
IR CAPITAL 8 1/2%	2010	8.500%	18.0	99.84	8.540%	8.49	8.852	15.46	17.971	18.046	0.13%	0.01	0.011	0.02	01-Apr-95	18	0.42	01-Oct-10	01-Oct-10	01-Oct-10
IR CAPITAL 8 3/4%	2012	8.750%	975.0	101.00	8.490%	9.09	9.472	17.46	984.722	989.393	6.89%	0.63	0.653	1.20	30-Mar-95	20	0.48	30-Sep-12	30-Sep-12	30-Sep-12
IR TREASU 8 1/4%	2015	8.250%	841.0	99.69	8.360%	0.85	0.666	20.35	[illegible]	[illegible]	[illegible]	[illegible]	0.041	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
									14065.876	14352.119	100.00%	2.80	2.920	6.84						

Table A 1 32 Irish Government Treasury Data - October 1995

Trade : 18-Oct-95
Sett : 23-Oct-95

Stock		Coupon	Nominal Issue	Market Price	Market Yield	Volatility	Duration	Life	Clean Market Value (IR£m)	Dirty Market Value (IR£m)	Stock Weight in Index	Weighted Volatility	Weighted Duration	Weighted Life	Ex-Div Date	Accrued Interest	Accrued Interest	First Redemption Date	Last Redemption Date	Redemption Date
IR.FUNDING VAR%	1998	6.350%	672.0	100.00	6.340%	0.16	0.162	0.09	672.006	678.899	4.36%	0.01	0.007	0.00	25-Aug-95	59	1.03	25-Nov-98	25-Nov-98	25-Nov-98
IR.FUNDING VAR%	1996	5.900%	466.0	100.00	5.890%	0.06	0.063	0.19	466.008	467.740	3.00%	0.00	0.002	0.01	30-Sep-95	23	0.37	30-Sep-96	30-Sep-96	30-Sep-96
IR.FUNDING VAR%	2000	5.830%	312.0	100.00	5.820%	0.01	0.011	0.24	312.007	312.206	2.00%	0.00	0.000	0.00	19-Oct-95	4	0.06	19-Apr-00	19-Apr-00	19-Apr-00
IR.CAPITAL 9 %	1996	9.000%	1019.0	102.00	6.140%	0.74	0.762	0.77	1039.418	1060.760	6.81%	0.05	0.052	0.05	30-Jul-95	85	2.09	30-Jul-96	30-Jul-96	30-Jul-96
IR.EXCHEQR 8 1/2 %	1996	8.500%	98.7	102.03	6.110%	0.90	0.924	0.94	100.699	101.228	0.65%	0.01	0.006	0.01	30-Sep-95	23	0.54	30-Sep-96	30-Sep-96	30-Sep-96
IR.FINANCE 13 %	1997/02	13.000%	95.0	107.59	6.660%	1.33	1.376	1.44	102.210	102.954	0.66%	0.01	0.009	0.01	01-Oct-95	22	0.78	01-Apr-97	01-Apr-02	01-Apr-97
IR.CAPITAL 7 3/4 %	1997	7.750%	246.0	101.37	6.820%	1.60	1.654	1.73	249.372	254.592	1.63%	0.03	0.027	0.03	15-Jul-95	100	2.12	15-Jul-97	15-Jul-97	15-Jul-97
IR.EXCHEQR 8 3/4%	1997	8.750%	1166.0	103.03	6.710%	1.62	1.677	1.76	1201.302	1225.883	7.87%	0.13	0.132	0.14	27-Jul-95	88	2.11	27-Jul-97	27-Jul-97	27-Jul-97
IR.DEVELO. 11 1/2%	1997/99	11.500%	99.0	107.64	6.850%	1.86	1.925	2.07	106.559	111.578	0.72%	0.01	0.014	0.01	15-May-95	161	5.07	15-Nov-97	15-Nov-99	15-Nov-97
IR.CAPITAL 9 3/4 %	1998	9.750%	954.0	105.45	7.050%	2.31	2.393	2.61	1006.038	1042.709	6.69%	0.15	0.160	0.17	01-Jun-95	144	3.84	01-Jun-98	01-Jun-98	01-Jun-98
IR.FINANCE 14 1/2%	1998/00	14.500%	28.0	114.16	7.490%	2.50	2.589	2.90	31.964	32.386	0.21%	0.01	0.005	0.01	15-Sep-95	38	1.51	15-Sep-98	15-Sep-00	15-Sep-98
IR.TREASU 6 1/4%	1999	6.250%	1781.0	96.92	7.450%	0.55	0.561	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
IR.CAPITAL 7 1/2 %	1999	7.500%	30.0	100.25	7.410%	3.20	3.323	3.73	30.074	30.690	0.20%	0.01	0.007	0.01	15-Jul-95	100	2.05	15-Jul-99	15-Jul-99	15-Jul-99
IR.CAPITAL 11 3/4%	2000	11.750%	40.0	112.17	7.430%	3.68	3.814	4.48	44.866	44.969	0.29%	0.01	0.011	0.01	15-Oct-95	8	0.26	15-Apr-00	15-Apr-00	15-Apr-00
IR.DEVELO. 12 1/4%	2000/03	12.250%	34.0	113.19	7.590%	3.78	3.924	4.65	38.485	39.968	0.26%	0.01	0.010	0.01	15-Jun-95	130	4.36	15-Jun-00	15-Jun-03	15-Jun-00
IR.TREASU 8 %	2000	8.000%	1067.0	101.63	[illegible]	0.01	0.014	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
IR.GOVER 9 %	2001	9.000%	430.0	104.69	7.640%	4.53	4.707	5.73	450.174	460.770	2.96%	0.13	0.139	0.17	15-Jul-95	100	2.46	15-Jul-01	15-Jul-01	15-Jul-01
IR.CAPITAL 8 %	2001	8.000%	22.0	100.94	7.740%	4.71	4.891	5.98	22.207	22.246	0.14%	0.01	0.007	0.01	15-Oct-95	8	0.18	15-Oct-01	15-Oct-01	15-Oct-01
IR.DEVELO. 14 3/4%	2002/04	14.750%	21.0	121.24	7.720%	4.91	5.096	6.28	25.459	26.163	0.17%	0.01	0.009	0.01	01-Aug-95	83	3.35	01-Feb-02	01-Feb-04	01-Feb-02
IR.CAPITAL 9 1/4%	2003	9.250%	1164.0	104.82	8.000%	5.66	5.886	7.72	1220.134	1250.792	8.03%	0.45	0.472	0.62	11-Jul-95	104	2.63	11-Jul-03	11-Jul-03	11-Jul-03
IR.EXCHEQR 8 1/4%	2003	8.250%	34.0	100.57	8.110%	5.81	6.048	8.02	34.193	34.139	0.22%	0.01	0.013	0.02	30-Oct-95	-7	-0.16	30-Oct-03	30-Oct-03	30-Oct-03
IR.TREASU 6 1/4%	2004	6.250%	1642.0	91.38	8.170%	0.01	0.014	[illegible]	[illegible]	1501.792	9.64%	0.00	0.001	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
IR.EXCHEQR 6 1/2%	2000/05	6.500%	161.0	92.48	8.110%	6.66	6.933	9.68	148.898	152.279	0.98%	0.07	0.068	0.09	27-Jun-95	118	2.10	27-Jun-00	27-Jun-05	27-Jun-05
IR.CAPITAL 12 1/2%	2005	12.500%	19.0	115.20	8.160%	7.06	7.350	10.15	21.887	22.733	0.15%	0.01	0.011	0.01	15-Jun-95	130	4.45	15-Dec-05	15-Dec-05	15-Dec-05
IR.TREASU 8 %	2008	8.000%	1424.0	99.39	8.140%	0.18	0.181	10.83	1415.380	1436.965	9.21%	0.02	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
IR.CAPITAL 9 %	2006	9.000%	226.0	103.78	8.100%	7.17	7.459	10.87	234.537	237.433	1.52%	0.11	0.114	0.17	01-Sep-95	52	1.28	01-Sep-06	01-Sep-06	01-Sep-06
IR.CAPITAL 8 1/4%	2008	8.250%	4.0	100.13	8.220%	7.82	8.143	12.78	4.005	4.082	0.03%	0.00	0.002	0.00	30-Jul-95	85	1.92	30-Jul-08	30-Jul-08	30-Jul-08
IR.CAPITAL 8 1/2%	2010	8.500%	18.0	101.18	8.220%	8.56	8.911	14.95	18.213	18.305	0.12%	0.01	0.010	0.02	01-Oct-95	22	0.51	01-Oct-10	01-Oct-10	01-Oct-10
IR.CAPITAL 8 3/4%	2012	8.750%	975.0	102.32	8.170%	9.22	9.601	16.95	997.585	1002.957	6.44%	0.59	0.618	1.09	30-Sep-95	23	0.55	30-Sep-12	30-Sep-12	30-Sep-12
IR.TREASU 8 1/4%	2015	8.250%	1018.0	100.00	8.250%	0.18	0.181	19.83	1018.000	1033.176	6.63%	0.01	0.012	1.31	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Clean Market Value (IR£m)	Dirty Market Value (IR£m)	Stock Weight in Index	Weighted Volatility	Weighted Duration	Weighted Life
15322.639	15583.606	100.00%	1.93	2.000	6.61

Stock	Coupon	Nominal Issue	Market Price	Market Yield	Volatility	Duration	Life	Clean Market Value (IR£m)	Dirty Market Value (IR£m)	Stock Weight in index	Weighted Volatility	Weighted Duration	Weighted Life	Ex-Div Date	Accrued Interest	Accrued Interest	First Redemption Date	Last Redemption Date	Redemption Date
Trade 19-Apr-96																			
Sett 22-Apr-96																			
IR.FUNDING VAR% 1998	5.190%	669.0	100.00	5.180%	0.15	0.156	0.09	669.006	674.424	3.96%	0.01	0.006	0.00	25-Feb-96	57	0.81	25-Nov-98	25-Nov-98	25-Nov-98
IR.FUNDING VAR% 1996	5.120%	466.0	100.00	5.120%	0.06	0.063	0.19	466.000	467.502	2.75%	0.00	0.002	0.01	30-Mar-96	23	0.32	30-Sep-96	30-Sep-96	30-Sep-96
IR.FUNDING VAR% 2000	5.210%	512.0	100.00	5.200%	0.01	0.008	0.24	512.012	512.231	3.01%	0.00	0.000	0.01	19-Apr-96	3	0.04	19-Apr-00	19-Apr-00	19-Apr-00
IR.CAPITAL 9 % 1996	9.000%	969.0	100.99	5.160%	0.27	0.274	0.27	978.566	998.383	5.86%	0.02	0.016	0.02	30-Jan-96	83	2.05	30-Jul-96	30-Jul-96	30-Jul-96
IR.EXCHEQR 8 1/2 % 1996	8.500%	71.0	101.39	5.140%	0.43	0.442	0.44	71.988	72.368	0.43%	0.00	0.002	0.00	30-Mar-96	23	0.54	30-Sep-96	30-Sep-96	30-Sep-96
IR.FINANCE 13 % 1997/02	13.000%	95.0	106.15	5.570%	0.90	0.923	0.94	100.840	101.550	0.60%	0.01	0.006	0.01	01-Apr-96	21	0.75	01-Apr-97	01-Apr-02	01-Apr-97
IR.CAPITAL 7 3/4 % 1997	7.750%	245.0	102.39	5.570%	1.17	1.199	1.23	250.867	255.961	1.50%	0.02	0.018	0.02	15-Jan-96	98	2.08	15-Jul-97	15-Jul-97	15-Jul-97
IR.EXCHEQR 8 3/4% 1997	8.750%	1173.0	103.62	5.510%	1.19	1.227	1.26	1215.431	1239.597	7.28%	0.09	0.089	0.09	27-Jan-96	86	2.06	27-Jul-97	27-Jul-97	27-Jul-97
IR.DEVELO. 11 1/2% 1997/99	11.500%	99.0	107.74	5.630%	1.45	1.495	1.57	106.663	105.946	0.62%	0.01	0.009	0.01	15-May-96	-23	-0.72	15-Nov-97	15-Nov-99	15-Nov-97
IR.CAPITAL 9 3/4 % 1998	9.750%	903.0	106.69	5.880%	1.92	1.980	2.11	963.383	997.853	5.86%	0.11	0.116	0.12	01-Dec-95	143	3.82	01-Jun-98	01-Jun-98	01-Jun-98
IR.FINANCE 14 1/2% 1998/00	14.500%	28.0	115.21	6.050%	2.14	2.200	2.40	32.258	32.680	0.19%	0.00	0.004	0.00	15-Mar-96	38	1.51	15-Sep-98	15-Sep-00	15-Sep-98
IR.TREASU 6 1/4% 1999	6.250%	1947.0	99.61	6.420%	0.06	0.057	2.94	[illegible]	[illegible]	11.43%	[illegible]	[illegible]	[illegible]	[illegible]	21	[illegible]	[illegible]	[illegible]	[illegible]
IR.CAPITAL 7 1/2 % 1999	7.500%	30.0	102.75	6.400%	2.85	2.945	3.23	30.826	31.430	0.18%	0.01	0.005	0.01	15-Jan-96	98	2.01	15-Jul-99	15-Jul-99	15-Jul-99
IR.CAPITAL 11 3/4% 2000	11.750%	40.0	113.31	6.750%	3.36	3.468	3.98	45.323	45.413	0.27%	0.01	0.009	0.01	15-Apr-96	7	0.23	15-Apr-00	15-Apr-00	15-Apr-00
IR.DEVELO. 12 1/4% 2000/03	12.250%	29.0	114.74	6.790%	3.47	3.591	4.15	33.276	34.531	0.20%	0.01	0.007	0.01	15-Dec-95	129	4.33	15-Jun-00	15-Jun-03	15-Jun-00
IR.TREASU 8 % 2000	8.000%	1516.0	103.61	6.810%	0.50	0.504	4.49	[illegible]	[illegible]	9.59%	0.05	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
IR.GOVER 9 % 2001	9.000%	336.0	107.03	6.900%	4.27	4.416	5.23	359.630	367.743	2.16%	0.09	0.095	0.11	15-Jan-96	98	2.41	15-Jul-01	15-Jul-01	15-Jul-01
IR.CAPITAL 8 % 2001	8.000%	22.0	103.57	6.990%	4.46	4.612	5.48	22.785	22.818	0.13%	0.01	0.006	0.01	15-Apr-96	7	0.15	15-Oct-01	15-Oct-01	15-Oct-01
IR.DEVELO. 14 3/4% 2002/04	14.750%	21.0	123.83	6.850%	4.66	4.822	5.78	26.004	26.691	0.16%	0.01	0.008	0.01	01-Feb-96	81	3.27	01-Feb-02	01-Feb-04	01-Feb-02
IR.CAPITAL 9 1/4% 2003	9.250%	1225.0	107.79	7.240%	5.50	5.701	7.22	1320.380	1352.024	7.94%	0.44	0.453	0.57	11-Jan-96	102	2.58	11-Jul-03	11-Jul-03	11-Jul-03
IR.EXCHEQR 8 1/4% 2003	8.250%	34.0	103.50	7.390%	5.67	5.879	7.53	35.189	35.128	0.21%	0.01	0.012	0.02	30-Apr-96	-8	-0.18	30-Oct-03	30-Oct-03	30-Oct-03
IR.TREASU 6 1/4% 2004	6.250%	1654.0	94.26	7.520%	0.49	0.504	8.50	[illegible]	[illegible]	9.46%	0.04	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
IR.EXCHEQR 6 1/2% 2000/05	6.500%	157.0	95.10	7.540%	6.58	6.830	9.19	149.309	152.578	0.90%	0.06	0.061	0.08	27-Dec-95	117	2.08	27-Jun-00	27-Jun-05	27-Jun-05
IR.CAPITAL 12 1/2% 2005	12.500%	13.0	117.47	7.640%	6.95	7.215	9.65	15.271	15.845	0.09%	0.01	0.007	0.01	15-Dec-95	129	4.41	15-Dec-05	15-Dec-05	15-Dec-05
IR.TREASU 8 % 2006	8.000%	1770.0	101.41	7.880%	0.68	0.671	10.33	[illegible]	[illegible]	11.10%	0.07	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
IR.CAPITAL 9 % 2006	9.000%	169.0	105.82	7.640%	7.10	7.373	10.37	178.834	181.000	1.06%	0.08	0.078	0.11	01-Mar-96	52	1.28	01-Sep-06	01-Sep-06	01-Sep-06
IR.CAPITAL 8 1/4% 2008	8.250%	4.0	102.25	7.750%	7.86	8.164	12.28	4.090	4.165	0.02%	0.00	0.002	0.00	30-Jan-96	83	1.87	30-Jul-08	30-Jul-08	30-Jul-08
IR.CAPITAL 8 1/2% 2010	8.500%	16.0	103.30	7.750%	8.70	9.038	14.45	16.527	16.606	0.10%	0.01	0.009	0.01	01-Apr-96	21	0.49	01-Oct-10	01-Oct-10	01-Oct-10
IR.CAPITAL 8 3/4% 2012	8.750%	975.0	104.41	7.700%	9.46	9.824	16.45	1018.007	1023.379	6.01%	0.57	0.591	0.99	30-Mar-96	23	0.55	30-Sep-12	30-Sep-12	30-Sep-12
IR.TREASU 8 1/4% 2015	8.250%	1095.0	101.94	7.770%	0.67	0.679	19.33	[illegible]	1177.554	6.92%	0.05	[illegible]	1.34	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
								16602.785	17024.657	100.00%	1.78	1.836	6.29						

Table A 1 34 Irish Government Treasury Data - October 1996

Trade : 21-Oct-96
Sett : 22-Oct-96

Stock	Coupon	Nominal Issue	Market Price	Market Yield	Volatility	Duration	Life	Clean Market Value (IR£m)	Dirty Market Value (IR£m)	Stock Weight in Index	Weighted Volatility	Weighted Duration	Weighted Life	Ex-Div Date	Accrued Interest	Accrued Interest	First Redemption Date	Last Redemption Date	Redemption Date
IR FUNDING VAR% 1998	5.750%	669.0	100.00	5.740%	0.16	0.159	0.09	669.006	675.114	3.97%	0.01	0.006	0.00	25-Aug-96	58	0.91	25-Nov-98	25-Nov-98	25-Nov-98
IR FUNDING VAR% 2000	5.630%	512.0	100.00	5.630%	0.01	0.008	0.24	512.000	512.237	3.01%	0.00	0.000	0.01	19-Oct-96	3	0.05	19-Apr-00	19-Apr-00	19-Apr-00
IR FINANCE 13 % 1997/02	13.000%	95.0	102.98	5.650%	0.43	0.443	0.44	97.828	98.538	0.58%	0.00	0.003	0.00	01-Oct-96	21	0.75	01-Apr-97	01-Apr-02	01-Apr-97
IR CAPITAL 7 3/4 % 1997	7.750%	245.0	101.39	5.680%	0.70	0.723	0.73	248.408	253.554	1.49%	0.01	0.011	0.01	15-Jul-96	99	2.10	15-Jul-97	15-Jul-97	15-Jul-97
IR EXCHEQR 8 3/4% 1997	8.750%	1008.0	102.14	5.680%	0.73	0.754	0.76	1029.555	1050.564	6.17%	0.05	0.047	0.05	27-Jul-96	87	2.08	27-Jul-97	27-Jul-97	27-Jul-97
IR DEVELO. 11 1/2% 1997/99	11.500%	90.0	105.27	5.850%	1.01	1.039	1.07	94.746	99.280	0.58%	0.01	0.006	0.01	15-May-96	160	5.04	15-Nov-97	15-Nov-99	15-Nov-97
IR CAPITAL 9 3/4 % 1998	9.750%	975.0	105.57	5.690%	1.50	1.538	1.61	1029.284	1066.503	6.26%	0.09	0.096	0.10	01-Jun-96	143	3.82	01-Jun-98	01-Jun-98	01-Jun-98
IR FINANCE 14 1/2% 1998/00	14.500%	28.0	113.00	5.830%	1.73	1.776	1.90	31.641	32.052	0.19%	0.00	0.003	0.00	15-Sep-96	37	1.47	15-Sep-98	15-Sep-00	15-Sep-98
IR TREASU 6 1/4% 1999	6.250%	1948.0	100.80	5.850%	0.55	0.559	2.44	[illegible]	2031.540	11.93%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
IR CAPITAL 7 1/2 % 1999	7.500%	28.0	103.60	5.870%	2.46	2.534	2.73	29.007	29.577	0.17%	0.00	0.004	0.00	15-Jul-96	99	2.03	15-Jul-99	15-Jul-99	15-Jul-99
IR CAPITAL 11 3/4% 2000	11.750%	40.0	114.15	6.020%	3.01	3.098	3.48	45.658	45.748	0.27%	0.01	0.008	0.01	15-Oct-96	7	0.23	15-Apr-00	15-Apr-00	15-Apr-00
IR DEVELO. 12 1/4% 2000/03	12.250%	29.0	115.62	6.060%	3.13	3.226	3.65	33.531	34.786	0.20%	0.01	0.007	0.01	15-Jun-96	129	4.33	15-Jun-00	15-Jun-03	15-Jun-00
IR TREASU 8 % 2000	8.000%	1430.0	105.52	[illegible]	0.01	0.011	[illegible]	[illegible]	1510.175	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
IR TREASU 8 1/2 % 2001	[illegible]	1362.0	[illegible]	[illegible]	0.01	0.011	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
IR GOVER 9 % 2001	9.000%	144.0	109.08	6.170%	3.97	4.090	4.73	157.074	160.587	0.94%	0.04	0.039	0.04	15-Jul-96	99	2.44	15-Jul-01	15-Jul-01	15-Jul-01
IR CAPITAL 8 % 2001	8.000%	18.0	105.87	6.270%	4.16	4.295	4.98	19.057	19.085	0.11%	0.00	0.005	0.01	15-Oct-96	7	0.15	15-Oct-01	15-Oct-01	15-Oct-01
IR DEVELO. 14 3/4% 2002/04	14.750%	20.0	125.57	6.120%	4.37	4.500	5.28	25.115	25.777	0.15%	0.01	0.007	0.01	01-Aug-96	82	3.31	01-Feb-02	01-Feb-04	01-Feb-02
IR CAPITAL 9 1/4% 2003	9.250%	1191.0	111.19	6.360%	5.32	5.485	6.72	1324.321	1355.388	7.96%	0.42	0.437	0.54	11-Jul-96	103	2.61	11-Jul-03	11-Jul-03	11-Jul-03
IR EXCHEQR 8 1/4% 2003	8.250%	34.0	107.09	6.510%	5.50	5.684	7.02	36.411	36.349	0.21%	0.01	0.012	0.01	30-Oct-96	-8	-0.18	30-Oct-03	30-Oct-03	30-Oct-03
IR TREASU 6 1/4% 2004	6.250%	1606.0	98.13	6.560%	0.01	0.011	[illegible]	[illegible]	1677.108	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
IR EXCHEQR 6 1/2% 2000/05	6.500%	157.0	99.04	6.700%	6.51	6.732	8.68	155.498	158.767	0.93%	0.06	0.063	0.08	27-Jun-96	117	2.08	27-Jun-00	27-Jun-05	27-Jun-05
IR CAPITAL 12 1/2% 2005	12.500%	13.0	120.78	6.900%	6.86	7.096	9.15	15.702	16.276	0.10%	0.01	0.007	0.01	15-Jun-96	129	4.41	15-Dec-05	15-Dec-05	15-Dec-05
IR TREASU 8 % 2006	8.000%	2242.0	104.87	6.920%	0.17	0.178	9.83	[illegible]	[illegible]	14.00%	[illegible]	[illegible]	1.36	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
IR CAPITAL 9 % 2006	9.000%	140.0	109.25	6.900%	7.08	7.326	9.87	152.952	154.712	0.91%	0.06	0.067	0.09	01-Sep-96	51	1.26	01-Sep-06	01-Sep-06	01-Sep-06
IR CAPITAL 8 1/4% 2008	8.250%	4.0	104.78	7.220%	7.88	8.167	11.78	4.191	4.267	0.03%	0.00	0.002	0.00	30-Jul-96	84	1.90	30-Jul-08	30-Jul-08	30-Jul-08
IR CAPITAL 8 1/2% 2010	8.500%	16.0	105.87	7.220%	8.84	9.157	13.95	16.939	17.017	0.10%	0.01	0.009	0.01	01-Oct-96	21	0.49	01-Oct-10	01-Oct-10	01-Oct-10
IR CAPITAL 8 3/4% 2012	8.750%	993.0	107.00	7.170%	9.70	10.053	15.95	1062.483	1067.716	6.27%	0.61	0.630	1.00	30-Sep-96	22	0.53	30-Sep-12	30-Sep-12	30-Sep-12
IR TREASU 8 1/4% 2015	8.250%	1096.0	104.20	7.270%	0.17	0.178	18.83	1140.987	1157.044	6.80%	0.01	0.012	1.28	18-Aug-96	65	[illegible]	[illegible]	[illegible]	[illegible]
								16707.910	16950.713	99.57%	1.53	1.575	6.37						

Table A 1 35 Irish Government Treasury Data - April 1997

Trade : 21-Apr-97
Sett : 22-Apr-97

Stock	Coupon	Nominal Issue	Market Price	Market Yield	Volatility	Duration	Life	Clean Market Value (IR£m)	Dirty Market Value (IR£m)	Stock Weight in Index	Weighted Volatility	Weighted Duration	Weighted Life	Ex-Div Date	Accrued Interest	Accrued Interest	First Redemption Date	Last Redemption Date	Redemption Date
IR FUNDING VAR% 1998	5 910%	669 0	100 00	5 900%	0 15	0 153	0 09	669 006	675 068	3 97%	0 01	0 006	0 00	25-Feb-97	56	0 91	25-Nov-98	25-Nov-98	25-Nov-98
IR CAPITAL 7 3/4 % 1997	7 750%	245 0	100 48	5 570%	0 23	0 233	0 23	246 172	251 214	1 48%	0 00	0 003	0 00	15-Jan-97	97	2 06	15-Jul-97	15-Jul-97	15-Jul-97
IR FUNDING VAR% 2000	5 780%	512 0	100 00	5 760%	0 01	0 008	0 24	512 024	512 267	3 01%	0 00	0 000	0 01	19-Apr-97	3	0 05	19-Apr-00	19-Apr-00	19-Apr-00
IR EXCHEQR 8 3/4% 1997	8 750%	862 0	100 79	5 570%	0 26	0 266	0 26	868 833	886 386	5 21%	0 01	0 014	0 01	27-Jan-97	85	2 04	27-Jul-97	27-Jul-97	27-Jul-97
IR DEVELO. 11 1/2% 1997/99	11 500%	90 0	103 02	5 670%	0 55	0 566	0 57	92 721	97 198	0 57%	0 00	0 003	0 00	15-Nov-96	158	4 97	15-Nov-97	15-Nov-99	15-Nov-97
IR CAPITAL 9 3/4 % 1998	9 750%	810 0	104 07	5 610%	1 05	1 082	1 11	842 966	873 669	5 13%	0 05	0 056	0 06	01-Dec-96	142	3 79	01-Jun-98	01-Jun-98	01-Jun-98
IR FINANCE 14 1/2% 1998/00	14 500%	28 0	110 14	5 770%	1 30	1 338	1 40	30 840	31 262	0 18%	0 00	0 002	0 00	15-Mar-97	38	1 51	15-Sep-98	15-Sep-00	15-Sep-98
IR TREASU 6 1/4% 1999	6 250%	1904 0	100 83	5 740%	0 06	0 057	[illegible]	1919 883	1926 734	11 32%	[illegible]	0 007	0 22	01-Apr-97	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
IR CAPITAL 7 1/2 % 1999	7 500%	26 0	103 29	5 740%	2 05	2 105	2 23	26 854	27 372	0 16%	0 00	0 003	0 00	15-Jan-97	97	1 99	15-Jul-99	15-Jul-99	15-Jul-99
IR CAPITAL 11 3/4% 2000	11 750%	40 0	113 14	5 820%	2 62	2 700	2 98	45 255	45 345	0 27%	0 01	0 007	0 01	15-Apr-97	7	0 23	15-Apr-00	15-Apr-00	15-Apr-00
IR DEVELO. 12 1/4% 2000/03	12 250%	29 0	114 58	5 870%	2 75	2 831	3 15	33 228	34 473	0 20%	0 01	0 006	0 01	15-Dec-96	128	4 29	15-Jun-00	15-Jun-03	15-Jun-00
IR EXCHEQR 6 1/2% 2000/05	6 500%	148 0	100 56	6 280%	2 84	2 930	3 18	148 822	151 877	0 89%	0 03	0 026	0 03	27-Dec-96	116	2 06	27-Jun-00	27-Jun-05	27-Jun-00
IR TREASU 8 % 2000	8 000%	1314 0	105 56	5 850%	0 50	0 509	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
IR TREASU 6 1/2% 2001	6 500%	2131 0	101 62	5 930%	0 50	0 509	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
IR GOVER 9 % 2001	9 000%	117 0	109 07	5 970%	3 61	3 720	4 23	127 607	130 404	0 77%	0 03	0 028	0 03	15-Jan-97	97	2 39	15-Jul-01	15-Jul-01	15-Jul-01
IR CAPITAL 8 % 2001	8 000%	18 0	106 13	6 070%	3 82	3 931	4 48	19 104	19 132	0 11%	0 00	0 004	0 01	15-Apr-97	7	0 15	15-Oct-01	15-Oct-01	15-Oct-01
IR DEVELO. 14 3/4% 2002/04	14 750%	20 0	125 03	5 920%	4 00	4 123	4 78	25 005	25 651	0 15%	0 01	0 006	0 01	01-Feb-97	80	3 23	01-Feb-02	01-Feb-04	01-Feb-02
IR CAPITAL 9 1/4% 2003	9 250%	1170 0	111 88	6 090%	5 02	5 169	6 22	1308 959	1338 886	7 86%	0 39	0 407	0 49	11-Jan-97	101	2 56	11-Jul-03	11-Jul-03	11-Jul-03
IR EXCHEQR 8 1/4% 2003	8 250%	33 0	107 96	6 240%	5 22	5 382	6 53	35 628	35 568	0 21%	0 01	0 011	0 01	30-Apr-97	-8	-0 18	30-Oct-03	30-Oct-03	30-Oct-03
IR TREASU 8 1/4% 2004	8 250%	1444 0	99 64	6 330%	0 50	0 509	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
IR CAPITAL 12 1/2% 2005	12 500%	13 0	121 61	6 680%	6 59	6 814	8 65	15 809	16 379	0 10%	0 01	0 007	0 01	15-Dec-96	128	4 38	15-Dec-05	15-Dec-05	15-Dec-05
IR TREASU 8 % 2006	8 000%	2636 0	105 88	6 690%	0 67	0 676	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	1 61	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
IR CAPITAL 9 % 2006	9 000%	137 0	110 20	6 680%	6 87	7 098	9 37	150 970	152 725	0 90%	0 06	0 064	0 08	01-Mar-97	52	1 28	01-Sep-06	01-Sep-06	01-Sep-06
IR CAPITAL 8 1/4% 2008	8 250%	4 0	106 25	6 920%	7 77	8 041	11 28	4 250	4 324	0 03%	0 00	0 002	0 00	30-Jan-97	82	1 85	30-Jul-08	30-Jul-08	30-Jul-08
IR CAPITAL 8 1/2% 2010	8 500%	16 0	107 41	6 920%	8 80	9 105	13 45	17 186	17 264	0 10%	0 01	0 009	0 01	01-Apr-97	21	0 49	01-Oct-10	01-Oct-10	01-Oct-10
IR CAPITAL 8 3/4% 2012	8 750%	1009 0	108 59	6 870%	9 74	10 070	15 45	1095 660	1101 219	6 47%	0 63	0 651	1 00	30-Mar-97	23	0 55	30-Sep-12	30-Sep-12	30-Sep-12
IR TREASU 8 1/4% 2015	8 250%	1234 0	105 55	7 000%	0 66	0 676	18 33	[illegible]	1371 305	8 05%	[illegible]	[illegible]	1 48	18-Aug-96	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
								17319 563	17818 671	104 66%	1 60	1 649	6 50						

Table A 1 36 Irish Government Treasury Data - October 1997

Trade 21-Oct 97
Sett 22-Oct-97

Stock	Coupon	Nominal Issue	Market Price	Market Yield	Volatility	Duration	Life	Clean Market Value (IR£m)	Dirty Market Value (IR£m)	Stock Weight in Index	Weighted Volatility	Weighted Duration	Weighted Life	Ex-Div Date	Accrued Interest	Accrued Interest	First Redemption Date	Last Redemption Date	Redemption Date
IR DEVELO 11 1/2% 1997/99	11 500%	90 0	100 35	5 990%	0 07	0 067	0 07	90 311	89 631	0 53%	0 00	0 000	0 00	15-Nov-97	-24	-0 76	15 Nov 97	15-Nov 99	15 Nov 97
IR FUNDING VAR% 1998	6 190%	669 0	100 00	6 180%	0 16	0 159	0 09	669 006	675 582	3 97%	0 01	0 006	0 00	25-Aug-97	58	0 98	25 Nov 98	25-Nov 98	25-Nov 98
IR FUNDING VAR% 2000	6 190%	783 0	100 00	6 180%	0 01	0 008	0 24	783 018	783 416	4 60%	0 00	0 000	0 01	19-Oct-97	3	0 05	19-Apr-00	19-Apr-00	19 Apr-00
IR CAPITAL 9 3/4 % 1998	9 750%	720 0	102 19	5 840%	0 59	0 606	0 61	735 733	763 217	4 48%	0 03	0 027	0 03	01-Jun-97	143	3 82	01-Jun 98	01-Jun-98	01-Jun 98
IR FINANCE 14 1/2% 1998/00	14 500%	28 0	106 84	5 770%	0 86	0 881	0 90	29 914	30 326	0 18%	0 00	0 002	0 00	15-Sep-97	37	1 47	15 Sep 98	15-Sep-00	15 Sep 98
IR TREASU 6 1/4% 1999	6.250%	1905.0	100.83	5.590%	0.56	0.559	1.44	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
IR CAPITAL 7 1/2 % 1999	7.500%	26.0	102.81	5.620%	1.61	1.658	1.73	26.732	27.260	0.16%	0.00	0.003	0.00	15-Jul-97	99	2.03	15-Jul-99	15-Jul-99	15-Jul-99
IR CAPITAL 11 3/4% 2000	11.750%	40.0	111.89	5.590%	2 22	2 286	2 48	44.756	44 846	0.26%	0.01	0.006	0.01	15-Oct-97	7	0.23	15-Apr-00	15-Apr-00	15-Apr-00
IR DEVELO. 12 1/4% 2000/03	12 250%	29 0	113 30	5.650%	2 36	2.423	2 65	32 856	34.111	0 20%	0.00	0.005	0.01	15-Jun-97	129	4 33	15-Jun-00	15-Jun-03	15-Jun-00
IR EXCHEQR 6 1/2% 2000/05	6 500%	143 0	102 63	5 320%	2 45	2 514	2 68	146 760	149 738	0 88%	0 02	0 022	0 02	27-Jun-97	117	2 08	27-Jun-00	27-Jun-05	27-Jun-00
IR TREASU 8 % 2000	8.000%	1686.0	105.50	5.810%	0.01	0.011	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
IR TREASU 6 1/2% 2001	6.500%	1859.0	102.01	5.650%	0.01	0.011	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
IR GOVER 9 % 2001	9.000%	114.0	109.05	5.710%	3.24	3.335	3.73	124.318	127.099	0.75%	0.02	0.025	0.03	15-Jul-97	99	2.44	15-Jul-01	15-Jul-01	15-Jul-01
IR CAPITAL 8 % 2001	8.000%	18 0	106.44	5 810%	3 45	3 551	3 98	19.159	19.186	0.11%	0.00	0.004	0.00	15-Oct-97	7	0.15	15-Oct-01	15-Oct-01	15-Oct-01
IR DEVELO. 14 3/4% 2002/04	14.750%	20 0	124.28	5.690%	3.63	3.737	4 28	24 855	25.517	0.15%	0.01	0.006	0.01	01-Aug-97	82	3 31	01-Feb-02	01-Feb-04	01-Feb-02
IR CAPITAL 9 1/4% 2003	9.250%	1114.0	112 57	5.780%	4.70	4 837	5.72	1254.023	1283.081	7 54%	0.35	0 365	0.43	11-Jul-97	103	2 61	11-Jul-03	11-Jul-03	11-Jul-03
IR EXCHEQR 8 1/4% 2003	8 250%	33 0	108 88	5 930%	4 92	5 062	6 02	35 930	35 871	0 21%	0 01	0 011	0 01	30-Oct-97	-8	-0 18	30 Oct-03	30-Oct-03	30-Oct-03
IR TREASU 6 1/4% 2004	6.250%	1467.0	101.35	5.940%	0.01	0.011	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
IR CAPITAL 12 1/2% 2005	12.500%	13.0	123.96	6.120%	6.38	6.580	8.15	16.115	16.689	0.10%	0.01	0.006	0.01	15-Jun-97	129	4.41	15-Dec-05	15-Dec-05	15-Dec-05
IR TREASU 8 % 2006	8.000%	2757.0	108.55	6.110%	0.16	0.178	8.63	2992.707	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
IR CAPITAL 9 % 2006	9.000%	137.0	112.78	6.120%	6.72	6.923	8.87	154.510	156.232	0.92%	0.06	0.064	0.08	01-Sep-97	51	1.26	01-Sep-06	01-Sep-06	01-Sep-06
IR CAPITAL 8 1/4% 2008	8.250%	4 0	109.67	6.250%	7.77	8.009	10.78	4.387	4.463	0.03%	0.00	0.002	0.00	30-Jul-97	84	1.90	30-Jul-08	30-Jul-08	30-Jul-08
IR TREASU 6 % 2008	6.000%	662.0	99.08	6.170%	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
IR CAPITAL 8 1/2% 2010	8 500%	16 0	110.48	6.350%	8.88	9.159	12.95	17.677	17.755	0.10%	0.01	0.010	0.01	01-Oct-97	21	0.49	01-Oct-10	01-Oct-10	01-Oct-10
IR CAPITAL 8 3/4% 2012	8 750%	898 0	112 34	6 200%	10.00	10.308	14.95	1008.849	1013.582	5.95%	0.60	0.614	0.89	30-Sep-97	22	0.53	30-Sep-12	30-Sep-12	30-Sep-12
IR TREASU 8 1/4% 2015	8.250%	1574.0	109.20	6.320%	0.18	0.178	17.83	[illegible]	1741.930	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
								17669.038	17884.200	105.05%	1.26	1.299	6.80						

Appendix 2

Outliers for Term Structure Identification 1980-1997

A.2.1 April 1980

The bonds excluded are: Finance Variable% 1983, National 4 ¼% 1975/80, National 5 ¼% 1979/84, Exchequer 6% 1980/85, National 7% 1987/92 and National 9 ¼% 1989/94.

A.2.2 October 1980

The bonds excluded are: Finance Variable% 1983, Nation. 4 1/4% 1975/80, National 5 1/4% 1979/84, Exchequer 6% 1980/85, National 7% 1987/92, National 9 1/4% 1989/94, National 9 1/4% 1982, National 9 1/4% 1981, National 4 1/4% 1975/80, National 14% 1985/90, National 11% 1993/98, National 5% 1971/81, Funding 8 1/2% 1981, Finance Variable% 1983, Finance 14 1/2% 1998/00, Exchequer 5 3/4% 1984/89 and Exchequer 14% 1990/92.

A.2.3 April 1981

The bonds excluded are: the short maturity 10% Exchequer 1981 bond, Finance 14 1/2% 1998/00, Finance 11 3/4% 1984, Finance 11 1/2% 1981, Exchequer 6 % 1980/85, Exchequer 5 3/4% 1984/89, Exchequer 14% 1990/92, a high coupon 14% National 1985 bond and 9 1/4% National 1982 and the 5 1/4% National 1979/84 which had an embedded Conversion feature.

A.2.4 October 1981

The bonds excluded are: high coupon 14 1/2% National 1988/00 bond, the 9 1/4% National 1989/94 bond and National 5 1/4% 1979/84, Finance Variable% 1986, Finance Variable% 1983, Finance 10 1/2% 1982, Exchequer 6 % 1980/85, Exchequer 5 3/4% 1984/89, Exchequer 11 1/2% 1982, Conversion 8 1/2 % 1986/88 and Conversion 13% 1984

A.2.5 April 1982

The bonds excluded are: National 9 1/4% 1989/94, National 5 1/4% 1979/84, National 14 % 1985, Finance Variable% 1986, Finance Variable% 1985, Finance Variable% 1983, Exchequer 6 % 1980/85, Development 11 1/2% 1997/99 and Conversion 9 % 1980/82.

A.2.6 October 1982

The bonds excluded are: National 9 3/4% 1992/97, National 9 1/4% 1989/94, National 5 3/4% 1982/87,National 5 1/4% 1979/84, National 11 % 1993/98, Funding 11 3/4% 1983, Finance Variable% 1986, Finance Variable% 1985, Finance Variable% 1985, Finance Variable% 1983, Exchequer 6 % 1980/85 and Development 14 3/4% 2002/04.

A.2.7 April 1983

The bonds excluded are: National 9 3/4% 1992/97, National 5 3/4% 1982/87, National 11 % 1993/98, Finance Variable% 1986, Finance Variable% 1985, Finance Variable% 1985, Finance Variable% 1983, Exchequer 15 % 1983 And Development 14 3/4% 2002/04.

A.2.8 October 1983

The bonds excluded are: Funding 11 1/2% 1983, Finance Variable% 1988, Finance Variable% 1986, Finance Variable% 1985, Finance Variable% 1985, Finance 12 % 1984, Finance 11 1/2% 1991/93, Exchequer 5 3/4% 1984/89,Development 14 3/4% 2002/04 And Development 12 1/4% 2003.

A.2.9 April 1984

The bonds excluded are: National 5 3/4% 1982/87, Finance Variable% 1988, Finance Variable% 1986, Finance Variable% 1985, Finance Variable% 1985, Finance 11 3/4% 1984, Exchequer 6 % 1985/90, Exchequer 6 % 1980/85, Exchequer 5 3/4% 1984/89, Development 14 3/4% 2002/04, Development 12 1/4% 2003 And Conversion 13 % 1984.

A.2.10 October 1984

The bonds excluded are: National 5 3/4% 1982/87, National 5 1/4% 1979/84, National 14 % 1985/90, Funding 11 1/2% 1985, Finance Variable% 1985, Finance Variable% 1985, Finance Variable% 1986, Finance Variable% 1988, Exchequer 6 % 1985/90, Exchequer 5 3/4% 1984/89, Development 2 1/2% 1989, Development 12 1/4% 2003 And Development 11 1/2% 1997/99.

A.2.11 April 1985

The bonds excluded are: National 14 % 1985/90, Finance Variable% 1985, Finance Variable% 1986, Finance Variable% 1989, Finance Variable% 1988, Finance 14 1/2% 1998/00, Finance 12 1/4% 1985, Exchequer 6 % 1985/90, Exchequer 12 % 1985, Development 2 1/2% 1989 And Capital 11 3/4% 2000.

A.2.12 October 1985

The bonds excluded are: National 9 3/4% 1992/97, National 14 % 1985/90, National 11 % 1993/98, Funding 15 1/2% 1986, Funding 10 % 1986, Finance Variable% 1986, Finance Variable% 1990, Finance Variable% 1989, Finance Variable% 1988, Exchequer 6 % 1980/85, Exchequer 10 3/4% 1986, Development 2 1/2% 1989, Capital 9 1/2% 1986 And Capital 11 3/4% 2000.

A.2.13 April 1986

The bonds excluded are: National 9 3/4% 1984/89, National 7 1/2% 1981/85, National 11% 1993/98, Finance Variable% 1990, Finance Variable% 1989, Finance Variable% 1988, Exchequer 6 1/2% 2000/05, Exchequer 6% 1985/90, Exchequer 12 1/2% 1986, Development 2 1/2% 1989 And Development 14 3/4% 2002/04

A.2.14 October 1986

The bonds excluded are: Funding 12 3/4% 1987, Finance Variable% 1990, Finance Variable% 1989, Finance Variable% 1988, Finance 14 1/2% 1998/00, Finance 13% 1997/02, Exchequer 13% 1994, Development 2 1/2% 1989, Development 14 ¾% 2002/04, Development 12 ¼% 2000/03, Development 11 ½% 1997/99, Capital 7 ¼% 1988 and Capital 12 1/2% 2005.

A.2.15 April 1987

The bonds excluded are: National 9 3/4% 1992/97, National 5 3/4% 1982/87, National 14% 1985/90, Finance Variable% 1990, Finance Variable% 1989, Finance Variable% 1988, Finance 16% 1987, Exchequer 9% 1987, Exchequer 11% 1987 and Capital 14% 1987.

A.2.16 October 1987

The bonds excluded are: Funding 11 1/4% 1988, Finance Variable% 1990, Finance Variable% 1989, Finance Variable% 1988, Finance 11 1/2% 1991/93, Development 12 1/4% 2000/03, Conversion 8 1/2% 1986/88, Capital 7 3/4% 1997, Capital 7 1/2% 1999, Capital 8 1/2% 1991, Capital 11 3/4% 2000, Capital 11% 1988 and Capital 8% 2001.

A.2.17 April 1988

The bonds excluded are: National 9 3/4% 1984/89, National 9 3/4% 1992/97, Funding 11 1/4% 1988, Finance Variable% 1993, Finance Variable% 1990, Finance Variable% 1989, Finance Variable% 1988, Finance 13% 1997/02, Finance 11 1/2% 1991/93, Exchequer 6 1/2% 2000/05, Exchequer 5 3/4% 1984/89, Development 2 1/2% 1989, Conversion 15% 1988, Capital 8% 1993, Capital 7 1/4% 1988, Capital 13% 1990, Capital 12 1/2% 2005, Capital 11% 1988, Capital 9 1/4% 2003 and Capital 9% 2006.

A.2.18 October 1988

The bonds excluded are: National 9 3/4% 1992/97, National 11% 1993/98, Finance Variable% 1993, Finance Variable% 1992, Finance Variable% 1990, Finance Variable% 1989, Finance 9% 1989 and Development 2 1/2% 1989.

A.2.19 April 1989

The bonds excluded are: National 9 3/4% 1992/97, National 9 1/4% 1989/94, National 11% 1993/98, Finance Variable% 1993, Finance Variable% 1992, Finance Variable% 1991, Finance Variable% 1990, Finance Variable% 1989, Finance 13% 1997/02, Exchequer 5 3/4% 1984/89, Development 2 1/2% 1989, Capital 11 3/4% 2000, Capital 10% 1989 and Capital 8% 2001.

A.2.20 October 1989

The bond excluded are: National 9 3/4% 1992/97, National 11% 1993/98, Finance Variable% 1993, Finance Variable% 1992, Finance Variable% 1991, Finance Variable% 1990, Exchequer 8 1/4% 2003, Exchequer 5 3/4% 1984/89, Exchequer 14% 1990/92, Capital 7% 1990, Capital 11 3/4% 2000, Capital 9% 2006 and Capital 8% 2001.

A.2.21 April 1990

The bonds excluded are: National 11% 1993/98, Finance Variable% 1994, Finance Variable% 1993, Finance Variable% 1992, Finance Variable% 1991, Finance Variable% 1990, Exchequer 9 1/4% 1991/96, Exchequer 6% 1985/90, Exchequer 11 1/2% 1990, Development 14 3/4% 2002/04, Capital 9 3/4% 1998, Capital 13% 1990 and Capital 11 3/4% 2000.

A.2.22 October 1990

The bonds excluded are: National 11% 1993/98, Funding Variable% 1995, Finance Variable% 1994, Finance Variable% 1993, Finance Variable% 1992, Finance Variable% 1991, Finance 11 1/2% 1991/93, Exchequer 6% 1985/90, Development 14 3/4% 2002/04, Capital 8% 1991 and Capital 7 1/2% 1991.

A.2.23 April 1991

The bonds excluded are: National 6 3/4% 1986/91, Funding Variable% 1995, Finance Variable% 1994, Finance Variable% 1993, Finance Variable% 1992, Finance Variable% 1991, Finance 12 1/2% 1991, Capital 8 1/2% 1991 and Capital 8 1/2% 2010.

A.2.24 October 1991

The bonds excluded are: Funding Variable% 1995, Finance Variable% 1994, Finance Variable% 1993, Finance Variable% 1992, Finance Variable% 1991 and Capital 8% 2001.

A.2.25 April 1992

The bonds excluded are: National 9 3/4% 1992/97, National 7% 1987/92, Funding Variable% 1995, Finance Variable% 1994, Finance Variable% 1993, Exchequer 7 1/4% 1992, Capital 8 3/4% 1992, Capital 11 3/4% 2000 and Capital 8% 2001.

A.2.26 October 1992

The bonds excluded are: National 9 3/4% 1992/97, National 11% 1993/98, Funding Variable% 1996, Funding Variable% 1995, Finance Variable% 1994, Finance Variable% 1993, Finance 13% 1997/02, Exchequer 13% 1994, Capital 8 1/2% 1992 and Capital 12 1/2% 2005.

A.2.27 April 1993

The bonds excluded are: National 9 3/4% 1992/97, National 9 1/4% 1989/94, National 11% 1993/98, Government 9% 2001, Funding Variable% 1996, Funding Variable% 1995, Finance Variable% 1994, Exchequer 9 1/4% 1991/96 and Development 7 1/2% 1988/93.

A.2.28 October 1993

The bond excluded are: Treasury 6 1/4% 2004, Funding Variable% 1996, Funding Variable% 1995, Finance Variable% 1994, Capital 8% 1993, Capital 7% 1994 and Capital 8 3/4% 2012.

A.2.29 April 1994

The bonds excluded are: Funding Variable% 1996, Funding Variable% 1995, Finance Variable% 1994, Exchequer 13% 1994 and Capital 7 3/4% 1997.

A.2.30 October 1994

The bonds excluded are: Funding Variable% 1998, Funding Variable% 1996, Funding Variable% 1995 and Capital 7 3/4% 1997.

A.2.31 April 1995

The bonds excluded are: Funding Variable% 1998, Funding Variable% 1996, Conversion 12% 1995, Conversion 9 1/2% 1995, Capital 12 1/4% 1995, Capital 12 1/2% 2005 and Capital 8% 2001.

A.2.32 October 1995

The bonds excluded are: Funding Variable% 2000, Funding Variable% 1998, Funding Variable% 1996 and Capital 9% 2006.

A.2.33 April 1996

The bonds excluded are: Funding Variable% 2000, Funding Variable% 1998, Funding Variable% 1996, Finance 14 1/2% 1998/00, Exchequer 8 1/2% 1996, Capital 9% 1996, Capital 8 1/4% 2008 and Capital 8 1/2% 2010.

A.2.34 October 1996

The bonds excluded are: Funding Variable% 2000, Funding Variable% 1998, Finance 14 1/2% 1998/00, Finance 13% 1997/02, Capital 9% 2006 and Capital 8% 2001.

A.2.35 April 1997

The bonds excluded are: Funding Variable% 2000, Funding Variable% 1998, Exchequer 8 3/4% 1997, Exchequer 6 1/2% 2000/05, Capital 8 1/2% 2010, Capital 8% 2001and Capital 7 3/4% 1997.

A.2.36 October 1997

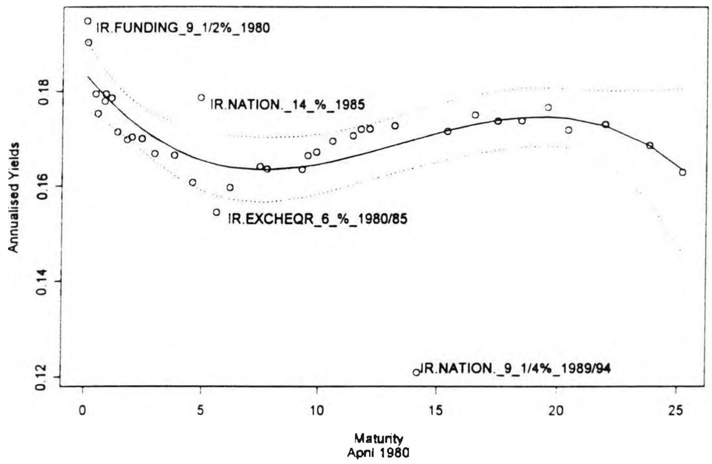
The bonds excluded are: Funding Variable% 2000, Funding Variable% 1998, Exchequer 6 1/2% 2000/05, Development 12 1/4% 2000/03, Development 11 1/2% 1997/99, Capital 8 1/4% 2008 and Capital 8% 2001.

Appendix 3

Results of Term Structure Identification 1980-1997

Comparison of Actual v. Implied Bond Prices

Initial Yield Function fitted to All Yields

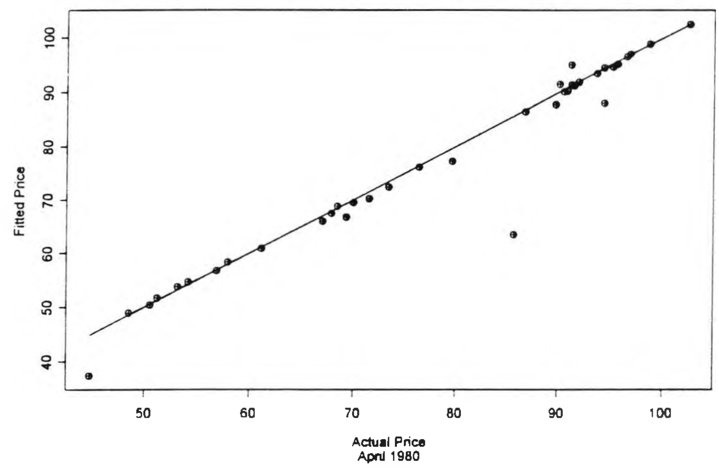


As explained in the methodology, the null hypothesis is that all bonds are part of the data set and outliers are bonds with highly significant yields who failed to be have acceptable yields within the 99% confidence interval for the appropriate degrees of freedom. Outliers distort the yield curve and are generally eliminated after being identified in the bootstrap procedure. The majority of outliers are generally composed of dual rate, low coupon, convertible or variable rate bonds. Dual rate bonds with coupons very close to market yields distort the curve since the embedded option is at the money. Since the holder is short the redemption option to the issuer, the prices is depressed by the present value of the option and biases the yield upwards as a consequence. Extremely low coupon bonds, as a result of their tax effect[1], tend to distort the rates with the residual errors being negatively sloped, i.e. the error term is expected to increase as the coupon level falls.

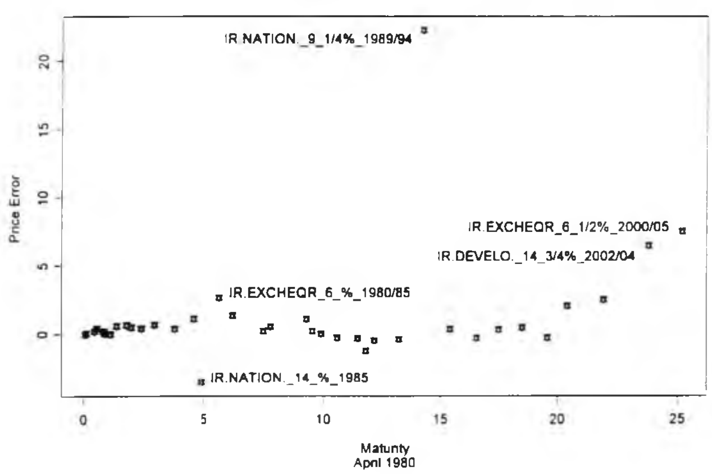
[1] Because of the low coupon, there is a yield short fall, which is made up by an increase in the bond price as it approached maturity. This increase in bond price is taken at a lower capital gains rate or not at all depending on the investor or tax time period and this distorted the bond market as investors sought to convert income tax liabilities into capital gain liabilities.

To remove the tax effect, only high coupon bonds might have been included in the sample but due to the size and lack of liquidity of the Irish market during much of the period covered by the data, this approach would not have been viable. Variable rate bonds and convertible bonds, due to the money market index and the option effect respectively, tend to cause the bonds to trade above the yield curve.

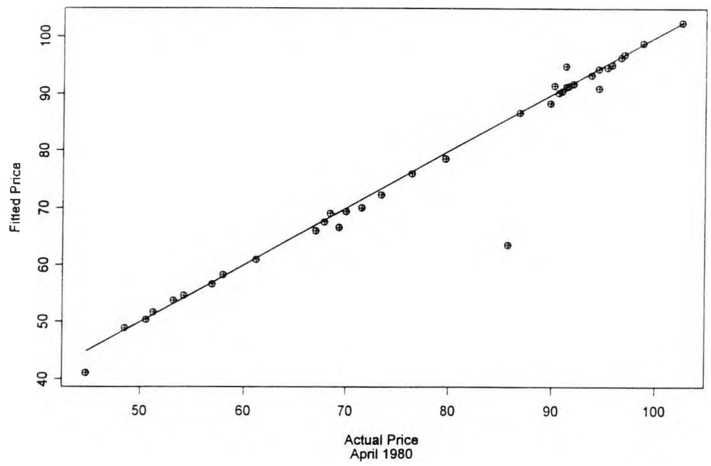
Fitted Price v. Actual Price for Step-wise Discount Data



Outlier Bond Price Identification from Step-wise Discount Data



Fitted Price v. Actual Price for Step-wise Spot Rate Data



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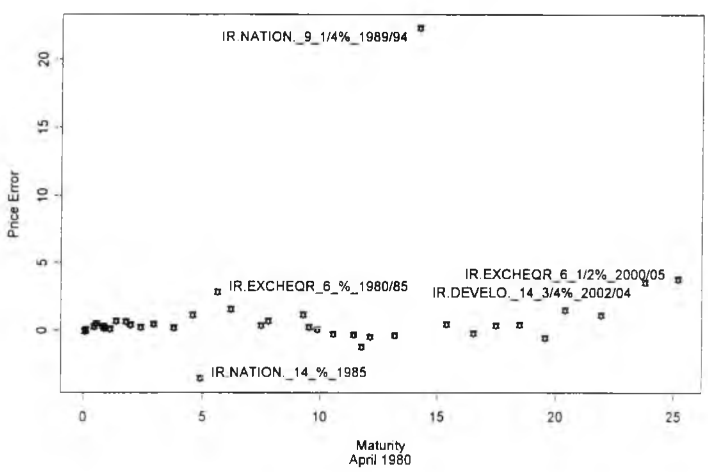
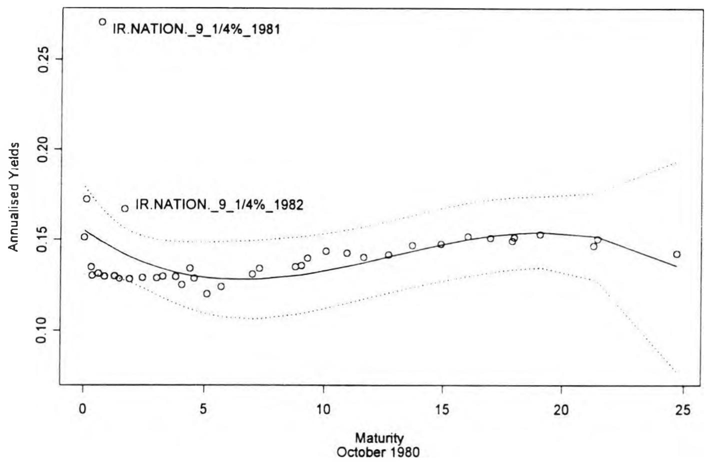
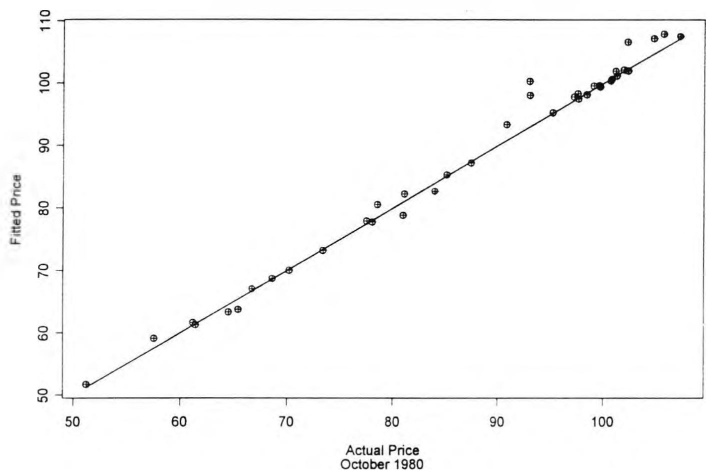


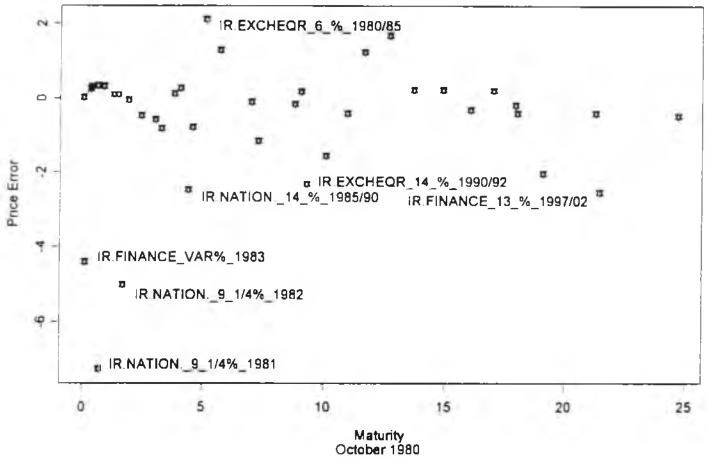
Initial Yield Function fitted to All Yields



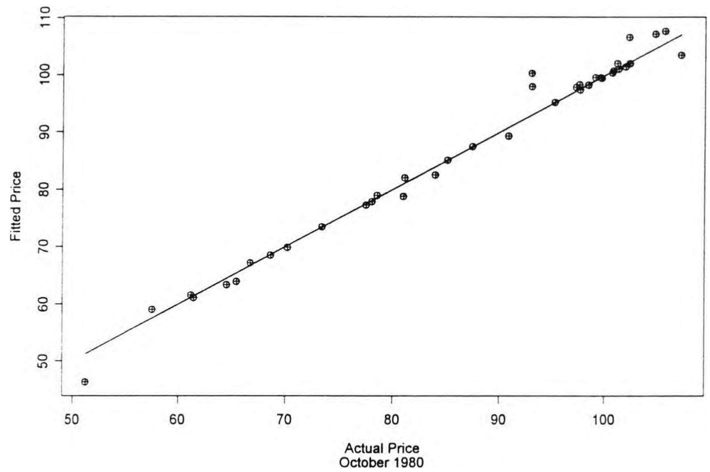
Fitted Price v. Actual Price for Step-wise Discount Data



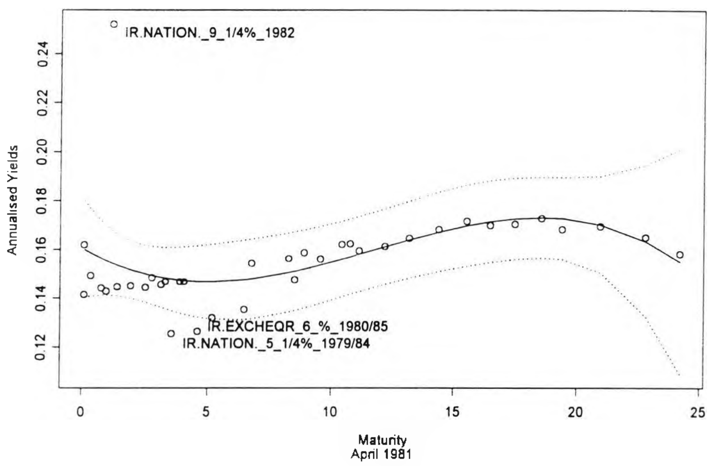
Outlier Bond Price Identification from Step-wise Discount Data



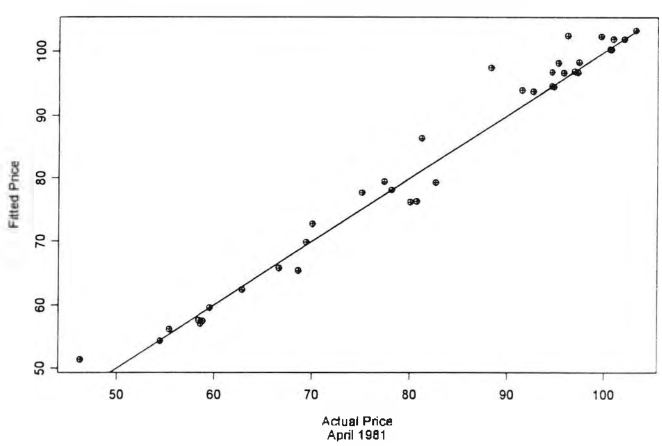
Fitted Price v. Actual Price for Step-wise Spot Rate Data



Initial Yield Function fitted to All Yields



Fitted Price v. Actual Price for Step-wise Discount Data



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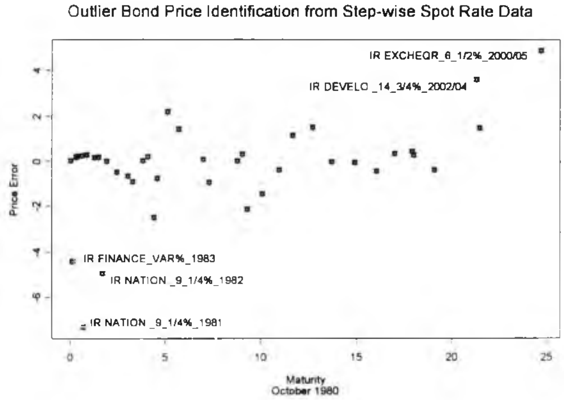

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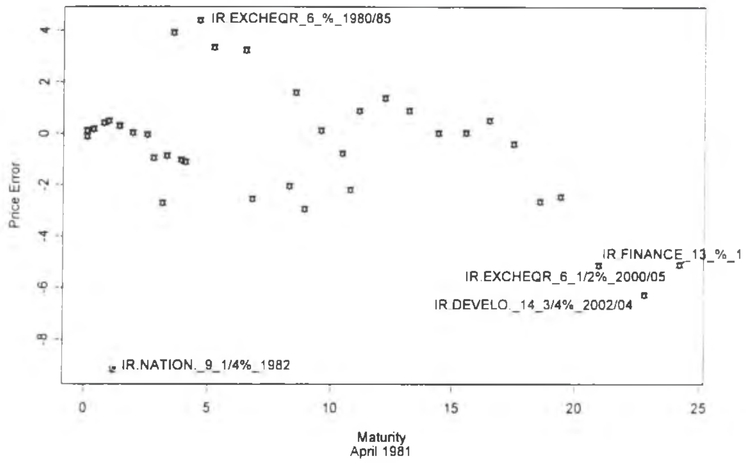
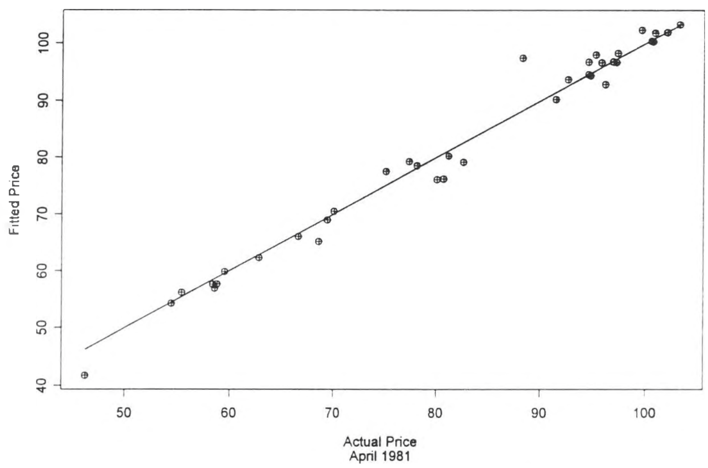
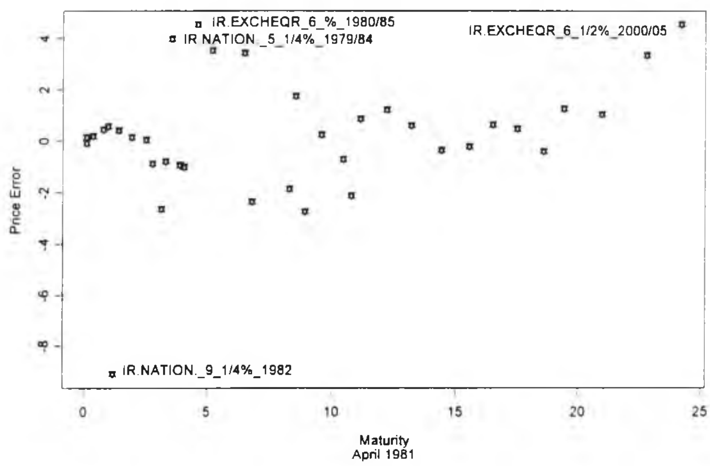


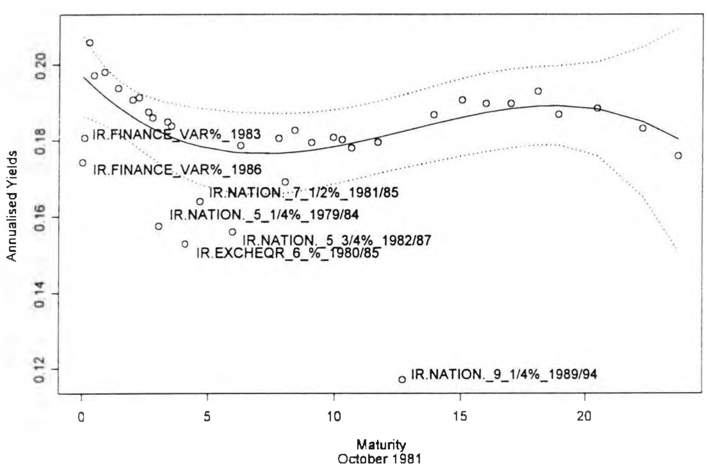
Fitted Price v. Actual Price for Step-wise Spot Rate Data



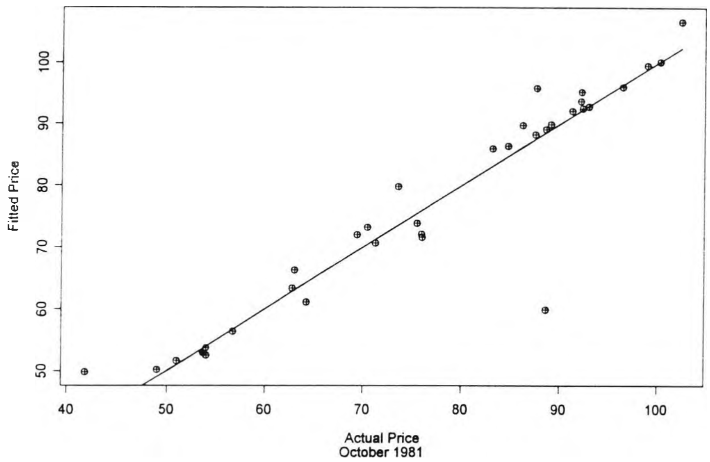
Outlier Bond Price Identification from Step-wise Spot Rate Data



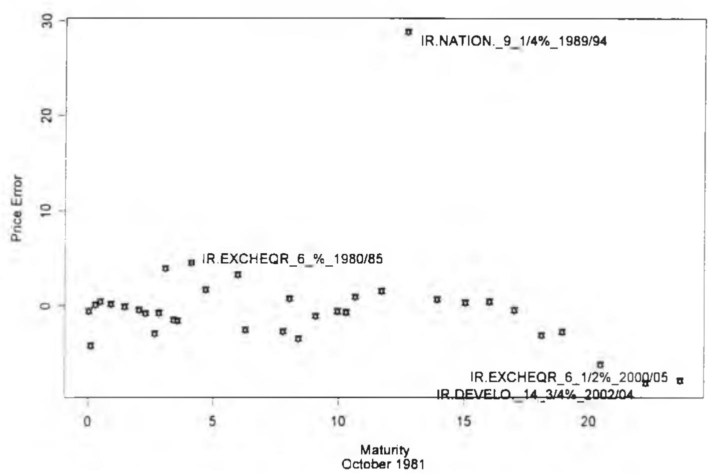
Initial Yield Function fitted to All Yields



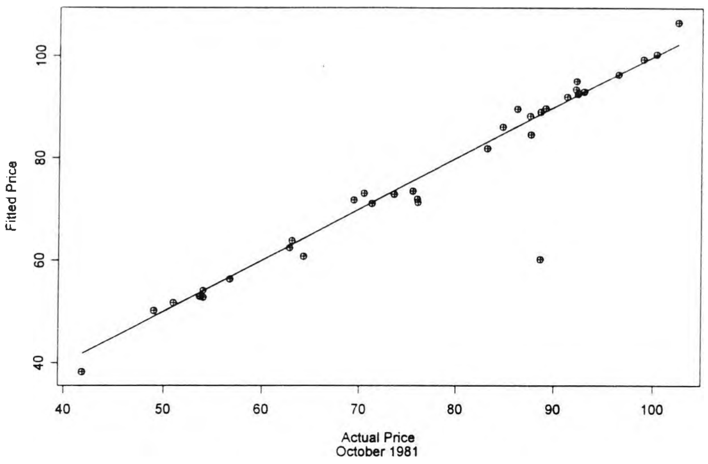
Fitted Price v. Actual Price for Step-wise Discount Data



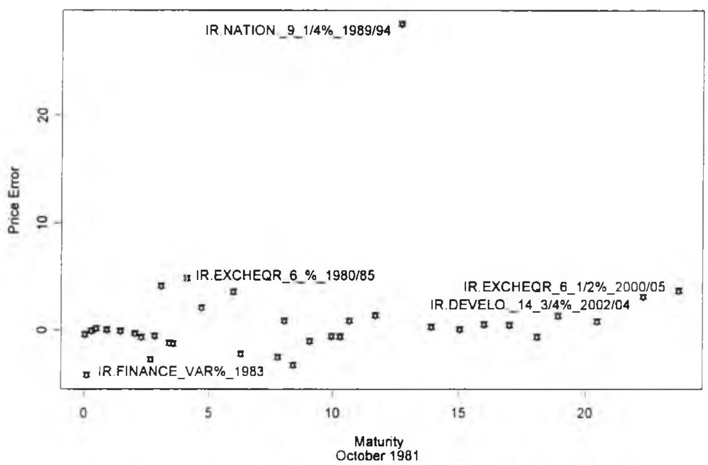
Outlier Bond Price Identification from Step-wise Discount Data



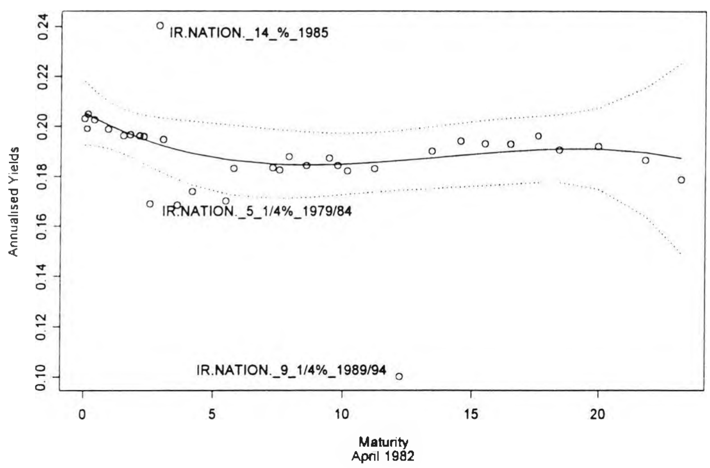
Fitted Price v. Actual Price for Step-wise Spot Rate Data



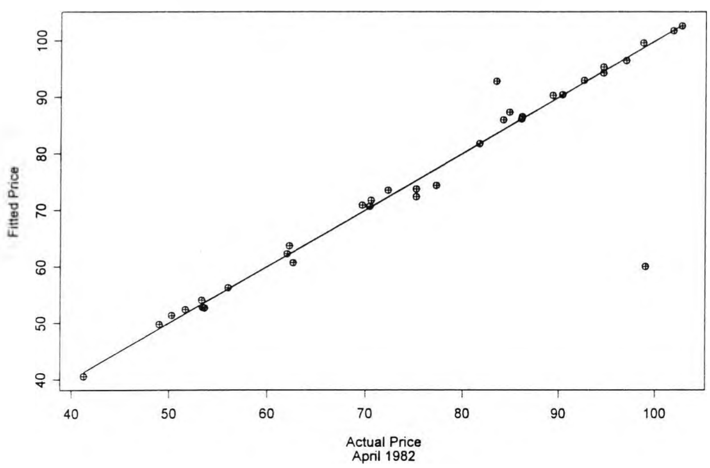
Outlier Bond Price Identification from Step-wise Spot Rate Data

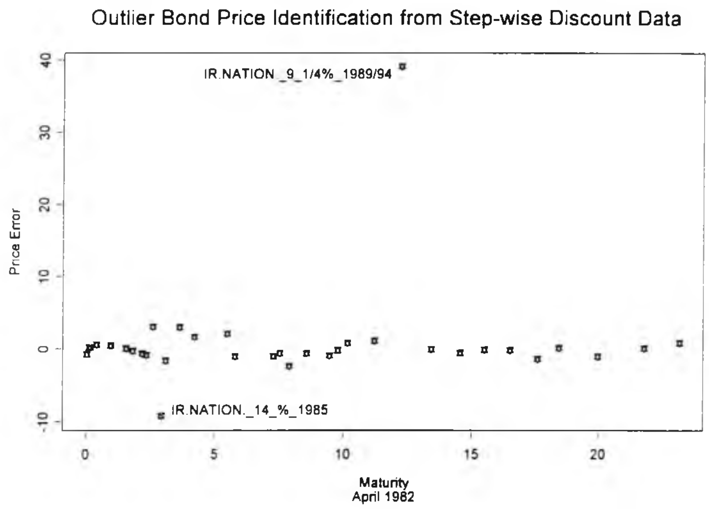


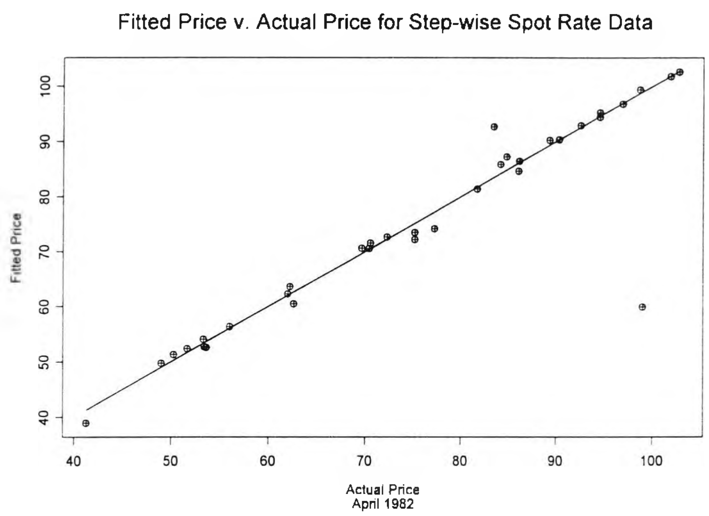
Initial Yield Function fitted to All Yields



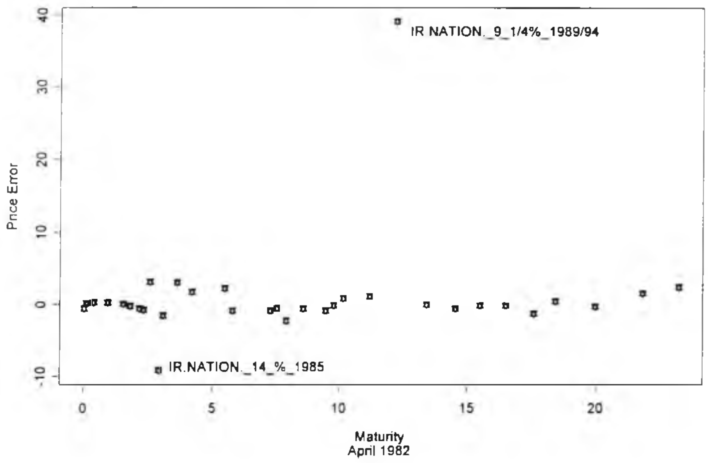
Fitted Price v. Actual Price for Step-wise Discount Data



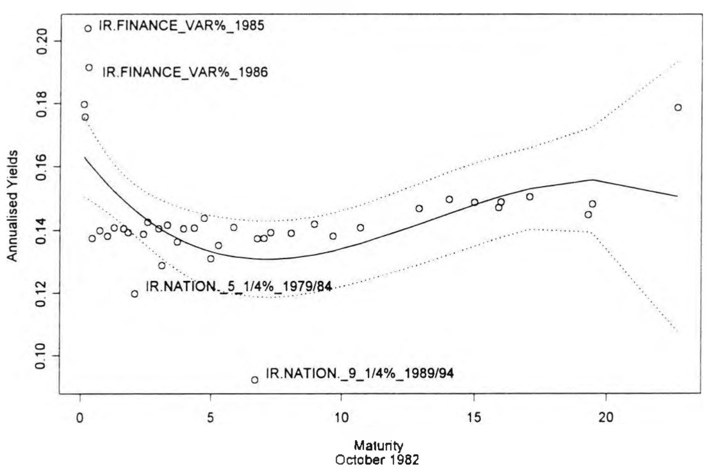

Outlier Bond Price Identification from Step-wise Discount Data
IR.NATION_9_1/4%_1989/94
IR.NATION._14_%_1985
Price Error
Maturity
April 1982


Fitted Price v. Actual Price for Step-wise Spot Rate Data
Fitted Price
Actual Price
April 1982

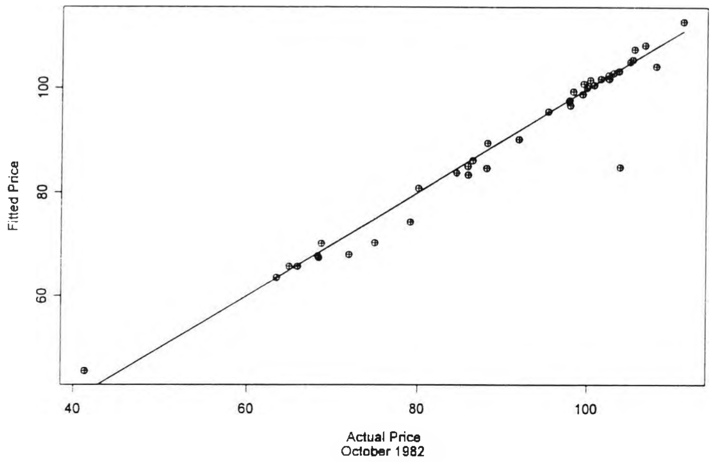
Outlier Bond Price Identification from Step-wise Spot Rate Data



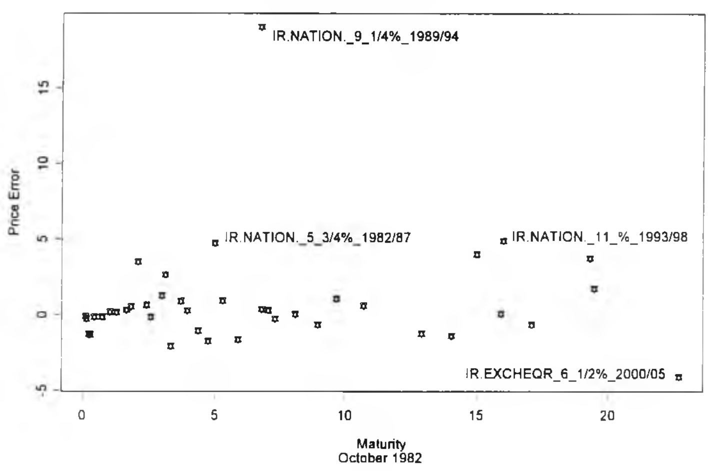
Initial Yield Function fitted to All Yields

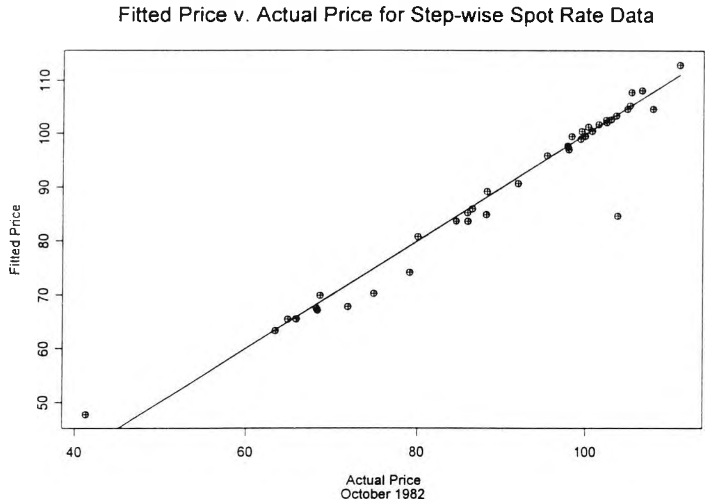


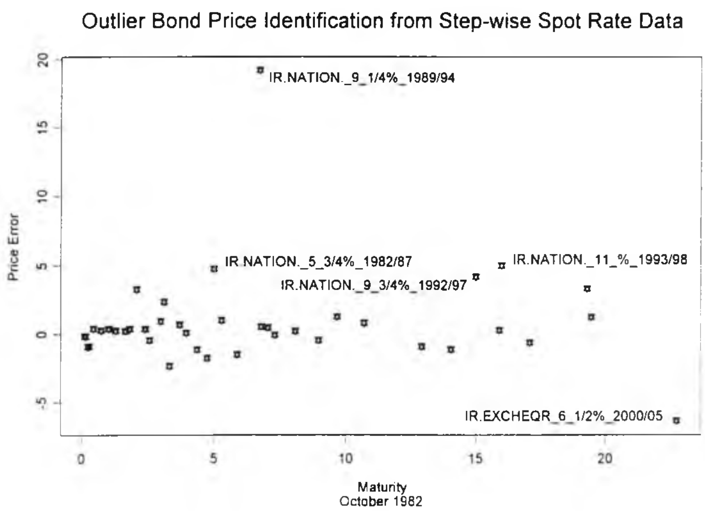
Fitted Price v. Actual Price for Step-wise Discount Data



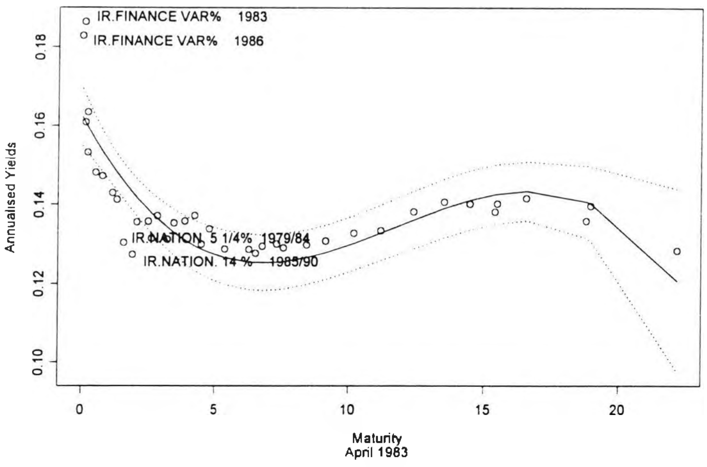
Outlier Bond Price Identification from Step-wise Discount Data



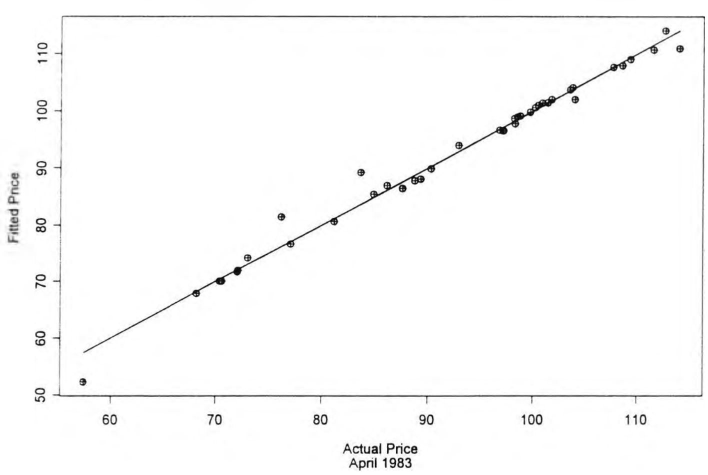

Fitted Price v. Actual Price for Step-wise Spot Rate Data
Fitted Price
Actual Price
October 1982


Outlier Bond Price Identification from Step-wise Spot Rate Data
Price Error
IR.NATION._9_1/4%_1989/94
IR.NATION._5_3/4%_1982/87
IR.NATION._9_3/4%_1992/97
IR.NATION._11_%_1993/98
IR.EXCHEQR_6_1/2%_2000/05
Maturity
October 1982

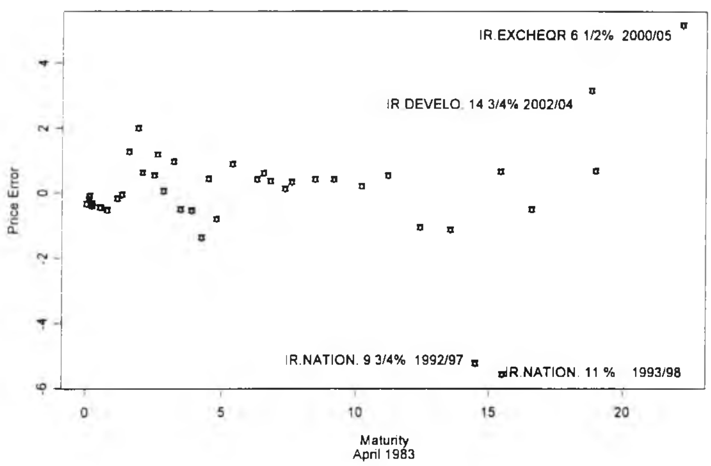
Initial Yield Function fitted to All Yields



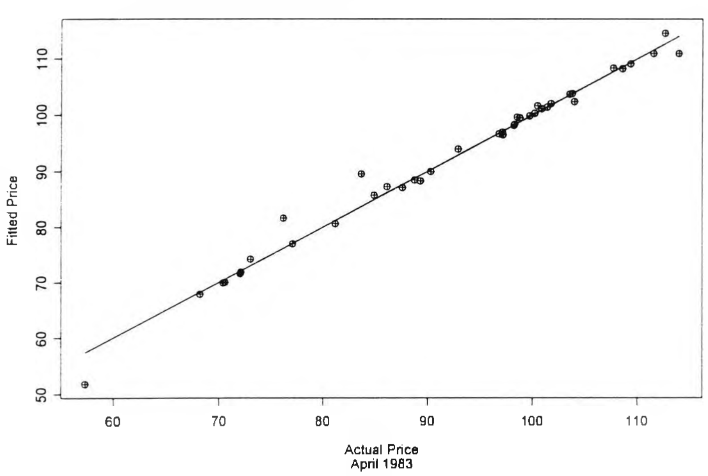
Fitted Price v. Actual Price for Step-wise Discount Data



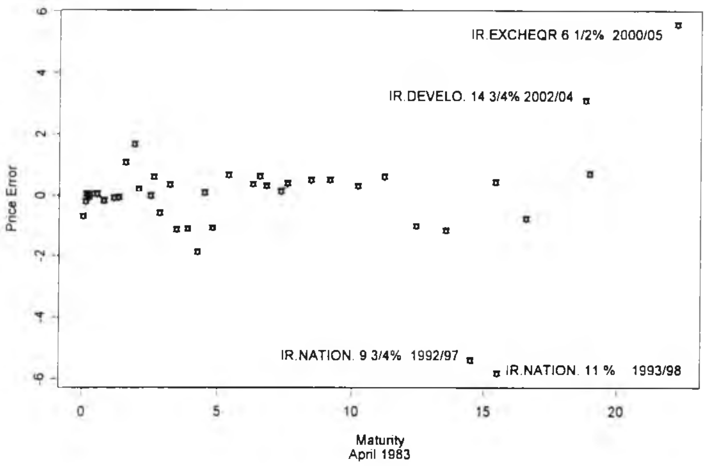
Outlier Bond Price Identification from Step-wise Discount Data



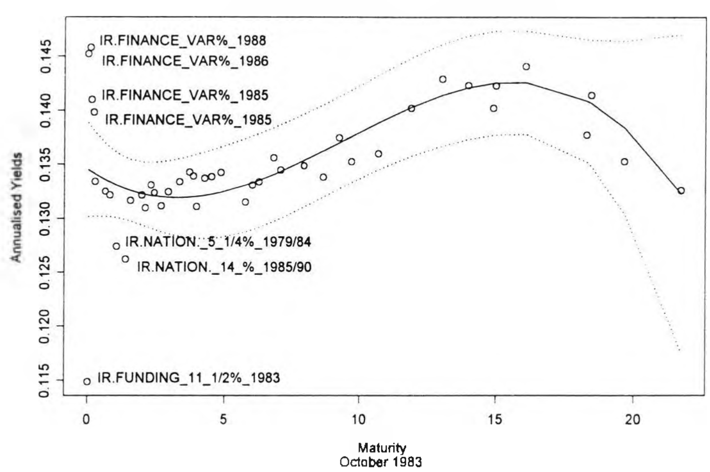
Fitted Price v. Actual Price for Step-wise Spot Rate Data



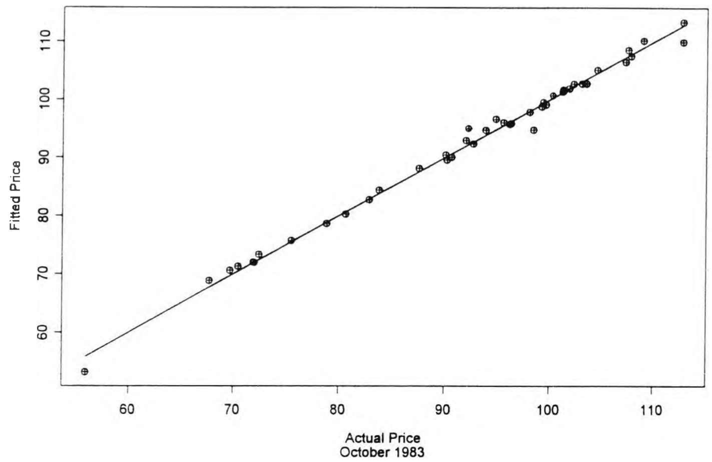
Outlier Bond Price Identification from Step-wise Spot Rate Data



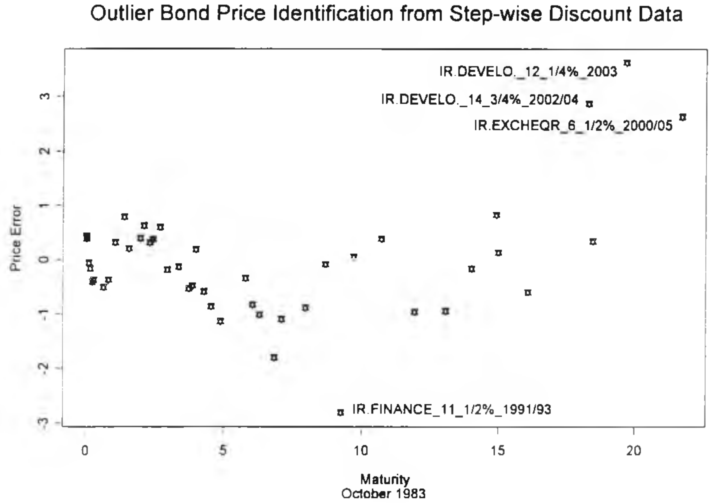
Initial Yield Function fitted to All Yields



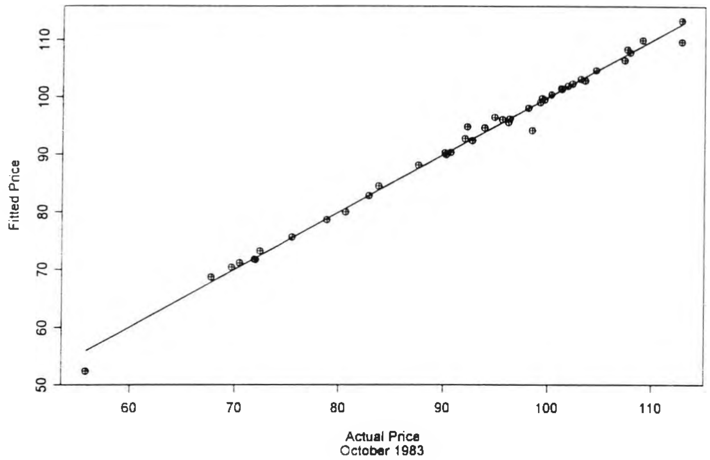
Fitted Price v. Actual Price for Step-wise Discount Data



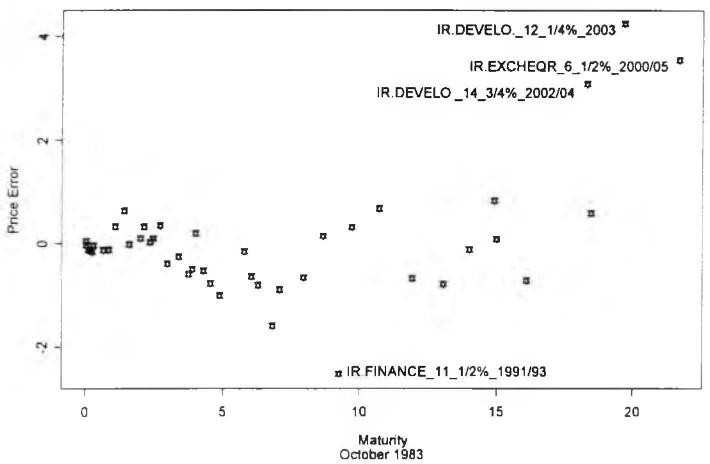
Outlier Bond Price Identification from Step-wise Discount Data



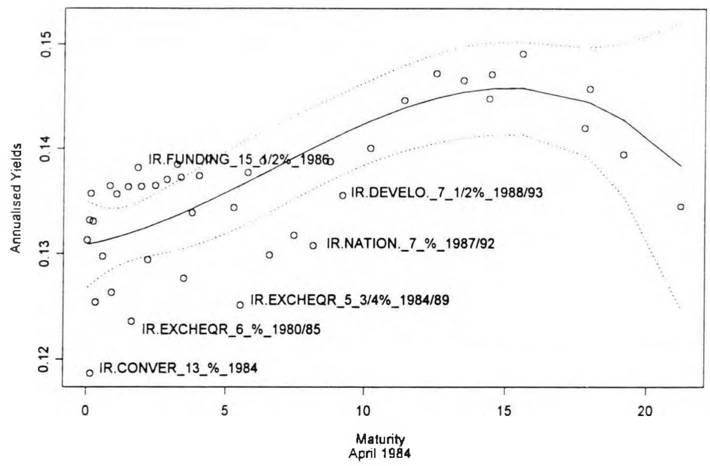
Fitted Price v. Actual Price for Step-wise Spot Rate Data



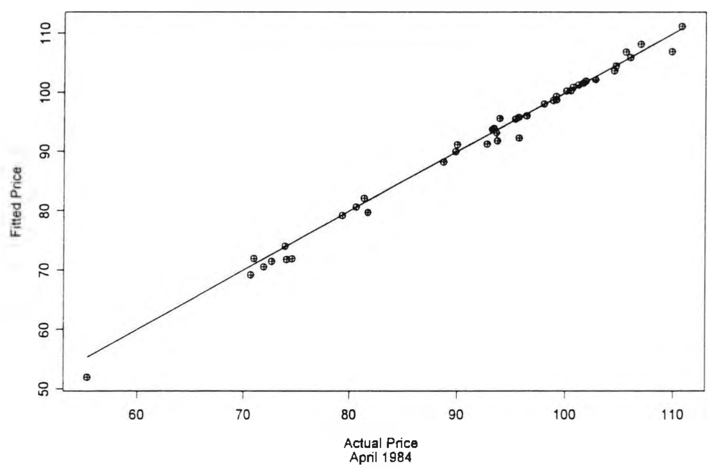
Outlier Bond Price Identification from Step-wise Spot Rate Data



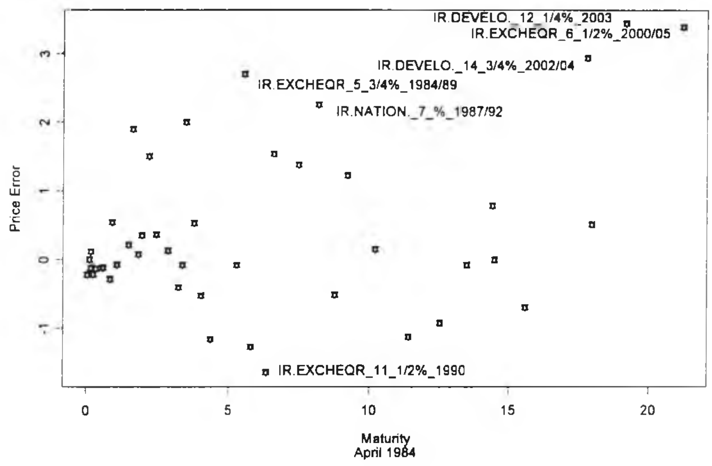
Initial Yield Function fitted to All Yields



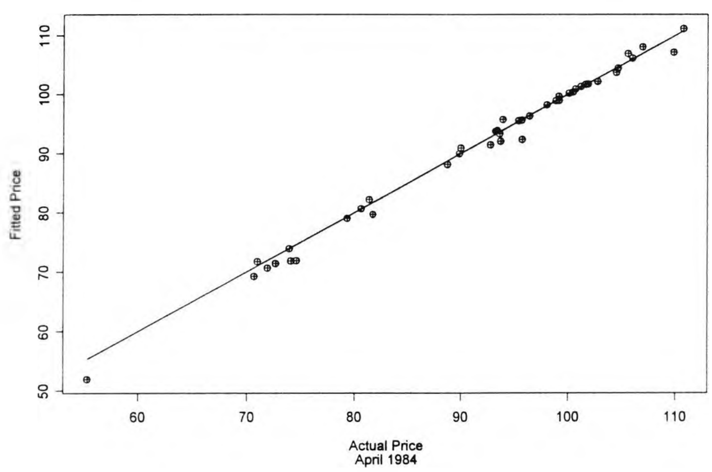
Fitted Price v. Actual Price for Step-wise Discount Data



Outlier Bond Price Identification from Step-wise Discount Data



Fitted Price v. Actual Price for Step-wise Spot Rate Data



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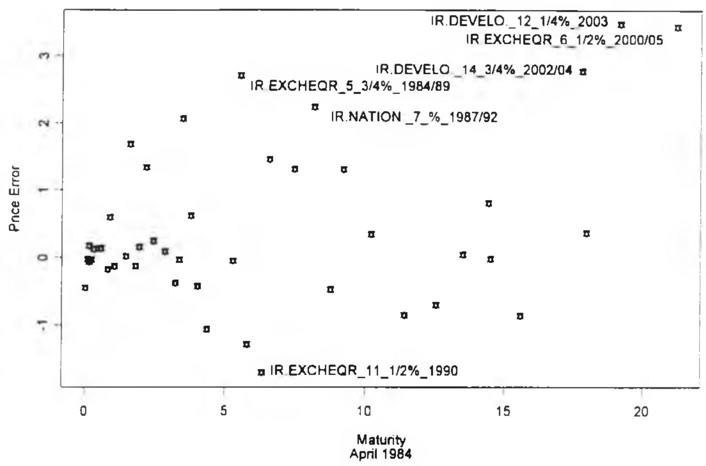
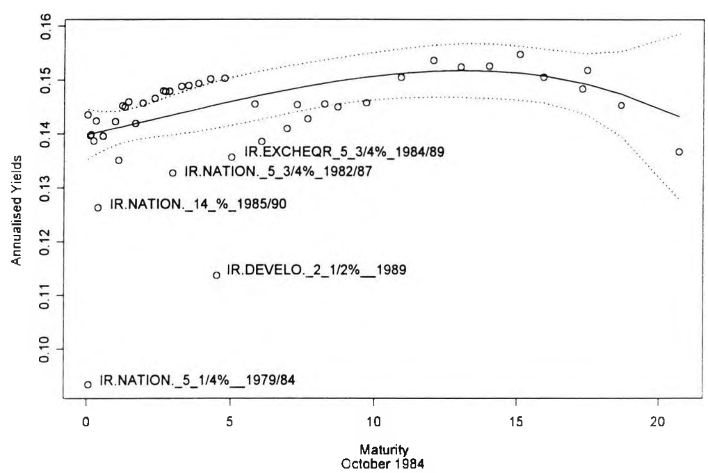
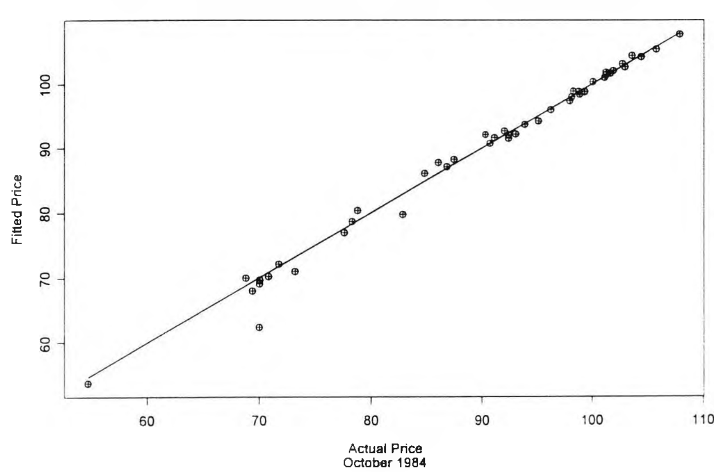


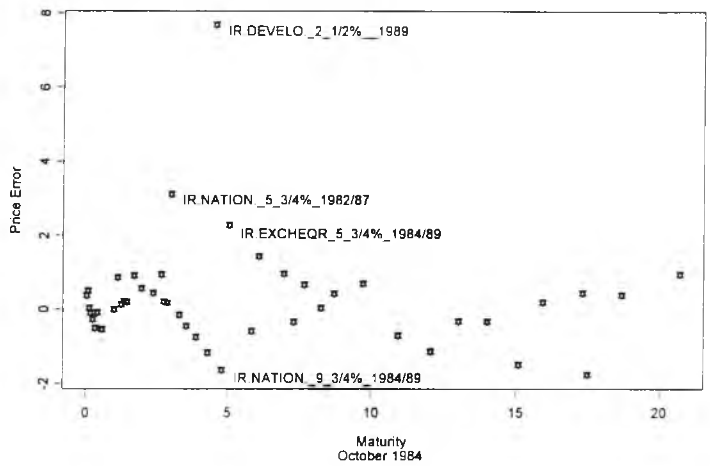
Initial Yield Function fitted to All Yields



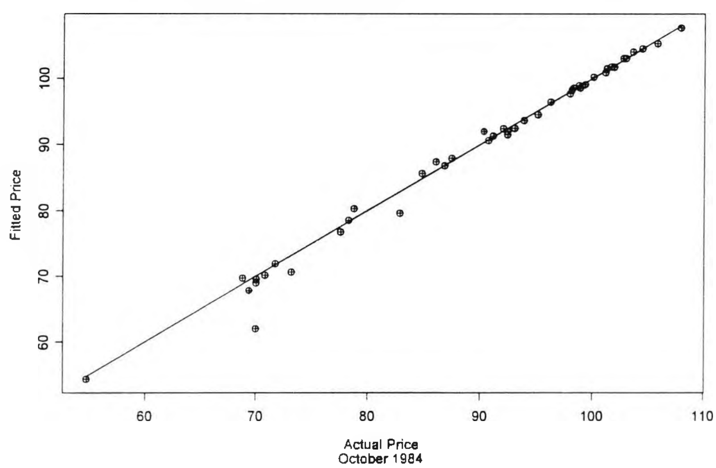
Fitted Price v. Actual Price for Step-wise Discount Data



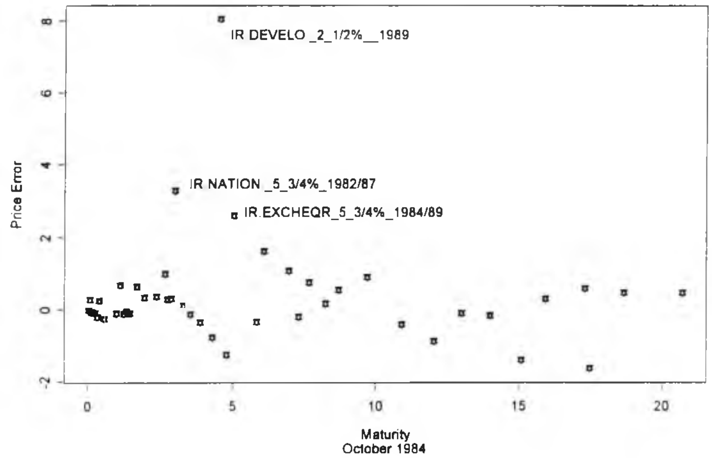
Outlier Bond Price Identification from Step-wise Discount Data



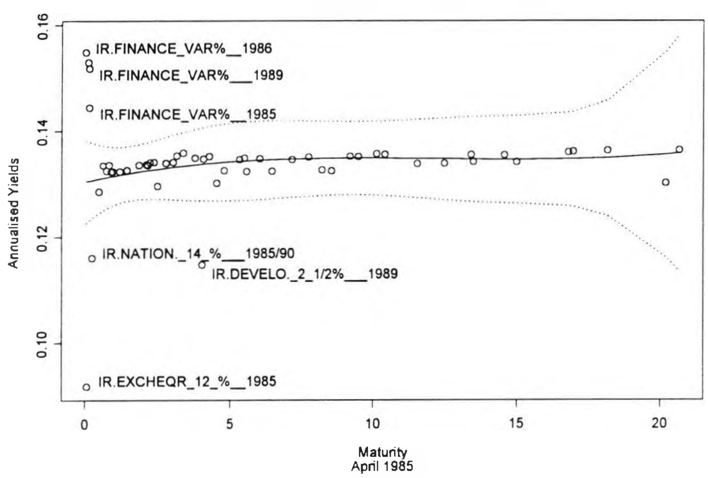
Fitted Price v. Actual Price for Step-wise Spot Rate Data



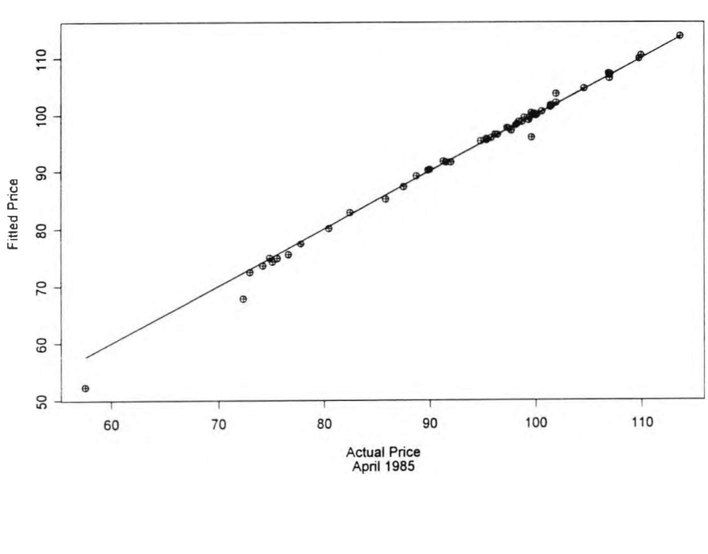
Outlier Bond Price Identification from Step-wise Spot Rate Data



Initial Yield Function fitted to All Yields



Fitted Price v. Actual Price for Step-wise Discount Data



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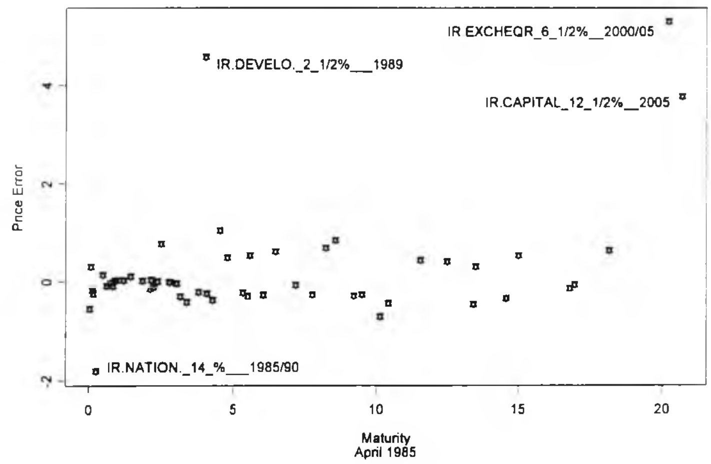
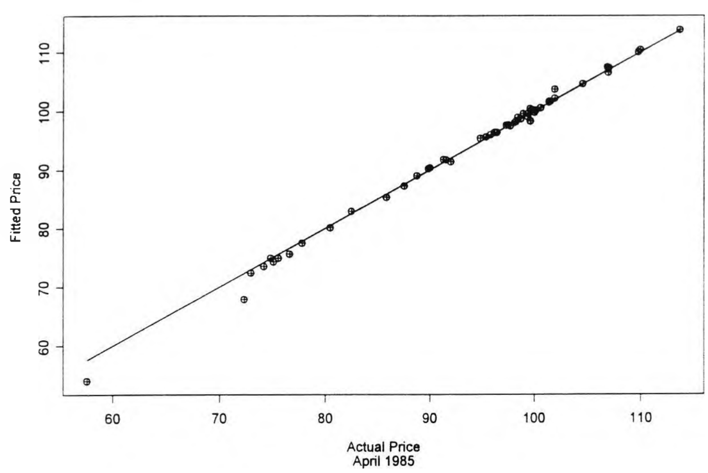


Fitted Price v. Actual Price for Step-wise Spot Rate Data



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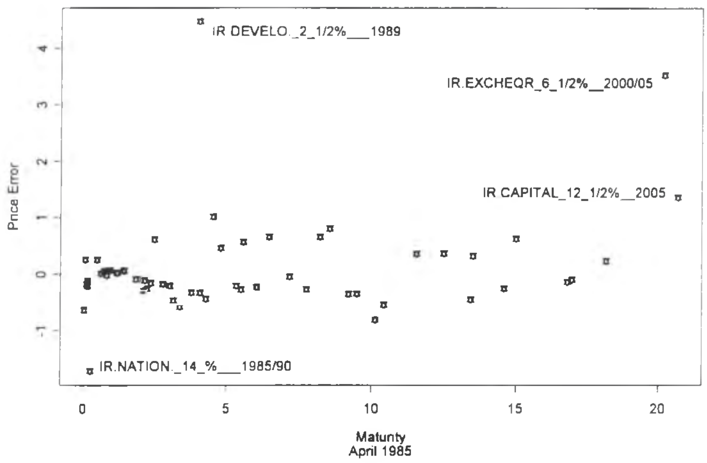

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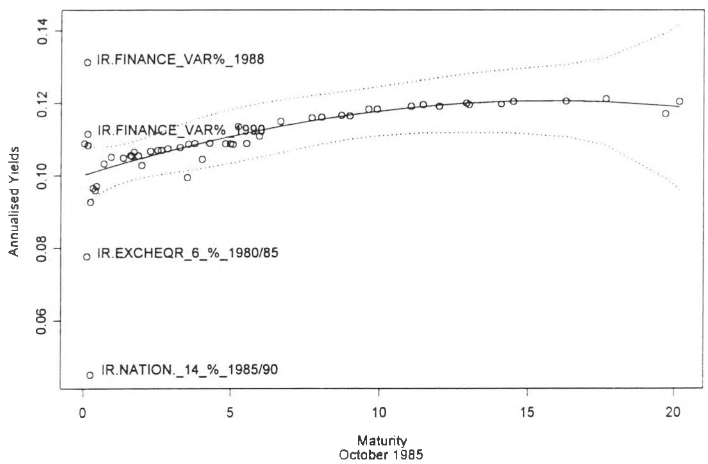
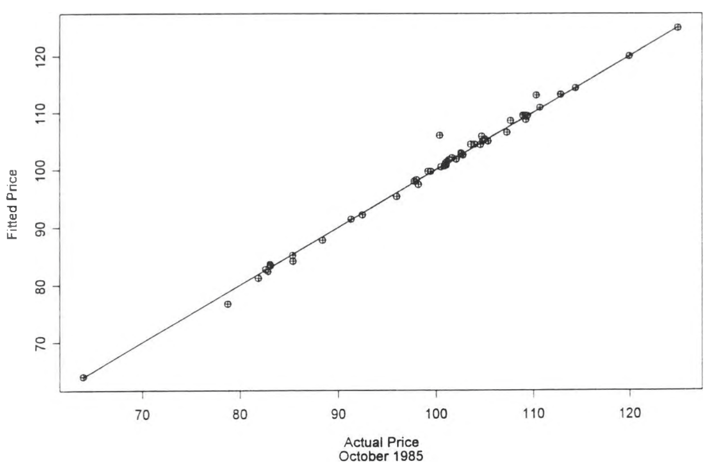


Fitted Price v. Actual Price for Step-wise Discount Data



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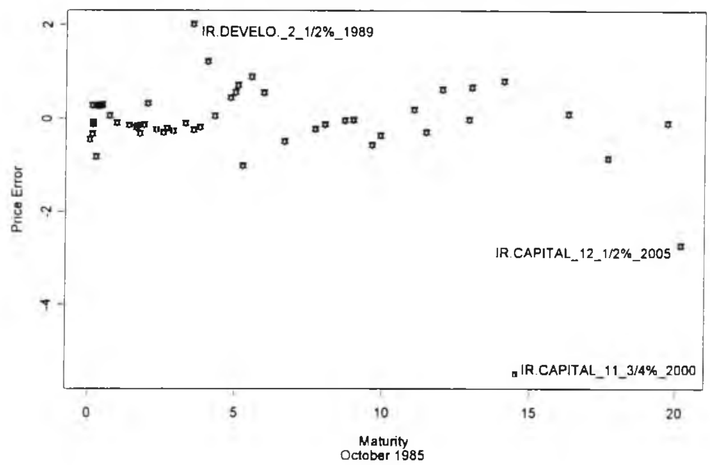

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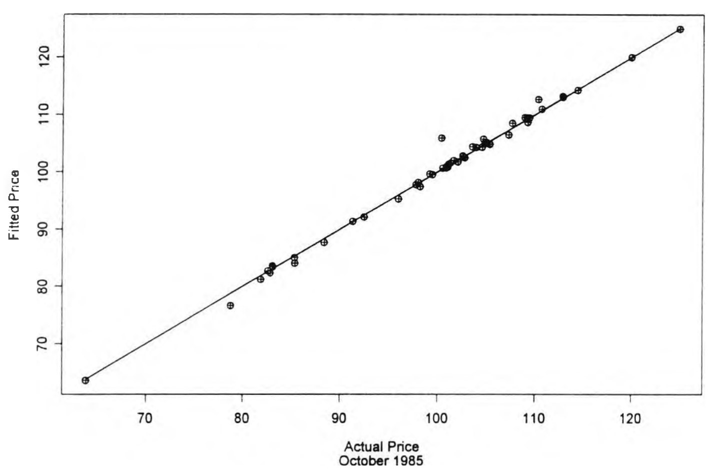

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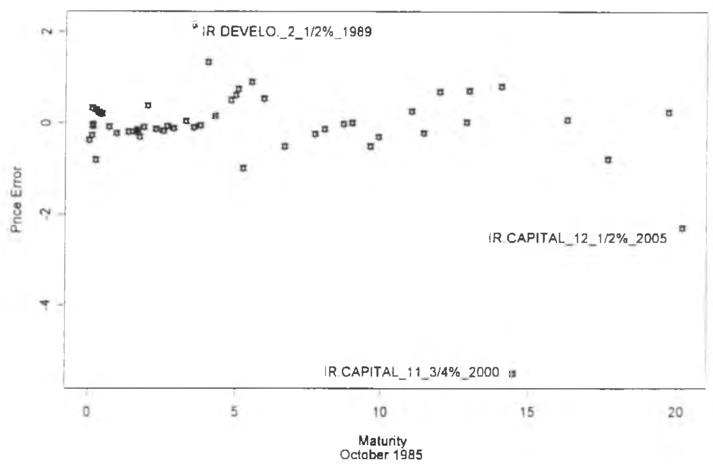

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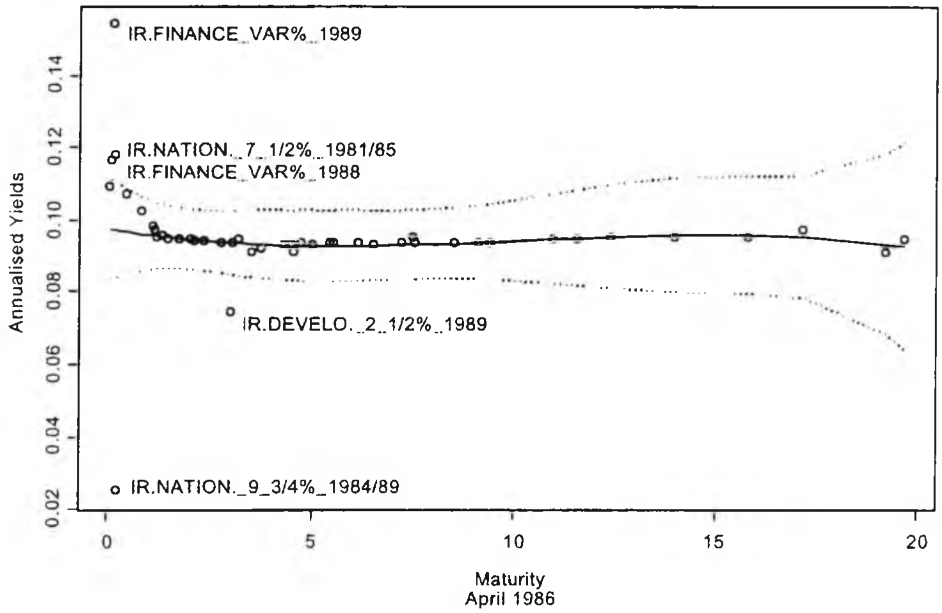

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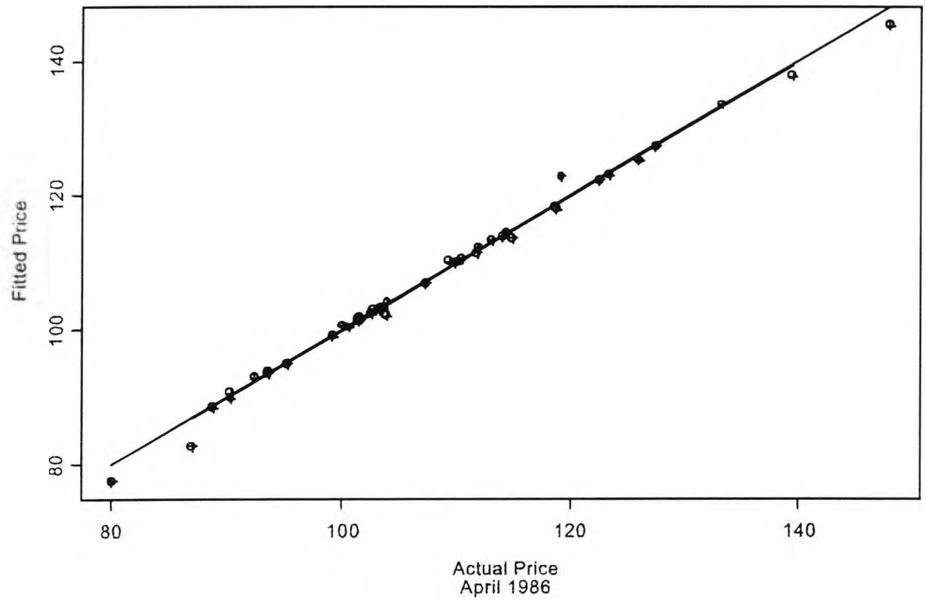

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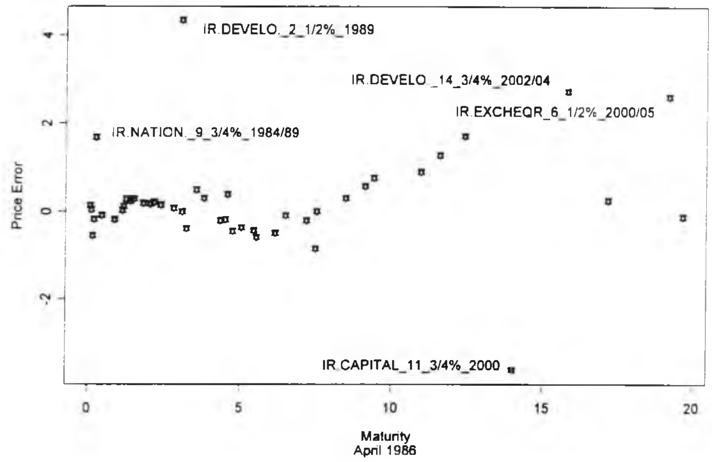

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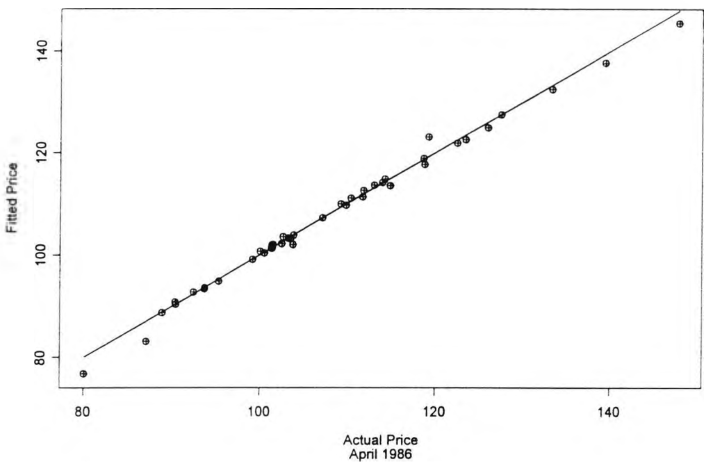

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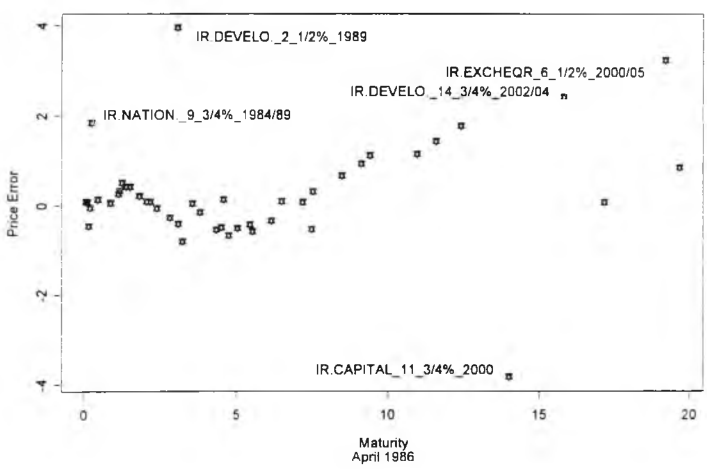

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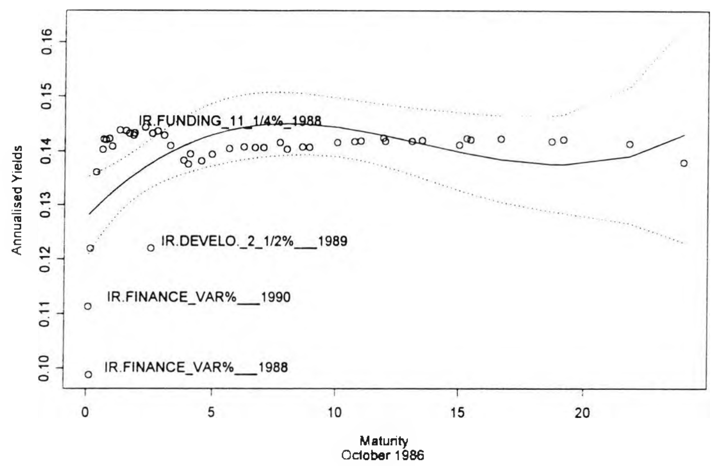

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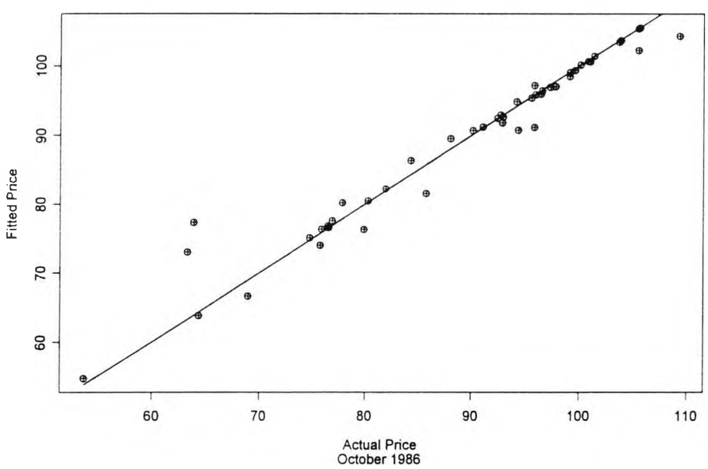

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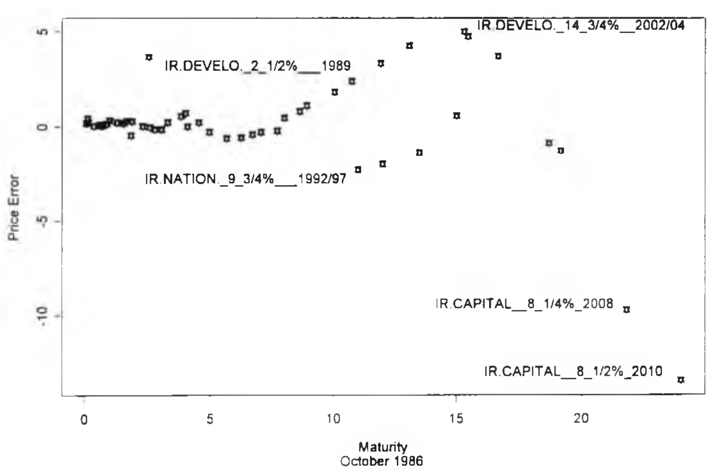

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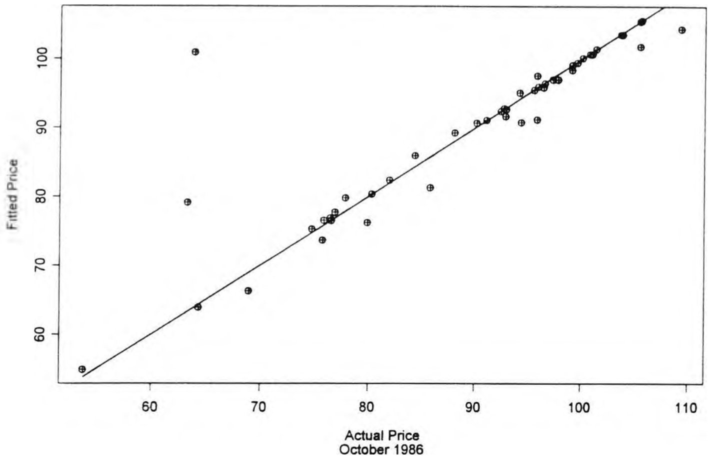

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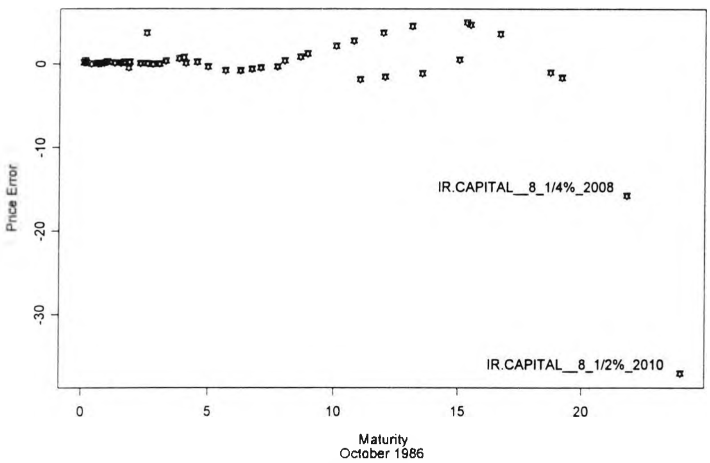

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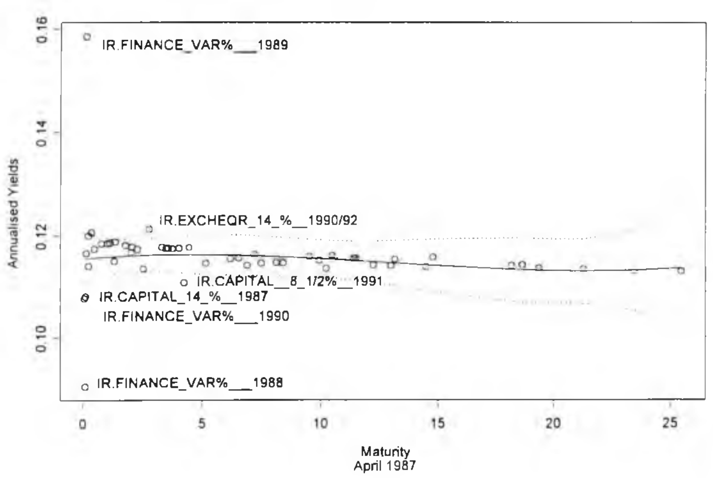

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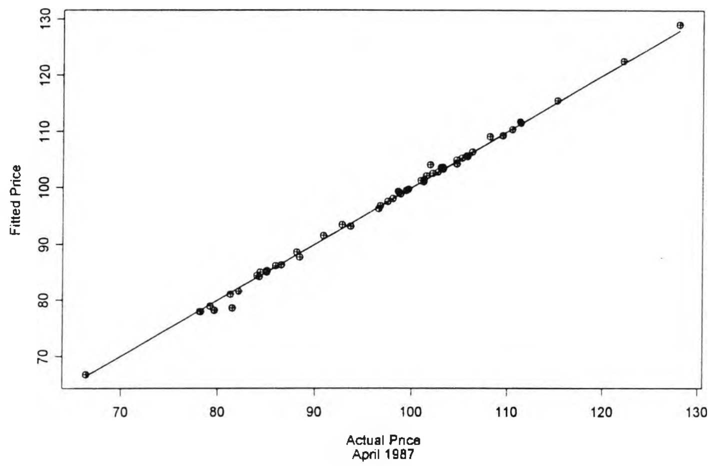

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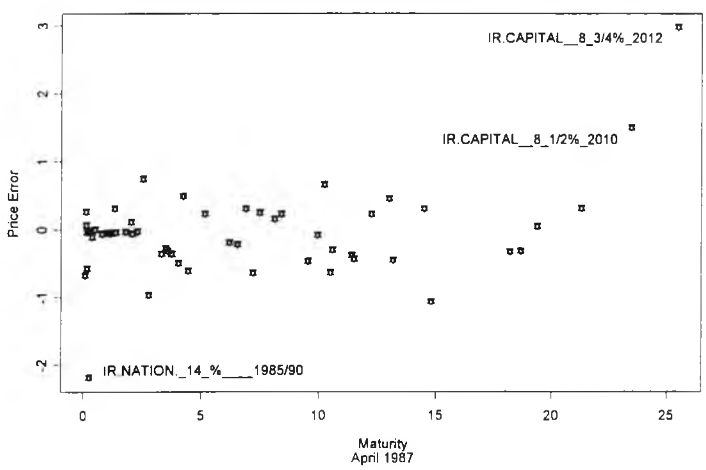

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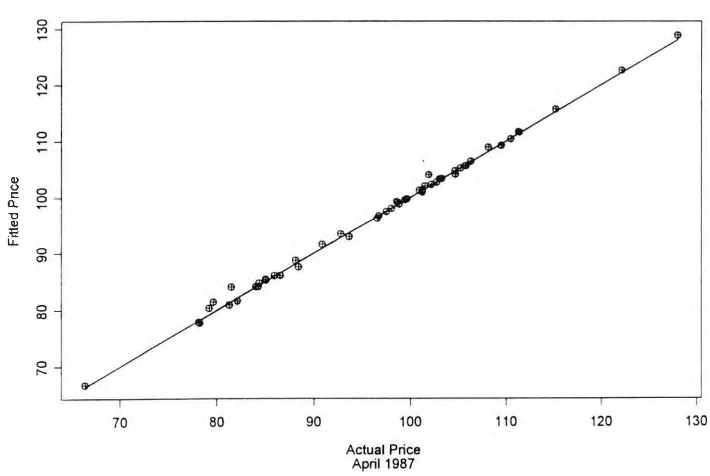

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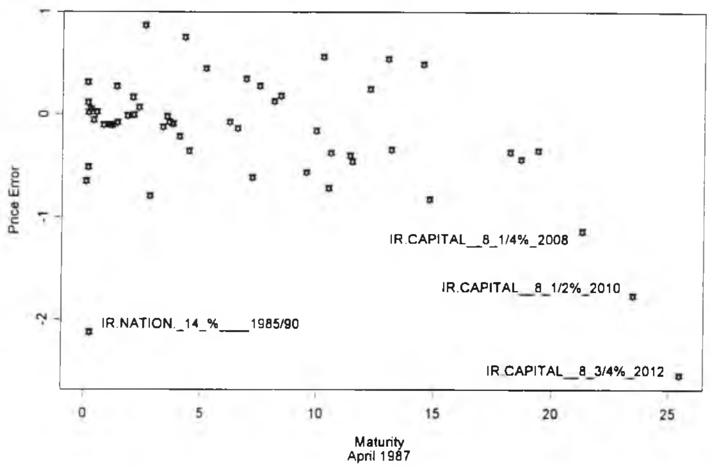

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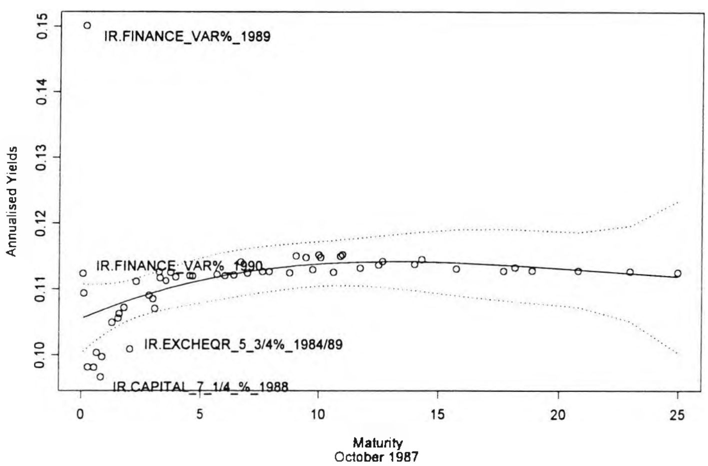

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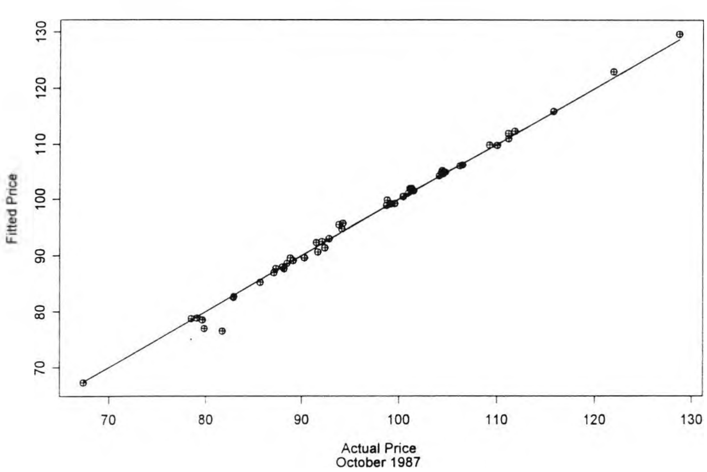

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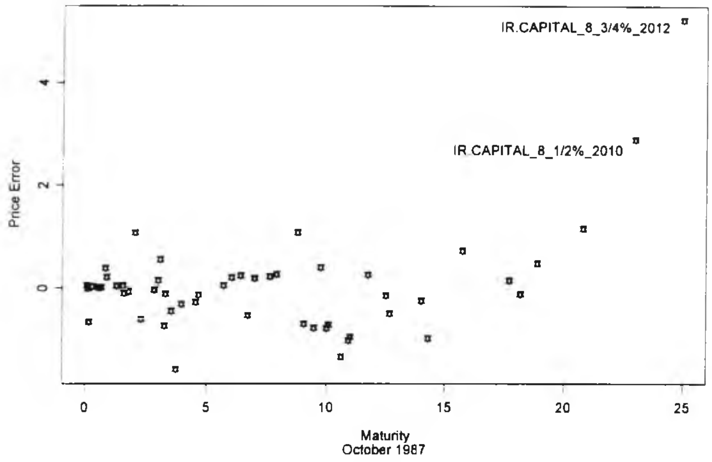

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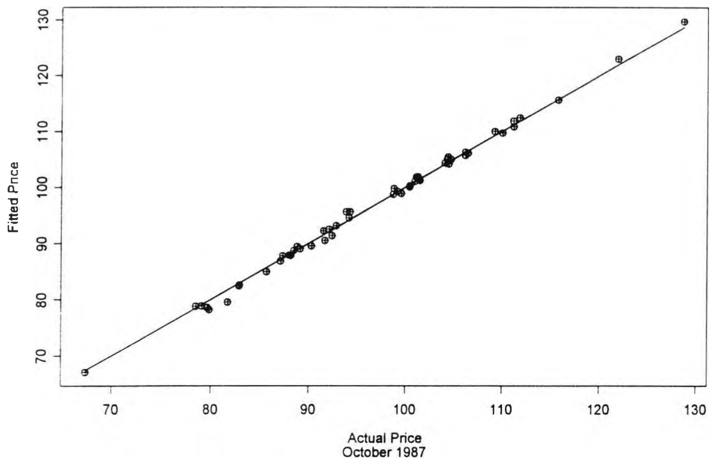

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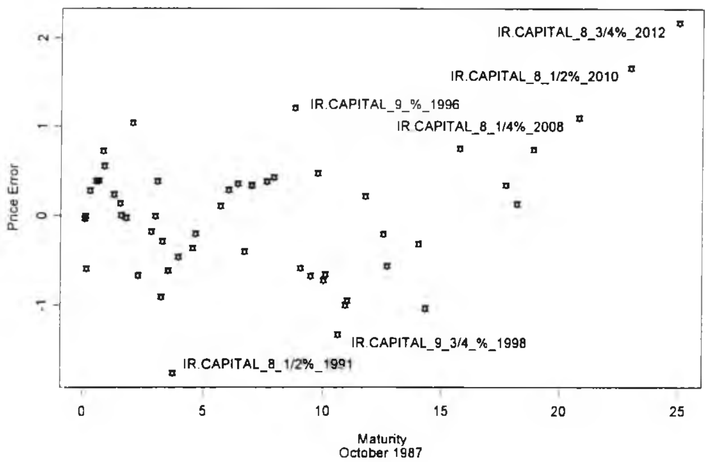

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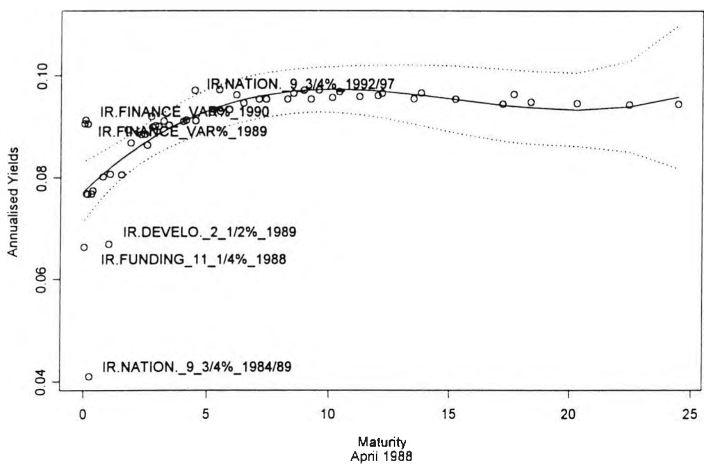

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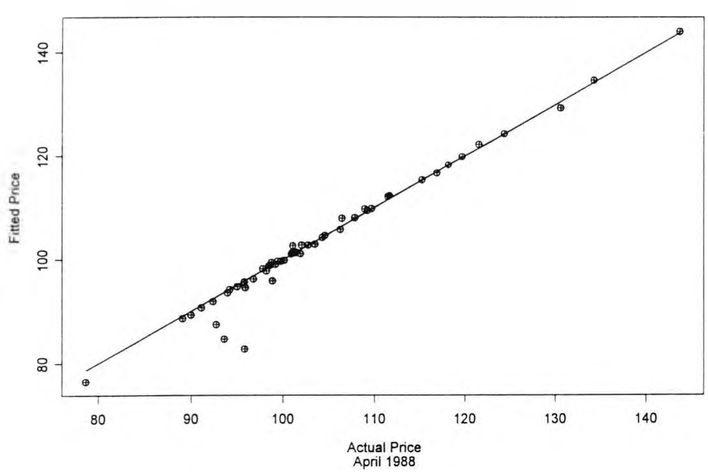

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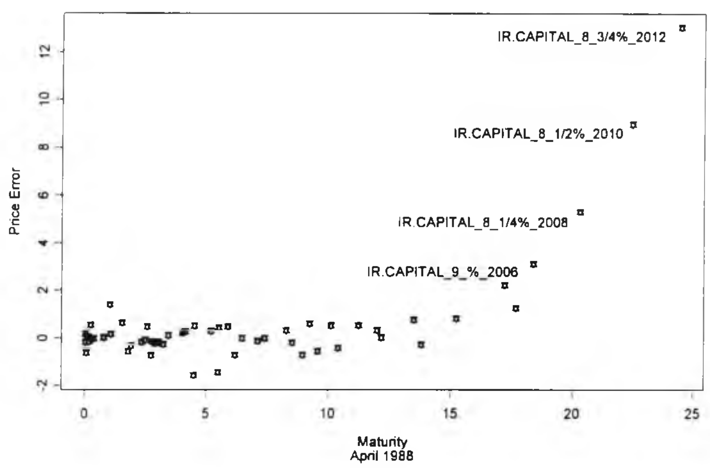

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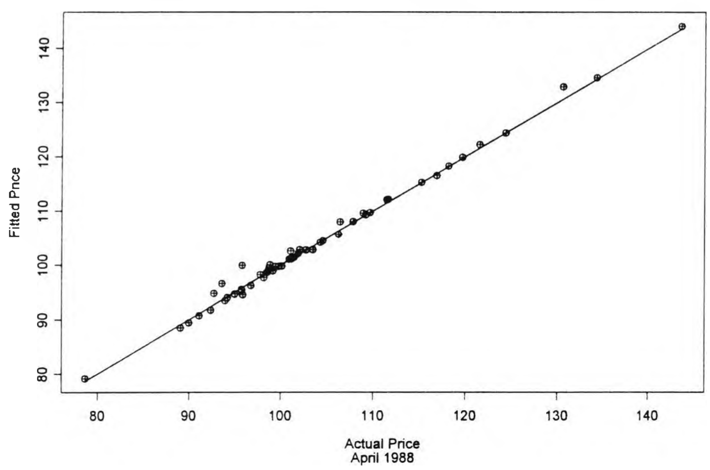

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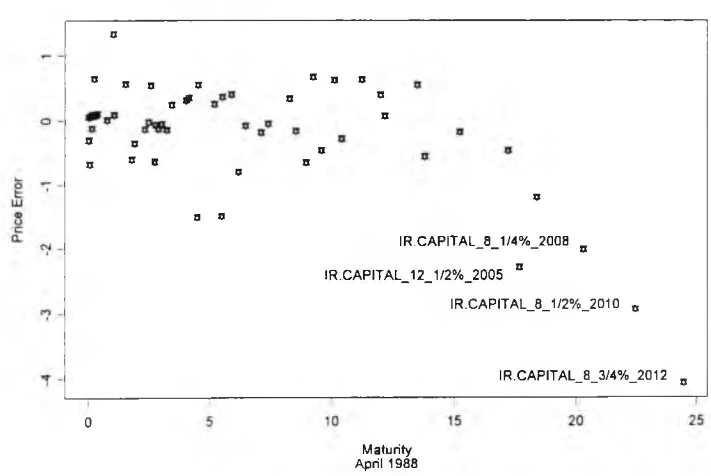

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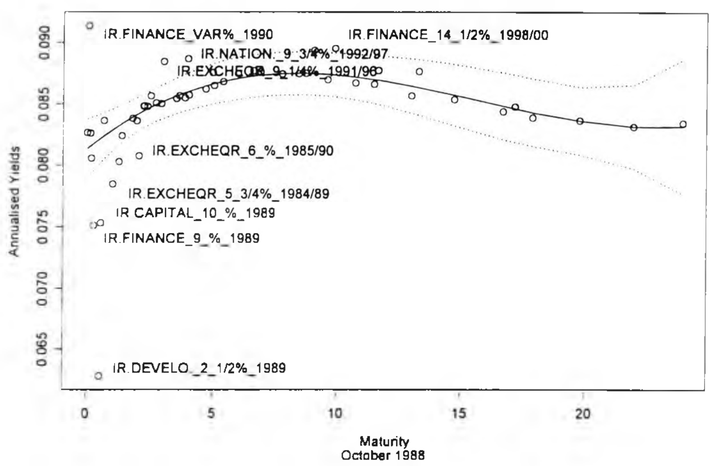

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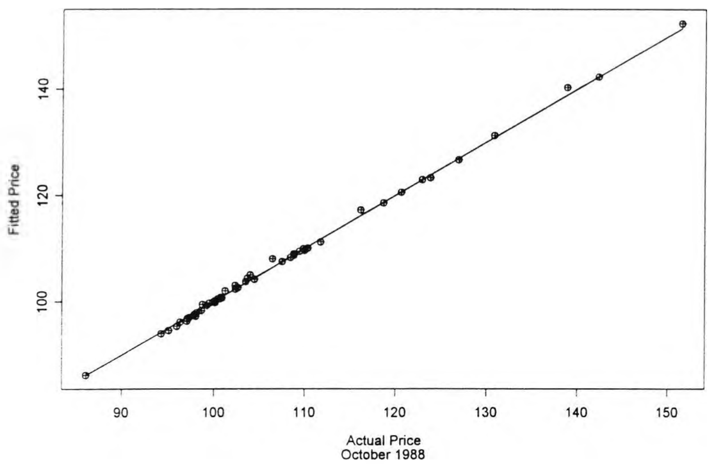

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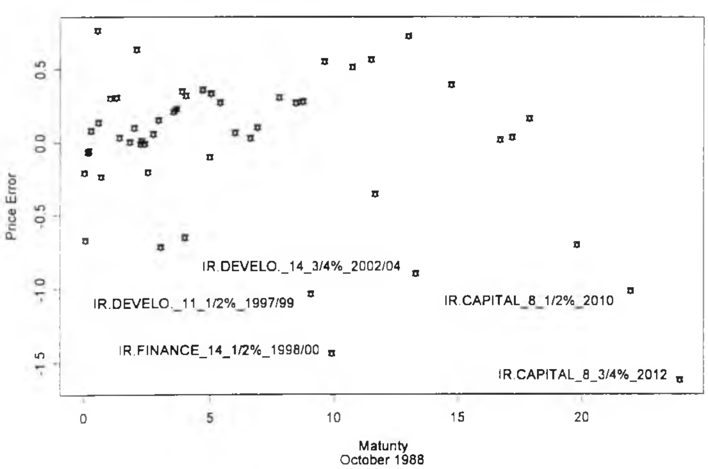

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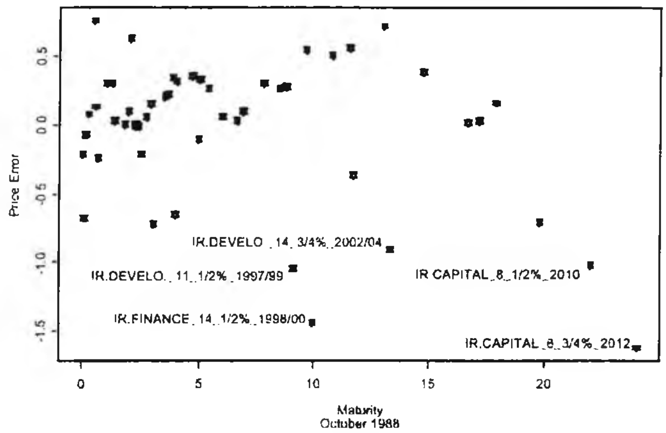
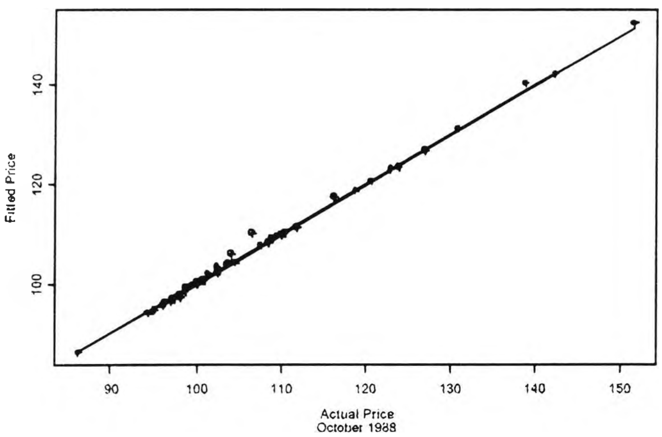


Fitted Price v. Actual Price for Step-wise Spot Rate Data



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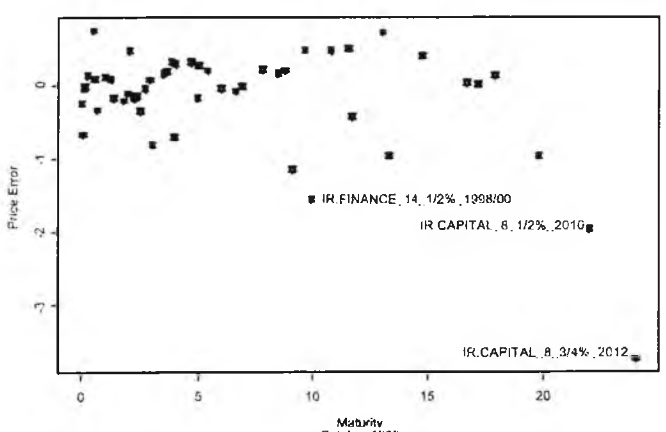
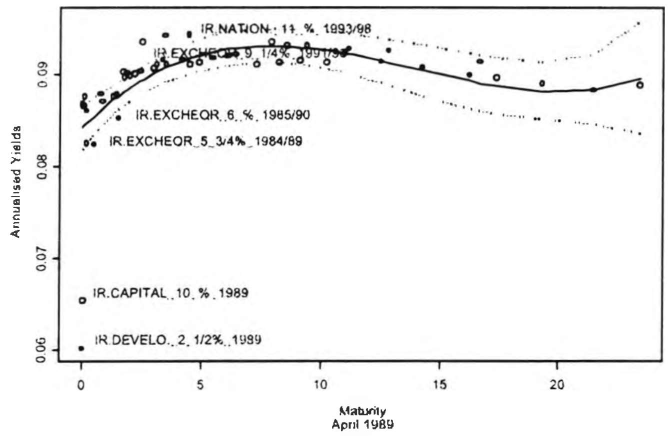


Initial Yield Function fitted to All Yields



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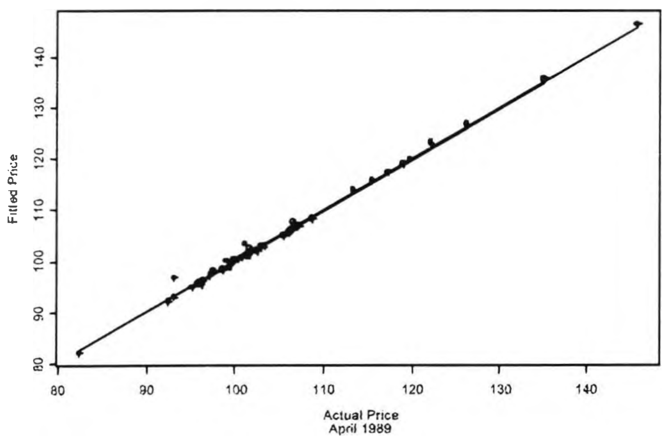

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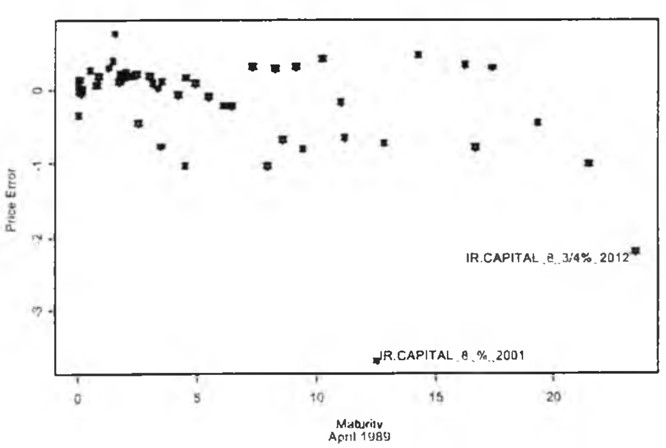

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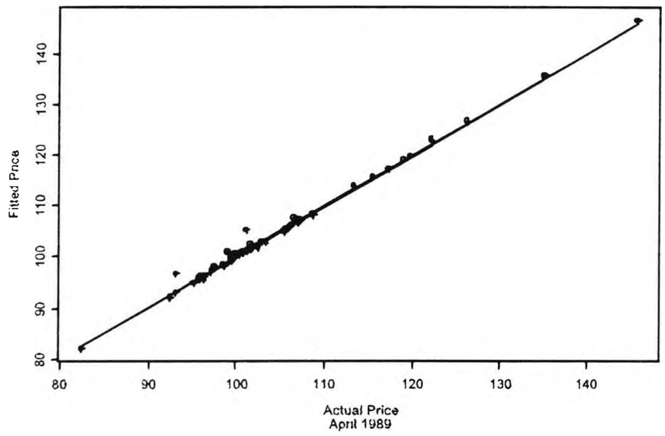

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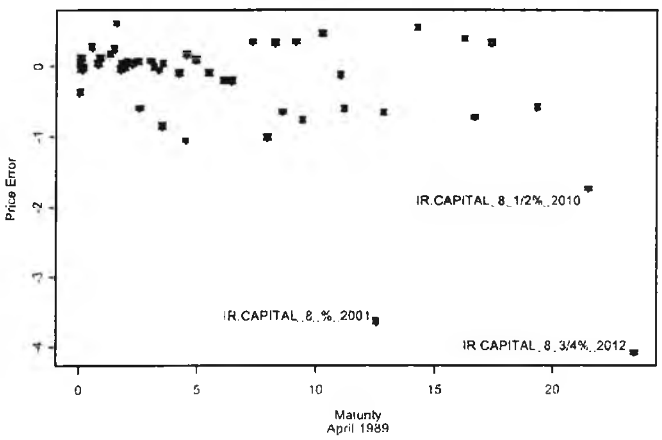

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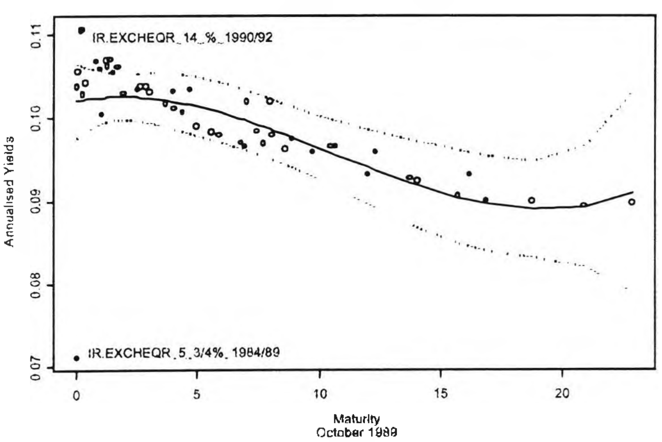

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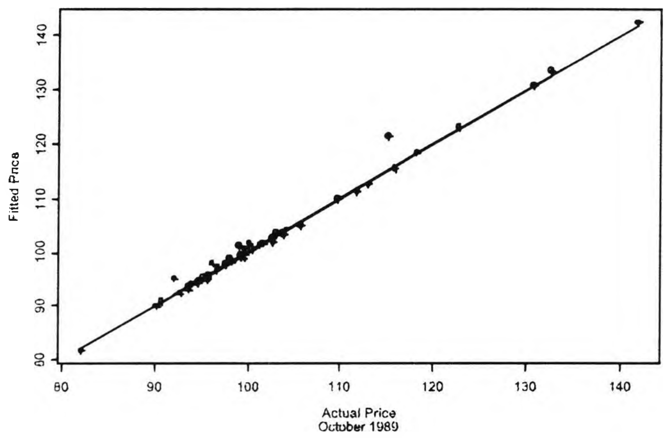

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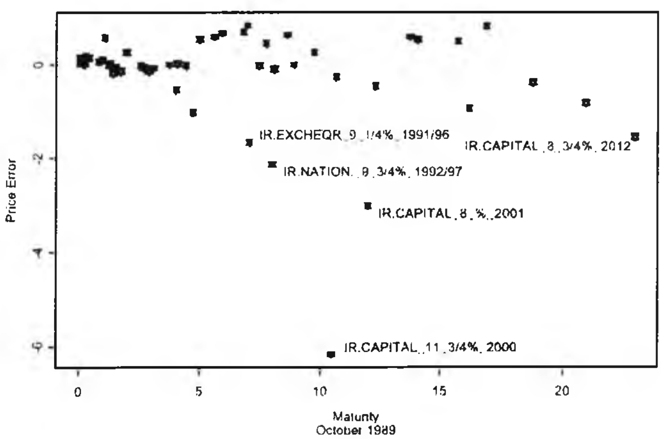

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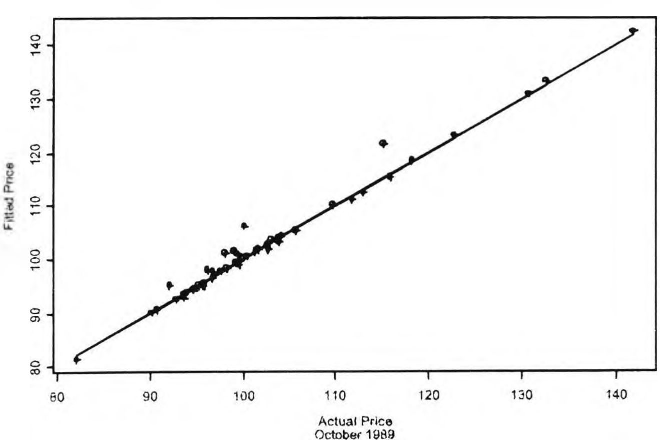

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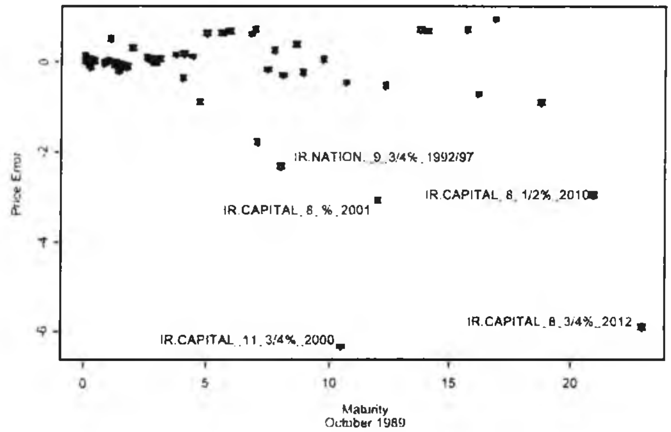

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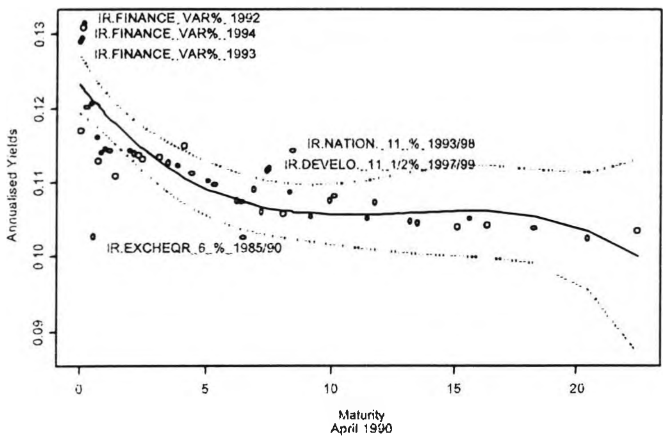

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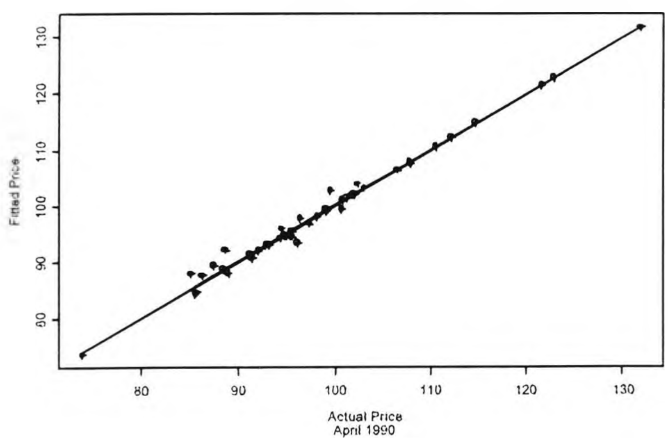

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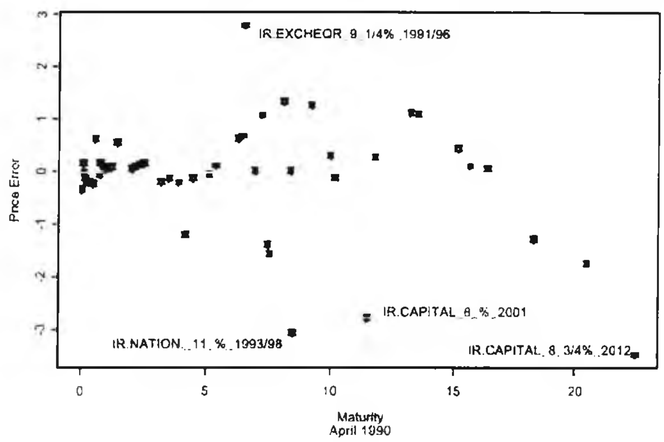

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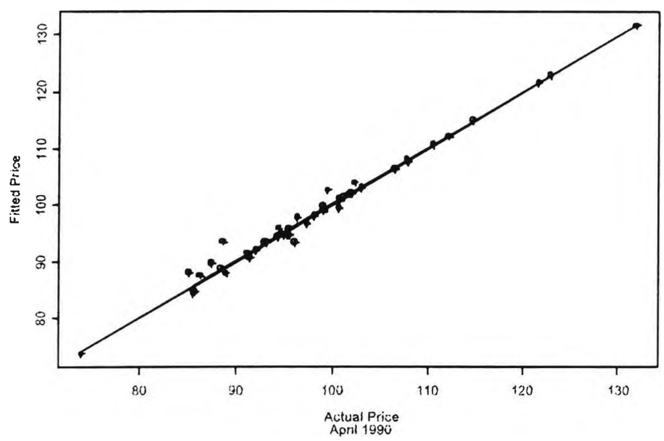

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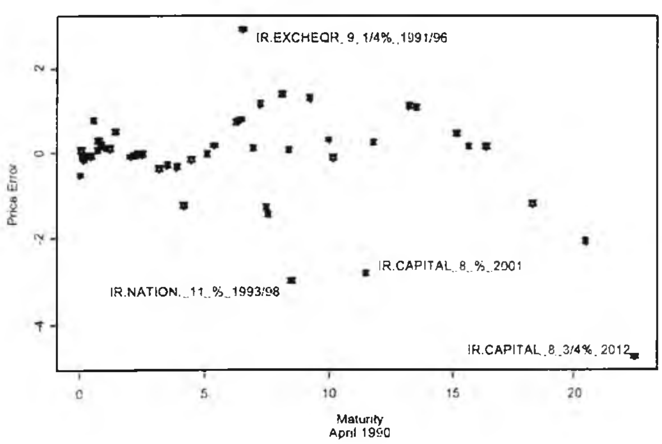

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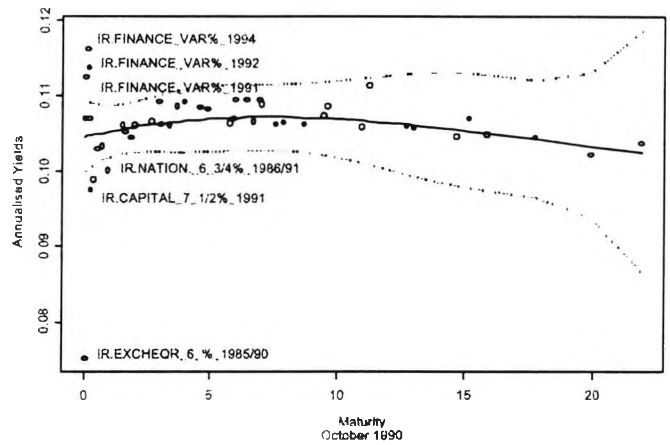

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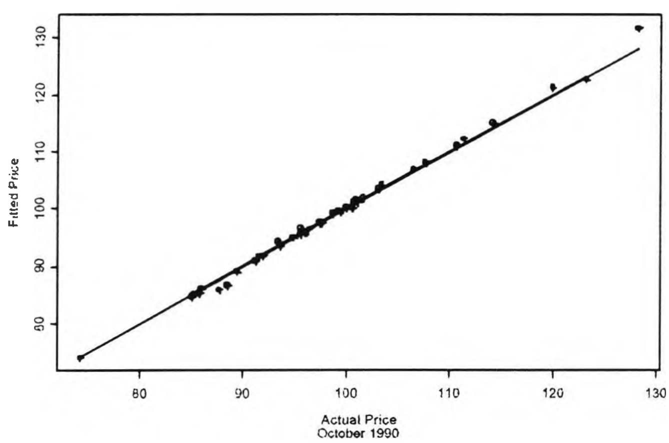

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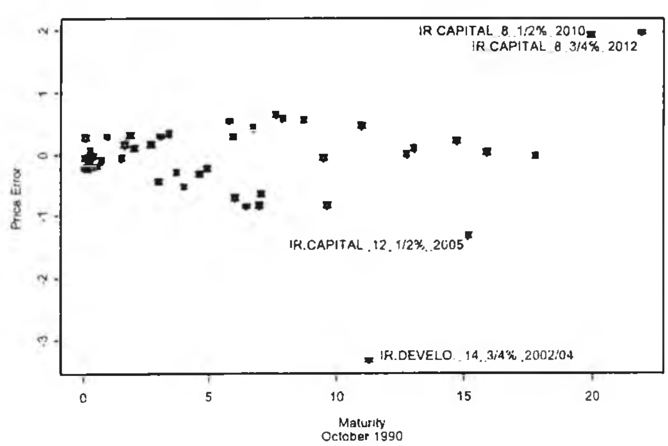

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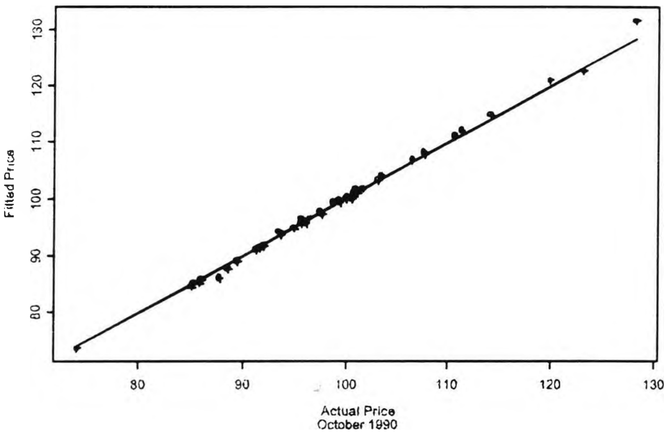

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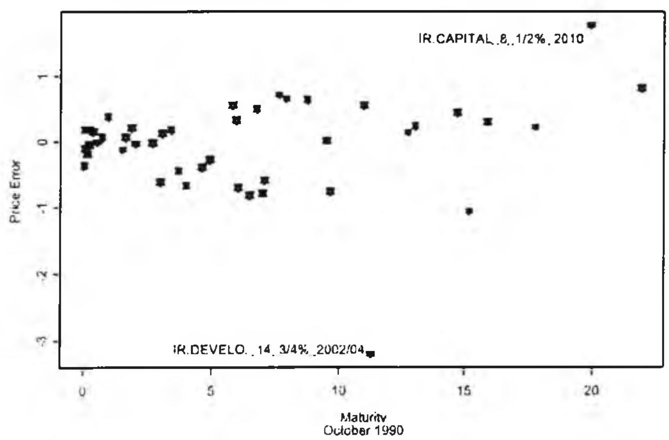

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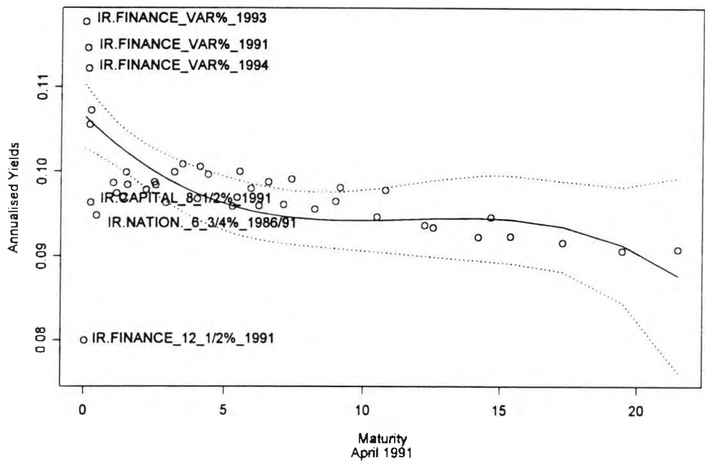

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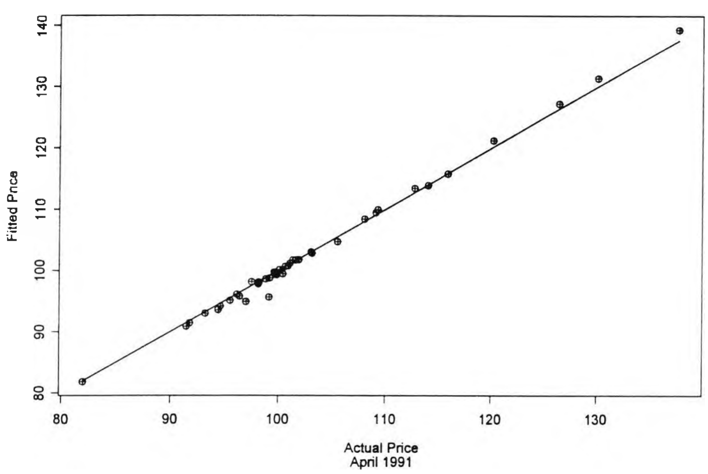

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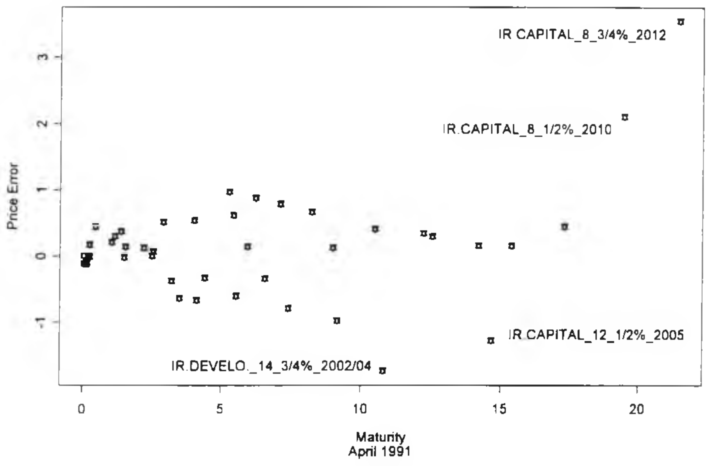

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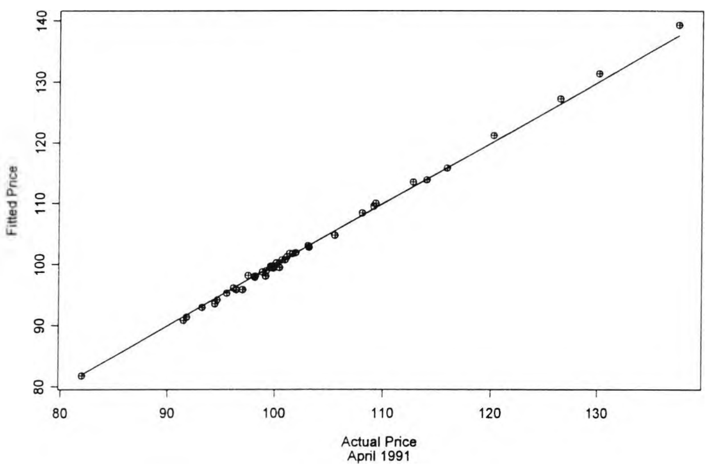

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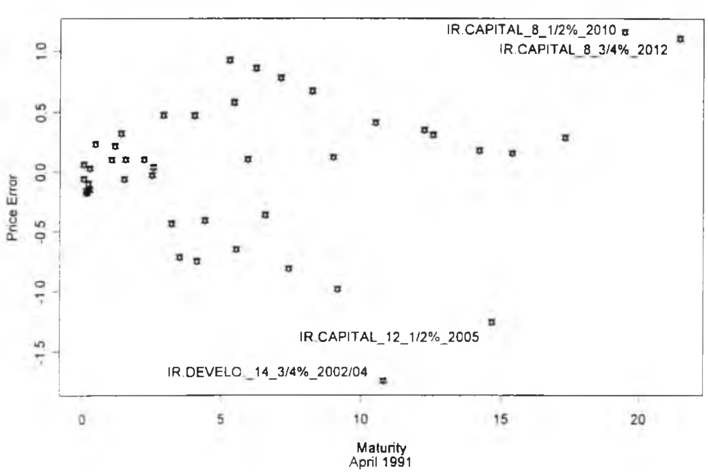
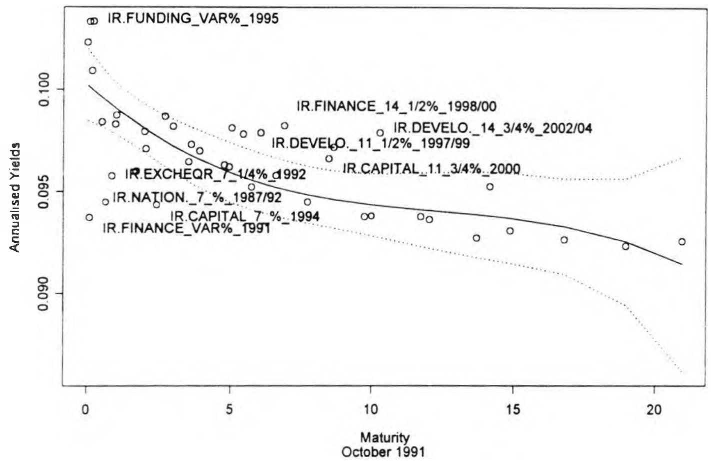
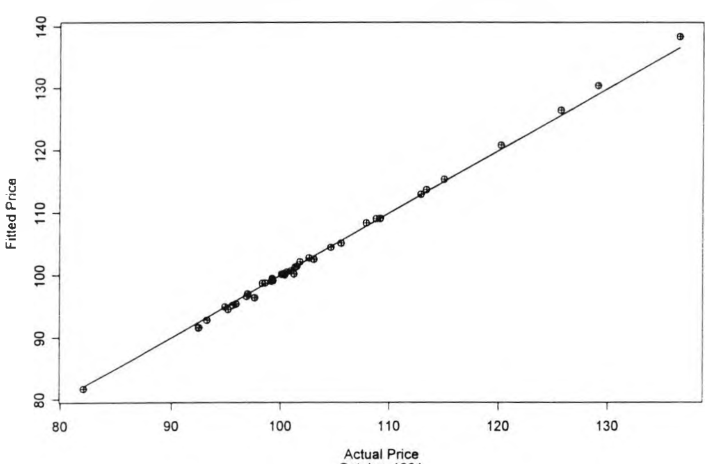


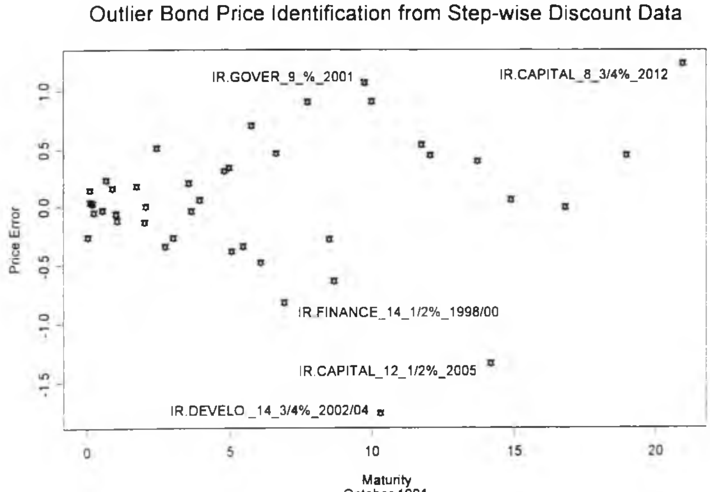
Initial Yield Function fitted to All Yields



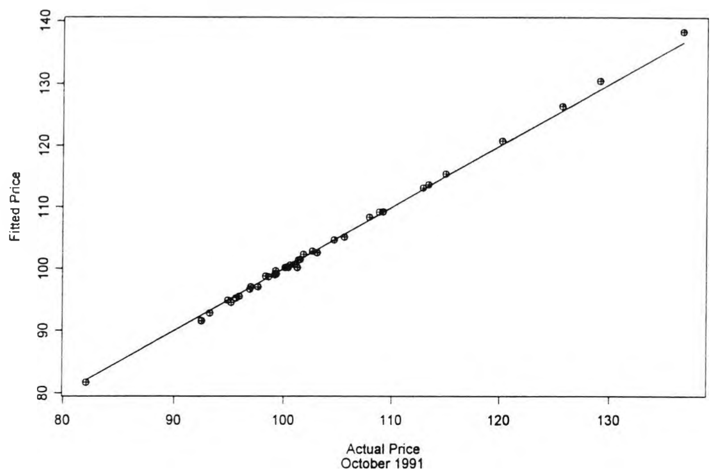
Fitted Price v. Actual Price for Step-wise Discount Data



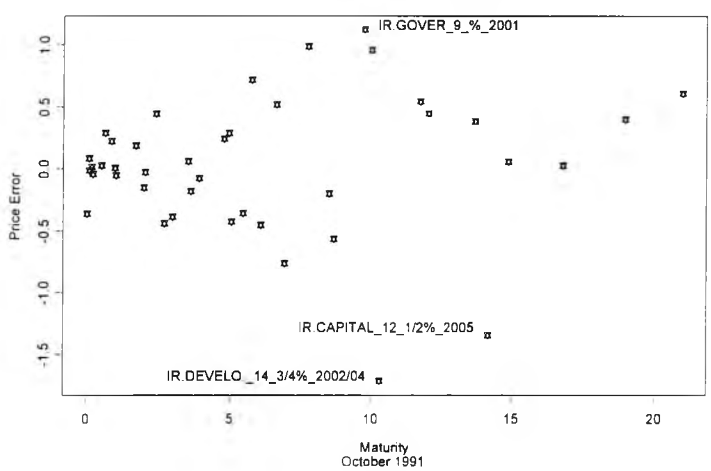
Outlier Bond Price Identification from Step-wise Discount Data



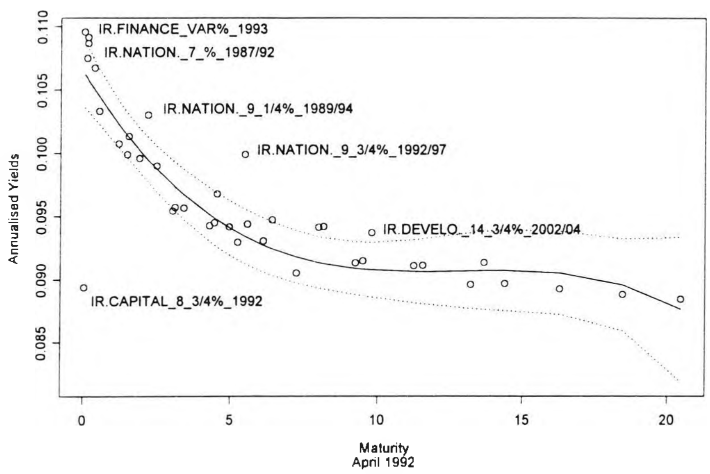
Fitted Price v. Actual Price for Step-wise Spot Rate Data



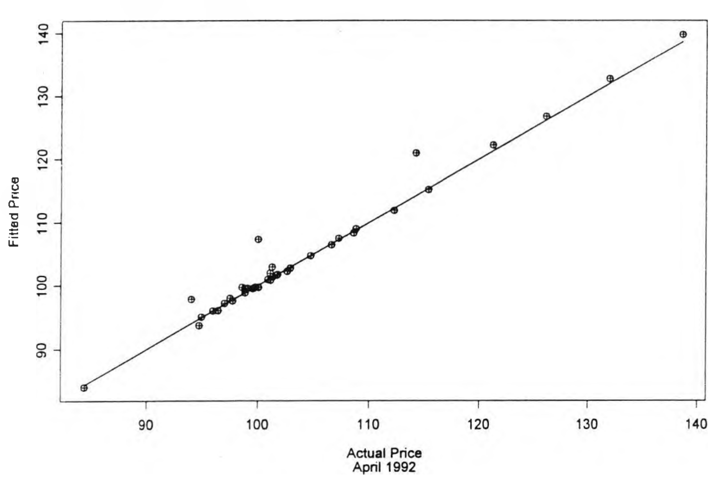
Outlier Bond Price Identification from Step-wise Spot Rate Data



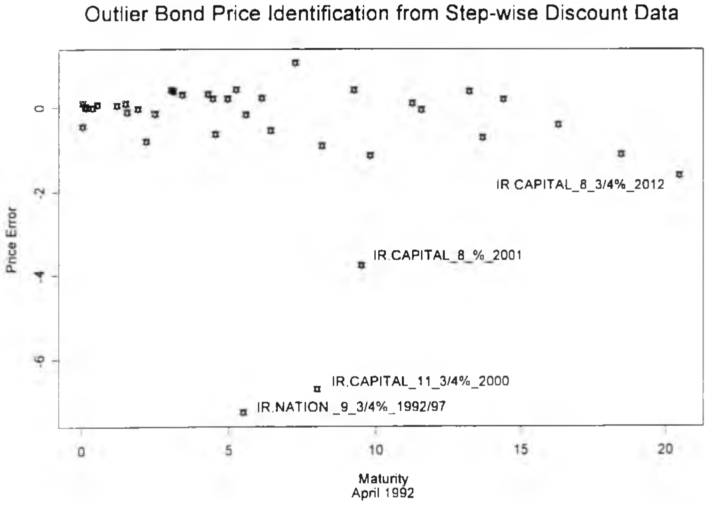
Initial Yield Function fitted to All Yields



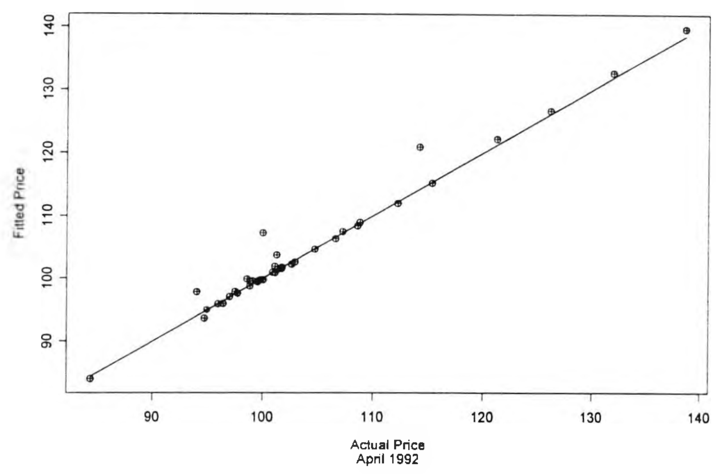
Fitted Price v. Actual Price for Step-wise Discount Data



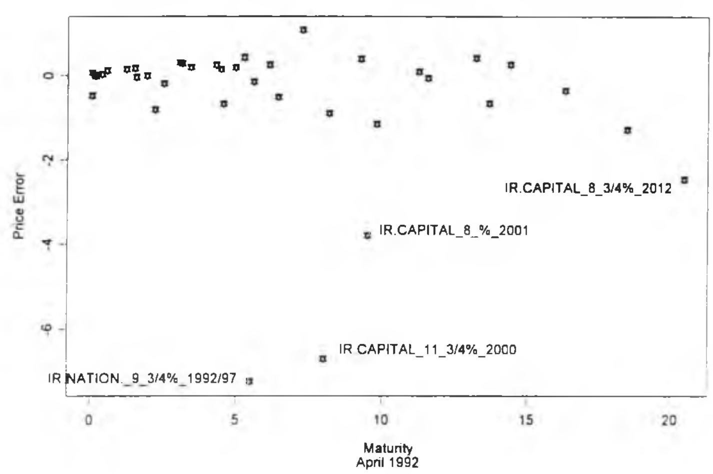
Outlier Bond Price Identification from Step-wise Discount Data



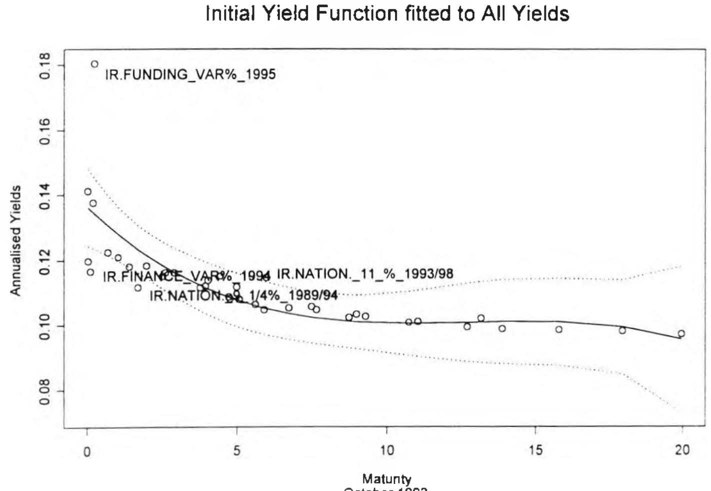
Fitted Price v. Actual Price for Step-wise Spot Rate Data



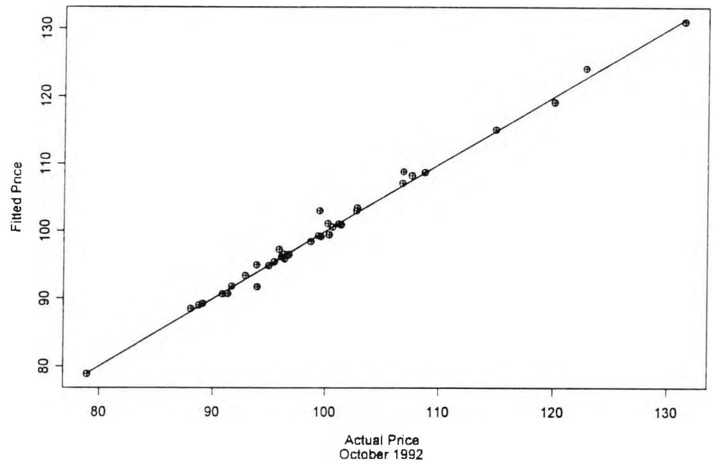
Outlier Bond Price Identification from Step-wise Spot Rate Data



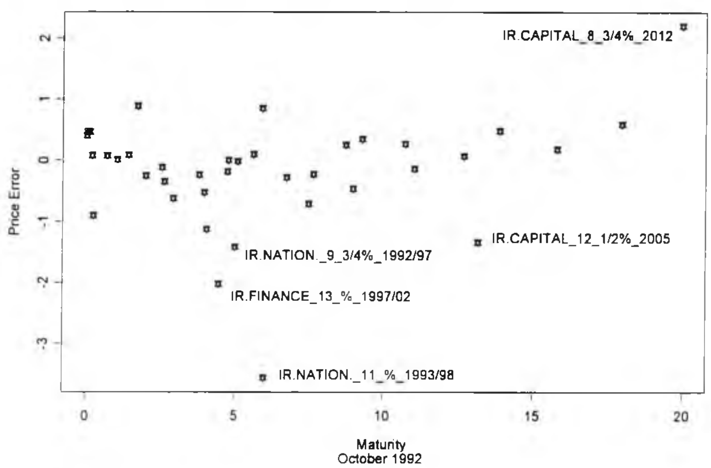
Initial Yield Function fitted to All Yields



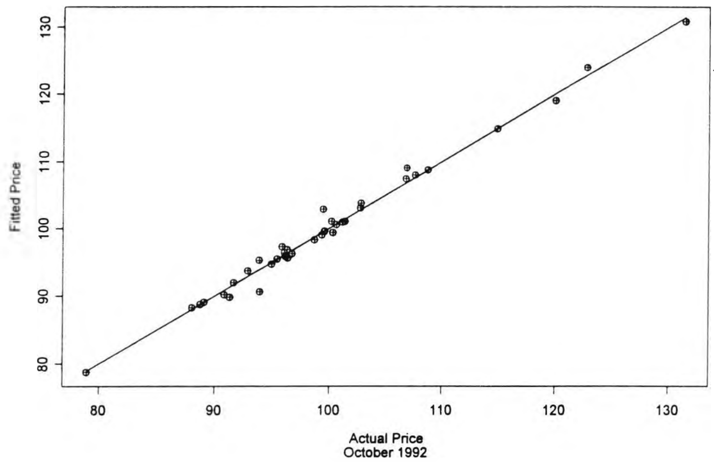
Fitted Price v. Actual Price for Step-wise Discount Data



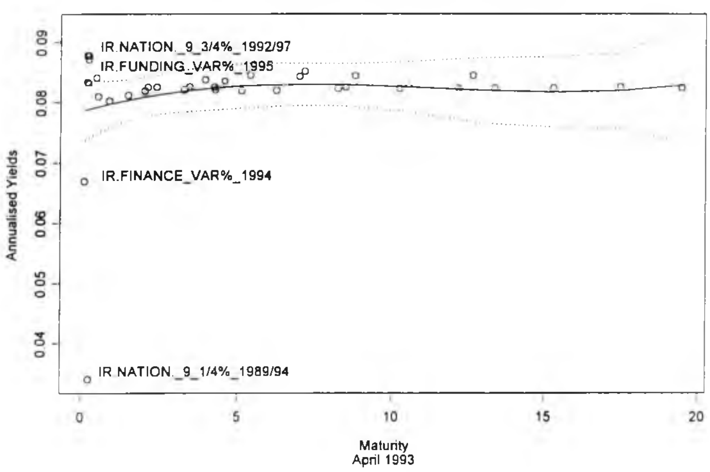
Outlier Bond Price Identification from Step-wise Discount Data



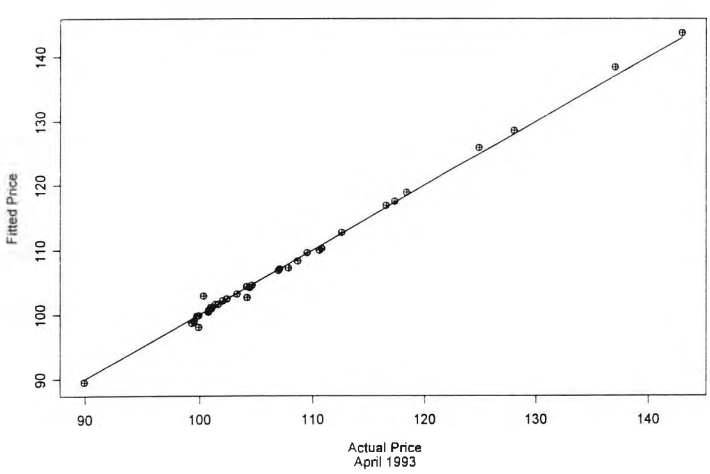
Fitted Price v. Actual Price for Step-wise Spot Rate Data



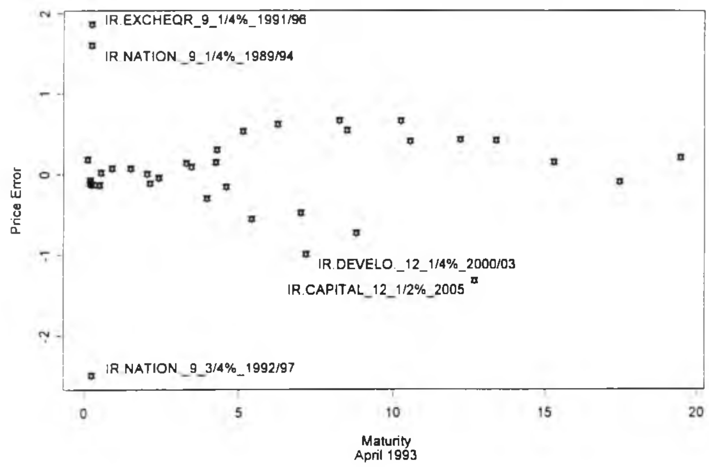
Initial Yield Function fitted to All Yields



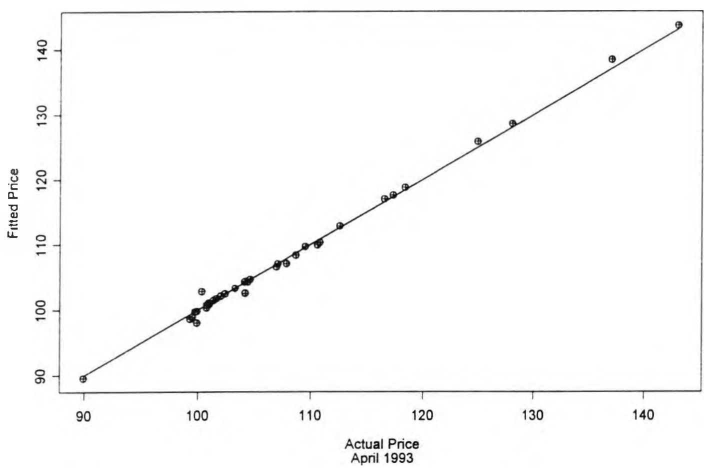
Fitted Price v. Actual Price for Step-wise Discount Data



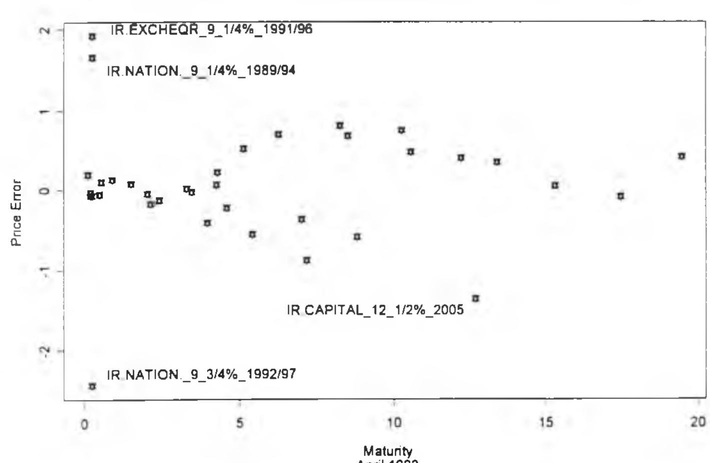
Outlier Bond Price Identification from Step-wise Discount Data



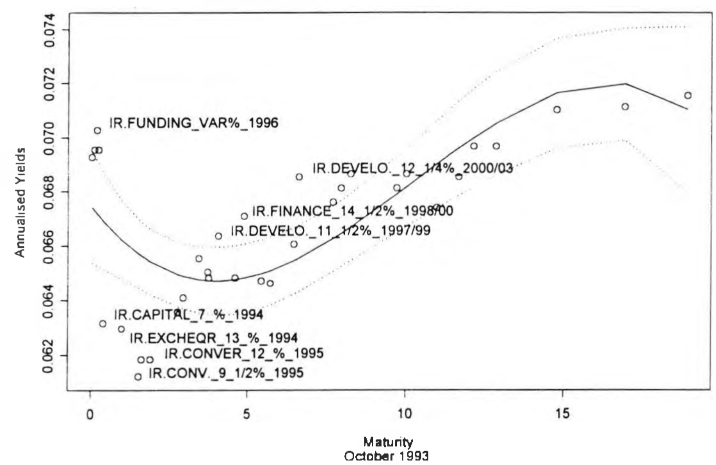
Fitted Price v. Actual Price for Step-wise Spot Rate Data



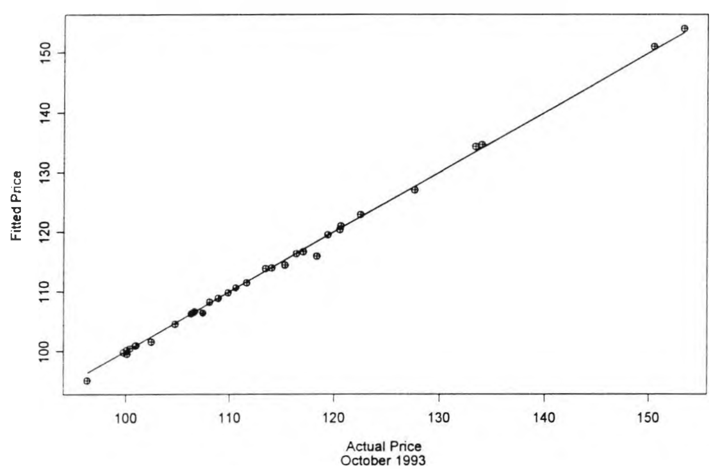
Outlier Bond Price Identification from Step-wise Spot Rate Data



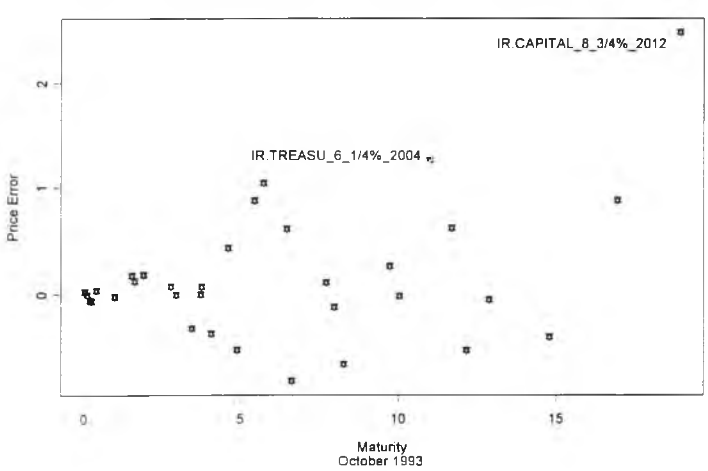
Initial Yield Function fitted to All Yields

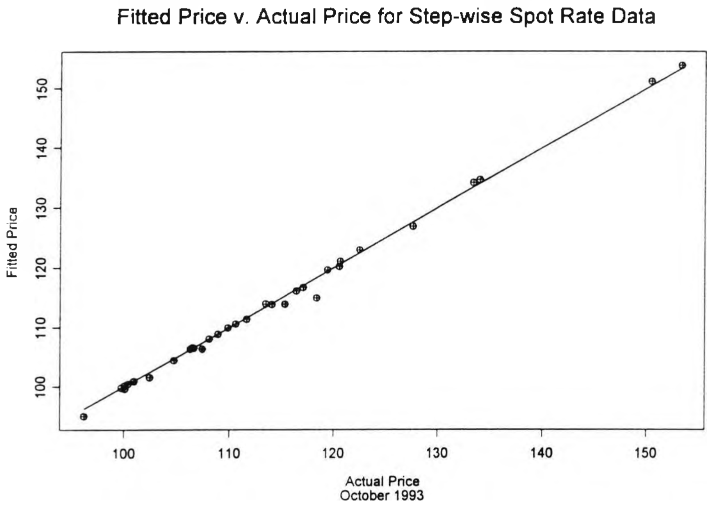


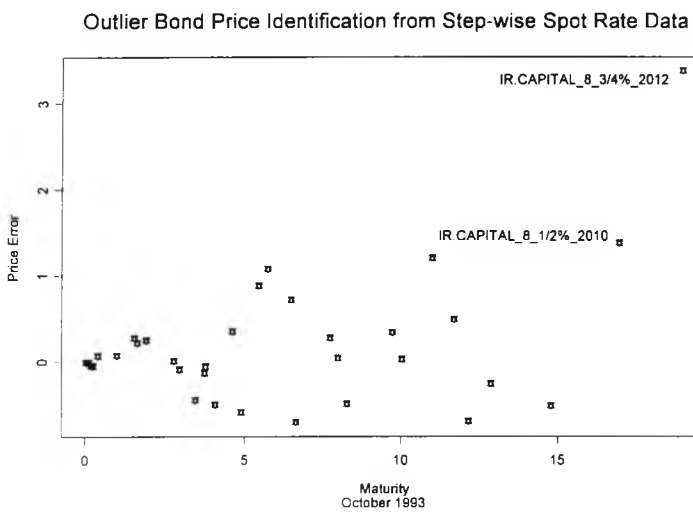
Fitted Price v. Actual Price for Step-wise Discount Data



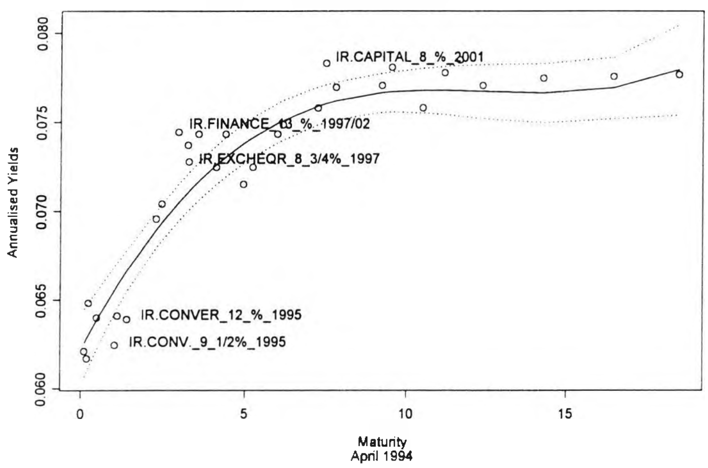
Outlier Bond Price Identification from Step-wise Discount Data



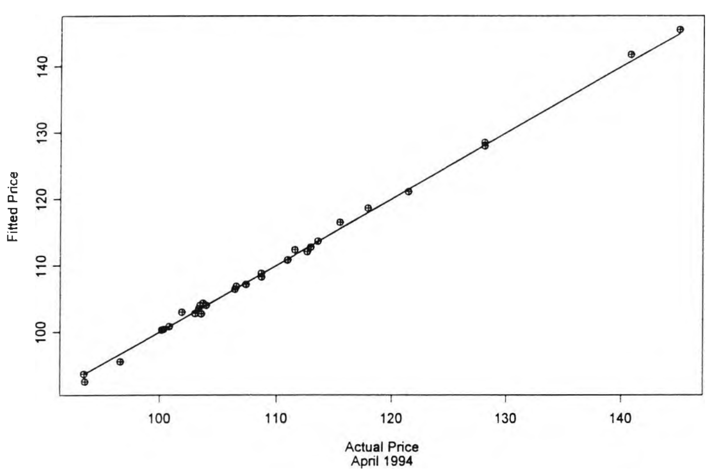

Fitted Price v. Actual Price for Step-wise Spot Rate Data
Fitted Price
Actual Price
October 1993
100
110
120
130
140
150


Outlier Bond Price Identification from Step-wise Spot Rate Data
IR.CAPITAL_8_3/4%_2012
IR.CAPITAL_8_1/2%_2010
Price Error
Maturity
October 1993
0
5
10
15

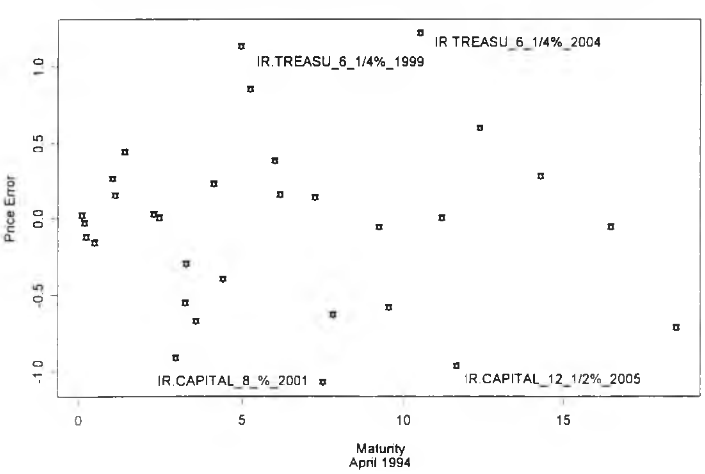
Initial Yield Function fitted to All Yields



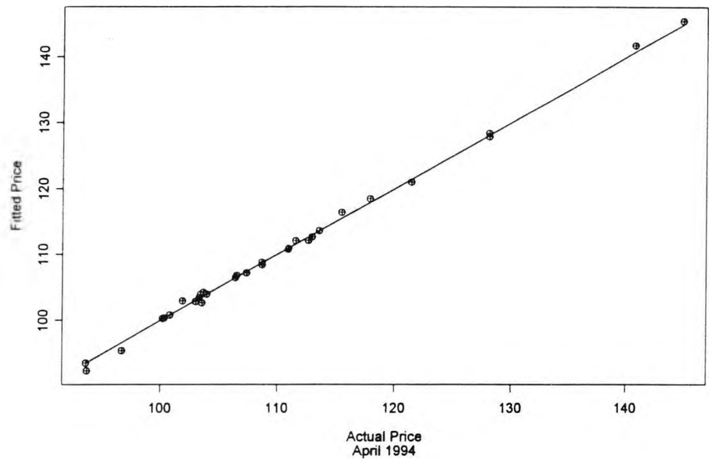
Fitted Price v. Actual Price for Step-wise Discount Data



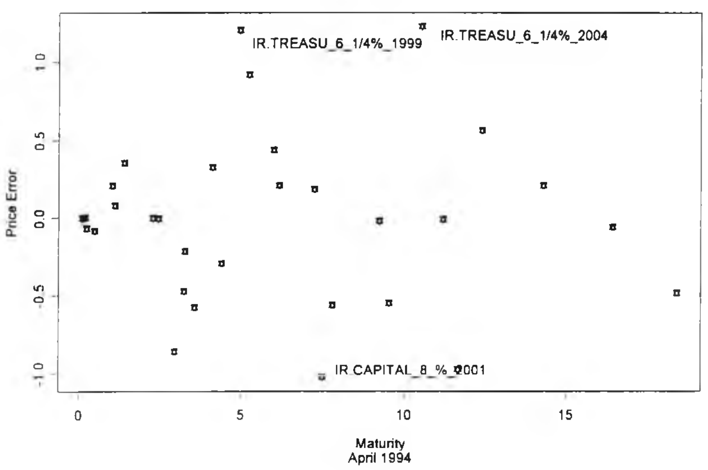
Outlier Bond Price Identification from Step-wise Discount Data



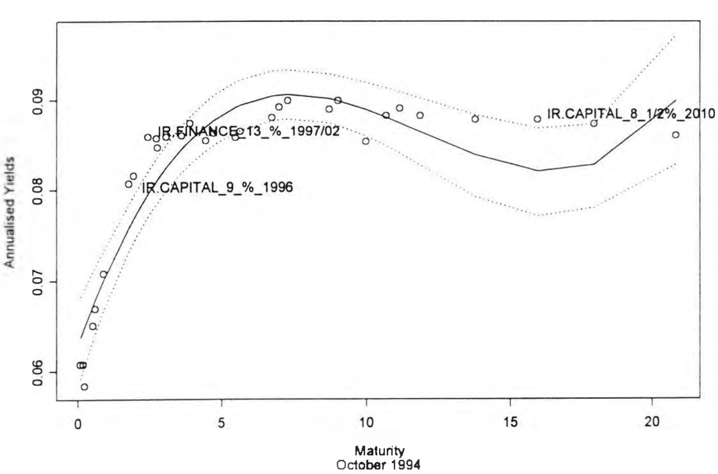
Fitted Price v. Actual Price for Step-wise Spot Rate Data

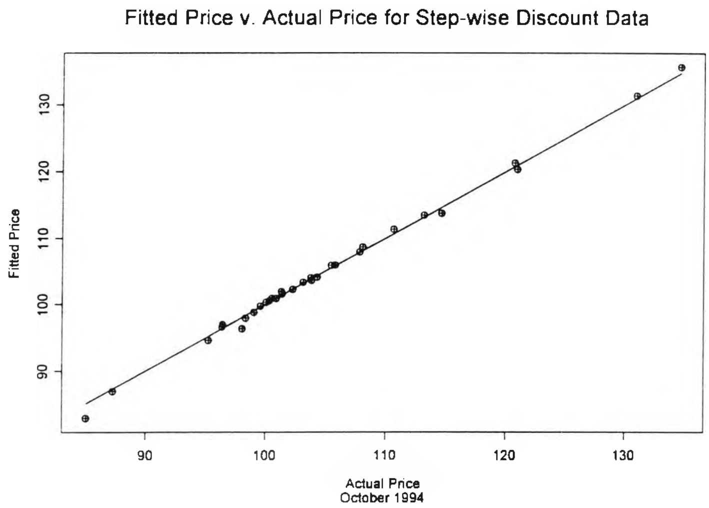


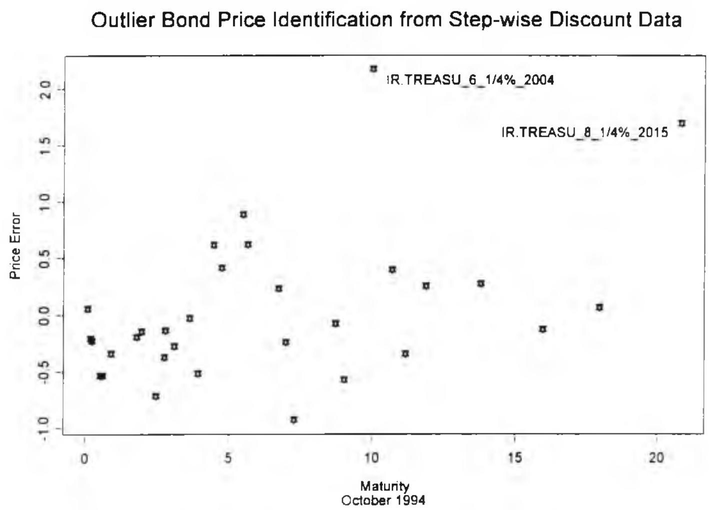
Outlier Bond Price Identification from Step-wise Spot Rate Data



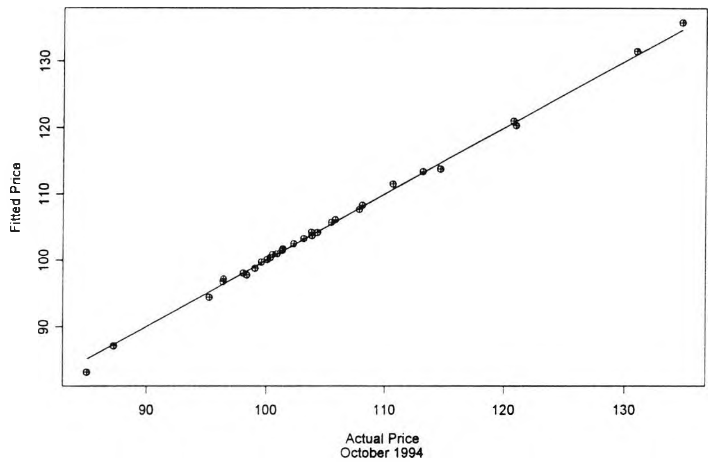
Initial Yield Function fitted to All Yields



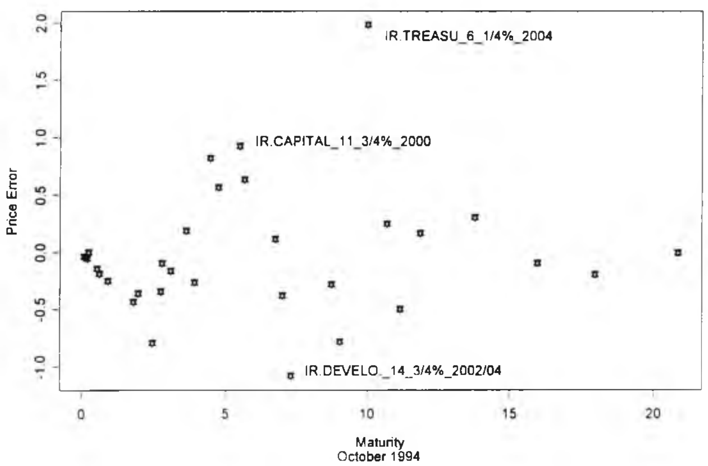

Fitted Price v. Actual Price for Step-wise Discount Data
Fitted Price
Actual Price
October 1994
90
100
110
120
130


Outlier Bond Price Identification from Step-wise Discount Data
IR.TREASU_6_1/4%_2004
IR.TREASU_8_1/4%_2015
Price Error
Maturity
October 1994
-1.0
-0.5
0.0
0.5
1.0
1.5
2.0
0
5
10
15
20

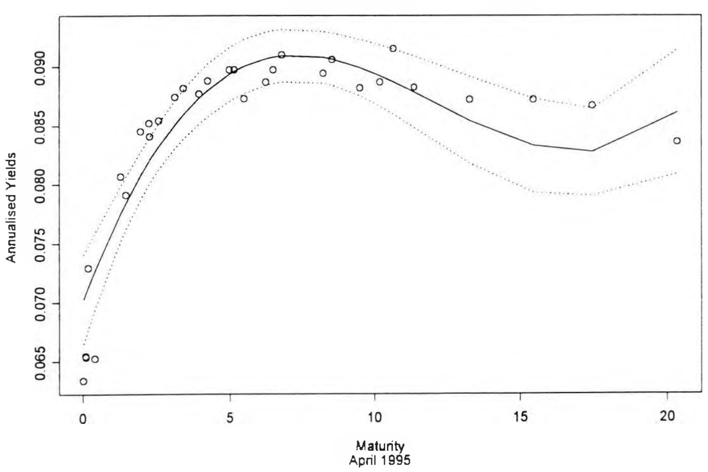
Fitted Price v. Actual Price for Step-wise Spot Rate Data



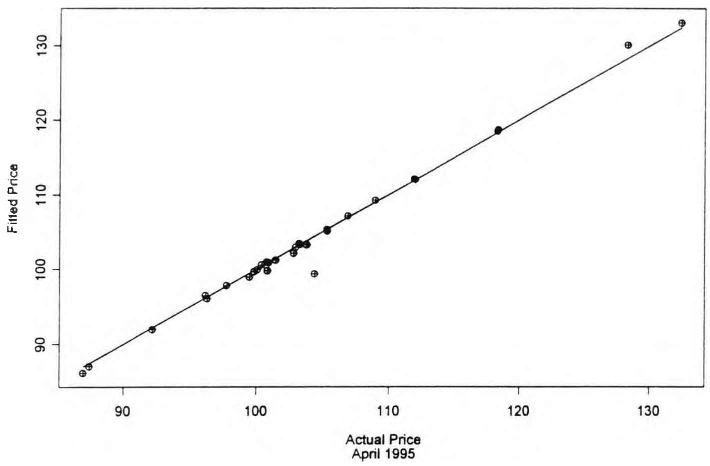
Outlier Bond Price Identification from Step-wise Spot Rate Data



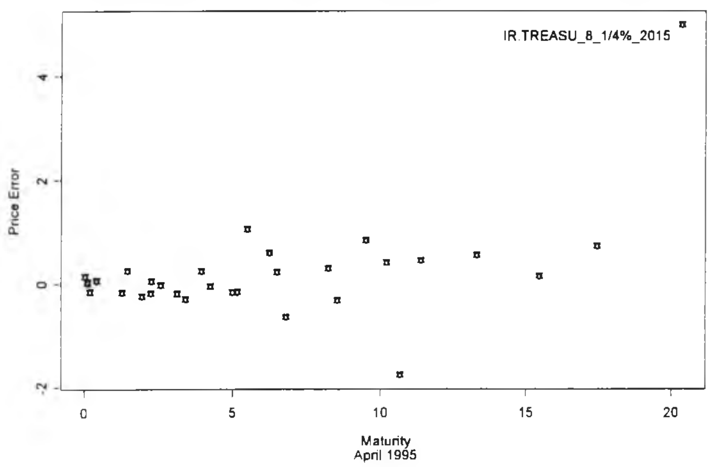
Initial Yield Function fitted to All Yields

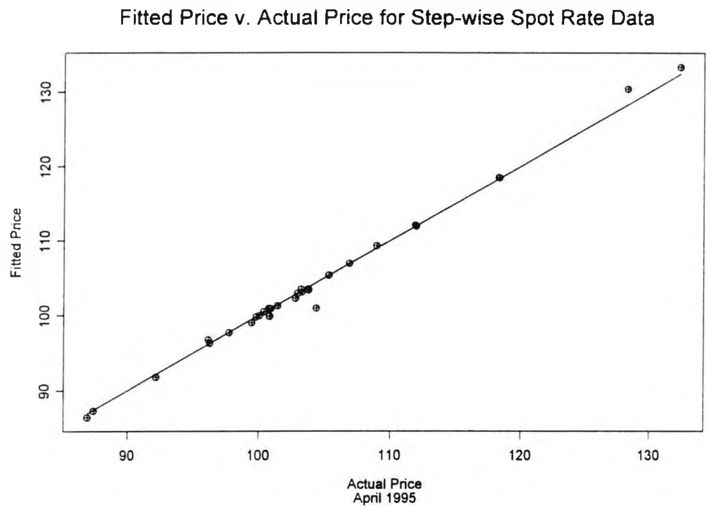


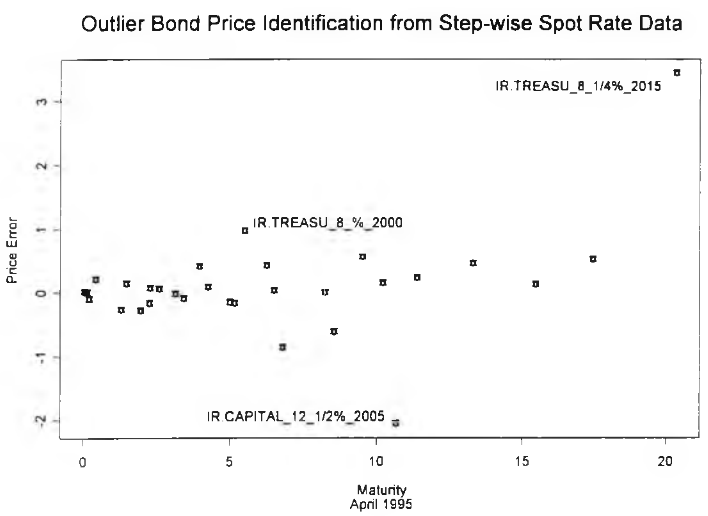
Fitted Price v. Actual Price for Step-wise Discount Data

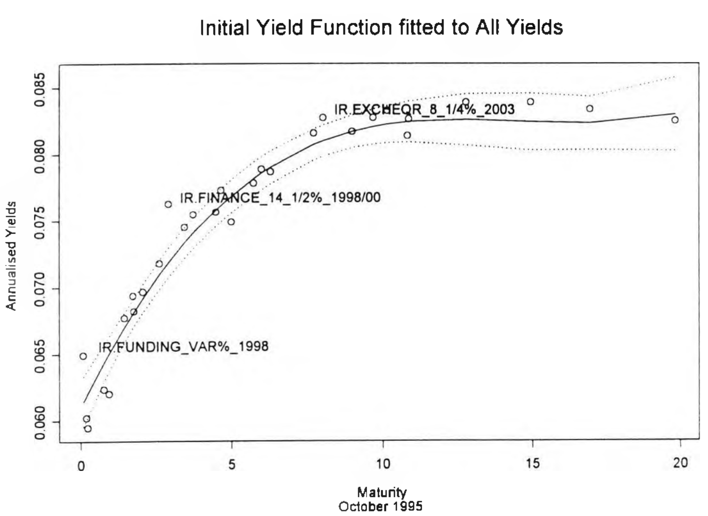


Outlier Bond Price Identification from Step-wise Discount Data

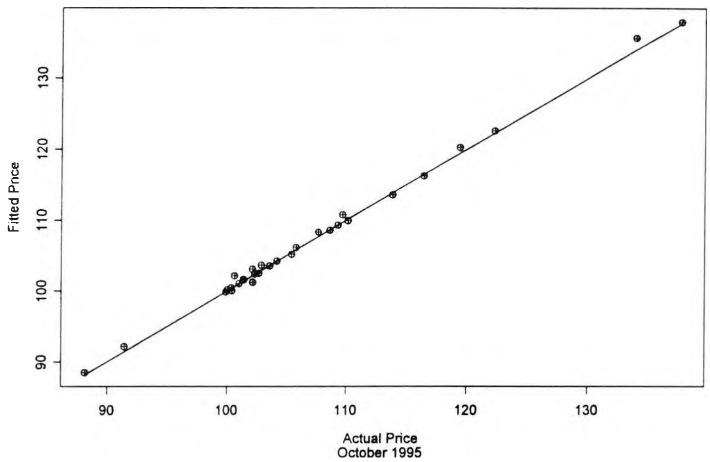



Fitted Price v. Actual Price for Step-wise Spot Rate Data
Fitted Price
90
100
110
120
130
Actual Price
April 1995

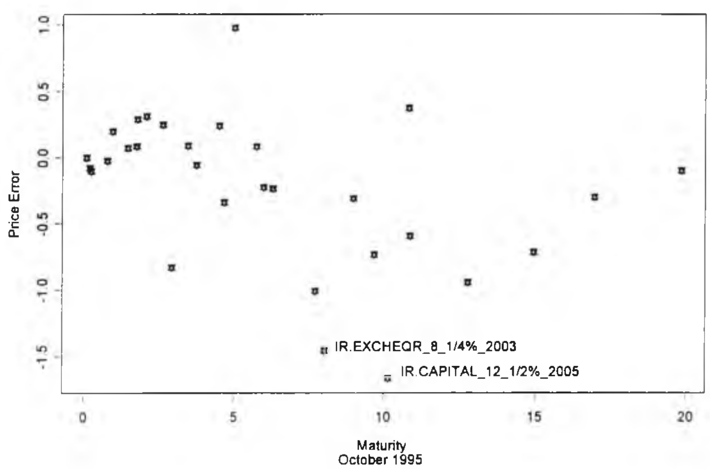

Outlier Bond Price Identification from Step-wise Spot Rate Data
IR.TREASU_8_1/4%_2015
IR.TREASU_8_%_2000
IR.CAPITAL_12_1/2%_2005
Price Error
-2
-1
0
1
2
3
0
5
10
15
20
Maturity
April 1995


Initial Yield Function fitted to All Yields
IR.EXCHEQR_8_1/4%_2003
IR.FINANCE_14_1/2%_1998/00
IR.FUNDING_VAR%_1998
Annualised Yields
0.060
0.065
0.070
0.075
0.080
0.085
0
5
10
15
20
Maturity
October 1995

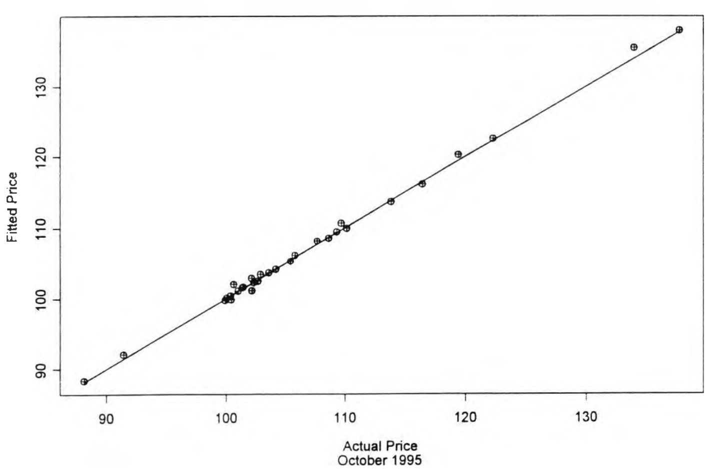
Fitted Price v. Actual Price for Step-wise Discount Data



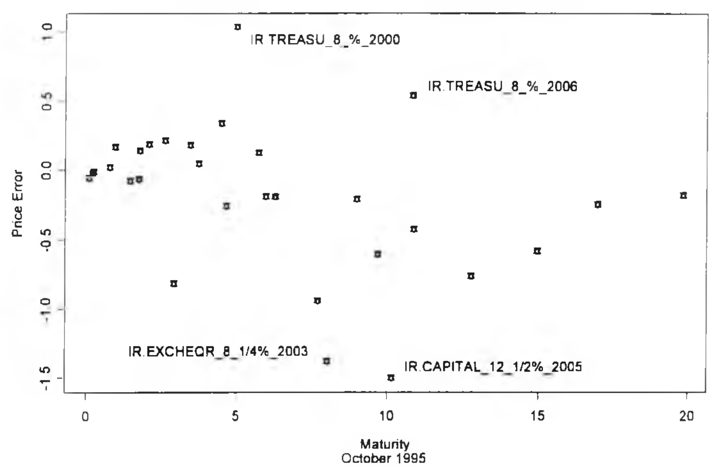
Outlier Bond Price Identification from Step-wise Discount Data



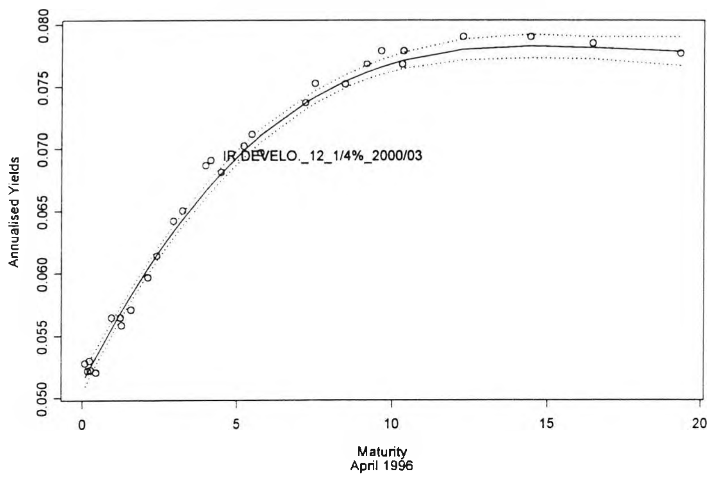
Fitted Price v. Actual Price for Step-wise Spot Rate Data



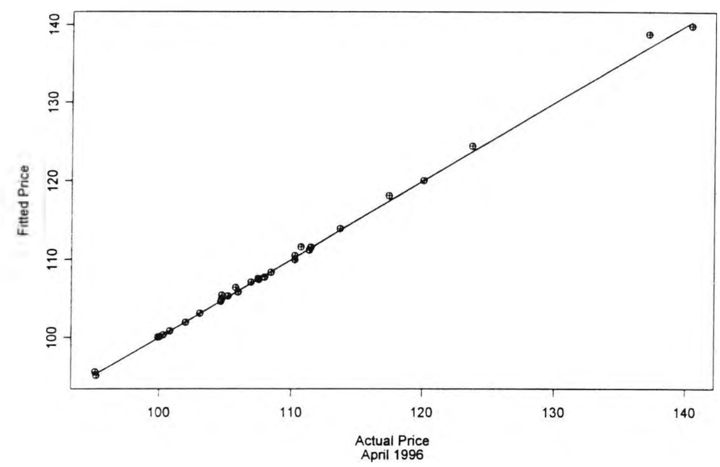
Outlier Bond Price Identification from Step-wise Spot Rate Data



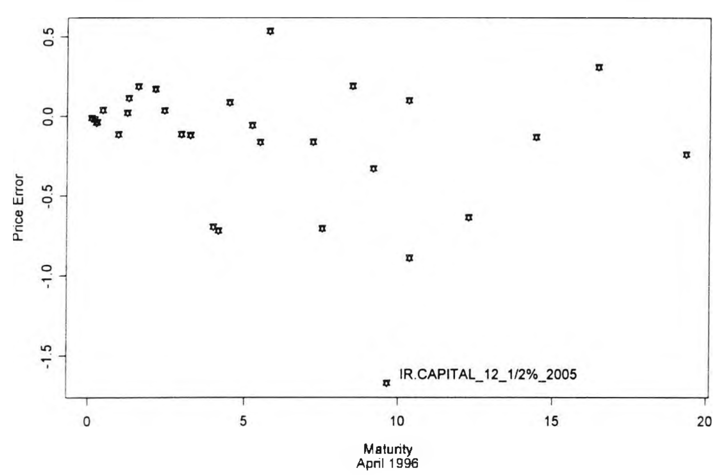
Initial Yield Function fitted to All Yields



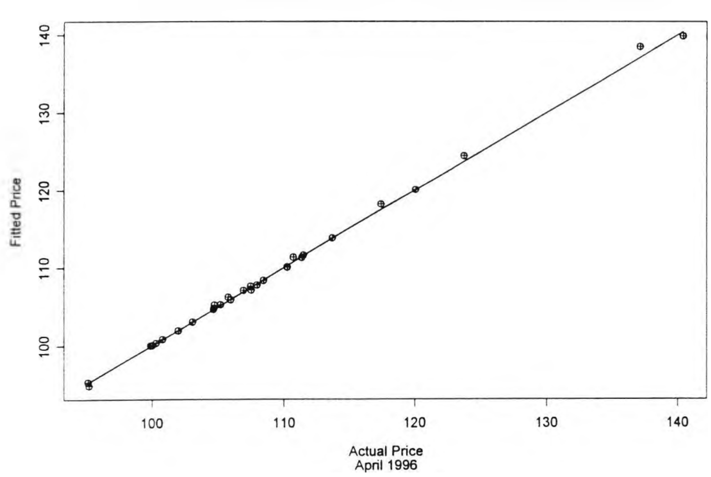
Fitted Price v. Actual Price for Step-wise Discount Data



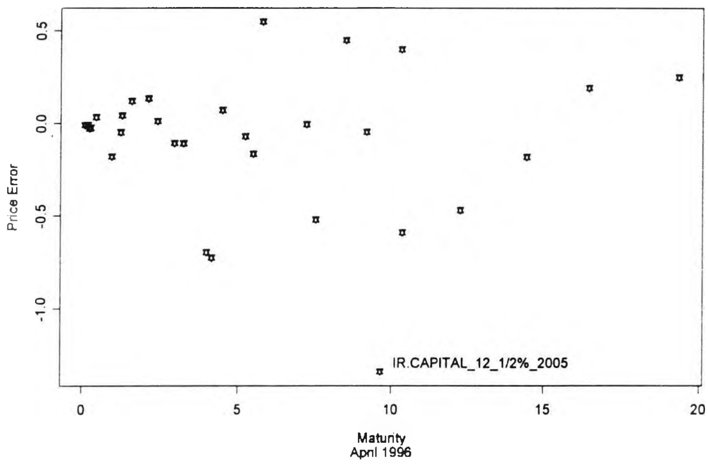
Outlier Bond Price Identification from Step-wise Discount Data



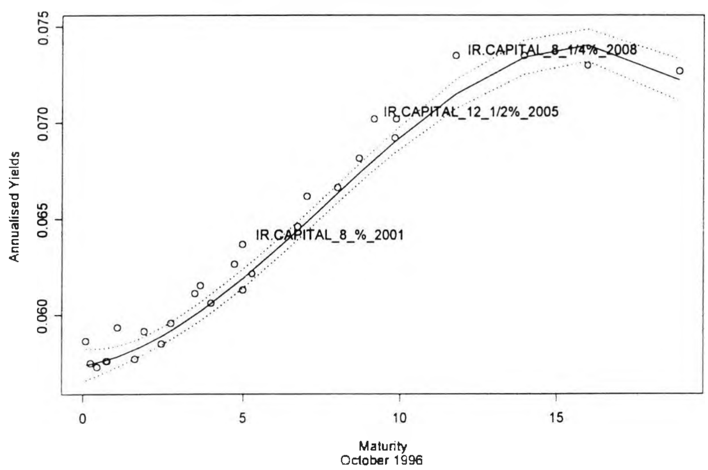
Fitted Price v. Actual Price for Step-wise Spot Rate Data



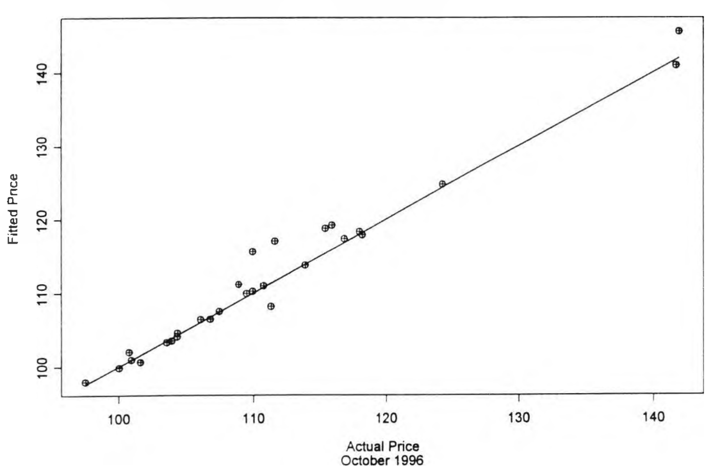
Outlier Bond Price Identification from Step-wise Spot Rate Data



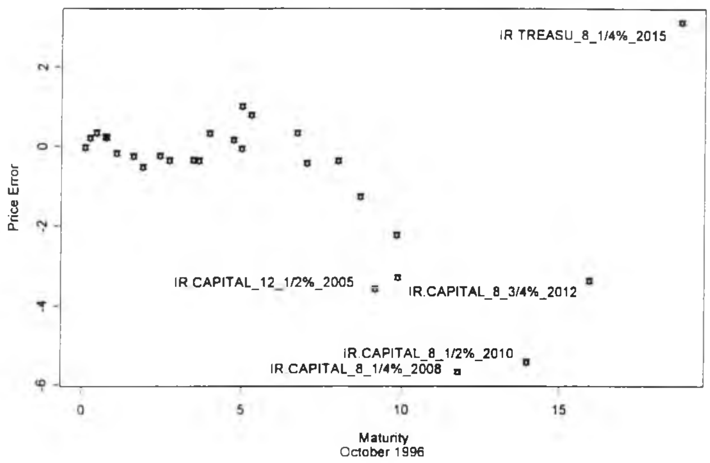
Initial Yield Function fitted to All Yields



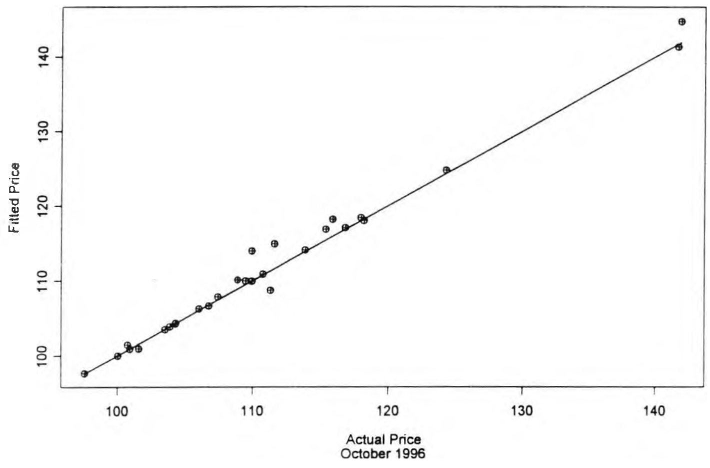
Fitted Price v. Actual Price for Step-wise Discount Data



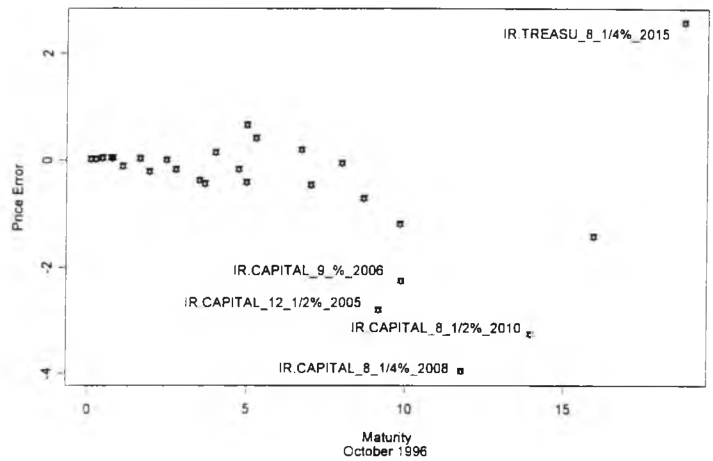
Outlier Bond Price Identification from Step-wise Discount Data



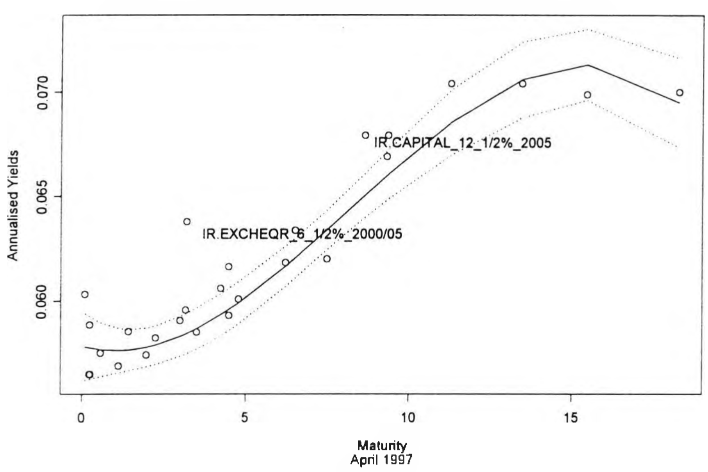
Fitted Price v. Actual Price for Step-wise Spot Rate Data



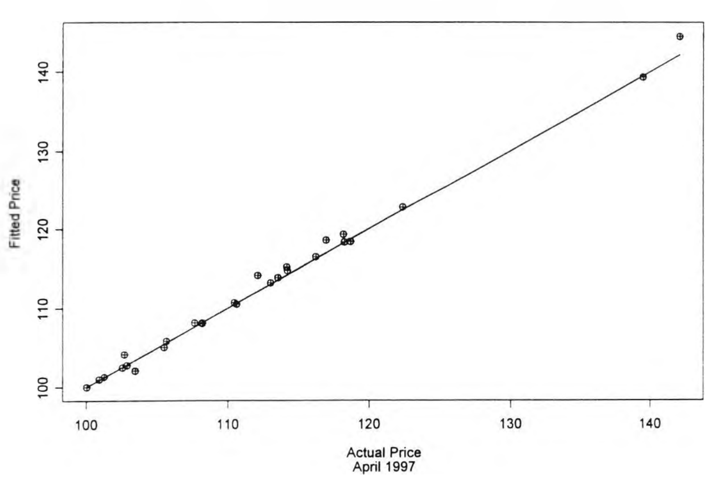
Outlier Bond Price Identification from Step-wise Spot Rate Data



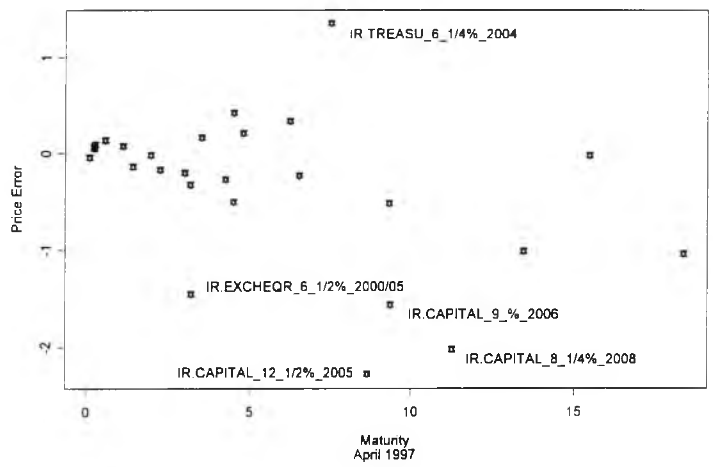
Initial Yield Function fitted to All Yields



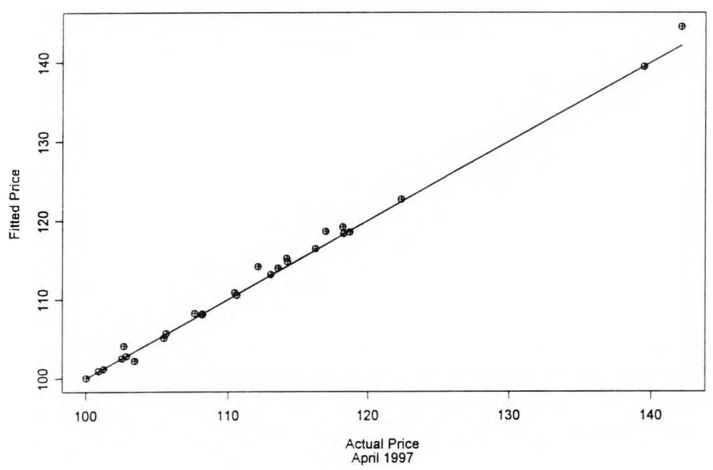
Fitted Price v. Actual Price for Step-wise Discount Data



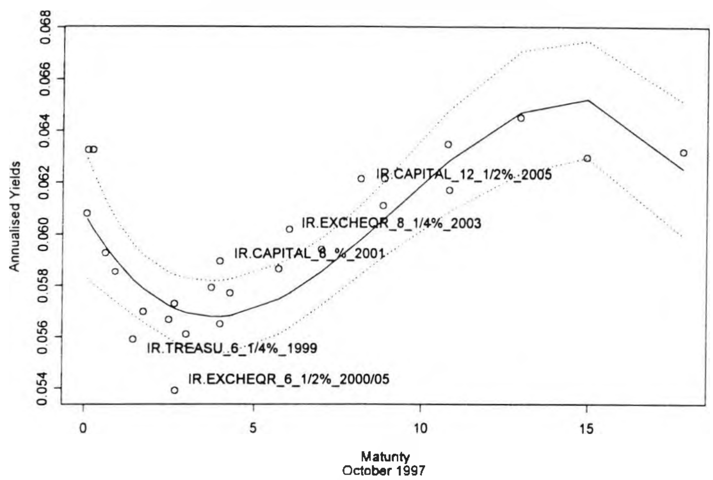
Outlier Bond Price Identification from Step-wise Discount Data



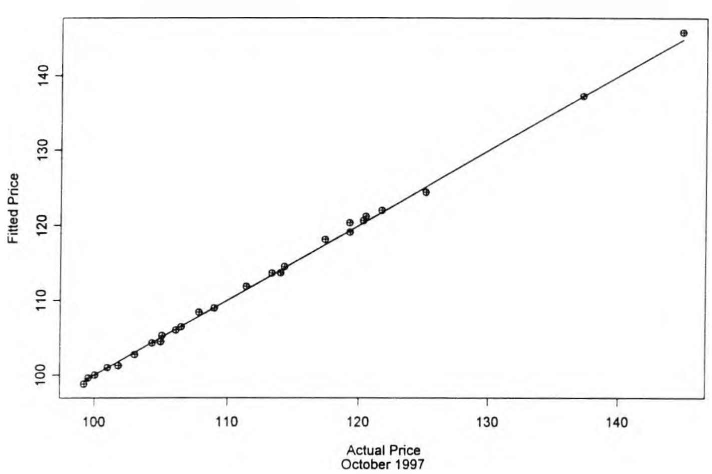
Fitted Price v. Actual Price for Step-wise Spot Rate Data



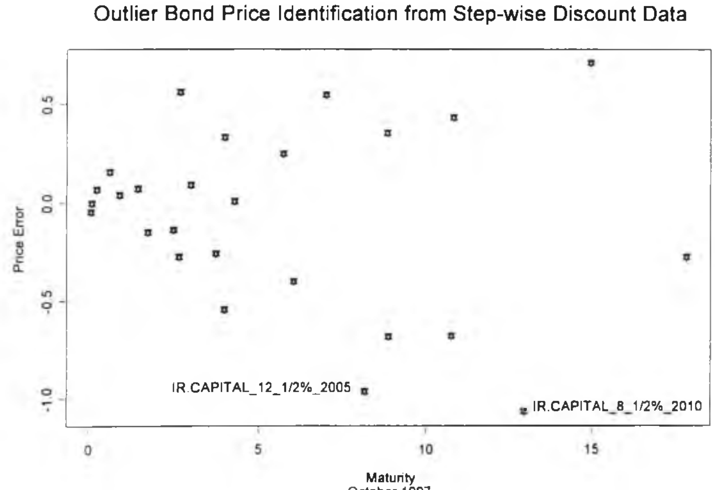
Initial Yield Function fitted to All Yields



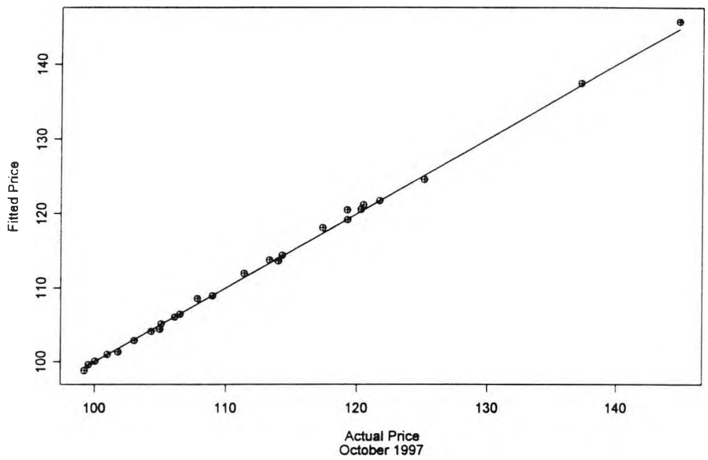
Fitted Price v. Actual Price for Step-wise Discount Data



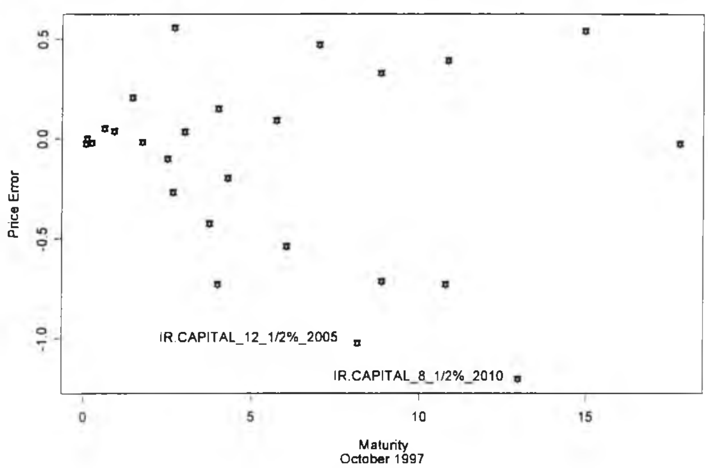
Outlier Bond Price Identification from Step-wise Discount Data



Fitted Price v. Actual Price for Step-wise Spot Rate Data



Outlier Bond Price Identification from Step-wise Spot Rate Data



Appendix 4

Parameters of Stochastic Models for Bond Prices

A.4.1 Distribution of Spot Rates & their Changes

From exhibit A.4.1, a similar decline in the long spot rate from a high of over 20% in 1981 to a low of just under 8% in 1997 can be seen.

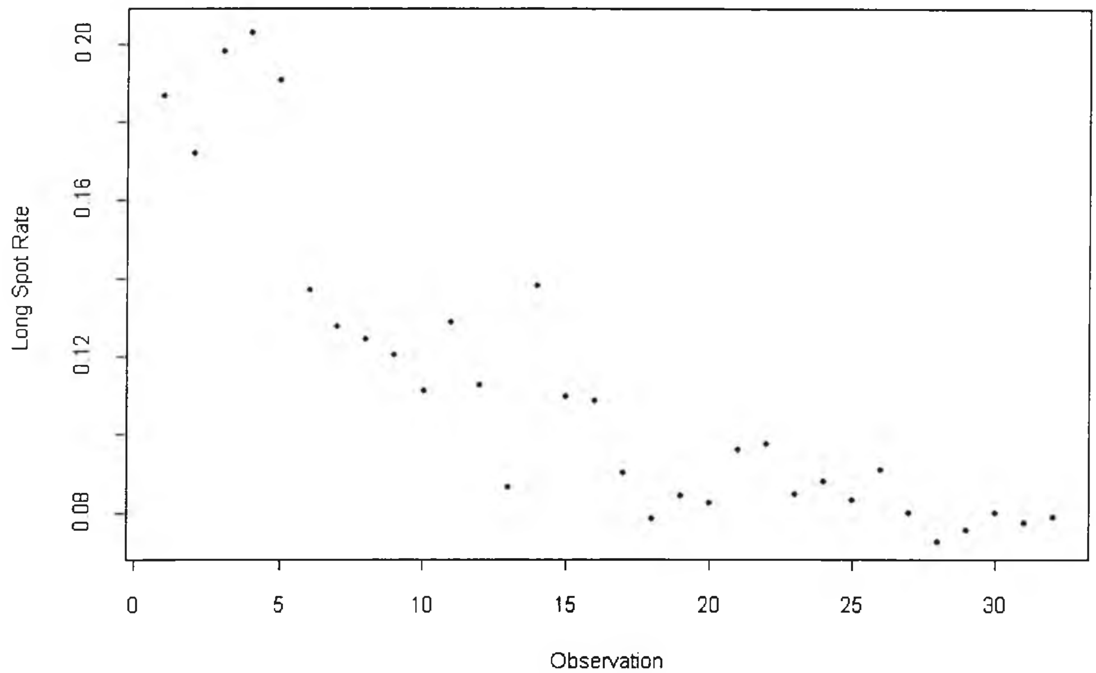


Exhibit A.4.1 Long Irish Spot Rates - 1980 to 1997

Source: Empirical

Then the statistical distribution which best fits the long spot rate time series from 1980 to 1997 is an Erlang distribution with the parameter estimates being ξ of 8.99 and β of 0.0119 shown in A.4.2;

$$f(l) = \frac{\beta^{-\xi} l^{\xi-1} e^{-l/\beta}}{\Gamma(\xi)} \qquad \text{(A.4.2)}$$

For the statistical distribution which best fits the spread spot rate time series from 1980 to 1997, by using Kolmogorov-Smirnov test the normal distribution is the closest fitting the data with the parameter estimates being μ of 0.00656 and σ of 0.0169 shown in A.4.3;

$$f(s) = \frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{(s-\mu)^2}{2\sigma^2}} \qquad \text{(A.4.3)}$$

From exhibit A.4.2, the term structure is normally shaped for 69% of the sample period and inverted for 31% of the time.

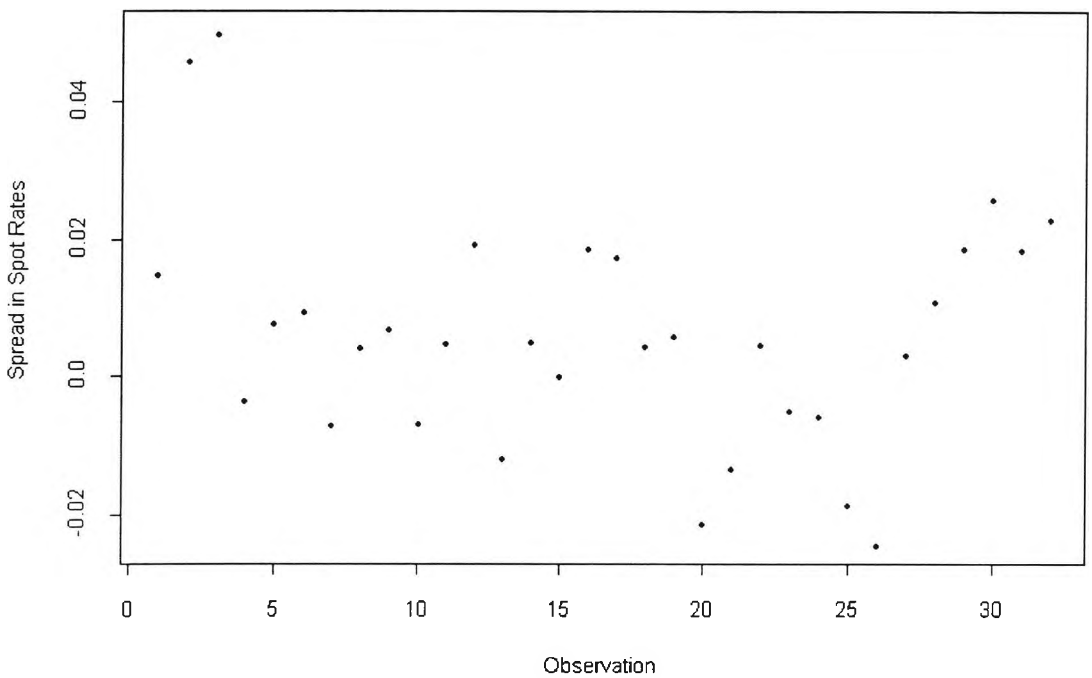


Exhibit A.4.2 Spread between Long and Short Irish Spot Rates - 1980 to 1997

Source: Empirical

The statistical distribution which best fits the changes in short spot rates time series from 1980 to 1997 is a normal distribution with the parameter estimates being μ of -0.00373 and σ of 0.0119 shown in A.4.3;

$$f(\Delta r) = \frac{1}{\sqrt{2\pi\sigma^2}} e^{-\frac{(\Delta r - \mu)^2}{2\sigma^2}} \quad \text{(A.4.3)}$$

In exhibit A.4.3, the autocorrelation of the changes in short spot rates time series is investigated and the hypothesis of autocorrelation is rejected.

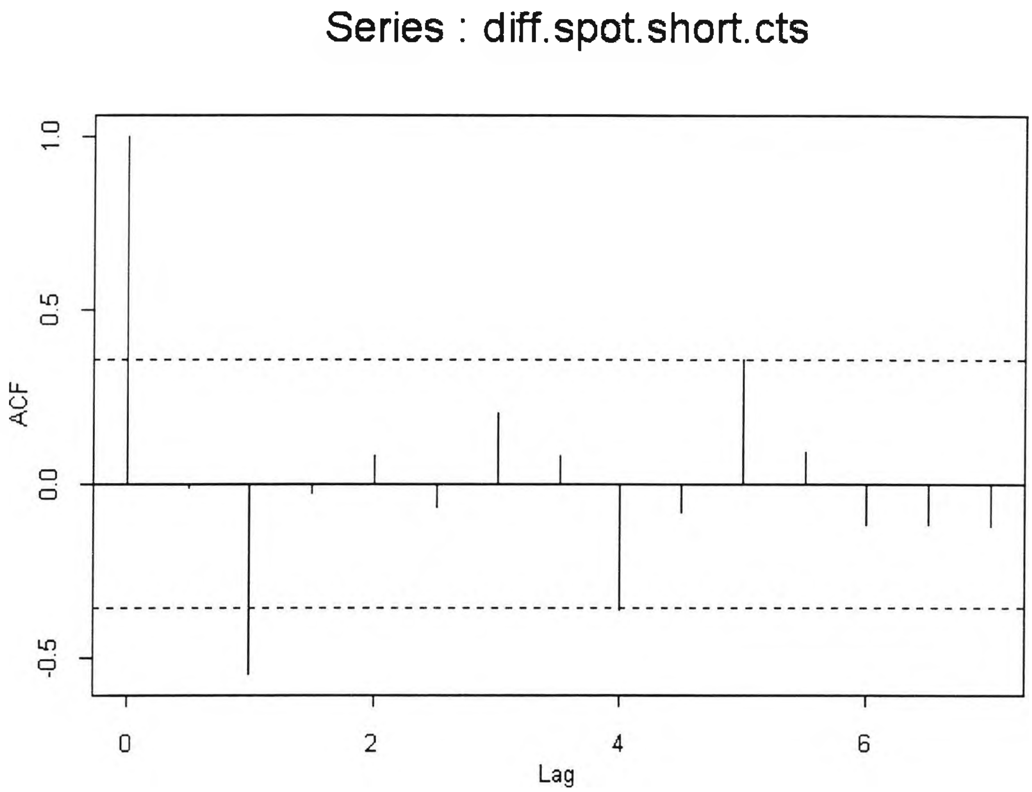


Exhibit A.4.3 Autocorrelation of Short Irish Spot Rates - 1980 to 1997

Then the statistical distribution which best fits the change in long spot rates time series from 1980 to 1997 is a Log-normal distribution with the parameter estimates being μ of -2.99 and σ of 0.32 and shifted by -0.0538 shown in A.4.4;

$$f(\Delta l) = \frac{1}{\Delta l\sqrt{2\pi\sigma^2}} e^{-\frac{(\ln(\Delta l) - \mu)^2}{2\sigma^2}} \quad \text{(A.4.4)}$$

For the statistical distribution which best fits the change in spread spot rates time series from 1980 to 1997, the Weibull distribution is identified to be the closest to the empirical data with the parameter estimates being μ of 4.29 and σ of 0.0603 and shifted by -0.0533 shown in A.4.5;

$$f(\Delta s) = \alpha \beta^{-\alpha} (\Delta s)^{\alpha-1} e^{-\left(\frac{\Delta s}{\beta}\right)^{\alpha}} \tag{A.4.5}$$

The estimation of the reversion of the short rate towards its six year moving mean is shown in table A.4.1.

Date	Short rate	d(Short rate)	mean	reversion
0487	13.36%	-1.40%	13.84%	0.4272
1087	11.97%	-1.14%	13.66%	0.2841
0488	10.83%	-2.74%	11.44%	0.1887
1088	8.09%	-0.19%	9.77%	0.2199
0489	7.90%	0.62%	10.56%	0.3890
1089	8.52%	2.01%	10.71%	0.2819
0490	10.53%	1.65%	10.95%	0.4004
1090	12.19%	-1.75%	10.80%	0.3556
0491	10.43%	-0.39%	10.57%	0.3809
1091	10.04%	0.12%	10.40%	0.4369
0492	10.16%	0.62%	10.33%	0.5448
1092	10.77%	3.36%	11.19%	0.3782
0493	14.14%	-5.76%	10.43%	0.7286
1093	8.37%	-1.67%	9.79%	0.6508
0494	6.71%	-0.52%	9.29%	0.5466
1094	6.19%	-0.35%	8.83%	0.4421
0495	5.84%	0.95%	9.04%	0.3838
1095	6.79%	-0.89%	8.76%	0.3366
0496	5.90%	-0.72%	8.16%	0.2698
1096	5.19%	0.63%	7.50%	0.2576
0497	5.82%	0.00%	6.93%	0.2953
1097	5.82%	0.42%	6.97%	0.2884

Table A.4.1 Discrete time equivalent of Short rate mean reversion

Source: Empirical

The estimation of the reversion of the long rate towards its six year moving mean is shown in table A.4.2.

Date	Long rate	d(Long rate)	mean	reversion
0487	14.08%	-2.88%	12.83%	0.1565
1087	11.20%	0.15%	12.70%	0.1580
0488	11.35%	-2.21%	10.13%	0.1692
1088	9.14%	-1.01%	10.27%	0.2464
0489	8.13%	0.60%	10.81%	0.3327
1089	8.74%	-0.25%	9.93%	0.2197
0490	8.49%	1.28%	10.47%	0.2600
1090	9.77%	0.51%	10.45%	0.3176
0491	10.28%	-1.36%	10.02%	0.3942
1091	8.92%	0.13%	9.92%	0.4635
0492	9.04%	-0.61%	9.67%	0.5731
1092	8.43%	1.34%	9.71%	0.6761
0493	9.77%	-1.58%	9.61%	0.6134
1093	8.19%	-0.43%	8.88%	0.5619
0494	7.75%	-0.02%	8.75%	0.5168
1094	7.74%	0.87%	8.73%	0.7801
0495	8.61%	0.00%	8.73%	0.7227
1095	8.61%	-0.20%	8.78%	0.6795
0496	8.42%	-0.42%	8.68%	0.6323
1096	8.00%	-0.11%	8.64%	0.5815
0497	7.89%	-0.78%	8.24%	0.4411
1097	7.11%	-0.73%	7.83%	0.4236

Table A.4.2 Discrete time equivalent of Long rate mean reversion

Source: Empirical

Appendix 5

Microstructure Background

In this appendix the structure and instruments of the main bond markets that compete with the Irish government bond market for international portfolio asset allocations are examined. The foreign markets where the Irish government raised funds are identified.

A.5.1 Germany

With an outstanding volume of more than Dm 2200bn at the end of 1991, the German bond market is one of Europe's largest. The government bond market, in particular, is given a strong boost following the economic and monetary union of the two German states in July 1990, and the subsequent unification in October 1990. In the wake of unification, new issuers came to the German capital market. These included Staatsbank, the German Unity Fund, Deutsche Reichsbahn and Treuhandanstalt.

The market comprises a wide range of investment instruments, with domestic bearer bonds playing the most important role and accounting for approximately 62 per cent of bonds outstanding. Ireland has been a regular issuer on the German capital market for over twenty years. In 1991, the National Treasury Management Agency (NTMA) tapped the "Schuldschein" market three times, raising funds totalling DM250 million. In 1992, extensive relationships continued to be developed in Germany, particularly with mortgage banks. This meant that the NTMA could tap the Schuldschein market both at short notice and for large volumes, including a single transaction of DM500 million. After the currency crisis had passed, the first public bond issue by the NTMA is in the Deutsche Mark market. The issue is for DM300 million, subsequently increased to DM500 million, with a maturity of 10 years.

In March 1993, the NTMA arranged a public bond issue of DM1,500 million which is Ireland's largest ever single issue in a foreign currency. Although not the largest issue in Deutsche Marks in 1993, it reflected the trend towards larger issues which has become evident in the major capital markets for reasons of liquidity and investor impact.

A.5.2 France

The French Government Bond market has undergone a huge transformation since the 1980's, particularly since 1986, when the Treasury pursued an attractive issuing policy for the international investor. Three milestones can be identified over the last decade: In 1982, the tax on bond transactions in the stock exchange is abolished. In 1986, the French Treasury began a regular competitive bidding auction plan for Treasury bills and bonds, with the first Treasury swap auction being done in 1987. A futures market opened in 1986 and met with swift success.

Treasury auction procedures operate through open competitive bidding. In November 1986, the decision to set up a group of primary dealers in government securities (SVT) is made and in February 1987 the Treasury officially chose 13 institutions. They are required to ;

1. Ensure all auctions run smoothly by assessing global market demand,
2. Maintain the liquidity of the government securities market,
3. Inform Treasury of market developments regularly.

The Treasury issues three categories of standardised debt; OATs which are Treasury bonds issued in order for the government to raise long term funds, BTAN's are Treasury bonds issued by the government to raise medium term debt with a maturity date of between 2 and 5 tears and BTFs are notes with a maturity of up to one year and are used by the government for short term financing.

A.5.3 United Kingdom

The UK government uses the gilt market as its major source of borrowing, as well as tapping retail investors via National Savings bonds. Gilts account for 60 per cent of the national debt. The first reform of the market occurred after the Big Bang in 1986, which primarily opened up the equity market but also led to some important improvements in the gilt market.

UK government securities are issued by the Treasury via the Bank of England. There are five issuing methods used:

1. Straight to the bank,
2. To the National Debt Commission,
3. To tender when the Bank invites bids for the stock,
4. By auction,
5. By Tap.

The government issues six types of bonds; Conventional gilts, Index-Linked Stocks, Optional Redemption gilts, Convertible gilts, Undated issues and Floating Rate Notes. Liquidity in the gilt market is managed by a system of gilt edged market makers otherwise known as GEMMs. GEMMs act as primary dealers in the market, and quote firm bid and offer prices at all times. They are able to trade stock positions acquired through market making, as they have access to Inter-dealer brokers.

In 1993, Ireland raised one bilateral loan of STG£73 million is contracted at a margin of 19 basis points below inter bank rates and with a maturity of 9 years. In May of the same year a four year EMTN (Euro Medium Term Note) of STG£10 million is issued at inter bank rates less 30 basis points. They have just introduced a REPO[1] market and plan to develop a strips market next year.

[1] Repos are best understood as short term collateralised loans. Treasury securities are the collateral. A repo transaction occurs when an investor lends money to a dealer and takes securities. A reverse repo is a transaction in which an investor lends securities to a dealer and borrows money.

A.5.4 Background to Capital Adequacy Requirement

The following variables are analysed to identify the market makers capital ;

- Source and type of price and/or yield data
- Time period from which data is drawn
- Exposed to risk time period
- Number of maturity bands
- Identification of loss distribution
- Bonds in which obligated to make a price
- Normal market liquidity, size and turnover
- Source and cost of debt funding
- Level of ruin barriers
- Number of Monte Carlo or Latin Hypercube simulations
- Treatment of non symmetrical loss distribution
- Risk Type I Capital Requirements
- Estimation of inter maturity hedging & relationships
- List of acceptable instruments for hedging purposes
- Risk Type II Capital Requirements
- Model for yield curve estimation
- Combination of sector & off the run exposures
- Risk Type III Capital Requirements
- Overall Master Model Approach for all Capital requirements
- Total cost of capital requirements
- Any special requirements for auction bids (i.e. taps, tranche, first or second price)

A.5.9.2 Riada Actuaries Indices and Bank of England GEMMS

The second source of data is Riada's REDS system which stretches from 1979 to date and the fixed income indices are calculated on a simple weighted capital basis, as per the Financial Times - Institute of Actuaries formulae and used primary and secondary market prices. Data covering the period of the 1st January 1990 to the 5th July 1993 inclusive is used. In assembling the data, the following assumptions are made; period of risk exposure is three days, funding cost is overnight DIBOR (i.e. Dublin Interbank Offered Rate), normal market liquidity, indices calculated on FT-Actuaries basis by Riada's and all returns are gross. As a direct result of the currency crisis, the short end of the yield curve is very volatile and consequently the proposed capital requirements in this area are quite high relative to the Bank of England model.

This three day time horizon is predominately influenced by the required reaction time as a regulator to a problem that may arise in a market makers position. The returns are calculated from a long or short position and the first four moments of the data are calculated in order that the loss distribution may be identified. Since the focus is short term movements, over a short time scale, i.e. market makers being subject to daily fluctuations in yields and remaining solvent over the year, a key decision is the most appropriate probability loss distribution. A market maker faces the very same potential loss profile as an insurance underwriter. In that regard, it must be appreciated that, if a probability distribution is not symmetrical, a different capital requirement would be needed for the same ruin barrier depending on whether the position is long or short.

In such a case, the larger of the two capital requirements which would be that for a short position is chosen since the distribution is negatively skewed. In the case of maturities, seven bands are used; one month, three months, one year, low coupon for five years, other five years, ten years and ten years plus. The risk can be calculated from the bottom up or the top down.

The standard deviation in the one month can be as volatile as the five to ten year of the yield curve. This is a direct result of the currency crisis. Over a three day holding the mean return is positive in the greater then one year area though is only about a penny. The Kurtosis is very high which means than the returns are very tightly distributed around the mean. A normal loss distribution would have the value of three. Finally, all the data displays negative skewness which implies that the mean is greater than the median. From our perspective, the implication is that the market will jump up rather than down and the risk is that the market maker is short rather than long.

Taking an assumption of normality and basing the price changes on the period of 1990 to date, the required capital requirements for Overall Open Position are set out in table A.5.1 along with the comparable Bank of England figures. Then with the appropriate ruin barrier of less than 0.000001%,viz, there is less than a million to one chance of a market maker becoming insolvent as a result of losses sustained over a one year period. The capital percentage is that of the nominal exposure, e.g. to hold £1m of the 8 3/4% Capital 2012 would require £51,000.

Maturity Band	**Capital**	**Odds of using Capital**	**B.O.E Capital**
One Month	2.30%	9,758,612,410,337 to 1	0.00%
Three Month	0.62%	8,830,587,504,648 to 1	1.00%
One Year	0.37%	5,976,907,269,238 to 1	1.50%
Low Coupon 1 to 5 Years	1.68%	7,531,103,055,804 to 1	5.00%
1 to 5 Years	2.07%	9,144,364,725,625 to 1	6.00%
5 to 10 Years	3.55%	9,908,910,071,222 to 1	7.00%
10+ Years	5.10%	4,291,185,924,126 to 1	8.00%

Table A.5.1 Risk Weights for Overall Open Position

Source: Empirical

It is envisaged that market makers would carry offsetting (or hedging) positions. This would reduce their capital requirements. Using inter maturity bands (with different volatilities) would leave them with an exposure to a non-paralleled move in the yield curve. Since all exposures would be in a nominal sense (i.e. equivalent to Bank of England approach), there would be a net volatility exposure. These problems are tackled using three approaches;

- Correlation Matrix of sectors
- Comparisons of Durations
- Regression Hedges Ratios and their Correlations

The highest correlation is 89% between 5 - 10 year area and the 10 year plus. The lowest is between the one month and the 10 year plus with a value of 17%. There are two conclusions to this analysis. Firstly, there are no negative correlations that would present the opportunity for substantially reduced capital requirements in a Markovitz Mean-Variance framework. Secondly, there seems to be a difference in behaviour between the "money" end of the yield curve and the rest of the yield curve. The latter would seem to be substantially correlated. There would be some grounds for the belief that the shorter end of the maturity spectrum displays greater yield volatility than the longer end. The last element of the analysis is to investigate how stable the maturity band's durations have been over the past three years. This is illustrated in exhibit A.5.1.

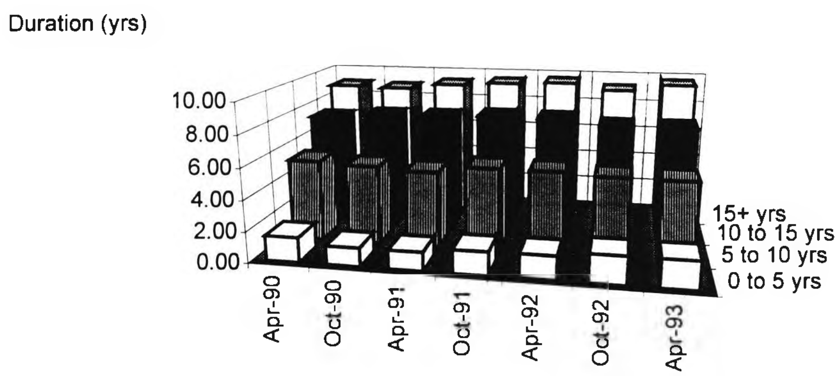


Exhibit A.5.1 Durations of Different Maturity Bands

Source: Empirical

The data from exhibit A.5.1 is shown in table A.5.2;

Band	0 to 5	5 to 10	10 to 15	15 to 25
Mean	1.53	5.25	7.64	9.28
Std.Dev.	0.25	0.15	0.18	0.29
Minimum	1.21	5.00	7.38	8.89
Maximum	1.82	5.42	7.86	9.64

Table A.5.2 Analysis of Duration for different maturity bands

Source: Empirical

From this it can be observed that the duration over the entire period did not change by more than three months in any six month period. The linear regressions are graphed in exhibit A.5.2. While the bond market shows some opportunities for cross hedging, the money market is very unstable.

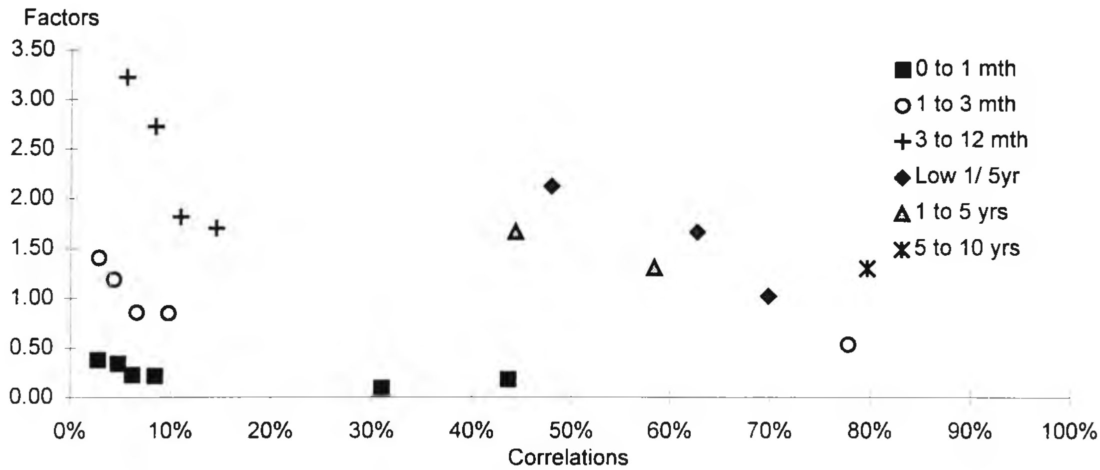


Exhibit A.5.2 Regression Inter-Maturity Hedges

Source: Empirical

A portfolio that is long the asset with greater maturity and short the asset with close maturity is constructed. The net capital requirements are set out in table A.5.3. For example, a five to ten year exposure short position and a ten year long position would require 1.50% in a risk II scenario. However, they would have required 8.66% if short and long positions could not be offsetable, and there is a substantial reduction in capital requirement of 7.16%.

Hedge Exposure	1 mth	3 mths	1yr	Low 1 / 5 yr	1 to 5 Yrs	5 to 10 Yrs
One Month						
Three Month	1.14%					
One Year	1.24%	0.20%				
Low Coupon 5 Years	1.41%	0.94%	0.93%			
1 to 5 Years	1.57%	1.17%	1.16%	0.66%		
5 to 10 Years	2.21%	2.03%	2.02%	1.42%	1.38%	
10+ Years	3.09%	2.98%	2.98%	2.44%	2.39%	1.50%

Table A.5.3 Net Capital for Exposures allowing offsetting Positions

Source: Empirical

The capital requirement for the reversed position of being long the asset with greater maturity being hedged by shorting the asset with the shorter maturity is almost symmetric. The Bank of England Requirements are set out in table A.5.4.

Hedge Exposure	1 mth	3 mths	1yr	Low 1 / 5 yr	1 to 5 Yrs	5 to 10 Yrs
One Month						
Three Month	1.00%					
One Year	1.50%	1.50%				
Low Coupon 5 Years	5.00%	5.00%	4.50%			
1 to 5 Years	6.00%	6.00%	5.50%	5.00%		
5 to 10 Years	7.00%	7.00%	6.50%	6.00%	7.00%	
10+ Years	8.00%	8.00%	7.50%	7.00%	8.50%	5.00%

Table A.5.4 Bank of England Net Capital for Exposures allowing offsetting Positions

Source: Bank of England Regulations for GEMMS

The final area is the area of inter maturity band risk which is a limited stand alone risk. An example would be if a market maker wished to hedge a short position in the 8 3/4% Capital 2012 by going long 8 1/2% Capital 2010. This is all within the maturity band of the 10+ area of the curve. There are three sources of price risk. Firstly, there are changes in the shape of the yield curve over the maturity band; secondly, movement of a particular stock closer to or further from its notional position on the benchmark yield curve and thirdly a small difference in the stock price volatilities. The main reasons for this risk are small issue size or tightly held stock by a foreigner, special estate duty privileges, dual dated or other option type features such as conversion rights. As the yield curve changes level and slope the option component of the bond with increase in value as it's option component moves from out of the money, through at the money to into the money and this will impact on the bond value. Finally, there tax effects such as small coupons for high rate tax payers high coupons for low rate tax payers. From chapter two, a cubic spline measured the type three price risk for each sector. An example is shown in exhibit A.5.3 below;

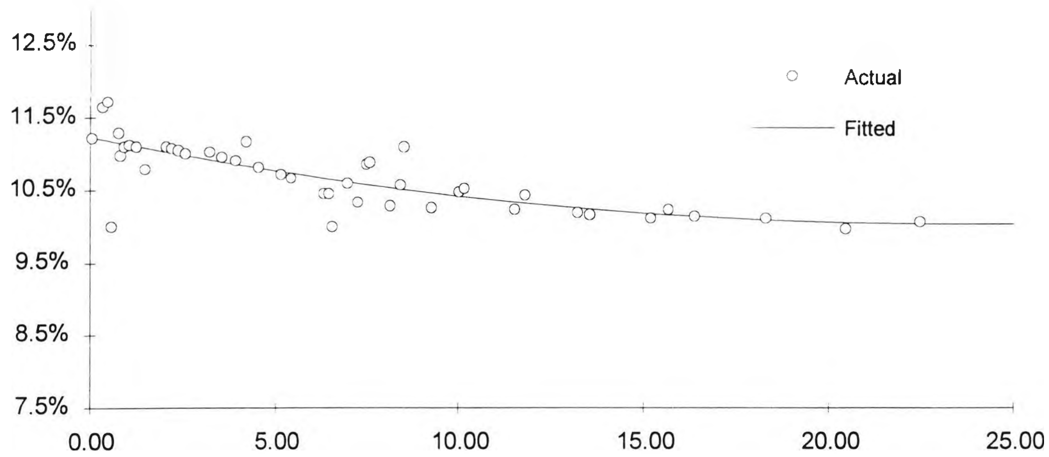


Exhibit A.5.3 April 1990 B Spline fitted to Yield Curve

Source: Empirical

These risks are shown in table A.5.5 by maturity band under the categories of "sector". The shorter maturity bands - overnight to one year - are treated in a similar manner to the 1 to 5 years sector. For the purposes of risk capital estimation these discrete risks have been treated as being 100% correlated to err on the conservative side.

Then, using the standard deviation over the period of 1990 to date and a normal distribution with a ruin barrier of 50,000 to 1, the intra maturity band capital requirement is calculated as follows;

Sector	Risk Type III Capital
Up to 5 years	1.078%
5 to 10 years	0.970%
10+ years	0.917%

Table A.5.5 Intra Maturity Band Capital

Source: Empirical

As indicated above, table A.5.3 sets out the net capital required for offsetting positions. This is the essential minimum capital required. However, the actual capital requirement may be greater than table A.5.5 indicates viz., using the Bank of England method. This method of calculating the capital required has also been computed by splitting the capital requirements derived in table A.5.6 into two elements. The first element is the amount available for hedging an offsetting position in a different maturity band and the second element is the core capital requirement. In computing the capital required for the long and short positions in a portfolio, the core capital for all stocks is added while the amount available for hedging is offset for equal nominal amounts of long and short positions. Table A.5.6 sets out the split between the amounts available for hedging and for core capital.

Maturity Band	Risk Weights Hedging	Risk Weights Core	Risk Weights Total
Up to a month	0.72%	1.59%	2.31%
1 to 3 months	0.40%	0.23%	0.63%
3 to 12 months	0.37%	0.00%	0.37%
Low Coupon 1 to 5 years	1.55%	0.14%	1.69%
1 to 5 years maturity	2.07%	0.00%	2.07%
5 to 10 years maturity	3.55%	0.00%	3.55%
Over 10 years maturity	4.18%	0.92%	5.10%

Table A.5.6 Master Table for Market Makers Risk Exposures

Source: Empirical

The capital requirement for a portfolio can be derived from table A.5.6 as follows. For example, the capital required for a long position in the over ten year maturity band and a short position in the five to ten year maturity band would be (4.18% + 0.92% +0.00%) - 3.55%. This nets out at 1.55% which exceeds the minimum net capital for exposures under offsetting positions set out in table A.5.3 of 1.50%. The capital for this two asset portfolio will be set at 1.55%. Since this illustration does not involve intra maturity band risk, it follows that table A.5.6 capital is not required in this case.

The Council Directive 93/6/EEC of 15 March 1993 deals with the subject of the capital adequacy of investments firms and credit institutions. The main objective of Council Directive 93/22/EEC of 10 May 1993 on investment services in the securities field is to allow investment firms authorised by the competent authorities of their home Member States to establish branches and provide services freely in other Member States.

A.5.2.4 EU Capital Adequacy Directive example for Primary Dealer

It is calculated as follows. Each nominal position is market to market by been multiplied by the closing clean price and accrued interest. The portfolio is organised into maturity bands and then zones for offset purposes. A worked example follows and this is the capital used in the next section.

The capital required by the market makers for a notional portfolio is shown in table A.5.7. This is done by a primary dealer netting his purchases and sales at the end of a trading day in a particular bond. Then, this net amount along with the start of the day's opening inventory is combined to arrive at the closing inventory position. They will adjust their settlement in the REPO and Reverse-REPO markets so that they can settle the following day. Profit or loss realised and recognised when marked to market, will be added to the capital dedicated to the business.

Stock	Long Nominal Position	Short Nominal Position	Net Nominal Position	Maturity	Zone	Price	Long Nominal Position	Short Nominal Position
Exch. NOTE 1M	£1,000,000	£0	£1,000,000	0.08	1	100.00%	£1,000,000	£0
EXCHEQR 8.3/4% 1997	£5,000,000	£0	£5,000,000	1.74	2	100.00%	£5,000,000	£0
CAPITAL 9.3/4% 1998	£10,000,000	£0	£10,000,000	2.58	2	100.00%	£10,000,000	£0
TREASURY 6.1/4% 1999	£0	£20,000,000	-£20,000,000	3.42	2	100.00%	£0	£20,000,000
TREASURY 8% 2000	£0	£4,000,000	-£4,000,000	4.97	3	100.00%	£0	£4,000,000
GOVER 9% 2001	£11,000,000	£0	£11,000,000	5.71	3	100.00%	£11,000,000	£0
TREASURY 6.1/4% 2004	£0	£22,000,000	-£22,000,000	8.97	3	100.00%	£0	£22,000,000
TREASURY 8% 2006	£10,000,000	£0	£10,000,000	10.80	3	100.00%	£10,000,000	£0
CAPITAL 8.3/4% 2012	£4,000,000	£0	£4,000,000	16.93	3	100.00%	£4,000,000	£0
TREASURY 8.1/4% 2015	£0	£7,000,000	-£7,000,000	19.81	3	100.00%	£0	£7,000,000
Total Position	£41,000,000	£53,000,000	-£12,000,000				£41,000,000	£53,000,000

Table A.5.7 Primary Dealer Notional Portfolio

Source: Empirical

Exchequer Notes are included along with Variable Bonds which are treated as short term paper with their 'notional' maturity been the next reset of coupon. The assumed prices of all bonds is 100% to get agreement on the calculation. After initial netting with a long position of £41m and short position of £53m, the net position is short £12m. Individual bond positions are grouped into maturity bands and weighted according to the EU-CAD in table A.5.8.

Maturity	Long Position	Short Position	Weighted Long Position	Weighted Short Position	Matched Weighted Position	Unmatched Weighted Position	Unmatched Weighted Long Position	Unmatched Weighted Short Position
0.08	£1,000,000	£0	£0	£0	£0	£0	£0	£0
0.25	£0	£0	£0	£0	£0	£0	£0	£0
0.50	£0	£0	£0	£0	£0	£0	£0	£0
1.00	£0	£0	£0	£0	£0	£0	£0	£0
2.00	£5,000,000	£0	£62,500	£0	£0	£62,500	£62,500	£0
3.00	£10,000,000	£0	£175,000	£0	£0	£175,000	£175,000	£0
4.00	£0	-£20,000,000	£0	-£450,000	£0	£450,000	£0	£450,000
5.00	£0	-£4,000,000	£0	-£110,000	£0	£110,000	£0	£110,000
7.00	£11,000,000	£0	£357,500	£0	£0	£357,500	£357,500	£0
10.00	£0	-£22,000,000	£0	-£825,000	£0	£825,000	£0	£825,000
15.00	£10,000,000	£0	£450,000	£0	£0	£450,000	£450,000	£0
20.00	£4,000,000	-£7,000,000	£210,000	-£367,500	£210,000	£157,500	£0	£157,500
>20.00	£0	£0	£0	£0	£0	£0	£0	£0
	£41,000,000	-£53,000,000	£1,255,000	-£1,752,500	£210,000	£2,587,500	£1,045,000	£1,542,500

Table A.5.8 Primary Dealer Netted Portfolio by Maturity

Source: Empirical

This gave a weighted long position of £1,255,000 and a weighted short position of £1,752,500. Then the long and short positions are matched within maturity band for £210,000 in the 15 to 20 years. This committed £210,00 of capital. All other positions are unmatched weighted positions to a value of £2,587,500 which are separated into £1,045,000 long and £1,542,500 short. After this the maturity bands are gathered into three zones of up to one year, one year to four years and four years plus. There are no positions in zone 1, £237,550 long and £450,000 short in zone 2, and £807,500 long and £1,092,500 short in zone three in table A.5.9.

Zone	Unmatched Long Position	Unmatched Short Position	Matched Position	Unmatched Position	After Zones Long Position	After Zones Short Position	Matched Zones 1-2	After Zones 1-2 Long Position	After Zones 1-2 Short Position
1	£0	£0	£0	£0	£0	£0	£0	£0	£0
2	£237,500	-£450,000	£237,500	£212,500	£0	-£212,500	£0	£0	-£212,500
3	£807,500	-£1,092,500	£807,500	£285,000	£0	-£285,000	£0	£0	-£285,000
Total	£1,045,000	-£1,542,500	£1,045,000	£497,500	£0	-£497,500	£0	£0	-£497,500

Table A.5.9 Primary Dealer Portfolio Positions by Zone

Source: Empirical

Consequently, zone 2 had £237,500 of matched positions and £807,500 of zone 3 matched positions. This committed £71,250 and £242,250 of capital respectively. The unmatched zone positions are £212,500 of zone 2 matched positions and £285,000 of zone 3. From table A.5.10, there is no matching positions between zone 1 and zone 2, between zone 2 and zone 3 or between zone 1 and zone 3.

Zone	Matched Zones 2-3	After Zones 2-3 Long Position	After Zones 2-3 Short Position	Matched Zones 1-3	After Zones 1-3 Long Position	After Zones 1-3 Short Position	Residual
1	£0	£0	£0	£0	£0	£0	£0
2	£0	£0	-£212,500	£0	£0	-£212,500	£212,500
3	£0	£0	-£285,000	£0	£0	-£285,000	£285,000
Total	£0	£0	-£497,500	£0	£0	-£497,500	£497,500

Table A.5.10 Primary Dealer Portfolio Unmatched Positions by Zone

Source: Empirical

After this zone matching there is a residual position of £497,500. This committed £497,500 of capital. The total capital that a primary dealer would have to commit is £832,000 in table A.5.11.

Matched Weighted Positions in all Bands	£21,000
Matched Weighted Positions in Zone 1	£0
Matched Weighted Positions in Zone 2	£71,250
Matched Weighted Positions in Zone 3	£242,250
Matched Weighted Positions in Zone 1/Zone 2	£0
Matched Weighted Positions in Zone 2/Zone 3	£0
Matched Weighted Positions in Zone 1/Zone 3	£0
Residual Unmatched Weighted Positions	£497,500
Required Capital	**£832,000**

Table A.5.11 Primary Dealer Portfolio EU-CAD Capital Requirement

Source: Empirical

Any individual bond position will initially attract the normal capital weighting. When a bond is matched within a maturity band by an equal and opposite position, this is given a 90% reduction of required capital. However, if it cannot be matched within a maturity band but within a zone band, the capital weight of the shorter maturity position will be given a 60% reduction in zone 1 and 70% reduction in zone 2 and 3.

The unmatched capital weight of the longer maturity bond within the zone band will attract 0% on the part greater than the capital weight of the shorter maturity position. This is followed by the matching on an inter zone basis rather than an intra basis, starting with zone 1 v. zone 2, then zone 2 v. zone 3 and finally zone 1 v. zone 3. You will notice that each zone in compared on a sequential basis starting with the shortest maturity and progressing to the longest. For matching between zone 1 v. zone 2, the capital weight of the shorter maturity zone will be given a 60% reduction in zone 1 and the weight of the longer maturity bond in zone 2 will attract 0% reduction on the part greater than the capital weight of the shorter maturity position in zone 1. Whenthere is matching between zone 2 v. zone 3, the capital weight of the shorter maturity zone will be given a 60% reduction in zone 2 and the weight of the longer maturity bond in zone 3 will attract 0% reduction on the part greater than the capital weight of the shorter maturity position in zone 2.

Finally, with matching between zone 1 v. zone 3, you have to load the capital weight of zone 1 bond weight by 50% and the longer maturity bond in zone 3 will still attract 100% weighting. This penalises traders who borrow in the money market and run positions beyond four years as they would be better off not matching the positions. All residual positions are unmatched by elimination and hence attract a capital weighting of 100%.

Appendix 6

Mismatch Reserve

In this appendix the approach is to use the data on a monthly basis from 1985 to 1997 and divide it into two sub-periods. The three month DIBOR represented the Irish money market, Riada total return indices represented short Irish government bonds, long Irish government bonds, all Irish government bonds, Salomon World Government Indices on a local basis are used for UK,US, Japan, France and Germany. In the case of equity markets total return indices; UK is FT-All Share, US is S&P Composite, Japan is Topix, France is CAC and Germany is Commerzbank. The monthly returns and risks are shown in table A.6.1.

Monthly	Return 1985-89	Risk 1985-89	Return 1990-97	Risk 1990-97
Immunised	0.65%	0.58%	0.44%	0.37%
Irish Money	0.89%	0.19%	0.72%	0.30%
Irish Short	0.58%	0.72%	0.37%	0.46%
Irish Total	0.59%	0.75%	0.39%	0.49%
Irish Long	0.74%	1.43%	0.39%	0.74%
Irish Equity	2.58%	7.31%	0.99%	5.20%
Japan Bond	0.79%	2.48%	0.79%	4.15%
U.K. Bond	0.70%	2.91%	0.97%	2.57%
German Bond	1.71%	7.17%	0.92%	4.84%
US Bond	0.36%	4.06%	0.68%	3.42%
French Bond	0.99%	1.75%	0.89%	2.13%
Japan Equity	2.46%	5.96%	-0.26%	7.81%
U.K. Equity	1.57%	6.84%	1.15%	4.47%
German Equity	1.71%	7.17%	0.92%	4.84%
US Equity	1.18%	6.98%	1.25%	4.51%
French Equity	2.33%	7.26%	0.83%	5.01%

Table A.6.1 Return and Risk of Total Return Indices in Irish Pounds

Source : Empirical

In table A.6.2 the correlation between the principal asset classes held by Irish general insurers is shown. There is a high correlation with the other bond classes and the immunised portfolio and with the UK bond market.

	Immunised	Irish Money	Irish Short	Irish Total	Irish Long	Irish Equity	Japan Bond	U.K. Bond
Immunised	100.0%	23.6%	99.8%	99.8%	38.6%	1.6%	10.4%	59.5%
Irish Money	23.6%	100.0%	16.3%	16.9%	2.2%	19.1%	-2.6%	-2.4%
Irish Short	99.8%	16.9%	100.0%	99.0%	39.0%	0.3%	10.8%	60.5%
Irish Total	99.8%	16.3%	99.0%	100.0%	39.0%	0.3%	10.8%	60.5%
Irish Long	38.6%	2.2%	39.0%	39.0%	100.0%	14.0%	10.2%	59.1%
Irish Equity	1.6%	19.1%	0.3%	0.3%	14.0%	100.0%	-1.4%	5.5%
Japan Bond	10.4%	-2.6%	10.8%	10.8%	10.2%	-1.4%	100.0%	30.8%
U.K. Bond	59.5%	-2.4%	60.5%	60.5%	59.1%	5.5%	30.8%	100.0%
German Bond	3.4%	5.8%	3.1%	3.1%	-4.2%	26.3%	3.2%	-11.5%
US Bond	-0.6%	-8.7%	0.0%	0.0%	-32.0%	7.7%	17.8%	1.3%
French Bond	17.8%	18.5%	16.7%	16.7%	4.1%	-2.7%	52.4%	17.4%
Japan Equity	11.3%	4.6%	11.1%	11.1%	17.4%	18.5%	51.7%	31.4%
U.K. Equity	8.6%	2.6%	8.6%	8.6%	23.6%	57.2%	14.1%	36.0%
German Equity	3.4%	5.8%	3.1%	3.1%	-4.2%	26.3%	3.2%	-11.5%
US Equity	3.4%	3.2%	3.2%	3.2%	-13.0%	49.0%	9.7%	2.8%
French Equity	14.6%	16.8%	13.6%	13.6%	-0.5%	37.4%	16.6%	7.7%

Table A.6.2 Correlation of Total Return Indices in Irish Pounds 1985 to 1989

Source : Empirical

In table A.6.3 the correlation between potential foreign asset classes held by Irish general insurers is shown. There is a high correlation between European bond classes and the US and UK equity market.

	German Bond	US Bond	French Bond	Japan Equity	U.K. Equity	German Equity	US Equity	French Equity
Immunised	3.4%	-0.6%	17.8%	11.3%	8.6%	3.4%	3.4%	14.6%
Irish Money	5.8%	-8.7%	18.5%	4.6%	2.6%	5.8%	3.2%	16.8%
Irish Short	3.1%	0.0%	16.7%	11.1%	8.6%	3.1%	3.2%	13.6%
Irish Total	3.1%	0.0%	16.7%	11.1%	8.6%	3.1%	3.2%	13.6%
Irish Long	-4.2%	-32.0%	4.1%	17.4%	23.6%	-4.2%	-13.0%	-0.5%
Irish Equity	26.3%	7.7%	-2.7%	18.5%	57.2%	26.3%	49.0%	37.4%
Japan Bond	3.2%	17.8%	52.4%	51.7%	14.1%	3.2%	9.7%	16.6%
U.K. Bond	-11.5%	1.3%	17.4%	31.4%	36.0%	-11.5%	2.8%	7.7%
German Bond	100.0%	8.0%	10.2%	27.9%	40.0%	100.0%	46.8%	67.5%
US Bond	8.0%	100.0%	27.9%	7.3%	18.8%	8.0%	62.9%	11.7%
French Bond	10.2%	27.9%	100.0%	19.9%	15.9%	10.2%	15.2%	13.1%
Japan Equity	27.9%	7.3%	19.9%	100.0%	40.5%	27.9%	38.7%	42.5%
U.K. Equity	40.0%	18.8%	15.9%	40.5%	100.0%	40.0%	67.0%	50.4%
German Equity	100.0%	8.0%	10.2%	27.9%	40.0%	100.0%	46.8%	67.5%
US Equity	46.8%	62.9%	15.2%	38.7%	67.0%	46.8%	100.0%	55.6%
French Equity	67.5%	11.7%	13.1%	42.5%	50.4%	67.5%	55.6%	100.0%

Table A.6.3 Correlation of Total Return Indices in Irish Pounds 1985 to 1989

Source : Empirical

Over the second period of 1990 to 1997, the principal changes in correlation is an increase of 40% between the immunised portfolio and the French bond market and a decrease in correlation of 29% with the UK bond market. The correlation of the long end of the Irish bond market with the UK bond market fell from 60.5% to 32%. The correlation of the long end of the Irish bond market with the US bond market fell from -32% to 24.2%.

The monthly mismatch reserves for individual classes and for a local asset class equally weighted in Irish bond and equities, then equally weighted in all bond markets and equity markets is shown in table A.6.4. The equity market require a mismatch reserve of twice the bond markets reflecting the balance between the greater return potential and the higher risk of holding these portfolios. The ruin barrier is set at a 5% and o.5% level. It is interesting to note the risk attaching to the German bond market after the unification with East Germany and the merits of holding a diversified portfolio.

Market	5% (20 to 1)	0.5% (200 to 1)
Irish Money	0.76%	1.34%
Irish Total	1.56%	2.39%
Irish Short	1.62%	2.33%
Irish Long	2.45%	4.05%
Bond Markets	2.52%	4.31%
French Bond	2.76%	4.39%
Equity Markets	3.29%	5.95%
Japan Bond	4.12%	6.34%
U.K. Bond	4.91%	7.65%
Local Market	5.31%	8.69%
US Bond	6.96%	10.91%
Japan Equity	7.95%	13.71%
Irish Equity	10.25%	17.03%
French Equity	10.29%	16.92%
U.K. Equity	10.41%	16.26%
German Bond	10.56%	17.22%
German Equity	10.89%	17.76%
US Equity	11.13%	17.48%

Table A.6.4 Mismatch Reserves of Excess of Assets over Liabilities 1985 to 1989

Source : Empirical

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