United Kingdom
Debt
Management
Office

Gilt Review

1998|1999

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Chapter 1: The economic and market background

Overview

Nominal and real gilt yields fell markedly over the 1998-99 financial year. The year began with yields broadly stable. However, the flight of capital from East Asia and Russia gathered momentum in June and by July major government bond yields had started a decline. This fall was accelerated after the Russian devaluation of the rouble and the imposition of a 90-day debt moratorium. Stock markets lost value over this period amidst growing fears of a global slowdown.

Yields continued to fall until early October. A sudden reversal of yields in the second half of October was caused by the liquidation of holdings in response to global economic difficulties. The associated substantial reduction in liquidity affected swap spreads around the world. Equity markets also fell sharply over this period.

Governments and central banks around the world responded by reducing interest rates. Yields fell further with the reduction in global interest rates. Stock markets, however, boosted by these cuts, began recovering lost ground. Bond yields reached their lowest levels in January, fuelled by continuing interest rate cuts and the devaluation of the Brazilian real.

The close of the financial year saw yields increase slightly from their year lows. The stabilisation of global financial markets encouraged liquidity and credit spreads to return to pre-crisis levels. The international community also began to focus their attention on the continued appreciation of the US equity market with growing concern that the US Federal Reserve might increase interest rates.

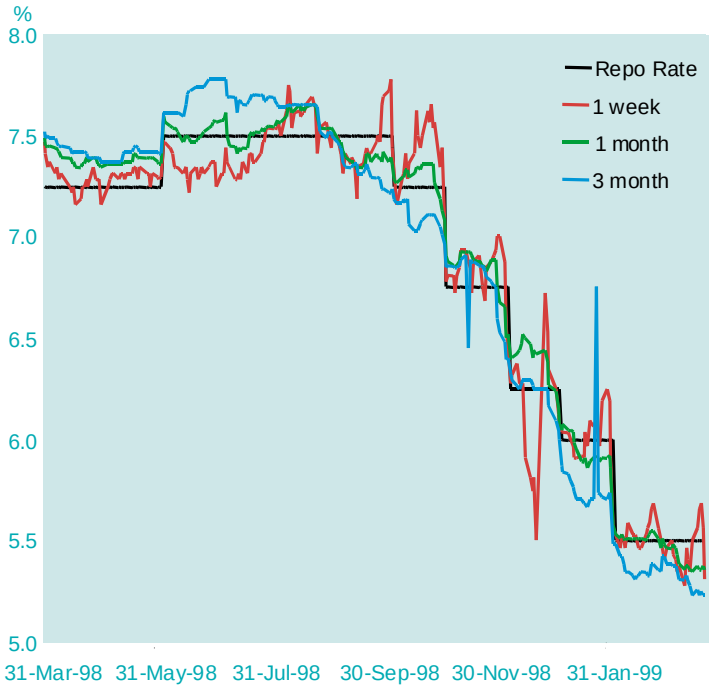
Economic Background

International bond yields fluctuated at the beginning of the financial year as the market speculated on the interest rate decisions of the Federal Reserve's Federal Open Market Committee (FOMC), the Bundesbank and the Bank of England's Monetary Policy Committee (MPC).

• Gilts stable early on

The April 1998 MPC decision to leave rates unchanged at 7.25% fuelled the market's speculation that interest rates were on hold and sterling remained strong. By mid-May the market considered that the UK interest rate cycle had peaked. However, stronger than expected labour market data (average earnings and employment numbers) seemed to indicate that the UK labour market was continuing to tighten. Chart 1 shows the course of UK interest rates over the year.

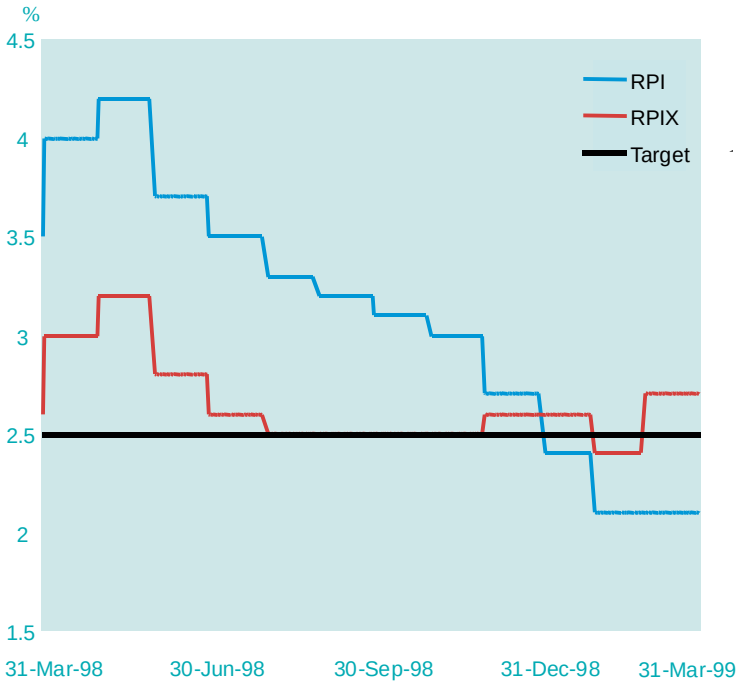
Chart 1
UK Interest rates 1998-99



Source: Bank of England

The MPC increased interest rates to 7.5% on 4 June, a move which surprised the market. The MPC pointed to inflationary pressures being greater than in the May projection. The decision was followed by the June RPIX release of 3.2%, which was above market expectations (the MPC RPIX target is 2.5%). Chart 2 below shows inflation rates over the year. The Governor of the Bank of England commented that the level of UK domestic demand was above that consistent with sustainable growth. The market anticipated a further interest rate increase in July.

Chart 2
UK Inflation rates 1998-99



Source: ONS

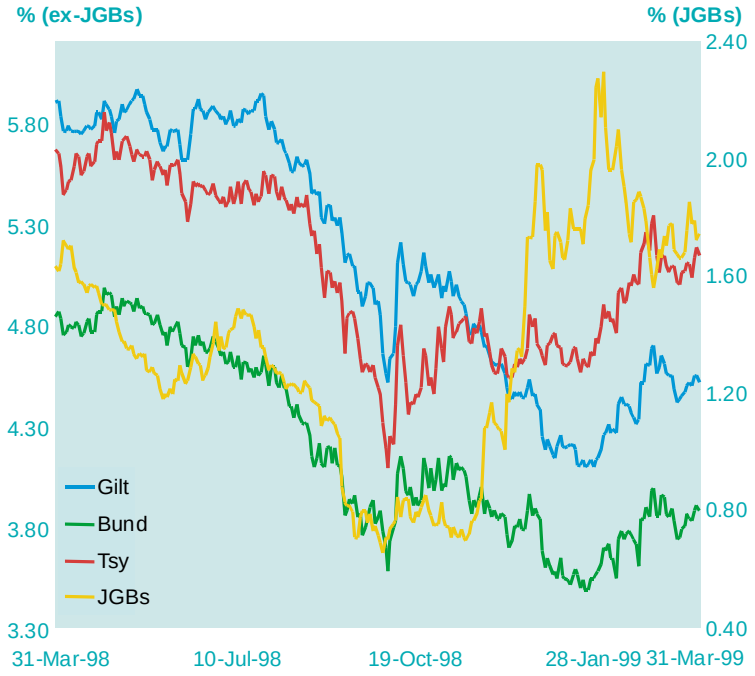
This scenario was mirrored internationally. In mid-May, German CPI data surprised the markets and left them wondering whether the Bundesbank would increase rates. The strength of the US economy was also causing the markets to consider an increase in the Fed Funds rate by the FOMC. The markets took some solace from the surprisingly low levels of US inflation. However, the strength of the Dow Jones index and other asset price measures continued to suggest an increasing prospect of inflation and an increase in interest rates in response by the FOMC.

Yields begin a sharp decline

Events in East Asia and Russia began to affect international bond yields in June. The markets became less concerned over the current strength of the US economy. They believed that the economic slowdown in East Asia would depress US exports and slow the economy. Similarly in Germany the markets began to discount a rate increase before the Bundestag elections in September. Capital was also beginning to take flight from emerging markets into countries and securities considered financial safe-havens. International government bond yields began to decline more sharply from the end of July. Chart 3 shows the direction of major international bond yields over the year.

The plight of East Asian economies continued to generate global deflationary pressure. The markets expected the Japanese government to introduce a further fiscal stimulus to reverse the apparent decline in its economy. The Japanese government produced an addiitonal package of measures, which included a 16 trillion yen income tax reduction. This failed to fulfil market expectations and added to pessimism about the Japanese economy.

Chart 3
International bond yields (10 year)



Source: DMO

The fall in international government bond yields accelerated when Russia devalued the rouble and imposed a 90-day debt moratorium. Market wariness of Russia had been somewhat allayed by a loan package organised by the IMF and the World Bank. The devaluation on 17 August both surprised the market and led to increasing inflows of capital to major government bonds. Government bond yields and stock markets fell. The German equity market fared worse than other major markets. This reflected the markets' estimate of the extent of exposure by German financial institutions to economic prospects in Russia.

These events decreased investors' appetites for risk and increased their concerns over other emerging markets. Capital began to leave Latin America at an increasing rate as investors feared contagion effects. Brazil and Venezuela were worst affected; the markets were most concerned over the effect a Brazilian devaluation would have on the other economies of the Americas.

Falling global demand and increasing fears of a liquidity crunch increased pessimism in equity markets, which began to fall from late July. The deterioration in equity markets was slowed and eventually reversed by the reduction in global interest rates. However, the reversal did not begin until early October.

Cuts in interest rates were hinted at from the start of September. On 4 September Mr Greenspan led markets to infer that the Federal Reserve was likely to relax interest rates. The Bank of Japan cut their interest rates by 25 basis points to 0.25% on 9 September. On 29 September the FOMC reduced the Fed Funds rate by 25 basis points to 5.25%.

Chart 4
UK conventional benchmark yields 1998-99

Source: DMO

Throughout July and August gilt yields had fallen in line with international government bond yields (see also chart 3). However, gilt yields had lagged other yields around MPC meetings. This illustrated the market's concern that the MPC would increase the repo rate in response to continuing reports of high levels of average earnings growth. But other data releases and survey evidence increasingly indicated a domestic and global slowdown, and the earnings data was revised downwards in September. This perceived removal of upside risk to UK interest rates allowed gilts to rally against bunds and Treasuries. The MPC cut rates by 25 basis points on 8 October.

The October shock

October saw a turbulent week that had repercussions for the rest of the financial year. The week beginning 5 October saw large reversals in bond yields. By the close of the following Monday yields on the ten-year benchmarks in the US Treasuries had increased by 65 basis points, bunds by 51 basis points and gilts by 69 basis points.

This reversal in bond yields was caused by changes in hedge fund positions rather than changes in economic fundamentals. However, this crisis did severely affect market liquidity. This was illustrated by the ballooning of swap spreads to over twice the usual level and by the spread between on- and off-the-run bonds. Before mid-August the spread of UK swaps over gilts (10 year maturity) averaged just over 50 basis points. The first week of October saw the UK spread touch 120 basis points. This same pattern affected both Germany and the US but the most extreme movements were in the sterling swaps market.

Yields resume their fall

Following this reversal, government bond yields began to fall as investors re-focussed on economic fundamentals. However, trading remained thin. A further round of global interest rate cuts supported the reduction in yields. The FOMC cut rates by 50 basis points to 4.75%. The first 25 basis point reduction was on 16 October and took place (for the first time since 1994) outside the scheduled cycle of FOMC meetings. The central banks of the euro area co-ordinated a 30 basis point cut of interest rates on 3 December. In five successive meetings, from October 1998 to February 1999, the MPC cut rates by 200 basis points, to 5.50%.

Global interest rate reductions increased business confidence and spurred equity markets. Major equity markets increased in value from October; however, the rally of the Nikkei 225 faltered at the start of December. The Japanese economy failed to show signs of recovery and the Japanese Government introduced a second fiscal stimulus package worth 24 trillion yen in November. The market anticipated an increase in JGB sales to finance this stimulus. The result was a sharp increase in JGB yields and a fall in the Nikkei. The Nikkei ended the year with a sharp increase throughout March but still finished below its level at the start of the year. See chart 5.

Chart 5
International equity indices

Source: Reuters: 1 April 1998=100

The values of the Dow Jones, the Dax and the FTSE 100 all continued to increase until the end of the financial year. The Dax's increase lagged both the Dow Jones and FTSE 100. This was the result of slowing levels of growth in the German and other core European economies. The Dow Jones, however, increased dramatically: from a financial year opening price low of 7,546 in early September, it rose by 44% to close the financial year at 10,832.

The rise in the Dow Jones relative to the FTSE contributed to ten-year benchmark gilt yields falling below the equivalent Treasury yields from the end of November. The continuing fall in UK interest rates and the strength of the dollar versus sterling also contributed. However, the strength of the Dow Jones began to raise fears that the FOMC might consider reverting to pre-crisis levels of interest rates.

The spread of gilt yields over bunds had also fallen as the interest rate differential between the UK and the rest of Europe fell. The UK 30 year benchmark, 6% Treasury 2028 traded through the equivalent German 30 year bond from September. Although this was partially a reflection of the comparatively low level of issuance in the UK, it also reflected a greater demand for long bonds from the more developed UK pension fund industry. This demand had risen because of an increasing focus on pension fund solvency ratios and the increasing maturity of funds (see section on page 28-31).

European government bond yields continued to fall until the end of January in line with other “safe-haven” countries. The fall had been aided by the devaluation of the Brazilian real on 13 January. The devaluation caused concern that Brazil would not be able to repay its foreign currency denominated liabilities. Capital again sought financial safe-havens. Gilt yields reached their financial year lows at the end of January. The ten-year benchmark gilt recorded closing yields of 4.10% on 26 and 29 January 1999. Conventional gilt yields had not reached these levels since the mid-1950s.

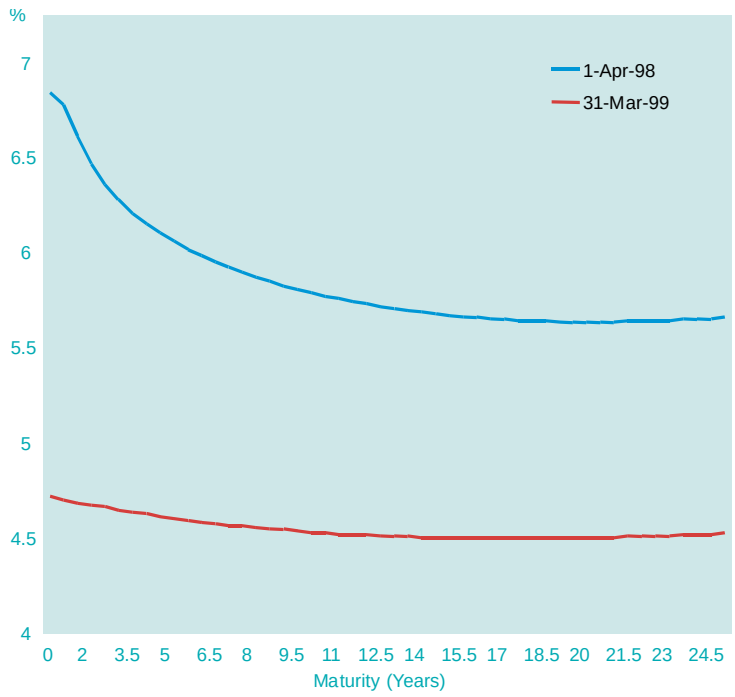
Yields begin to retreat

From the end of January gilt yields, along with US and German Government bond yields, increased slightly because of increasing yields in Japan and the strength of the US economy. Japanese yields rose by 160 basis points in two and a half months, nearly reaching 2.40%. The strength of the Dow Jones and the US economy continued to cause the markets to anticipate an increase in US interest rates as the year ended.

The Gilt Market

UK conventional gilt yields closed the year significantly lower than they had started, despite the sharp upward spike in October. The thirty-year gilt benchmark closed the year 122 basis points lower, the ten-year 142 lower and the five-year 144 basis points lower. Chart 6 shows the significant move downward in the zero coupon yield curve over the course of the year.

Chart 6
UK zero coupon yield curves



Source: Bank of England

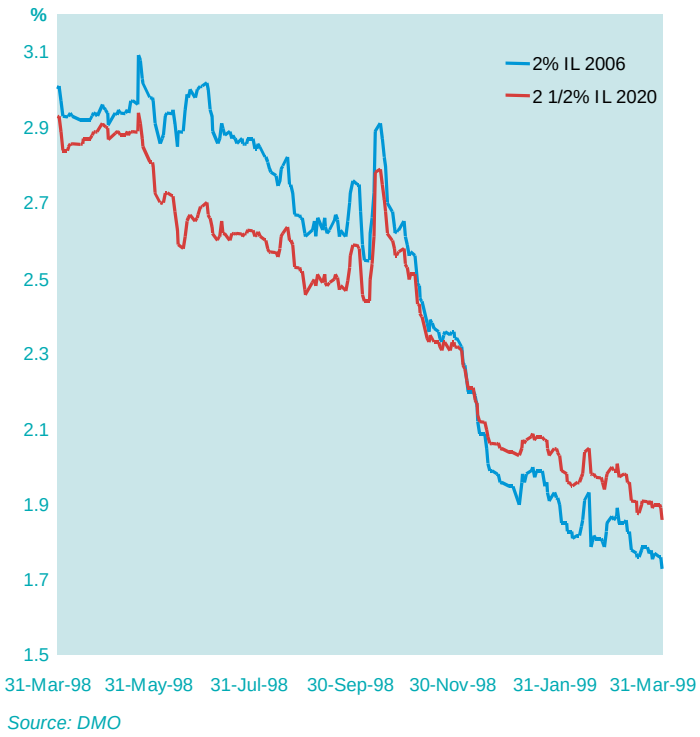
Because the UK Government had a low financing requirement (see next chapter) the UK Debt Management Office (DMO) held only two conventional auctions in 1998-99: £3bn nominal of 6% Treasury 2028 on 20 May 1998 and £2.5bn nominal of 5¾% Treasury 2009 on 29 July 1998. Both auctions were well covered (full auction details are provided in Table 7 on page 19).

The DMO also made three conversion offers to help support gilt market liquidity, given the low level of primary issuance. The then short benchmark, 6½% Treasury 2003, was supported by two conversions closing on 22 July 1998 and 1 February 1999. Both of these conversions saw large participation with the source gilts, 11¾% Treasury 2003-07 and 12½% Treasury 2003-05, reduced to rump status after the conversion. 8% Treasury 2009 was also converted into the medium benchmark, 5¾% Treasury 2009. The 8% Treasury 2009 was, however, not reduced to rump status, partly as a consequence of the wide retail distribution of holdings of this gilt. In response to calls from market participants to ease the illiquidity in the remaining amount of 8% Treasury 2009 the DMO subsequently opened a switch offer allowing holders of 8% Treasury 2009 to switch into 5¾% Treasury 2009. By the end of March 1999, some £65 million of 5¾% 2009 had been issued under this facility, but 8% 2009 still remained too large to be reduced to rump status.

The Index-linked Gilt Market

Index-linked yields fell steadily through the year. Chart 7 shows how the real yields fell on both 2% IL Treasury 2006 and 2½% IL Treasury 2020, by 127 and 107 basis points respectively. This decline was at a fairly constant rate throughout the year, but the crisis in October hit index-linked gilts as well as conventionals. The continued fall in index-linked yields was caused by a combination of factors: demand from pension funds as those funds mature, and some supply effects as a result of low levels of primary issuance. These effects are discussed more fully in the review of the MFR on pages 28-31.

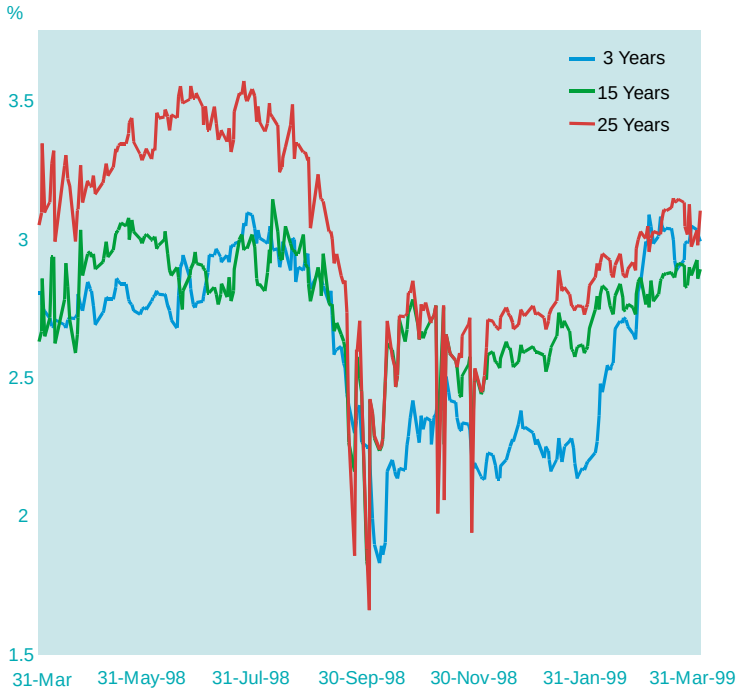
Chart 7
Index-linked real yields



Source: DMO

The value of index-linked gilts compared to conventional gilts fluctuated throughout the year. Chart 8 shows the implied forward inflation rates; the expected value of inflation in future years calculated from the differential of index-linked and conventional gilts[1]. The chart shows that implied forward inflation rates rose slightly until conventional yields dropped in late July. From this point there was a fall in the implied rates as index-linked gilts lagged the rally in conventionals. The implied 20-year inflation rate reached 1.66% on 29 September[2]. This suggested too low a level of inflation twenty years forward assuming a constant 2.5% inflation target and suggested an overvaluation of conventional gilts relative to index-linked. The continued appreciation of index-linked gilts throughout the rest of the year led to a correction of implied forward inflation rates back to levels more consistent with a 2.5% inflation target.

Chart 8
UK implied forward inflation rates



Source: Bank of England

The DMO introduced index-linked auctions in 1998-99. The first of these auctions was held on 16 November (rescheduled from 28 October to avoid the risk of a clash with the Pre-Budget Report). Before the introduction of these auctions the DMO issued £600 million nominal of four different index-linked gilts through taps. The transition of issuance to auctions went well for both auctions. The first auction of 2.5% IL Treasury 2013 was 2.29 times covered and the second, of 2½% IL Treasury 2024, was 1.83 times covered. The strike prices in both auctions were close to the secondary market price at close of bidding.

[1] Implied forward inflation rates are not a pure measure of forward inflation expectations. Included in these estimates of forward inflation are the inflation risk premium and a distortion created by curve convexity. These factors will be somewhat offset by a greater liquidity premium being priced into conventional gilts.

[2] Derived forward inflation rates are an expression of RPI but the MPC's inflation target is RPIX.

The UK's Fiscal Framework and Projected Public Finances

This section provides an overview of the new fiscal framework and summarises the Budget forecasts and projections for UK public finances over the next five years.

The UK Government has recently implemented a process of reform to the fiscal framework of the UK, as well as to the monetary framework. The aim of this reform is to deliver a key requirement of fiscal policy: sound public finances.

The UK Government introduced a number of these reforms in the Code for Fiscal Stability. The Code has five governing principles: transparency, stability, responsibility, fairness and efficiency. The Code also requires that the Government must clearly state its fiscal rules and objectives.

Transparency is a key element of the new fiscal framework. Scrutiny of the economic and fiscal plans by the public and Parliament is designed to encourage a longer-term approach to Government decision-making. The Code provides for the publication of a number of reports setting out comprehensive accounts of the Government's fiscal strategy and the state of the public finances.

The Government has two strict and overriding fiscal rules to deliver sound public finances.

- *The Golden Rule* – on average over the economic cycle the Government may only borrow to invest, not to fund current spending.

- *The Sustainable Investment Rule* – Public sector net debt as a percentage of GDP will be held at a stable and prudent level over the cycle. The Government currently believes that, other things being equal, a modest reduction to below 40% of GDP would be desirable.

The Golden Rule is supported by a number of other changes to the fiscal framework governing public expenditure. New regimes to plan and control public spending are designed to create equal incentives to spend on capital and current expenditure projects.

All public spending, excepting financial transactions, now comes under Total Managed Expenditure (TME). Within TME current and capital expenditures are planned and managed separately. Around half of the TME is managed through the Departmental Expenditure Limits. These limits are firm multi-year limits, set in cash terms. The current limits are for three years and allow departments to roll over funds from one year to the next within this period. The limits facilitate planning by departments and they provide incentives for departments to manage effectively their costs.

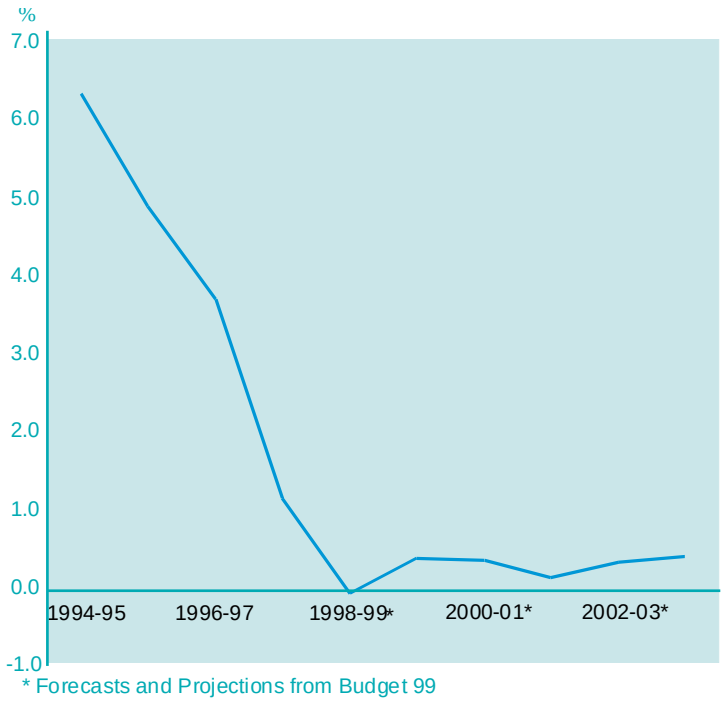
The other half of TME is an annually managed component that covers expenditure that cannot be reasonably planned over a multi-year period, such as social security payments. These are scrutinised annually as part of the budget round.

A further change to public accounting will enhance the effectiveness of the changes to the spending control regimes and fiscal policy. The Government is implementing Resource Accounting and Budgeting (RAB). RAB distinguishes between current and capital spending by planning, controlling and accounting for departmental spending on a full accruals basis. This involves recognising the capital costs of public assets and investments, such as depreciation and interest, as they occur. This reform will put the Government's accounts on a similar footing to those found in the private sector.

A range of new controls to achieve the two overriding fiscal rules are in place and the aim of maintaining sound public finances is being achieved. Forecasts and projections of the public finances over the next few years show that recent improvements are expected to continue.

The chart below illustrates the public sectors' net borrowing requirement from 1994-95 with forecasts and projections out to 2003-04. This shows a modest surplus in the financial year 1998-99. Borrowing increases slightly after this as the economy grows below-trend. However, the deficit remains low compared to levels seen over the last few decades.

Chart 9
Public sector net borrowing as a percentage of GDP

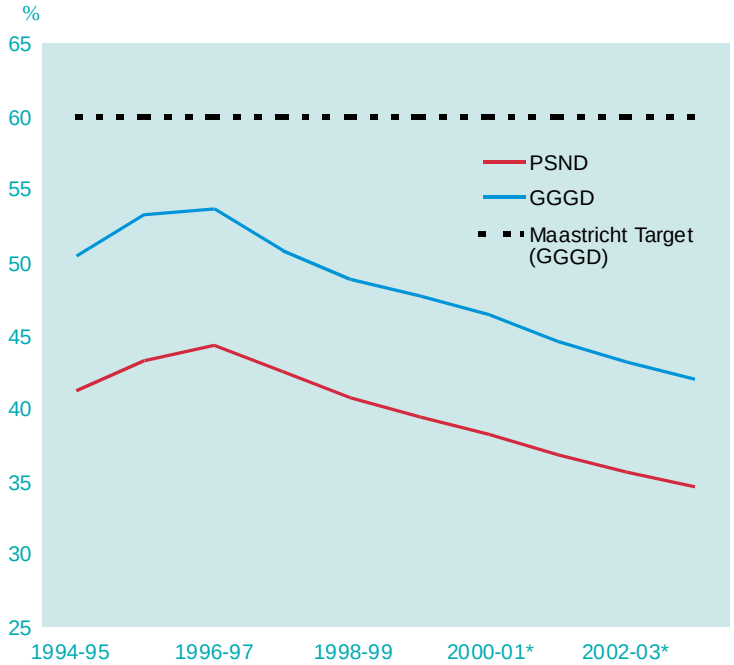


* Forecasts and Projections from Budget 99

Chart 10 shows the effect of low public sector net borowing on the level of public sector net debt and gross general debt. Public sector net debt as a percentage of GDP is projected to fall over the next few years. On current projections this will fall below 40% by 1999-2000 and below 35% by 2003-04. This would be in accord with the sustainable investment rule.

The path of gross general government debt also demonstrates the improvement of public finances. The chart below shows gross general government debt as a percentage of GDP (*the Maastricht definition*). This mirrors the decline of the public sector net debt showing that on current assumptions the public finances are set to continue to improve over the next few years.

Chart 10
Public sector net debt as a percentage of GDP



* Forecasts and Projections from Budget 99

Chapter 2: UK Government Financing

The DMO's annual remit, contained in The Debt Management Report, published each March, contains a projection of the required gilt sales for the coming financial year. It details the intended split between conventional and index-linked financing, including the maturity mix of conventional sales. This section reviews the Remit for 1998-99 and looks forward to the Remit for 1999-2000. The main feature of 1998-99 was a sharply declining financing requirement, due to the continuing health of the public finances, but despite this, the Government delivered its commitment to supply a minimum of £2.5 billion (cash) of index-linked gilts. As a result, the Government ended 1998-99 over shooting its requirement for gilt sales.

The financing remit for 1998-99

The remit to the DMO setting out the framework for gilt issuance in 1998-99 was published on 19 March 1998. The underlying objective was to finance the Central Government Net Cash Requirement (CGNCR[3]) plus maturing debt and any net increase in the foreign exchange reserves by the sale of debt (ie gilts, National Savings products and Treasury bills and other short term debt).

The Government stated that it had no plans to change significantly the level of ultra short-term debt in 1998-99. Accordingly, in the DMO's remit for 1998-99, the Government indicated that it did not intend to use net Treasury bill issuance or gilts of less than three years maturity to finance the 1998-99 requirement.

The gilt sales target for the year was initially forecast at £14.2 billion, based on a CGNCR forecast of £3.7 billion in the March 1998 Budget. The gilt financing arithmetic in table 1 below shows how the financing requirement altered during the year. The gilt sales requirement fell sharply over the course of the year as a result of two main developments:

- The CGNCR outturn for 1997-98 was lower than previously forecast, increasing the adjustment necessary to offset the gilt sales overshoot in 1997-98 from £5.1 to £8.2 billion (announced in the EFSR on 11 June);

- A sharp decline in the forecast of the 1998-99 CGNCR from £3.5 billion in the EFSR to a surplus of £2.1 billion in the Pre-Budget Report in November 1998.

[3] Until the publication of the Economic and Fiscal Strategy report (EFSR) in June 1998, the financial aggregate being financed by gilts was the Central Government Borrowing requirement (CGBR). The CGBR was renamed the Central Government Net Cash Requirement (CGNCR) in the EFSR. At the same time, Government accounts were presented for the first time on an ESA 95 basis.

Together these changes reduced the financing requirement by almost £9 billion between March and November 1998. The gilt financing requirement also fell sharply from £14.2 billion to £6.4 billion over this period although this fall was mitigated to a limited extent by the decline in the expected financing contribution from National Savings, which was revised down from £1 billion to £0.1 billion.

The March 1999 Budget saw a further small reduction in the gilt sales requirement to £5.9 billion (as the forecast CGNCR surplus for the year increased by £600 million). However, the CGNCR outturn for 1998-99, published on 20 April 1999, showed a further significant increase in the CGNCR surplus (to £4.5 billion). This, combined with an increase in the National Savings contribution to £0.4 billion, contributed to a final gilt sales requirement of only £4 billion, a fall of £10.2 billion from the initial forecast. Although these later adjustments had no impact on gilt sales in 1998-99, they did increase the final overshoot carried forward into the 1999-2000 financing arithmetic.

Table 1: The 1998-99 Gilt Financing requirement*

£ billion	**Budget**	**EFSR**	**Pre-Budget Report**	**Budget**	**1998-99 Outturn**
	March 1998	**June 1998**	**November 1998**	**March 1999**	**April 1999**
CGNCR Forecast	3.7	3.5	–2.1	–2.7	-4.5
Net change in official reserves	0.0	0.0	0.0	0.0	0.1
Gilt redemptions	16.7	16.8	16.8	16.9**	17.0
Overfund from 1997-98	–5.1	–8.2	–8.2	–8.2	–8.2
Financing Requirement	**15.2**	**12.1**	**6.5**	**6.1**	**4.4**
Financed by:					
National Savings	1.0	0.5	0.1	0.2	0.4
Sales of other public debt	0.0	0.0	0.0	0.0	0.0
Gilt Financing Requirement	**14.2**	**11.6**	**6.4**	**5.9**	**4.0**
Assumed gilt sales 1998-99	–	–	8.1- 8.6	8.2	8.1
Implied overshoot 1998-99	–	–	1.7- 2.2	2.3	4.1

* *Figures may not sum due to rounding*

** *Includes ESA 95 reclassification of Bank of England holdings*

The original remit (March 1998)

Six gilt auctions were initially planned for the year, comprising four conventional auctions and two index-linked auctions. The original auction calendar was as set out in table 2 below:

Table 2: Gilt auction calendar (published March 1998)

Auction date	Type
Wednesday 20 May 1998	Conventional
Wednesday 29 July 1998	Conventional
Wednesday 28 October 1998	Index-linked
Late November/ early December 1998*	Conventional
Wednesday 27 January 1999	Index-linked
Wednesday 24 March 1999*	Conventional

** Subject to Chancellor's decision on Budgetary timetable*

The original planned split of issuance was as follows:

Table 3: Maturity split (published March 1998)

Short conventionals (3-7 year maturity)	£2.7 billion
Medium conventionals (7-15 year maturity)	£2.7 billion
Long conventionals (>15 year maturity)	£5.3 billion
Index-linked gilts	£3.6 billion

Index-linked

The most significant development was the transition to issuing index-linked gilts by auctions as opposed to taps. This followed strong support from the market during a consultation process in 1998.

The original remit provided for index-linked issuance of 25% of total sales in 1998-99, up from 20% in the previous year. Underpinning this was a commitment to gross supply of at least £2.5 billion (cash) of index-linked gilts. This commitment reflected the Government's belief that a minimum level of supply was necessary to make the planned introduction of index-linked auctions viable.

The remit allowed the DMO to issue a maximum of £1.5 billion (cash) of index-linked gilts by taps in the first half of 1998-99 before the first auction. Two index-linked taps were held in the first quarter (both for £150 million nominal) of 2½% IL 2024 on 3 April 1998 and 2½% IL 2016 on 21 May 1998.

Conventional

Conventional issuance, accounting for 75% of total sales was weighted toward long maturity gilts. 50 per cent of planned conventional issuance was intended at the long end of the curve, with the rest split equally between medium and short-dated maturities. However, the Government stated that it did not intend to maintain these issuance proportions in future years. Only one gilt auction was scheduled in the first quarter, with £3 billion nominal of 6% 2028 being sold on 20 May 1998.

The revised remit: (EFSR, June 1998)

A £3.1 billion reduction of the gilt financing requirement (to £11.6 billion) was announced on 11 June 1998 in the Economic and Fiscal Strategy Report (EFSR), largely as a result of a lower than expected outturn in Government borrowing in 1997-98. The original remit was amended accordingly as follows:

- The conventional gilt auction originally scheduled for November/December 1998 was cancelled, taking the number of scheduled conventional auctions down to three. Following the long gilt auction of May 1998 the decision was taken not to auction any more long conventional gilts in 1998-99. The two planned index-linked auctions remained as scheduled. The amounts of planned issuance were revised downward as follows:

Table 4: Changes in planned issuance (announced June 1998)

£ billion	Budget	EFSR
Short conventionals	2.7	2.5
Medium conventionals	2.7	2.5
Long conventionals	5.3	3.1
Index-linked	3.6	3.5

- The maturity structure of gilt sales was revised accordingly. The cancellation of one (long) conventional auction had the effect of increasing the proportion of index-linked issuance from 25% to 30% of all sales. The proportion of conventional sales accounted for by longs fell from 50% to 38% (the proportion of shorts and mediums increased from 25% to 31% of planned conventional sales).

- The second conventional gilt auction (£2.5 billion of a new ten year gilt 5¾% 2009) was held on 29 July 1998.

- Two index-linked taps (both for £150 million nominal) of 4⅛% IL 2030 on 12 June and 4⅜% IL 2004 on 7 August were also held.

The revised remit: (Pre-Budget Report, 3 November 1998)

An even larger reduction to the gilt financing requirement, by £5.2 billion to £6.4 billion, was announced in the Pre-Budget Report, as a surplus for the financial year was forecast. By the end of October 1999 gilt sales had already passed the new revised gilt sales requirement (having reached £6.5 billion).

The 1998-99 remit was revised further as follows:

- The final conventional gilt auction (a short scheduled for March 1999) was cancelled;

- In fulfilment of the commitment to issue at least £2.5 billion (cash) of index-linked gilts, the two scheduled index-linked auctions were kept in place supported by a facility to be able to tap an additional £0.5 billion (cash) for market management purposes. Given that index-linked sales had reached £0.9 billion (cash) by the end of October, the balance of index-linked sales for 1998-99 was projected to be £1.6-2.1 billion. It was therefore decided to over-finance in 1998-99 in support of the transition to index-linked auctions.

- Overall planned issuance amounts were revised as follows:

Table 5: Changes in planned issuance (announced November 1998).

£ billion	EFSR	PBR
Short conventionals	2.5	0
Medium conventionals	2.5	2.5
Long conventionals	3.1	3.1
Index-linked	3.5	2.5-3.0

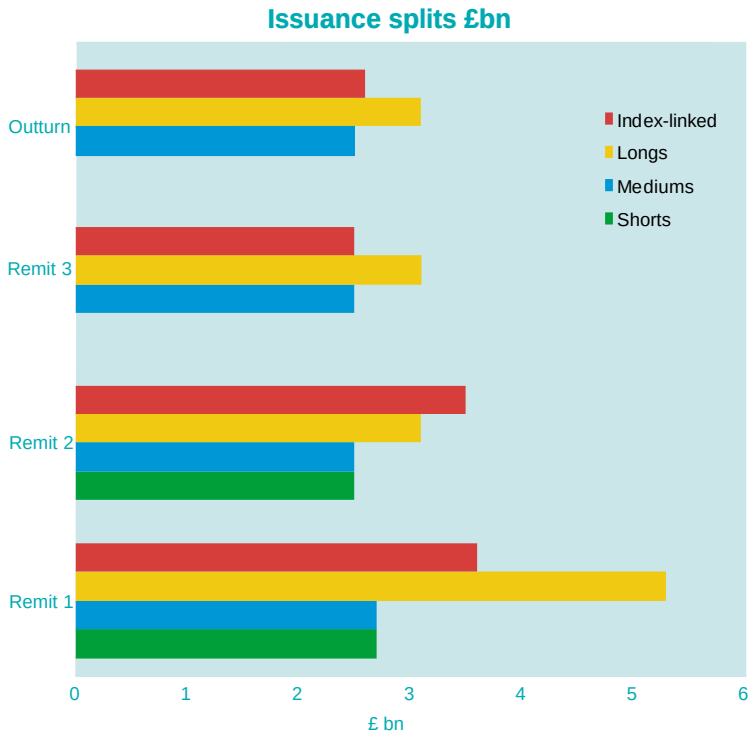
- Final gilt sales for 1998-99 were in line with the final remit amounts.

Table 6: Gilt sales by type and maturity.

£ billion	PBR	Final
Short conventionals	0	0
Medium conventional	2.5	2.5
Long conventionals	3.1	3.1
Index-linked	2.5-3.0	2.6

The issuance splits across the three remits and the outturn was as shown in chart 11 below:

Chart 11
Issuance splits across the remits and outturn



Source: DMO

Gilt Auctions and Taps 1998-99

Conventional

As in recent years, all conventional issuance was by auction. Under the 1998-99 remit, taps of conventional stocks were reserved for market management purposes in conditions of temporary excess demand in a particular gilt or when there was an exceptionally sharp general rise in the market. It was envisaged that conventional tap issuance would not constitute more than 5% of total expected issuance (down from 10% in 1997-98). In the event, no conventional taps were held.

Results of conventional gilt auctions

The remit provided that conventional auctions were to be between £2-3 billion (nominal). £5.5 billion nominal of conventional gilts were issued at the two auctions, raising £5.56 billion cash.

- The first auction was a re-opening of the ultra-long thirty year benchmark 6% 2028 on 20 May 1998, a gilt that had been auctioned for the first time in December 1997. £3 billion nominal was issued, to take the nominal amount in issue to £5 billion, and to permit stripping of the gilt.

- The second and final conventional auction was of a new ten year gilt 5¾% 2009 on 29 July 1998. £2.5 billion nominal was issued and the gilt was strippable from the outset.

The results of the two auctions are summarised below:

Table 7: Conventional auction results 1998-99.

Date	Gilt	Nominal Issued £bn	Cover	Tail (bp)	Lowest Accepted Price LAP[4]	Yield at LAP
20 May 1998	6% 2028	£3.0	2.26	0	£102-30	5.79%
29 July 1998	5¾% 2009	£2.5	2.93	0	£100-05	5.73%

Index-linked Taps

Following strong market support for IG auctions, the DMO published proposals for the conduct of such auctions on 10 June 1998 and sought applications from market participants to become specialist index-linked market makers (IG GEMMs). In order to allow time for the selection process and to prepare the mechanics of the new auction process, the remit provided that auctions would not begin until October 1998.

Accordingly, the remit allowed up to £1.5 billion (cash) of index-linked gilts to be issued by taps before the start of auctions. Four index-linked taps were held in the first half of 1998-99, each for £150 million (nominal), together raising £940 million (cash). The results are summarised overleaf.

[4] Prices in £/32nds.

Table 8: Results of index-linked taps 1998-99.

Date	Gilt	Nominal Issued	Price at issue	Price when exhausted[5]	Yield when exhausted[6]
3 April 1998	2½% IL 2024	£150m	£151-12	£151-12	2.84%
21 May 1998	2½% IL 2016	£150m	£185-08	£185-08	2.88%
12 June 1998	2½% IL 2030	£150m	£160-24	£160-24	2.53%
7 August 1998	4⅜% IL 2004	£150m	£128-10	£128-10	2.92%

Index-linked Auctions

The DMO announced the appointment of 8 IG GEMMs on 10 September, opening the way for the launch of the auction process. The remit provided that index-linked auctions were to be for between £0.5-£1 billion (cash) each.

The first index-linked auction was scheduled for 28 October 1998. However, on 30 September 1998 the DMO announced that, to avoid a possible clash with the publication of the Pre-Budget Report, the first auction would be moved to 25 November.

Two index-linked auctions were held, each for £450 million (nominal), each raising some £800 million cash. The results of the auctions are summarised below.

Table 9: Results of index-linked auctions 1998-99.

Date	Gilt	Nominal Issued	Cover	Clearing Price (CP)[7]	Yield at CP[8]
25 November 1998	2½% IL 2013	£450m	2.29	£160.24	2.42%
27 January 1999	2½% IL 2024	£450m	1.83	£181.60	2.01%

The first two index-linked auctions were generally perceived to have gone well. The yield on the January auction was the lowest real yield at which any gilt had been issued up to that time.

[5] Prices in £/32nds.
[6] Assuming 3% inflation.
[7] Prices in multiples of £0.01.
[8] Assuming 3% inflation.

Conversion Offers

The 1998-99 remit also provided that the DMO might offer to convert unstrippable stocks into strippable benchmarks of a similar maturity. These offers provided a means of increasing the size of strippable benchmarks faster than would otherwise be the case in the prevailing low issuance environment.

The DMO held three conversion offers during the year, two into the five year benchmark and one into the new ten year benchmark. The main features of the offers are shown in table 10 below.

Table 10: Conversion offers results

Date of conversion	Source gilt	Destination gilt	% of source gilt converted	New destination gilt created (nominal)
22 July 1998	11¾% 2003-07	6½% 2003	92.6%	£3,446 million
16 November 1998	8% 2009	5¾% 2009	83.8%	£3,377 million
1 February 1999	12½% 2003-05	6½% 2003	93.1%	£2,541 million

As a result of the three conversion offers the respective amounts in issue of the gilts concerned changed as follows:

Table 11: Impact of conversion offers on gilts in issue.

Gilt	Before conversion £m (nominal)	After Conversion £m (nominal)
6½% 2003	**2,000**	**7,987**
5¾% 2009	**2,500**	**5,877**
11¾% 2003-07	3,150	234
8% 2009	3,450	560
12½% 2003-05	2,200	152

Both 11¾% 2003-07 and 12½% 2003-05 were reduced to rump status as a result of the offers. GEMMs are not obliged to make a market in such gilts and the DMO will make a bid on request from a GEMM for them. 8% 2009 was not reduced to rump status, partly as a consequence of the much large number of retail holders of that gilt compared to the other source gilts chosen (37,000 compared to some 8,000 on 12½% 2003-05 for example).

Following the conversion offer, 8% 2009 traded very illiquidly in the market and the DMO was asked by market participants to consider re-opening the offer in some way. On 11 January 1999 the DMO launched a switch facility for remaining holders of 8% 2009 to switch into 5¾% 2009. The offer will remain open until 5¾% 2009 is next auctioned. By the end of March 1999, £64.4 million nominal of 5¾% 2009 had been issued as a result of the facility (out of a possible £400 million nominal). £54.8 million of 8% 2009 had been bought in.

The Gilt Portfolio

In nominal terms there were £291.3 billion of gilts outstanding at the end of March 1999 (including the inflation uplift on index-linked gilts). This was a reduction of £6.1 billion on the amount outstanding at the end of March 1998 and reflects the excess of redemptions over new issuance.

Despite the fall in the nominal amount in issue, the *value* of gilts outstanding rose over the year by £20.4 billion to £336.3 billion.

Eight gilts were redeemed in 1998-99. £110 million of the 7¼% 1998 gilt (redemption date 30 March 1998) was also redeemed in the 1998-99 financial year. Total redemptions were just under £17 billion.

Table 12: Gilt redemptions 1998-99

Gilt	Date	Redemption £m
7¼% 1998	30 March 1998	110
4⅝% IL 1998	27 April 1998	810
14% 1998-2001	22 May 1998	950
15½% 1998	30 September 1998	860
12½% 1998	20 November 1998	3,880
9½% 1999	15 January 1999	1,875
12% 1999-2002	22 January 1999	65
Floating rate 1999	11 March 1999	5,475
12¼% 1999	26 March 1999	2,945
		16,970

The breakdown of the portfolio by maturity of gilt at the end of March 1998 compared with a year earlier is shown in the table below:

Table 13: Gilt portfolio maturity split

	March 1998 (%)	March 1999 (%)
Ultra short (0-3 years)	17.5	18.8
Short (3-7 years)	24.7	24.0
Medium (7-15 years)	31.3	32.8
Long (+15 years)	25.4	23.3
Undated	1.1	1.1

The table below shows the sectoral holding of gilts (by market value) at the end of the March 1998 and March 1999.

Table 14: Sectoral holdings of gilts

	March 1998 Holdings £bn*	(%)	March 1999 Holdings £bn*	(%)
Local Authorities and Public Corporations	2,460	0.8	3,559	1.1
Banks	21,508	6.7	15,999	4.8
Building Societies	718	0.2	682	0.2
Insurance Companies and Pension Funds	206,539	64.4	213,018	63.6
Other Financial Institutions	11,335	3.5	8,195	2.4
Private non-Financial Institutions	1,340	0.4	705	0.2
Households	16,321	5.1	28,124	8.4
Overseas	60,384	18.8	64,630	19.3
TOTAL	**320,605**		**334,912**	

*ONS National Accounts data released 29 July 1999

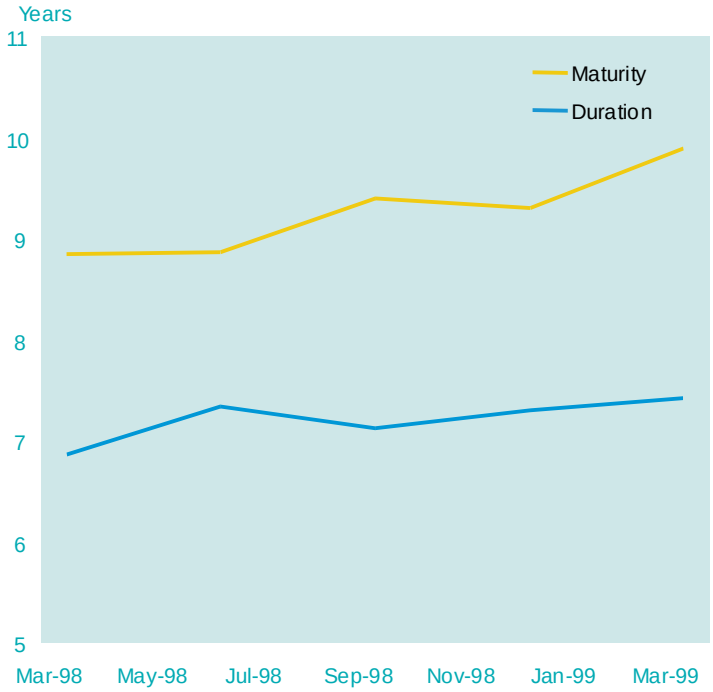
In *Monetary and Financial Statistics, July 1999* the Bank of England published estimates of the beneficial holdings of gilts at end-December 1998 collected from a survey of members of the Central Gilts Office (CGO). The results of the survey are compared with those of the previous CGO survey in 1995. The CGO survey indicated some significant differences in the pattern of sectoral holdings compared to estimates previously published by the ONS (and used by the DMO in its Quarterly Gilt Reviews). In particular, the CGO survey suggested that holdings by the insurance and pension fund sectors were lower than suggested by the CGO survey, and those by households much higher.

The ONS has taken account of the results of the CGO survey alongside its regular sources to restate the sectoral data in *National Accounts*. Some differences between the CGO and ONS estimates remain (ONS uses a wider variety of sources in compiling its estimates). In particular the precise balance between insurance company, pension fund and individual gilt holdings differs between the two sets of estimates. But in general the main trends are corroborated: rising holdings by insurance companies, pension funds, and households/persons, as opposed to declining holdings by banks and building societies. The proportion of gilts held overseas is shown to be broadly the same by both sources – at just under 20%.

Portfolio maturity and duration

The chart below shows how the maturity and modified duration of the gilt portfolio has changed over the year. Over the past year the maturity of the portfolio has increased slightly from 8.84 to 9.9 years. Modified duration has increased slightly from 6.87 to 7.42 years. These increases are a continuation of trends underway since the end of 1996-97 and reflect both the greater proportion of long-dated and index-linked issuance within total issuance and the switch from high to current coupon gilts in particular as a consequence of the conversion offer programme.

Chart 12
Portfolio maturity and duration[9]



Source: DMO

[9] Portfolio maturity is calculated using nominal value weights whilst portfolio duration is calculated using market value weights.

Financing Remit 1999-2000

The DMO's remit for 1999-2000 was published on 9 March 1999 following the Chancellor's Budget statement. On the basis of a forecast CGNCR of £6.2 billion gilt sales of £17.3 billion were planned. The remit is reproduced in full in Annex B.

An innovation welcomed by the market was the provision in the remit of an indication of how gilt issuance would be affected by specific changes to the financing requirement. In particular:

- Any increases or reductions to the financing requirement would be accommodated first by an adjustment to the level of planned Treasury bill issuance of up to £3 billion;

- Any increases or reductions to the financing requirement of more than £3 billion would be accommodated through a combination of adjustment to the size and number of gilt auctions and, as necessary, changes to Treasury bill issuance (but in such a way that a minimum Treasury bill stock of £5 billion is maintained);

- If the financing requirement were to increase or decrease by a sufficient amount to justify a change to the auction programme (and it was not too late in the financial year to make the change) the expectation is that the DMO would first add a long gilt auction (in the case of an increase in the financing requirement). In the event of a reduction in the financing requirement, the DMO would first cancel a short auction.

The financing arithmetic was restated on 20 April 1999, following the publication of the outturn CGNCR for 1998-99, which showed a higher surplus than expected at the time of the Budget. This increased the over-financing adjustment from 1998-99 at the expense of the 1999-2000 financing requirement. The volume of planned gilt sales remained unchanged at £17.3 billion and the change was absorbed through a reduction in planned Treasury bill sales.

Table 15 below shows the financing arithmetic as presented in the Budget and as updated on 20 April 1999:

Table 15: The 1999-2000 gilt financing requirement (£ billion)

	Budget	20 April
CGNCR Forecast	–6.2	–6.2
Net financing for official reserves*	2.4	2.3
Gilt redemptions	14.8	14.9
Gilt sales residual from 1998-99	–2.3	–4.1
Financing requirement	**21.0**	**19.3**
Financed by		
National Savings	0.1	0.1
Treasury Bills & other short term debt	3.6	1.9
Gilt Financing Requirement	**17.3**	**17.3**
Of which: Short conventional gilts	5.0	5.0
Medium conventional gilts	3.0	3.0
Long conventional gilts	5.8	5.8
Index-linked gilts	3.5	3.5

* estimated at prevailing exchange rates

The noteworthy features reflected in the gilt financing arithmetic for 1999-2000 were:

- An increase in short term debt for cash management purposes, and;
- Net financing for the official reserves.

Short term debt and cash management

It is intended that the DMO takes over the management of the Government's daily cash position (from the Bank of England) in 1999-2000. In practice, it will be around the end of this period. In preparation for this, the Government decided to increase the stock of Treasury bills in 1999-2000 to such a level that will enable the DMO to start using them as the main instrument for smoothing the seasonal fluctuations in the Government's cash flow.

This will require an increase in the stock of short-term debt of £1.9 billion above that necessary for unwinding the effects of excess gilt sales in 1998-99.
The Budget forecast an overall requirement to increase the level of short term debt by £5.9 billion in 1999-2000. This is broken down as follows:

Table 16: increase in short term debt.

	£bn
• Increase in stock of T Bills (from £3.8 billion to £10 billion)	6.2
• Financing of cash deposit at Bank of England	0.2
• Less repayment of Ways and Means (to £17 billion)	–0.5
	5.9

This increase was presented in two parts in the Budget financing arithmetic:

- the first (as shown in previous years) being the increase in short term debt necessary to unwind the over financing by gilts in 1998-99 (£2.3 billion at the time of the Budget);
- the second being the residual increase of £3.6 billion necessary to reach the planned level of Treasury bills and Ways and Means.

The CGNCR outturn for 1998-99, published on 20 April, together with a revised contribution from National Savings, increased the amount of gilt over-financing in 1998-99 to £4.1 billion (as shown in the restated financing arithmetic).

Overall the financing requirement fell by £1.7 billion to £19.3 billion but this reduction was taken account of by a reduction in planned Treasury bill issuance of the same amount rather than planned gilt sales. This was in line with the provisions of the remit, which insulated gilt sales from financing requirement reductions of £3 billion or less.

Accordingly the net increase in Treasury bill issuance presented in the financing arithmetic as being attributable to preparations for the transfer of cash management was reduced by £1.7 billion to £1.9 billion. The gilt financing requirement remained unchanged.

Financing for official reserves

On 5 January 1999, the Bank of England announced that it would be starting a Euro bill programme in the first half of 1999-2000 and issuing Euro Bills in its own name to finance its provision of intra-day liquidity through TARGET. Euro bills that had been issued on behalf of the Treasury would be allowed to mature over this period.

The Bank also announced that sterling, equivalent to E3½ billion, would be swapped into foreign currency assets to replace the E3½ billion that the Euro Treasury Bill programme contributed to the foreign currency reserves. To finance this swapping activity, the equivalent of E3½ billion was added to the sterling financing requirement for 1999-2000. The spread between gilt and swaps yield meant that swapping out of sterling was a more cost effective method of financing than borrowing directly in foreign currency.

The Minimum Funding Requirement (is the effect on the gilts market overstated?)

The Minimum Funding Requirement (MFR) and its review have been the subject of much comment in the press and analysts' reports. Many claim that the MFR has been the main cause of the increased demand for gilts.

This section reviews the Minimum Funding Requirement (MFR) and the effects it may have had on the gilt market. It also reviews what has been said about the future of the MFR, with reference to the press release of 3 March 1999 from Pensions Minister, Stephen Timms.

The section concludes that there are many fundamental changes that are affecting the gilts market including falling gilts supply and a salary-based pension industry approaching steady state equilibrium. It argues that these are having far greater effects on the demand for gilts than the MFR.

The Pensions Act (1995)

The Minimum Funding Requirement was part of the reform of the regulation of occupational pension schemes introduced by the Government in the Pension's Act (1995). This legislation implemented a pension reform package, initially discussed in the Goode Report (1994) and introduced the concept of a Minimum Funding Requirement. The detail of the Minimum Funding Requirement was fleshed out in Actuarial Guidance Note no. 27. These reforms are being phased in through each pension fund's three-yearly review of solvency. The reforms began to take effect from April 1997 and are to be fully implemented by the end of the year 2002.

The Government's pension reform was not intended to be a prescriptive guidance of pension fund investment. The MFR, therefore, did not include prescriptions on the type of assets in which a pension fund has to invest. Rather it determined the discount rates to be used for assessing the value of pension fund liabilities with reference to different types of asset classes for different members of the scheme. Liabilities for pensioners were to be assessed using a discount rate relating to yields on current gilts (either index-linked or conventional as appropriate). Liabilities for younger members were to be assessed in relation to rates of return based on equity investment, with a blending of these two asset classes during the 10 years preceding pension age.

> *"The current gilt yields to be used for valuing pensioner liabilities should be the gross redemption yield on the FT-Actuaries Fixed Interest 15 year Medium Coupon Index or the FT-Actuaries Index-linked Over 5 years (5% inflation) Index, as appropriate."*[10]

[10] GN 27: Retirement Benefit Schemes – Minimum Funding Requirement. Appendix 2: Current Factors for Use in MRF Valuation.

Market reports suggest that the use of this valuation is likely to have led to an increase in gilts' importance to pension funds. In addition to gilts' role as a portfolio investment, gilts also act as a hedge against the MFR solvency test.

The Gilts Market

There has been considerable analysis of the effect of the MFR on the incentives for pension funds to hold gilts. Indeed, since the phased introduction of the MFR, long gilt yields and index-linked gilt yields have fallen sharply. The coincidence of these events has led many to conclude that the fall in yields is because of the introduction of the MFR. However, there are several factors that have contributed to the fall in yields. These include low levels of primary issuance, the effects of funds maturing, the need to reduce the volatility of pension fund assets and "limited price indexation". These factors are discussed below.

The last three years has seen a marked contraction in the level of primary issuance of gilts, as a result of a significant reduction of the Government's net cash requirement. The effect of this reduced supply of gilts has been to increase prices and thus decrease yields on all gilts. Chart 13 below shows the dramatic reduction of net gilt supply over the last three years.

Chart 13
Net Gilt sales requirement 1990-91 to 1999-2000

* expected

Source: HM Treasury

Salary-related pension funds are becoming increasingly mature, which creates a greater demand for gilts. The increasing demand for gilts reflects a combination of: funds set up in the 1960s beginning to mature; the pension fund system moving towards stock equilibrium and the demographic profile of the UK's working population.

There is now a more even distribution of young and mature pension funds, with more funds in a steady-state equilibrium.[11] The needs of young and mature funds, however, are quite different. In a pension fund's infancy it needs to invest in long term instruments, that will grow over a number of decades to provide a capital sum at the end. Equities are the usual vehicle for such investment since, over a period of decades, they have tended to yield larger capital growth. Many also regard equity returns as having good correlation with final salary liabilities. A maturing pension fund has different needs. Here matching liabilities with assets of the appropriate maturity becomes more important. The pension fund will be paying out pensions and thus have a requirement for conventional and index-linked bonds, which have a term which is appropriate given the length of the pension liabilities. Maturing UK pension funds thus have an increasing demand for gilts and other bonds.

Maturing pension funds also have a greater requirement for asset value stability as they have less cash coming in relative to going out. This means that should a fund require an increase in funds to increase its solvency ratio, for example after unexpected asset depreciation, it will have fewer payments to make good the shortfall. This will require a greater proportionate increase in payments from those paying into the fund than from a younger fund, which can make the adjustment over a greater number of years and contributors. This increases a pension fund's desire to reduce asset volatility as it ages. Demand for gilts and other bonds increases because of the lower volatility of this asset class.

Expected changes to Accounting Standards may also be increasing demand for gilts. These changes may require companies to mark-to-market the value of their occupational pension scheme liabilities and account for them on their balance sheet. This may introduce greater volatility to corporate balance sheets. Again by increasing the holding of gilts and other bonds over equities such volatility may be somewhat reduced. The full implementation of these changes will not occur until September 1999 at the earliest. However, forward looking companies can be expected to have taken account of this in their portfolio selections.

The fall in inflation expectations below 5% has led to an increased demand for index-linked gilts because of the guarantees of Limited Price Indexation (LPI) on deferred pensions. LPI is a guarantee on the indexation of pension payments. In its simplest form this guarantees indexation of annuity payments at 5%, or in line with retail prices, whichever is lower. While inflation expectations were greater than 5%, an assumption could be made that the payments would increase by 5%. In this case, conventionals gilts could match the indexation requirements of such an annuity. However, lower inflation expectations make it more likely that they will be valued as index-linked annuities and so need to be matched with index-linked gilts. This has created further demand for index-linked gilts, to hedge this increased exposure to retail price movements.

[11] A pension fund in steady-state equilibrium has a proportion of pensions being paid and contributions from paying members, which will remain constant in future, other things being equal.

All of the above factors are likely to have contributed to the relative price increases in conventional and index-linked gilts. Further, none of the above factors will necessarily reverse in the near future.

Review of the MFR

On 3 March 1999 the Pensions Minister, Stephen Timms, announced the terms of reference for the review of the Minimum Funding Requirement. The actuarial profession will undertake the review and then submit proposals to the DSS, in around a year's time. The DSS press release stated that:

> *"The review's aim is to find the best way to safeguard the pension rights of those in occupational pension schemes.*
>
> *The review will focus on the valuation method, and consider fundamental changes in approach to the existing system."*

The intention of the Pensions Act was to protect pension holders if a pension-providing company went bankrupt. The UK Government was keen not to constrain pension funds in the types of asset they could hold. This was seen to be detrimental to pension holders. Pension funds were left to maximise their portfolio returns subject to a prudent set of guidelines on asset valuation to ensure a minimum level of solvency if the fund had to be wound up.

It is clear that any reform will not be made quickly. The Institute of Actuaries is expected to submit proposals to DSS early next year. There will, in all likelihood, then follow a consultative process. Further, it is not clear that any of the proposed changes to the MFR will be substantial in the effects that they have on the gilt market. Finally, any change to the MFR will not change the other factors contributing to current levels of gilt yields. The outlook for gilts supply remains low by historic standards; the pension fund industry is approaching a steady state equilibrium and changes to the accounting standards may continue to create demand for gilts and other bonds to reduce asset volatility. Further, while inflation expectations remain below 5%, limited price indexation will continue to exert downward pressure on index-linked gilt yields.

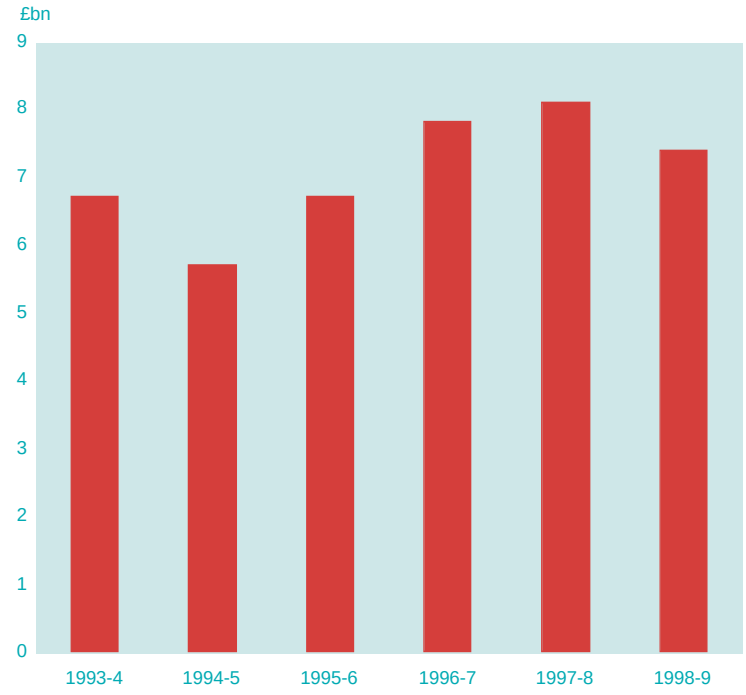
Any further developments will be announced by the DSS.

Chapter 3 : Market developments

Turnover

In 1998-99 market turnover in gilts fell 8.6% to £1.86 trillion, or £7.37 billion per day, compared with 1997-98. The reduction was primarily a reflection of the contraction in trading experienced worldwide, in the wake of the financial crises of late summer and early autumn 1998 and possibly of reduced issuance. Chart 14 below shows average daily turnover since 1993-94.

Chart 14
Average daily turnover in UK Government Bonds

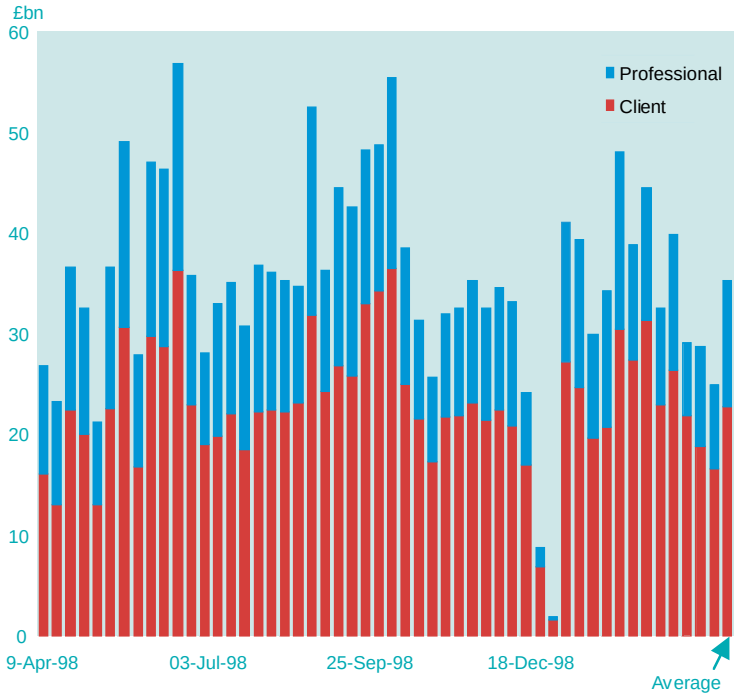


Source: GEMMs

The average value of bargains struck between ‘professional’ or ‘wholesale’ counterparties in 1998-99 was £5.06 million, and £69,800 in the ’retail’ market.

Chart 15 below shows weekly aggregate totals of gilt turnover through the Gilt-Edged Market Makers (GEMMs) in 1998-99.

Chart 15
Aggregate daily turnover of all GEMMs (week by week basis)



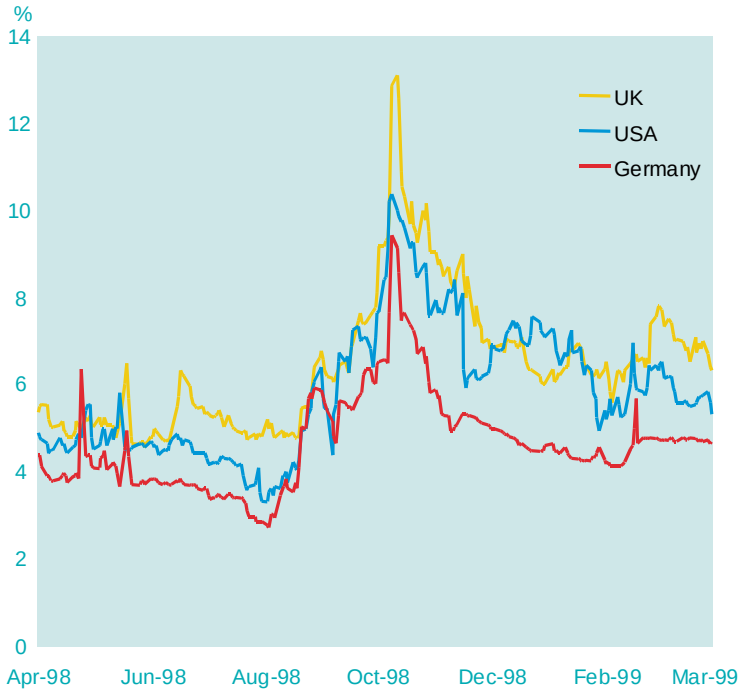
Source: GEMMs

Gilt market turnover data is currently published by the DMO on a quarterly basis in the Quarterly Gilts Review and on annual basis in the Gilt Review. The London Stock Exchange also publishes weekly gilt market turnover data, on a subscription basis.

Market volatility

The table below compares implied gilt market volatility (at around 10 years maturity) derived from option prices with US Treasury and German bond implied volatility. The volatility of bond prices can be used as an indicator of the degree of uncertainty attached to prospective returns. In the past year there has been a fairly close correlation between the three major markets, although UK yields have been seen as more uncertain than those in the US and Germany. Gilts reacted more sharply to the October shock than US Treasuries or Bunds.

Chart 16
Implied Bond Market Volatility 1998-99



Source: Bloomberg

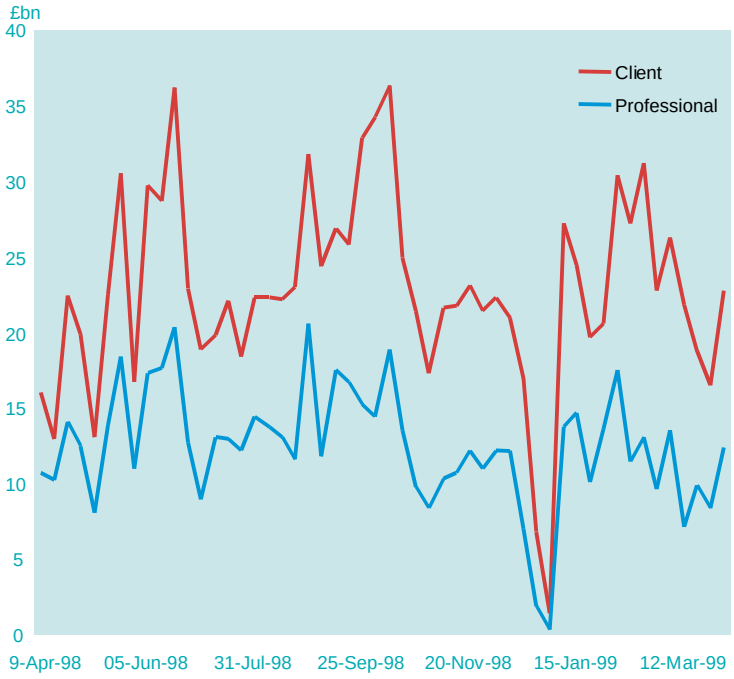
Concentration of GEMM activity

This section examines GEMMs' levels of turnover in the client and professional markets[12] *and analyses the levels of concentration in each of these markets using Herfindahl indices. The section concludes that GEMM trading is not overly concentrated and that the level of concentration was broadly unchanged over the financial year 1998-99.*

The weekly level of GEMM turnover fell slightly over the year. This was the counterpart of a slight decline in the volume of professional trades over the year. The level of turnover from clients, however, remained broadly constant throughout the year. The chart overleaf shows the weekly turnover in both the professional market and the client market. This clearly illustrates the direct relationship between the two markets.

[12] This section defines professional trades as all trades that have as a counterparty an Inter Dealer Broker (IDB), another GEMM, the DMO or the Bank of England. All other trades are assumed client trades.

Chart 17
Turnover in the Client and Professional Markets



Source: GEMMs

The DMO regularly monitors the GEMM markets, including their degree of concentration. There were sixteen GEMMs throughout the financial year 1998-99, with Morgan Stanley becoming a GEMM as Nikko Securities withdrew in May 1998. The DMO would be concerned if there were signs of high or markedly increasing market concentration as this may lead to a few GEMMs maintaining and exploiting market power. This could reduce the attractiveness of the gilts market to investors and increase the cost of Government borrowing.

To measure the level of concentration the DMO makes use of the Herfindahl index. This index is used across a number of industries as a measure of market concentration. It is used by both the Monopolies and Mergers Commission and the US Department of Justice. It is calculated thus:

$$\Sigma_{i=0}^{n} \text{(market share}_i)^2,$$

where
i represents the **i**th firm in the market and;
n represents the number of firms in the market.

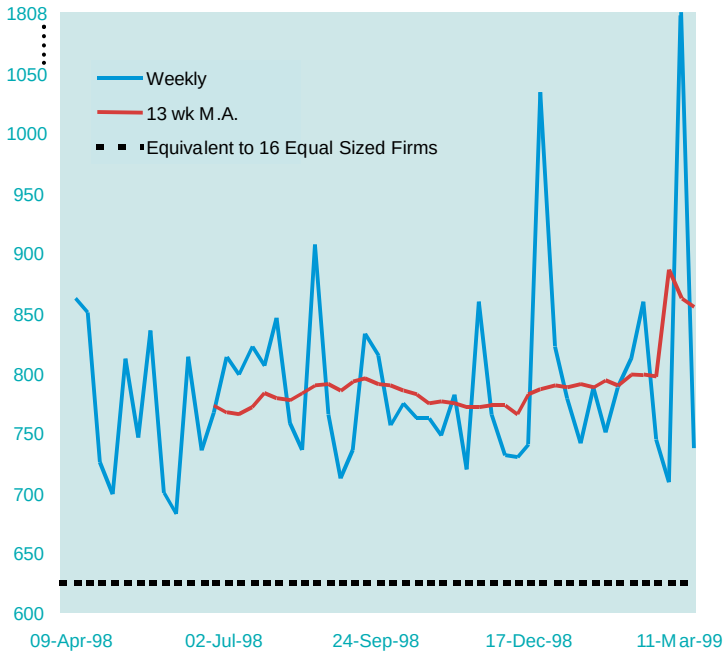
The Herfindahl index can then be interpreted by calculating the same figure based on numbers of firms with equal market share. For example

10 Equal Size Firms =	10 x $(10\%)^2$	= 1000
16 Equal Size Firms =	16 x $(6.25\%)^2$	= 625

The higher the index relative to its reference value, the greater the concentration of market share.

The chart below illustrates the Herfindahl index (HI) calculated from the GEMMs' market shares of the client market for the financial year 1998-99. This shows that there is a fair degree of variation of weekly levels of concentration. The chart also plots a thirteen-week moving average for the period. This is designed to illustrate trend variations in concentration. This shows that levels of concentration in the client market remained fairly constant over the year, averaging a value of 800. This is equivalent to between 12 and 13 equal sized firms.

Chart 18
Herfindahl Index Values for the Client Market



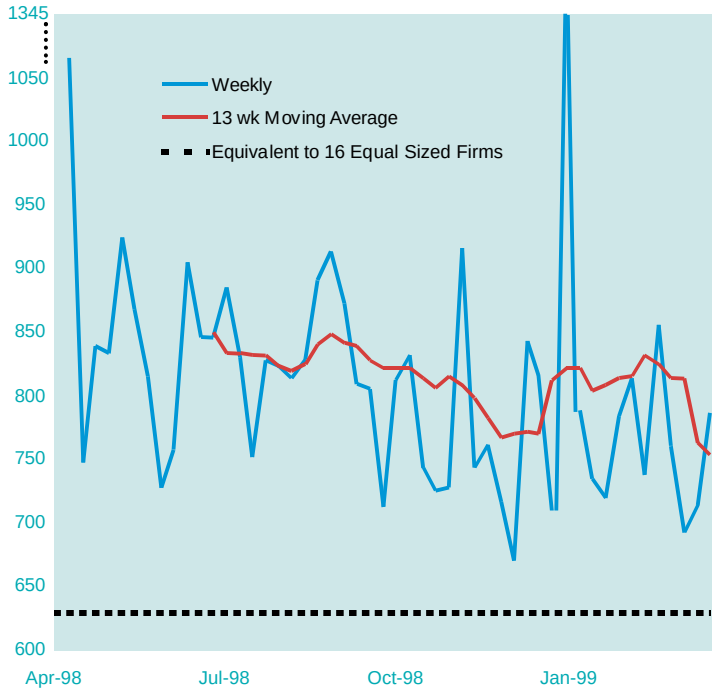
Source: GEMMs

The client chart also shows two large spikes where concentration in those weeks significantly increased above average. These spikes have different explanations. The first spike occurred in the run up to Christmas, recording a HI value of 1033 in the week ending 24 December. It can be seen from Chart 17 that that period was characterised by very low levels of trading. All of the GEMMs saw falling volume; however, a few GEMMs saw a smaller proportionate decline leading to the observed increase in concentration. The second spike was much bigger; the HI value increased to 1808 (off the scale) in the week ending 12 March. In this week the turnover volume was only just below the average weekly volume for the year. This was caused by one GEMM increasing its turnover volume to over three times its average level.

The DMO was not concerned by either of these one-off increases in concentration; it would only be concerned if there were a long run increase.

The chart below shows the same summary statistics for the professional market.

Chart 19
Herfindahl Index Values of the Professional Market



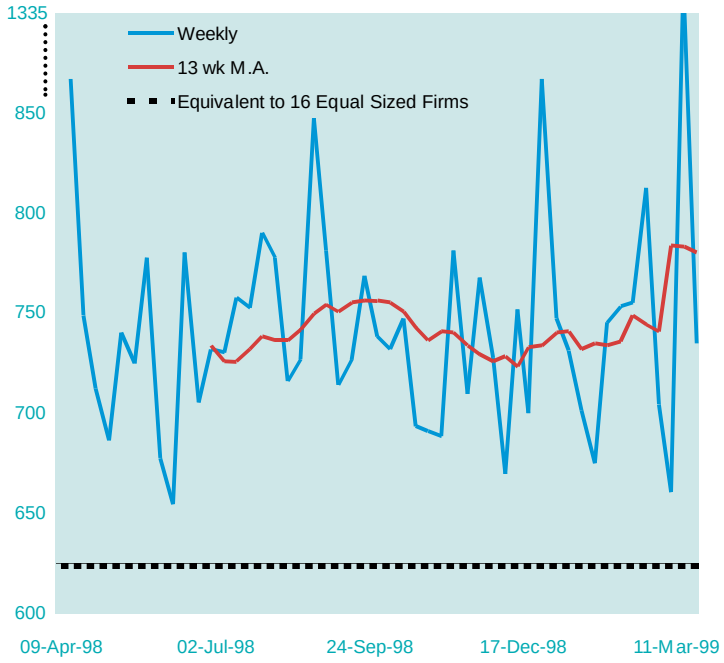
Source: GEMMs

The professional market saw a slight decline in concentration over the year. Concentration saw a trend decline from a HI value of around 860 to around 770. This was equivalent to an increase in the number of equal sized firms from 11-12 to 12-13. The chart also shows a large increase in concentration for the week ending 31 December. This was caused by the same reduction in volume of trade as witnessed in the client market.

The final chart opposite shows the concentration of the total GEMM market, combining client and professional markets. The client market's concentration trends dominate concentration in the total market, reflecting the greater volume in the client market. Hence we see a fairly constant level of concentration throughout the year. The HI average throughout the year had a value of 750, equivalent to 13 to 14 equal sized firms. The fact that concentration is lower in the total market than in either of the component markets indicates a small degree of specialisation. Some GEMMs played a greater role in the client market while others played a greater role in the professional market.

An average level of concentration in the total market equivalent to 13-14 equal sized firms shows a fairly even distribution of turnover between GEMMs. With 16 GEMMs, the level of concentration cannot drop much further. As a result, the DMO currently has no concerns over the level of gilt market concentration.

Chart 20
Herfindahl Index Values of the Total Market



Source: GEMMs

GEMMs – establishment of a specialist index-linked market-maker list

On 10 September the DMO announced those market-makers recognised by it as index-linked specialist GEMMs. This specialist function was introduced to improve liquidity in the index-linked market; the changes were suggested in a consultation document issued by the DMO on 10 June 1998. This subset of GEMMs has agreed to make markets in index-linked stocks, supplying the secondary market with a source of guaranteed liquidity. In return, IG GEMMs have the exclusive right to bid via telephone to the DMO in index-linked auctions and exclusive access to the index-linked 'shop window'. In addition, the DMO will, on request from any of these GEMMs, bid for index-linked stock at a price of the DMO's choosing.

The full list of GEMMs appears at Annex C.

Conversion offer methodology

On 5 August 1998 the DMO published a consultation document on the proposed conduct of gilt conversion offers. In addition to explaining the rationale and constraints on the conversion offer process, it proposed a number of features for future conversion offers:

- **Maturity of conversion candidates:** no consideration to be given to conversions of stock with less than around 5 years to maturity;
- **Size of conversion candidates:** no consideration to be given to candidate stocks with £5 billion (nominal) or more in issue;
- **Timing of offers:** offers are not to be scheduled so that the fixed conversion terms on any two offers run concurrently. Moreover, conversion offers should not be scheduled to coincide with a gilts auction in the same maturity area;

- **Offer timetable:** a shorter period, with the dropping of the initial two week period between announcement of offer and setting of terms was proposed. If an offer were not to settle on the coupon date of the source stock, an offer would be made for forward settlement three weeks in the future. In addition the possibility of shortening the three week offer period itself was explored;
- **Pricing methodology:** the DMO could not commit itself to set the conversion terms equal to the ratio of the prices of the two stocks in the market at the time of the offer being made. Instead, the DMO yield curve model would be used to determine the terms. The conversion ratio (a 'dirty price' ratio) would be calculated by valuing both the source and destination stocks by discounting each of the cash flows to the conversion date using the forward yield curve on the date of announcement of the conversion terms;
- **Interaction of conversion offers with deliverable stocks into futures contracts:** conversion offers are not to be made for a stock that is cheapest-to-deliver, or has a reasonable likelihood of becoming cheapest-to-deliver, for any of the listed gilt futures contracts. Also, an offer would not be made for a deliverable stock between the date on which the futures exchange publishes the official list of deliverable gilts and the delivery period itself.

The market responded positively to the proposals. On 16 November 1998, alongside the results of the 8% 2009 into 5¾% 2009 conversion offer, the DMO published its response to the consultation exercise. In addition to confirming the approach on most issues as originally outlined, the statement also included the following decisions:

- **Timetable:** the abolition of the initial two week period between announcement and the setting of the terms. The three week offer period itself was left in place;

- **Pricing methodology:** the modification of the method used to derive conversion terms. In future, whilst continuing to use its yield curve model to provide a benchmark ratio for the offer, the DMO would (at its discretion), adjust this ratio to take some account of the observed cheap/dear characteristics of the source and destination stocks.

Convention changes

A number of important changes to gilt market trading conventions were introduced for trades settling after 1 November 1998. The changes helped bring the gilt market more in line with major overseas bond markets. They had been announced in a joint Treasury/Bank publication in March 1998 and represented the conclusion of extensive consultation with the market. The changes, which were well received, were as follows:

- Gilt prices are now quoted in decimals (ie £ and pennies) as opposed to £1/32nds. (Accordingly, auction bids are to two decimal places and Gilt-edged Market Makers' reference prices are also published to 2 decimal places);

- The daycount convention for the calculation of accrued interest has changed to "actual/actual" from "actual/365";

- GEMMA reference prices for strips are now compiled from yield (not price) data;

- The DMO formulae on price/yield conventions[13] were adopted as the standard market yield convention from 1 November 1998.

In addition, on 31 July 1998, the arrangements for special ex-dividend periods on gilt trading came to an end. Under these arrangements, parties to a gilt transaction could agree to trade on an ex-dividend basis during the 21 days prior to the ex-dividend date (the purchaser would accordingly take delivery of the gilt without the right to the next dividend). Since the abolition of these arrangements fewer trades should now give rise to credit exposure on dividend payments.

CGO/CREST merger

Following close consultation with market practitioners, the CGO system was upgraded and moved on to CREST software in 1997. CGO has the functionality to:

- settle stock and cash transfers;
- reconcile positions and transfers in the system;
- transfer collateral overnight - delivery by value (DBV) - to allow the members to issue stock against a secured overnight loan;
- strip and reconstitute gilts;
- offer a flexible membership and portfolio management structure;
- offer an automatic transaction reporting to the London Stock Exchange and the Financial Services Authority;
- allow settlement banks to extend credit to CGO members and control their exposure; and
- process stock lending and repo (sale and purchase) transactions efficiently.

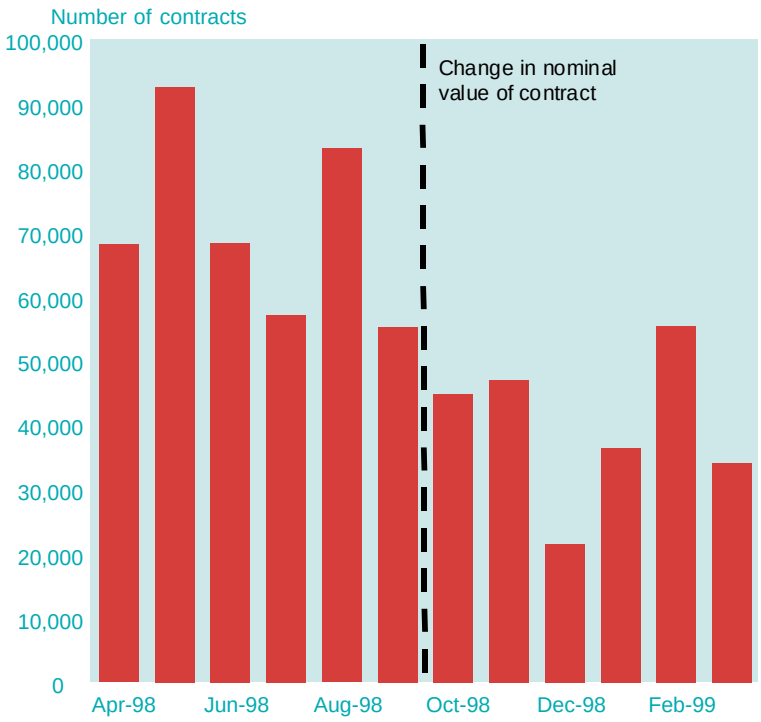
On 24 May 1998, the Bank of England announced that the CGO and CREST systems were to be merged and would be operated and managed by CREST with effect from the second quarter of 1999 (the transfer took place on 24 May 1999). It is also the intention to merge the operations by absorbing CGO into CREST from the second quarter of 2000.

Futures markets

Volume in the long gilt contract averaged over 64,000 lots per day in calendar year 1998. The gilt contract is widely used by the GEMMs to hedge their conventional positions. Average daily volumes trades are shown in the chart below. The number of contracts traded reflects the doubling of the size of futures contracts from £50,000 to £100,000 from September 1998 onwards. A number of other changes have been made to the contract specifications in line with wider developments in the market. Prices are now quoted in decimals to £0.01, the actual/actual daycount convention for accrued interest and the DMO's price/yield formulae have been adopted, the notional coupon has been reduced to 7% and the maturity band of stocks in the deliverable basket has been lowered to 8¾-13 years.

[13] UK Debt Management Office, "Formulae for Calculating Gilt prices from Yields", published 8 June 1988. Effective 1 November 1998.

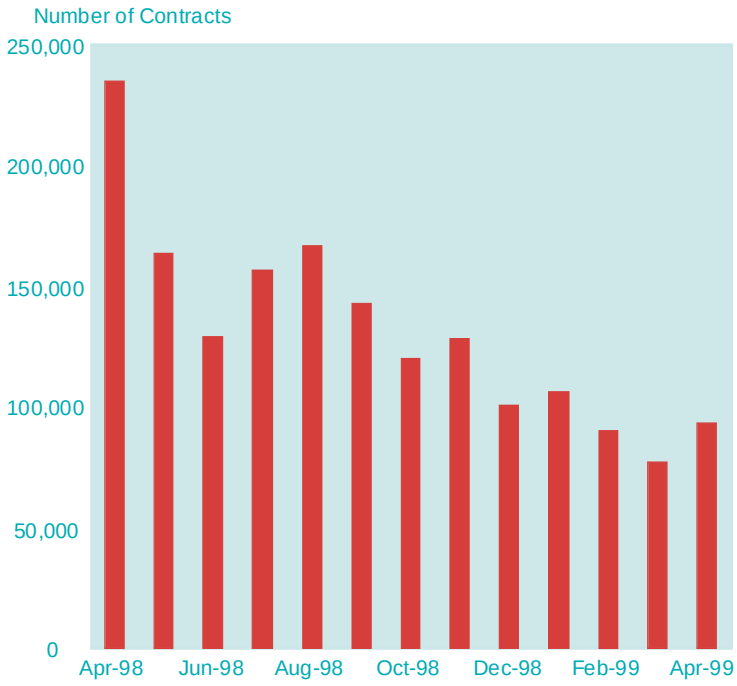
Chart 21
LIFFE Long Gilt Future: Average daily volume on a monthly basis



Source LIFFE

The number of open interest contracts, representing the underlying level of hedging demand, averaged around 135,000 in 1998-99, but showed a falling trend over the course of the year, in line with the numbers (and size) of contracts traded.

Chart 22
LIFFE Long Gilt Future: Open interest at month end



Source LIFFE

In January 1998, LIFFE relaunched a five year gilt futures contract, also traded in units of £0.01, with a notional contract size of £100,000 and a notional coupon of 7%. The delivery basket includes all eligible stocks with a remaining maturity of 4-7 years. However, the level of activity in the contract has been low.

Move to electronic trading

LIFFE introduced electronic trading for its gilt futures contracts on 12 April 1999 when Connect for futures was launched. The short-term interest rate products will be added from August onwards, with the short sterling contracts expected to go live on Connect on 6 September 1999.

The transition to LIFFE Connect has gone quite smoothly, although there have been some teething problems. Market reaction to the system has been generally positive; participants have commented that their ability to see the depth of the market has improved price discovery. The long gilt futures contract has traded an average of 30,000 contracts a day since the introduction of Connect. This compares favourably with the levels of turnover experienced in the early part of the year.

Gilt strips

One new strippable gilt was issued in 1998-99 (5¾% 2009, auctioned for the first time on 29 July 1998) and 6% 2028 became strippable following the May 1998 auction. This took the number of strippable gilts to ten. The nominal amount of strippable stock rose by £15.26 billion to £101.40 billion as a result of the two gilt auctions and successful conversion offers into 6½% 2003 (nominal in issue increased by £5.99 billion) and 5¾% 2009 (nominal increased by £3.78 billion). The strippable gilts at the end of March 1999 are shown in table 17:

Table 17: Strippable gilts and amount stripped

Gilt	Redemption Date	Amount in issue (£m)	Amount stripped (£m)	% of issue
8% Treasury 2000	7 December 2000	9,800	125	1.27
7% Treasury 2002	7 June 2002	9,000	242	2.69
6½% Treasury 2003	7 December 2003	7,987	115	1.44
8½% Treasury 2005	7 December 2005	10,373	489	4.71
7½% Treasury 2006	7 December 2006	11,700	166	1.42
7¼% Treasury 2007	7 December 2007	11,000	249	2.26
5¾% Treasury 2009	7 December 2009	6,277	81	1.29
8% Treasury 2015	7 December 2015	13,787	210	1.52
8% Treasury 2021	7 June 2021	16,500	487	2.95
6% Treasury 2028	7 December 2028	5,000	154	3.08

However, the gilt strip market has continued to grow only slowly since its introduction in December 1997. The nominal amount of gilts held in strippable form rose by 20% from £1.88 to £2.3 billion over the course of the year but still accounts for under 3% of the amount in issue that is potentially strippable. The continuing inversion of the yield curve over most of 1998-99, which makes strips appear more expensive relative to conventionals, looks to have been an important factor in inhibiting demand. For more information on strips see chapter 5 (page 51).

IDB review

The London Stock Exchange (LSE) and the DMO published a joint consultation paper on the role and regulation of inter-dealer brokers on 25 June 1998. The paper was very wide ranging and sought views on a number of issues relating to the business of IDBs operating in both the equity and the gilt market. The DMO and LSE received 21 responses representing the views of GEMMs, IDBs, end-investors, other brokers and other official bodies.

One of the questions asked was whether there was any need for gilt IDBs to remain separately capitalised. The consensus view was that there was no need for this; consequently, the LSE and DMO announced in February 1999 that they would no longer require gilt IDBs to be separately capitalised. This change came into effect on 22 March 1999.

The DMO and LSE engaged in further discussions and consultation with the market on other aspects of the IDB business. Following this, the DMO and LSE have put forward some proposals, which, if implemented, would create a new category of gilt broker - the Wholesale Dealer Broker (WDB). A WDB would be free to offer its service to a wide range of wholesale market participants including the GEMMs. However, the existing IDBs would be able to continue to operate in a broadly unchanged fashion. The LSE has issued draft rules to effect these changes to its members for consultation. These rules are expected to come into force in the near future.

Special repo agreements

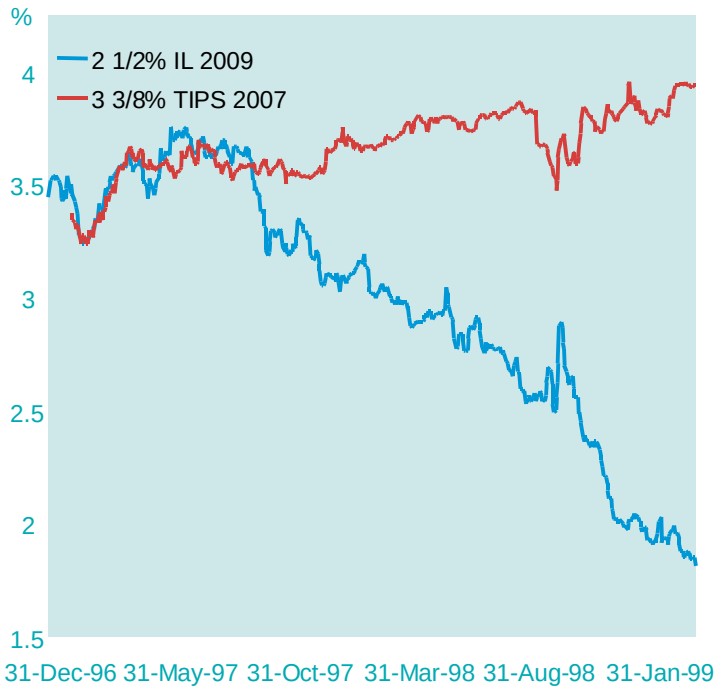
Under its remit, the DMO may create and repo out stock for market management purposes. In 1998-99 the DMO has been negotiating with the GEMMs a series of bilateral special repo agreements setting out the terms under which the DMO would be prepared to offer stock if a special repo operation was necessary.

No special repo operations were held in 1998-99.

Chapter 4: UK and US index-linked yield differentials

The chart below shows real yields in the UK and US, as described by yields on the UK's 2½% IL Treasury 2009 and the US's 3⅜% Treasury Inflation Indexed Security 2007. The chart shows the divergence of the yields on Index-linked Gilts (IGs) and Treasury Inflation Indexed Securities[14] from January 1997 and the widening of these yields until 31 March 1999. Market commentators have used this differential to illustrate that IGs are expensive. This article suggests that the divergence of the two yields can be at least partially explained by the divergence of economic fundamentals between the two economies and the idiosyncrasies of the two markets.

Chart 23
IG and TIPs' Implied Real Yields



Source: Bank of England

Yields on index-linked bonds provide observations of economies' real yields. The UK has had index-linked bonds in issue since March 1981. Estimating real yields for countries without index-linked bonds is more problematic. The yield is calculated by adjusting nominal yields for inflation. However, crucial assumptions have to be made about the expected path of inflation. Further difficulties include the choice of the measure of inflation, for example producer price indices, consumer price indices etc.

[14] Treasury Inflation Indexed Securities were initially referred to as Treasury Inflation Protection Securities (TIPS). Although the bonds were never issued under this name, the name still persists in the market place. Reflecting this, this chapter refers throughout to TIPS.

The launch of the US TIPS on 29 January 1997 provided the first direct observation of real yields in the US. Real yields in the US have been relatively constant since then. The yield on the 3⅜% TIPS 2007 has drifted upwards, but has not moved far from its average of 3.69%. The standard deviation of daily yields since its launch has been 0.15%. IG yields by comparison have seen a long and sustained fall in their implied real yields from the levels of February 1997. Yields on the 2½% IL Treasury 2020 fell by almost half, or 162 basis points, from the end of February 1997 to the end of March 1999.

Economic fundamentals and the idiosyncrasies of the different markets have contributed to the difference in the diverging yields of the two sets of index-linked bonds.

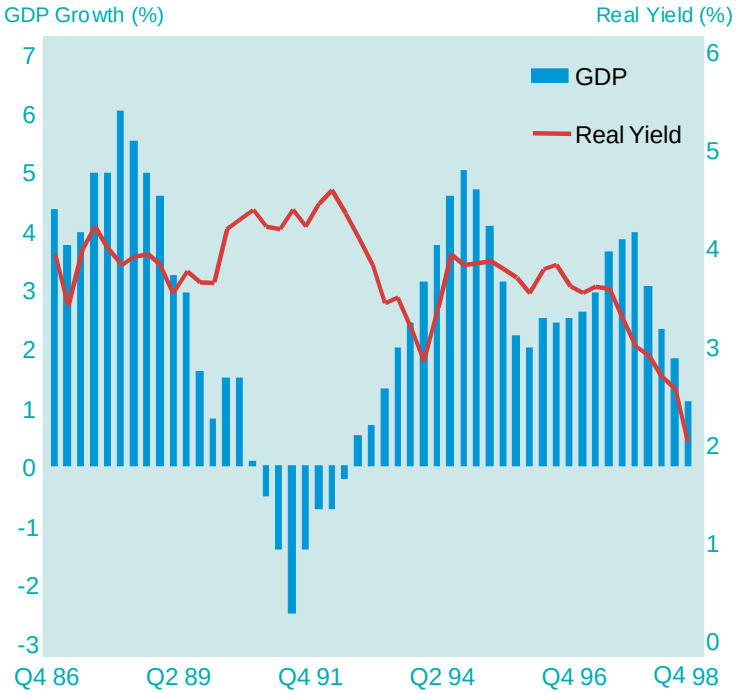
Economic Fundamentals

(i) Growth

Theoretically, an economy's real yield (on its gross investment) should tend towards its real growth rate over the long run. This relationship exists because higher levels of growth lead to higher levels of investment. This investment will in effect be financed through borrowing. The increase in demand for capital will tend to increase the cost of borrowing. Simultaneously, the higher expected returns that a growing economy should create, permit investors to pay the higher costs of capital.

Analysis of UK real yields and growth rates shows that rates of growth do have a statistically significant relationship with real yields. The chart below illustrates this relationship. Sterling's membership of the ERM and the previous shadowing of the deutschemark at the start of the decade provide the only period where index-linked yields did not change in line with the growth rate of the UK economy. Over this period interest rates were strongly influenced by growth in the buoyant German economy, via the exchange rate.

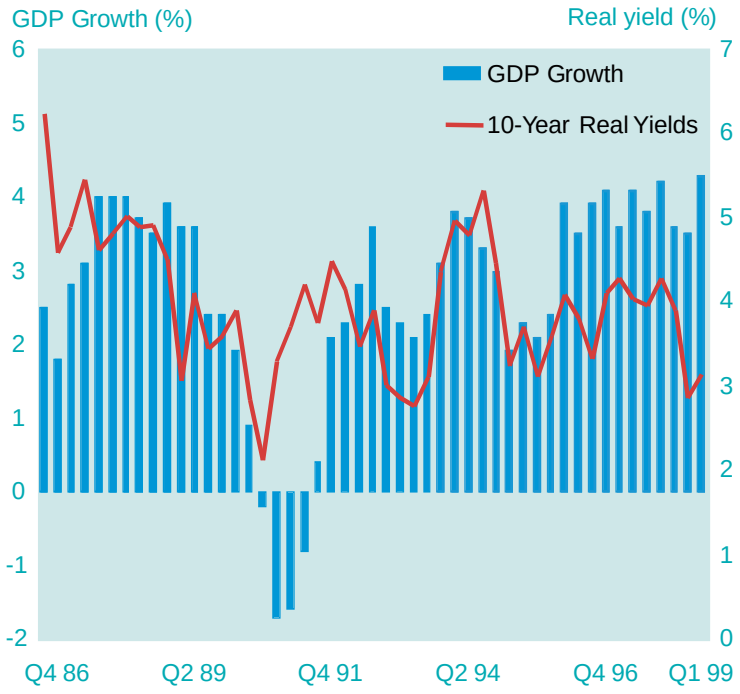
Chart 24
Index-linked 10 year Real Yields and the Annual Rate of GDP Growth (quarterly) in the UK.



Source DMO/HM Treasury

A similar analysis can be performed for the US economy. In this case, historic real yields are derived from nominal yields and inflation. Again there is a statistically significant relationship between the real yields and the rate of growth of the US economy. A longer run of TIPS' real yields should show an even stronger relationship: in the final quarters, where TIPS yields are available, there is a stronger relationship between TIPS' yields and growth than with the calculated real yields and growth. This is because TIPS' yields were not distorted by the flight to quality that drastically reduced US Treasuries nominal yields in the second half of 1998. The chart below illustrates the relationship in the US.

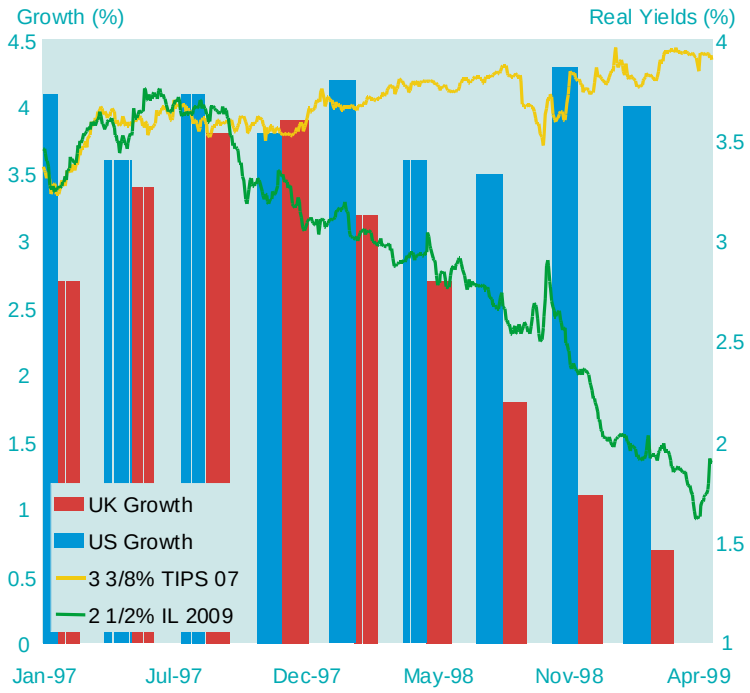
Chart 25
Index-linked 10 year Real Yields and the Annual Rate of GDP Growth (quarterly) in the US



Source: DMO/Datastream

Comparing the growth rates of the US and the UK over the last two years, there was a similar divergence in quarterly growth rates as in index-linked bond yields.

Chart 26
Divergence of UK and US Quarterly Growth Rates and Daily Real Yields



Source: DMO/Datastream

This suggests we can explain some of the divergence in real yields by the divergence of the rates of growth in the two economies.

(ii) Supply

The difference in the levels of supply of index-linked debt from the US and the UK also contributed to the divergence of real yields. Table 18 below shows the levels of gross issuance of index-linked bonds over the last three years.

Table 18

	Index-linked Gross		Levels of GDP		% of GDP	
Calendar Year	**US (in $bn)**	**UK (in £bn)**	**US GDP (in $bn)[1]**	**UK GDP (in £bn)[1]**	**% US GDP**	**% UK GDP**
1997	33.5	5.2	7093.1	754.6	0.47	0.69
1998	34.1	2.4	7364.6	801.0	0.46	0.30
1999[2]	15.0	1.7	7678.5	837.6	0.20	0.20

[1] GDP at the start of the first quarter, ie the level of GDP from the end of the previous calendar year.
[2] Calendar Year to end May 1999.

The table shows that the Federal Reserve have issued fairly constant nominal amounts over the past two and a half years at around $8bn per quarter since Q1 1997. This was a deliberate policy decision to build up the TIPS market to achieve a critical mass for liquidity. However, this constant supply of TIPS applied upward pressure on yields as the market absorbed the securities.

The improvement in the UK Government's finances led to a reduction in issuance over the last two years. Unlike supply in the US, the UK has nearly halved its annual issuance. Other things being equal we would have expected this relative reduction in issuance to produce downward pressure on yields in the UK.

Special Features

The UK Market

Index-linked gilts were the subject of much market analysis over the last financial year. Index-linked as well as conventional gilt yields are more fully discussed in the article on page 28. In brief, above and beyond the fundamentals causing falling yields there were specific institutional changes creating an increased demand for index-linked gilts. Pension funds that had started up in the 1960s were steadily maturing as the pension fund industry approached steady state equilibrium. This created a greater demand for gilts and bonds over other investments, for example equities. Pension fund actuaries also concentrated more on their solvency ratios. Finally, the limited price indexation of annuities meant that as inflation expectations remained below 5%, there was an increased demand for index-linked gilts.

The US Market

US TIPS are indexed to the US CPI. The CPI has been reviewed and amended since the launch of TIPS. The Boskin report criticised the calculation of the CPI and suggested reforms that could be made. These included moving to calculating the index on a geometric rather than an arithmetic mean. The CPI calculation was subsequently kept under review by the Bureau of Labour Statistics. The reforms that were made to the CPI following this process went further and faster than the markets were anticipating. The cash value of the coupon and principal of TIPS, directly reduced by CPI reforms, lead to a slight downward movement in the prices of the bonds.

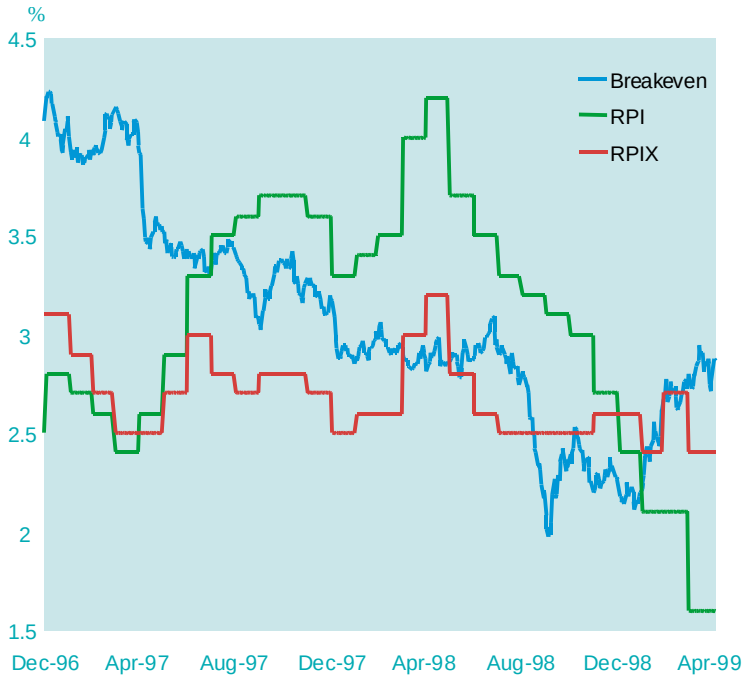
US inflation has also continued to surprise the markets. The markets have expected increasing rates of inflation because of the strong growth of the US economy and the levels of asset prices. However, US inflation remained lower than expected, reducing the value of the inflation protection inherent in TIPS. This reduction has also been reflected in the price of the bonds. In the UK on the other hand, breakeven inflation has rarely fallen below 2.5%, other than during the financial crisis of October 1998. This may reflect the credibility of Bank of England's Monetary Policy Committee remit. The MPC inflation target is explicitly symmetric, being no more or less than 1% either side of 2.5%.

Breakeven Inflation

Breakeven inflation provides a different perspective for looking at index-linked bonds. Breakeven inflation is that level of inflation needed to equate nominal yields on index-linked bonds and their conventional counterparts. Breakeven inflation does not strictly provide an unbiased estimate of expected inflation. Within calculated breakeven inflation is an inflation risk premium, though the size of the premia are likely to fall as the rate of inflation falls, and a purely mathematical bias caused by curve convexity. In contrast, the fact that indexed securities tend to trade less liquidly than conventional bonds will tend to act in the opposite direction. Overall these influences probably result in calculated breakeven inflation to be slightly higher than the underlying expected future inflation as derived from gilt prices.

The charts below show breakeven inflation for the UK and the US, calculated from ten-year bonds. The charts therefore represent the expected average rate of inflation over the next ten years. Both charts show a fall in breakeven inflation over the last few years, as actual inflation performance has increased credibility. But they also show that, although breakeven inflation in the UK has recently been on a par with actual current inflation, in the US it has been lower since mid 1998. This implies a degree of underperformance in TIPS compared to their conventional Treasury counterparts.

Chart 27
10-Year Breakeven Inflation and Inflation Measures in the UK

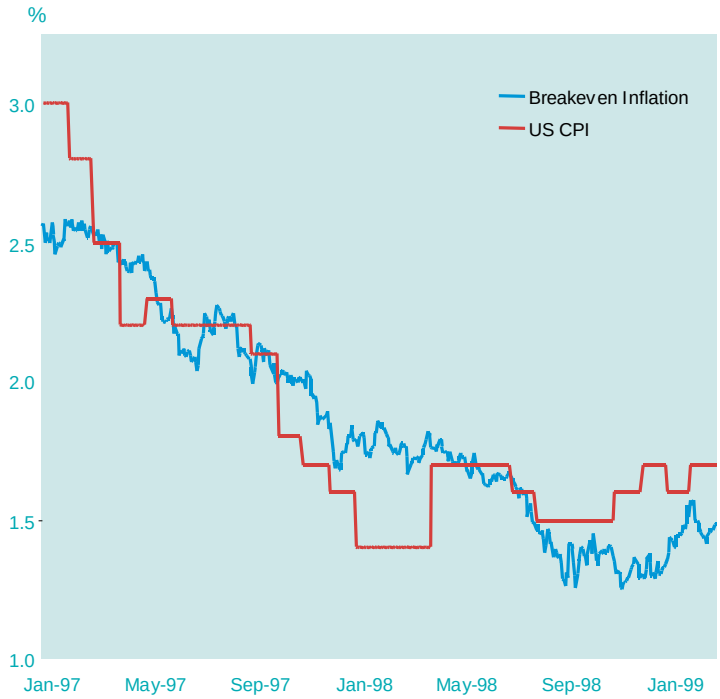


Source: ONS/DMO

Over the last financial year, the ten-year breakeven inflation rate in the UK shown in the chart above has not strayed far from underlying inflation, although the financial crisis in October caused a sudden fall. This implies that the value of index-linked gilts has been broadly in line with that of conventionals.

Chart 27 also shows that breakeven inflation over the last financial year has closely followed actual RPIX, not RPI and perhaps illustrates the credibility of the MPC's inflation target. Chart 28 below shows the equivalent statistics for the United States.

Chart 28
10 year breakeven inflation and inflation measures in the US



Source: DMO/Datastream

This chart shows that US ten-year breakeven inflation has been lower than the actual inflation rate since July 1998. The ten-year breakeven inflation suggests that investors believe that the US economy will average a 1.5% inflation rate for the next ten years. This seems too low an average inflation rate, given current inflation levels, and implies that the yield on TIPS is slightly undervalued relative to Treasuries.

There is now clearly a significant differential between IGs and TIPS. Some of this can be explained by the divergent rates of growth of the two economies and the levels of supply. There are also special features in the two markets that affect the bonds differently. Looking at the levels of yields in terms of the breakeven inflation rate, we may conclude that the value of IGs has remained broadly in line with their conventional counterparts. However, in the US market, we may infer a degree of underperformance in TIPS compared to their conventional counterparts. This underperformance has also contributed to the observed differential between IGs and TIPS.

Chapter 5: Gilt strips

Valuing strips

Ahead of the launch of the official gilts strips facility the UK authorities consulted market practitioners on detailed issues concerning the trading of gilt strips. One of the issues discussed was whether strips should trade on a price or a yield basis. Of those consulted, the overwhelming majority were in favour of trading on a yield basis, provided that a market convention could be established for calculating settlement prices for trades executed on this basis. The formula agreed by the market for converting yields into prices is as follows:

$$P = \frac{100}{\left[1 + \frac{y}{2}\right]^{\frac{r}{s} + n}}$$

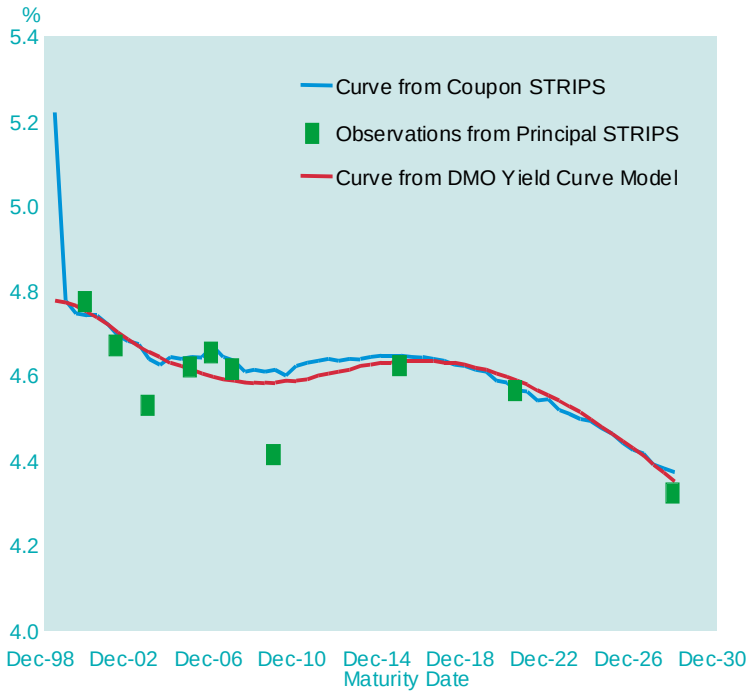
where:
P = Price per £100 nominal of the strip.
y = Strip gross redemption yield (decimal) ie if the yield is 8% then y = 0.08.
r = Number of days from the settlement date to the next quasi-coupon date[15].
s = Number of days in the quasi-coupon period in which the settlement date occurs.
n = Number of remaining quasi-coupon periods after the current period.

Strips are zero-coupon bonds that pay a single cash flow at redemption, making them free from *reinvestment risk* - the risk that the holder of a coupon bond may not be able to re-invest future coupon payments at the redemption yield at purchase. The introduction of the gilt strips market means that it is now possible to observe traded zero-coupon rates directly in the market rather than having to obtain *theoretical* zero-coupon rates from a yield curve model. Chart 29 compares the theoretical zero-coupon curve with the corresponding strips zero-coupon curve for 31 March 1999. Zero-coupon rates are important because they can be used to calculate the theoretical value of a coupon-bearing bond - the value of the bond if it was priced on the yield curve. The theoretical price is defined as the sum of the discounted cash flows, using zero-coupon rates as the discount rates.

It is important to distinguish between the strips zero-coupon yield curve and the par yield curve for coupon-bearing gilts. In the situation where the yield curve is upward sloping, the strips curve will always lie above the yield curve for coupon-bearing gilts. This is because the value of a zero-coupon gilt is only determined by

[15] Quasi-coupon dates are the dates on the semi-annual cycle defined by the maturity date, irrespective of whether the cash flows occur on those dates.

Chart 29
UK zero-coupon curves on 31 March 1999



Source: DMO

the discount rate applicable to the maturity payment, whilst the coupon-bearing gilt valuation is affected by the regular coupon payments, each of which is discounted at a lower rate than the maturity payment (given the upward sloping curve).

In a downward sloping yield curve environment, the strips curve will always lie below the yield curve for coupon gilts. Superficially, this makes strips look less attractive than coupon gilts. However, when assessing whether strips genuinely provide value relative to gilts it is not enough to simply compare the yield on a strip with that on a strippable coupon gilt of the same maturity. This takes no account of the differences in nature between the two instruments and the rates that apply to them. The true measure of relative value between the sectors is obtained by comparing the value of the coupon gilt with the combined value of all the strips that make up that bond. This will indicate whether or not the arbitrage condition between bonds and strips holds (ie that the price of the bond should be the sum of the prices of the bond's components) and hence will highlight if there are any pricing discrepancies between the sectors and in particular, whether there is an incentive to strip or re-constitute the bond.

As zero-coupon instruments, strips can be considered building blocks which can be used to create a variety of synthetic assets such as annuities and deferred payment bonds. Strips are also attractive to investors because of the lack of reinvestment risk, making them useful in helping to immunise a portfolio against

interest rate risk. Other important attributes of strips are that they typically have higher duration than coupon-bearing bonds and are also much more convex. The concepts of duration and convexity and their significance for strips are discussed in detail below.

Duration

The maturity of a bond gives little indication of the timing or sizes of its cash flows. For example, for two bonds with the same maturity date but very different coupons, the higher coupon bond provides a larger proportion of its return in the form of coupon income than the lower coupon bond, and thus provides its return at a faster rate. Its value is therefore less subject to subsequent (unexpected) fluctuations in interest rates.

A useful measure to capture the speed of payment of a bond, and hence its price risk relative to other bonds, is the average maturity of the stream of its cash flows. The weighted average time to its cash flows is known as the bond's *Macaulay* duration, the weights being the present value of each of the payments as a proportion of the total present value of all cash flows.

From the Macaulay duration of a bond it is straightforward to derive its modified duration:

$$\text{Modified Duration} = \frac{\text{Macaulay Duration}}{\left(1 + \frac{r}{2}\right)}$$

where: r is the bond's redemption yield.

The modified duration of a bond provides a measure of how sensitive its price is to small changes in yield:

Percentage change in bond price = - modified duration x change in yield

So for example, a bond with a modified duration of 10 years will experience roughly a 5% (–10 x –0.50) rise in price if the yield falls by 50 basis points.

The following three factors generally imply higher duration[16] of a bond:

- The lower the coupon;
- The lower the yield;
- The longer the maturity

[16] This argument holds for both Macaulay duration and modified duration.

This dependency of a bond's duration on the coupon, yield and maturity is illustrated in Table 19.

Table 19

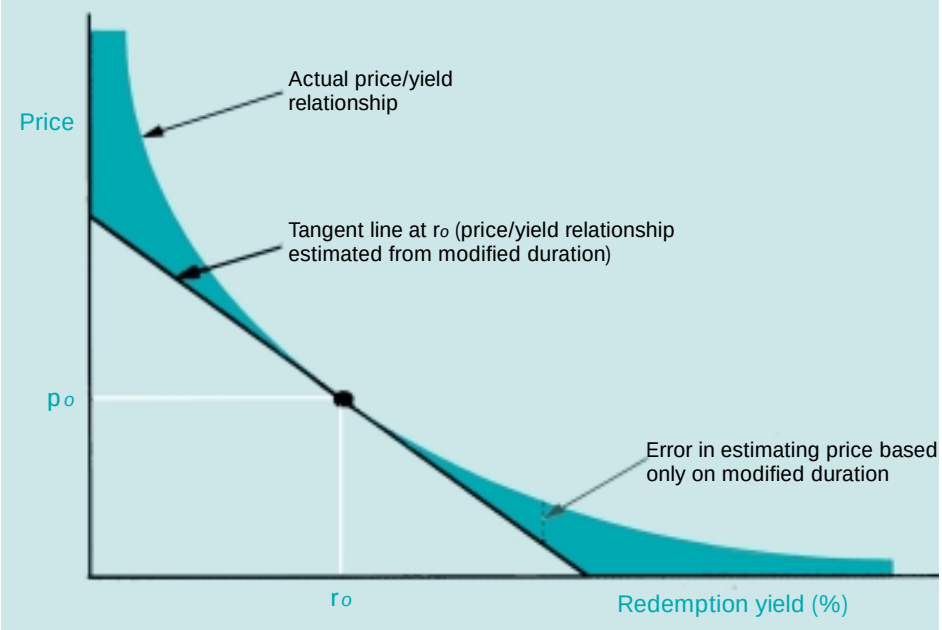
Modified Duration	5% coupon 10 year bond	10% coupon 10 year bond	5% coupon 30 year bond	10% coupon 30 year bond
Yield = 5%	7.8	6.9	15.5	13.7
Yield = 10%	7.1	6.2	10.4	9.5

Convexity

Although modified duration describes the price sensitivity of a bond under small yield changes, this approximation can break down under larger changes. This breakdown is due to the fact that the price/yield relationship estimated from the modified duration of a bond is linear whilst the actual function defining a bond's price in terms of its yield is in fact much more complex – giving a convex relationship between price and yield. The chart below shows this relationship for a bond whose price today is p_0, corresponding to a yield of r_0.

The tangent line drawn through the point (p_0, r_0) has a slope[17] equal to the bond's modified duration. This line indicates the estimate of the price/yield relationship provided by duration - clearly, the larger the change in yield the greater the degree of error in the price estimated from the bond's duration - reflecting the divergence between the true price/yield relationship and the estimate of it that is provided by the tangent line. To demonstrate this, consider a 30 year bond of 5% coupon trading at par. If there was a 200 basis point increase in the yield this would give rise to a 25% fall in the price. However, the duration approximation would suggest that the price would in fact fall by 31% - a significantly larger fall than would occur in practice.

Chart 30
Price/yield relationship



[17] In fact the slope of the tangent is actually -(modified duration) x the bond's current price. However, as an illustration of the concept of modfied duration, this statement is perfectly acceptable.

The curvature of a bond's price/yield relationship (ie, the degree to which it diverges from the straight-line estimation) is referred to as its *convexity*. The convexity of a bond is positively related to the dispersion of its cash flows - thus, all other things being equal, if one bond's cash flows are more spread out in time than another's then it will have a higher dispersion and hence a higher convexity. Convexity is also positively related to duration.

In principle, a more convex bond will fall in price less than a less convex one when yields rise, and will rise in price more when yields fall, ie convexity can be equated with the potential to outperform. Thus, other things being equal, the higher the convexity of a bond the more desirable it is to investors and some investors may be prepared to accept a bond with a lower yield in order to gain convexity. Convexity is in principle of more value if uncertainty - and hence expected volatility - is high. By using duration and convexity measures together it is possible to obtain a much closer estimate of a bond's change in price for a given move in yields. For instance, in the example given earlier, a combined duration and convexity approach would predict a price fall of 24% for a rise in yield of 200 basis points.

Duration and convexity of strips

The following points highlight some of the more interesting stylised facts about how duration and convexity of strips compare with those of coupon bonds:

- Strips have a Macaulay duration equal to their time in years to maturity.
- Strips have a higher duration than coupon bonds of the same maturity.
- Strips are more convex than coupon bonds of the same maturity.
- Strips are less convex than coupon bonds of the same duration.

The reason that a strip is less convex than an ordinary coupon-bearing bond of identical duration is that the coupon bond will have more dispersed cash flows than the strip.

Although strips are less convex than bonds of identical duration, the highest duration conventional bond currently has a modified duration of about 15 years, whereas the principal strip from that bond has a duration of around 29 years, meaning that strips are the most convex instruments in the gilt market. Table 20 compares the duration and convexity of 10 year and 30 year coupon-bonds with those of the 10 year and 30 year strips[18] .

Table 20

	10 year bond	10 year strip	30 year bond	30 year strip
Modified duration	7.8	9.6	15.5	29.3
Convexity	73.6	99.9	352.1	870.9

[18] The coupon bonds are assumed to have coupons of 5% and yields are assumed to be 5%.

ANNEX A

The DMO website

The DMO's web site can be found at www.dmo.gov.uk and has been set up in a way that is intended to be as beneficial to its readers as possible. At present it comprises:

- information regarding the structure and organisation of the DMO;
- the Debt Mangement Report including the DMO financing remit;
- the gilt auction calendar;
- copies of the DMO's major publications (including the Annual and Quarterly Gilt Reviews);
- all major announcements and press releases;
- static data relating to the gilts market including the current gilt stock list and gilt ISIN and SEDOL codes.

Although fully functional, the site is still under development and plans are in place to incorporate an on-line user-operable database providing both the market and the general public with easy access to daily data on gilts prices and yields as well as the issuance history for each stock. In the meantime, any comments and queries on the design and layout of the DMO's site can be addressed to the site's designer, Toby Masson, on 0171 862 6535 or at toby.masson@dmo.gov.uk

Further information relating to UK Government debt can also be accessed on HM Treasury website at www.hm-treasury.gov.uk and the Bank of England website at bankofengland.gov.uk

ANNEX B

THE DMO REMIT 1999-2000

Objectives

1. The Debt Management Office (DMO), an Executive Agency of HM Treasury, has been given the following objectives:

- To meet the annual remit set by Treasury Ministers for the sale of gilts, with high regard to long-term cost minimisation and risk.

- To provide a high-quality efficient service to primary dealers and investors in gilts, consistent with achieving low cost issuance.

- Once the office takes over responsibility for cash management, to provide for the daily aggregate cash needs of the Exchequer in an efficient and cost-effective manner.

- To promote a liquid market for gilts and conduct operations in a predictable, transparent way with a view to reducing the overall cost of financing.

- To act as sponsor of the gilts market, liaising with the Bank of England, Financial Services Authority, LIFFE and London Stock Exchange, so that the market is healthy, orderly and well-regulated, to meet the issuer's needs.

- To advise Ministers on setting the remit to meet the Government's debt management objectives.

- To provide policy advice to Treasury Ministers and senior officials on new instruments and structural changes to the gilt market that will help to lower the cost of debt management.

Quantity of gilt sales

2. The Debt Management Office, on behalf of the Government, will aim for gilt sales of approximately £17.3 billion in 1999-2000, subject to confirmation of the size of any overshoot of the gilt sales target in 1998-99. This figure assumes the transfer of government cash management responsibilities to the DMO during 1999-2000 and takes account of the resulting adjustment to the stock of short term debt instruments.

3. In the event that cash management responsibilities are not transferred to the DMO in 1999-2000 the gilt financing requirement will be adjusted downward by carrying forward the over-financing from 1998-99 but no further change to the level of short term financing instruments would be assumed in 1999-2000.

Pace of gilt sales

4. The DMO will aim to sell gilts at a broadly even pace through the year. Within-year seasonal fluctuations in the pattern of central government expenditure and revenue will be met by other financing means, including changes to the weekly Treasury bill tender and, until such time as the DMO takes over responsibility for cash management, the Ways & Means advances.

Amount and maturity mix of index-linked gilt issuance

5. Over 1999-2000, the Debt Management Office will aim to make about 20 per cent of its gilts sales in index-linked stocks, subject to lower and upper limits of £2.5 billion and £4.0 billion (cash). On the initial financing requirement this would result in sales of £3.5 billion index-linked (cash).

6. Four auctions of index-linked stocks are planned in 1999-2000. Given that auctions will only cover a single stock, it will not be possible to reopen each stock in this year and issuance will be directed at medium- and longer-dated maturities, ie stocks dated 2009 and beyond. However, the DMO will be prepared to issue up to a further £0.5 billion (cash) of index-linked stocks through taps between auctions, if necessary, whether for market management purposes or to relieve any overall market shortages.

7. To ensure the medium-term viability of the index-linked auction programme, the authorities remain committed to a minimum supply of £2.5 billion (cash) of index-linked stocks in 1999-2000 and for the foreseeable future.

Amount and maturity mix of conventional gilt issuance

8. Five auctions of conventional stocks are planned in 1999-2000; two each in the short (3-7 years) and long (15 years and over) maturity areas and one in the medium (7-15 years) area.

9. On the assumption of the transfer to the DMO of cash management responsibilities during 1999-2000, any increases or reductions in the 1999-2000 financing requirement in this remit will be accommodated first by an adjustment to the level of planned Treasury bill issuance of up to £3 billion. Any increases or reductions to the financing requirement of more than £3 billion will be accommodated through a combination of an adjustment to the number and size of gilt auctions and, as necessary, changes in planned Treasury bill issuance (in such a way that a minimum Treasury bill stock of £5 billion is maintained).

10. If the 1999-2000 financing requirement increases by a sufficient amount to justify a change to the auction programme, and it is not too late in the financial year to make the change, the current expectation is that the DMO would first add a long gilt auction to the financing programme. If the 1999-2000 financing requirement decreases by a sufficient amount, again subject to timing constraints, the current expectation is that the DMO would first cancel a short gilt auction. If the financing requirement were to change sufficiently to justify the addition or cancellation of a second gilt auction, again subject to timing constraints, the DMO would expect to have consulted the market about the maturity of the gilt auction to be added or cancelled.

11. For 1999-2000, there are no plans to meet the financing requirement through sales of gilts with a maturity of less than 3 years, but the DMO reserves the right to tap sub-3 year gilts for market management purposes.

Method of issuance of gilts

12. Auctions will constitute the primary means of issuance of all gilts (conventional and index-linked). The authorities plan to hold five auctions of conventional gilts and four autions of index-linked gilts on the calendar set out below. All auctions will be single auctions held on the day indicated.

13. Each auction of conventional gilts is planned to be for between £2 billion and £3 billion (cash) of stock on a competitive bid price basis. Each auction of index-linked gilts will be for between £0.5 billion and £1.25 billion (cash) of one stock on a uniform price basis.

14. The programme of conventional and index-linked gilt auctions may be supplemented between auctions by official sales of stock by the DMO “on tap”. Taps of stocks will be used only as a market management instrument in conditions of temporary excess demand in a particular stock or sector. Paragraph 6 above describes the circumstances applying to index-linked taps. Conventional stocks have not been tapped since late 1996 and the DMO would only contemplate taps of conventional stocks in exceptional circumstances.

15. After an auction, the DMO will generally refrain from issuing stocks of a similar type or maturity to the auction stock for a reasonable period. Such stock will only be issued if there is a clear market management case.

16. For the purposes of market management, the Debt Management Office may create and repo out stock.

The auction calendar

17. The calendar for auctions in 1999-2000, covering auctions of conventional and index-linked stocks, is shown overleaf.

GILT AUCTION CALENDAR 1999-2000

	Date	Type
Apr 1999	Wednesday 28th	Index-Linked
May 1999	Wednesday 26th	Conventional
June 1999	Wednesday 23rd*	Conventional
July 1999	Wednesday 28th	Index-Linked
Aug 1999		
Sept 1999	Tuesday 28th	Conventional
Oct 1999	Wednesday 27th**	Index-Linked
Nov 1999	Wednesday 24th**	Conventional
Dec 1999		
Jan 2000	Wednesday 26th	Index-Linked
Feb 2000		
Mar 2000	Wednesday 29th**	Conventional

**** the June auction was subsequently brought forward one day to 22 June.***

*** Subject to confirmation following the Chancellor's decisions on the budgetary timetable.*

- If required, a sixth conventional gilt auction would be held on Wednesday 23 February 2000. If not required, cancellations of conventional auctions would be announced at the same time as the publication of a lower financing requirement. DMO will bear in mind the need to provide sufficient notice to the market of the cancellation of an auction.

In-year consultation and announcements on auctions

18. Towards the end of each calendar quarter, the DMO will publish, with the agenda for the consultation meetings with gilt market participants, details of progress to date with the gilt issuance programme, including any changes to the Government's financing requirement and any changes to the gilts auction programme. The DMO will then consult Gilt-Edged Market-Makers and end-investors on the auction programme for the following quarter, and any other issues that may arise. Following that consultation, at the end of the quarter, the DMO will announce plans for the auctions scheduled for the coming quarter. For each auction, this will indicate the stock to be auctioned or, where relevant, the approximate maturity of a new stock.

19. The auction plan for the first quarter of 1999-2000 will be announced at 3.30pm on Wednesday 31 March 1999.

20. Full details of these, and subsequent, auctions will be announced at 3.30pm on the Tuesday of the week preceding the auction.

Coupons

21. As far as possible, coupons on new issues of gilts will be close to par yields at the relevant maturity, at the time of issue.

Buy-ins of short maturity debt

22. Following the transfer of cash management, the DMO will also take over from the Bank of England responsibility for buying in stocks close to maturity to manage Exchequer cash flows.

Conversions and Switch Auctions

23. In order to build up the pool of benchmark stocks further, the Debt Management Office envisages making offers for the conversion of unstrippable stocks into benchmarks of similar maturity during 1999-2000. Details of any such offers will be announced in due course, in the light of market conditions.

24. The programme of conversion offers may be supplemented by switch offers into benchmark stocks during 1999-2000. Before the start of any such programme the DMO will publish proposals outlining the structure of such switch offers.

Reviews to the remit

25. This remit, and in particular the timing of auctions and the allocation between maturity bands and index-linked, may be varied during the year in the light of substantial changes in the following:

- the Government's forecast of the gilt sales requirement (including any possible changes arising from any slippage in the timetable for cash management) ;
- the level and shape of the gilt yield curve;
- market expectations of future interest and inflation rates; and
- market volatility.

26. Any revisions to this remit will be announced.

ANNEX C

GILT-EDGED MARKET-MAKERS RECOGNISED BY THE DMO (**indicates additional IG GEMM status)

ABN Amro Bank NV
199 Bishopsgate
London
EC2M 3XW

Barclays Capital **
5 The North Colonnade
Canary Wharf
London
E14 4BB

CS First Boston Gilts Limited
One Cabot Square
London
E14 4QJ

Deutsche Morgan Grenfell
Winchester House
1 Great Winchester Street
London
EC2N 2DP

Dresdner Kleinwort Benson **
Ebbgate House
2 Swan Lane
London
EC4R 3UX

Greenwich Nat West Gilts **
135 Bishopsgate
London
EC2M 3UR

Goldman Sachs International Limited
Peterborough Court
133 Fleet Street
London
EC4A 2BB

HSBC Greenwell **
Thames Exchange
10 Queen Street Place
London
EC4R 1BQ

JP Morgan Securities Limited
PO Box 161
60 Victoria Embankment
London
EC3P 3DB

Lehman Brothers International
(Europe) **
1 Broadgate
London
EC2M 7HA

Merrill Lynch International **
Ropemaker Place
25 Ropemaker Street
London
EC2Y 9LY

Morgan Stanley & Co
International Limited **
25 Cabot Square
Canary Wharf
London
E14 4QA

Salomon Smith Barney
Victoria Plaza
111 Buckingham Palace Road
London
SW1W 0SB

Société Générale
Société Générale House
41 Tower Hill
London
EC3N 4SG

Warburg Dillon Reed
1 Finsbury Avenue
London
EC2M 2PP

Winterflood Securites Ltd **
Walbrook House
23-29 Walbrook
London
EC4N 8LA

GILT INTER DEALER BROKERS

Cantor Fitzgerald
One America Square
London
EC3N 2LT

Exco WCLK
30 Cornhill
London
EC3V 3ND

Garban
8 Montague Close
London Bridge
London
SE1 9RD

ANNEX D

Gilts in issue at 31 March 1999

1. Conventional and floating rate gilts

Stock	Redemption date	Amount in issue £m	Amount held in Stripped form £m	Official Govt holdings £m**
10½% Treasury 1999	19-May-99	1,252	-	15
6% Treasury 1999	10-Aug-99	6,950	-	476
10¼% Conversion 1999	22-Nov-99	1,798	-	17
9% Conversion 2000	03-Mar-00	5,358	-	42
13% Treasury 2000	14-Jul-00	3,171	-	96
8% Treasury 2000	07-Dec-00	9,800	125	219
10% Treasury 2001	26-Feb-01	4,406	-	15
11½% Treasury 2001-04	19-Mar-01	1,620	-	142
Floating Rate 2001	10-Jul-01	3,000	-	16
7% Treasury 2001	06-Nov-01	12,750	-	692
7% Treasury 2002	07-Jun-02	9,000	242	76
9¾% Treasury 2002	27-Aug-02	6,527	-	12
8% Treasury 2002-06	05-Oct-02	2,050	-	65
8% Treasury 2003	10-Jun-03	8,600	-	418
10% Treasury 2003	08-Sep-03	2,506	-	-
6½% Treasury 2003	07-Dec-03	7,987	115	32
3½% Funding 1999-2004	14-Jul-04	543	-	32
9½% Conversion 2004	25-Oct-04	3,412	-	-
6¾% Treasury 2004	26-Nov-04	6,500	-	363
9½% Conversion 2005	18-Apr-05	4,842	-	-
8½% Treasury 2005	07-Dec-05	10,373	489	188
7¾% Treasury 2006	08-Sep-06	4,000	-	261
7½% Treasury 2006	07-Dec-06	11,700	166	132
8½% Treasury 2007	16-Jul-07	7,397	-	216
7¼% Treasury 2007	07-Dec-07	11,000	249	91
5½% Treasury 2008-12	10-Sep-08	1,000	-	56
9% Treasury 2008	13-Oct-08	5,621	-	-
8% Treasury 2009	25-Sep-09	560	-	55
5¾% Treasury 2009	07-Dec-09	6,277	81	546
6¼% Treasury 2010	25-Nov-10	4,750	-	249
9% Conversion 2011	12-Jul-11	5,273	-	110
7¾% Treasury 2012-15	26-Jan-12	800	-	148
9% Treasury 2012	06-Aug-12	5,361	-	-
8% Treasury 2013	27-Sep-13	6,100	-	330
8% Treasury 2015	07-Dec-15	13,787	210	86
8¾% Treasury 2017	25-Aug-17	7,550	-	179
8% Treasury 2021	07-Jun-21	16,500	487	127
6% Treasury 2028	07-Dec-28	5,000	154	43
2½% Treasury	Undated	474	-	-
3½% War	Undated	1,909	-	-
2½% Consolidated	Undated	275	-	-
4% Consolidated	Undated	358	-	-
		228,137	**2,318**	**5,545**

2. Index-linked gilts	Maturity date	Nominal Outstanding	Nominal Inflation uplifted (£m)	Including Official Govt holdings (£m**)
2½% I-L Treasury 2001	24-Sep-01	2,150	4,477	23
2½% I-L Treasury 2003	20-May-03	2,700	5,588	12
4⅜% I-L Treasury 2004	21-Oct-04	1,300	1,563	-
2% I-L Treasury 2006	19-Jul-06	2,500	5,865	-
2½% I-L Treasury 2009	20-May-09	2,625	5,433	26
2½% I-L Treasury 2011	23-Aug-11	3,100	6,778	3
2½% I-L Treasury 2013	16-Aug-13	4,200	7,675	7
2½% I-L Treasury 2016	26-Jul-16	4,125	8,238	25
2½% I-L Treasury 2020	16-Apr-20	3,800	7,466	10
2½% I-L Treasury 2024	17-Jul-24	4,450	7,427	-
4⅛% I-L Treasury 2030	22-Jul-30	1,650	1,991	-
		32,600	**62,501**	**106**

3. Rump stocks

Stock	Redemption date	Amount outstanding (£m)	Official Government holdings (£m**)
2½% I-L Treasury Conversion 1999	22-Nov-99	2	–
8½% Treasury 2000	28-Jan-00	110	92
9½% Conversion 2001	12-Jul-01	4	3
9¾% Conversion 2001	10-Aug-01	35	28
10% Conversion 2002	11-Apr-02	21	11
9½% Conversion 2002	14-Jun-02	2	2
9% Exchequer 2002	19-Nov-02	83	64
9¾% Conversion 2003	07-May-03	11	9
13¾% Treasury 2000-2003	25-Jul-00	53	4
10% Treasury 2004	18-May-04	20	5
10½% Exchequer 2005	20-Sep-05	23	13
12½% Treasury 2003-2005	21-Nov-03	152	38
9¾% Conversion 2006	15-Nov-06	6	3
11¾% Treasury 2003-2007	22-Jan-03	234	38
13½% Treasury 2004-2008	26-Mar-04	96	5
12% Exchequer 2013-2017	12-Dec-13	57	1
2½% Annuities	-	3	-
2¾% Annuities	-	1	-
3½% Conversion	-	108	75
3% Treasury	-	55	-
		1076	**391**

Double-dated issues currently above par are assumed to be called at the first maturity opportunity

** Includes holdings by National Investments and Loans Office (NILO) and DMO. Excludes local authority, public corporation and Bank of England holdings.

United Kingdom
Debt
Management
Office

Cheapside House
138 Cheapside
London EC2V 6BB