United Kingdom
Debt Management Office

DMO Annual Review

2005-06

The United Kingdom **Debt Management Office** is an Executive Agency of HM Treasury

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Page No

Chapter 1: Foreword by the Chief Executive

2005-06 was a very significant year for the DMO and the gilt market. In May 2005, the UK re-entered the world of 50-year conventional gilt issuance for the first time since 1960, and in September 2005 the DMO launched the world's longest-dated (50-year) index-linked sovereign bond. Exceptionally, the DMO issued the 50-year index-linked bond initially by means of a syndicated offer – the first time the UK has used such an issuance technique for any gilt (subsequent issues of this bond have, however, been by auction). This, and all new index-linked gilts, are now designed to incorporate a three-month inflation lag – recognised as international best practice.

2005-06 also marks the twenty-fifth anniversary of the introduction of index-linked gilts and this year's Annual Review includes a brief review of the history of these important instruments.

The end of 2005 and the start of 2006 were characterised by particularly low and sometimes highly volatile yields on very long maturity gilts. One of the features of this period was an increased call from the market for a greater degree of responsiveness to be included in the DMO's remit to react in-year to changing market circumstances. The DMO and HM Treasury have responded to these calls by including a limited degree of flexibility in the remit for 2006-07. Alongside the pre-committed issuance programme of £53.0 billion a fixed amount of supplementary issuance of £2.5 billion per quarter is being allocated in-year, in light of evolving market conditions.

Alongside these events, an equally important area of activity for the DMO has been the delivery of the Exchequer cash management function. Here, the DMO has started to implement planned improvements to its cash management practice following the Review in 2004-05. The key motivations of the Review were to examine whether the existing cash management framework remained appropriate, and to explore new ways of measuring the performance of the cash management function, while taking into account any possible impact from the Bank of England's reforms to the framework for its operations in the Sterling money markets. The box on page 29 reviews progress here.

On the other side of the Government balance sheet, in December 2005 the Public Works Loan Board (PWLB) again began making available 50-year loans to local authorities. The PWLB advanced net loans of £5 billion in 2005-06.

This edition of the Annual Review also includes, at Chapter 6, an important review of the work being undertaken to analyse quantitatively the expected cost and risk for the UK Government of various gilt issuance strategies.

Robert Stheeman
August 2006

Chapter 2: The Economy and Financial Markets

Fiscal and macroeconomic developments

During 2005-06 world economic growth slowed slightly following robust growth in 2004-05. UK real Gross Domestic Product (GDP) growth also slowed after strong growth in the previous financial year.

Inflation dropped marginally over the year, as measured by the Consumer Price Index (CPI) – the Bank of England's target measure. Inflation fell from 1.9% in April 2005 to 1.8% in March 2006, although during the course of the year inflation reached 2.5%.

The Bank of England repo rate was reduced by 25 basis points (bps) in 2005-06. At the start of the financial year the repo rate was at 4.75%, and was cut to 4.50% in August 2005, remaining at that level for the rest of the year.

The tax-GDP ratio is expected to have risen in 2005-06, as a result of stronger than expected receipts, a consequence of stronger growth in the financial sector and from higher receipts of North Sea oil taxes. Total receipts as a percentage of GDP are expected to have increased from 38.3% in 2004-05 to 39.7% in 2005-06 and Total Managed Expenditure (TME) as a percentage of GDP from 41.7% in 2004-05 to 42.8% in 2005-06. The Central Government Net Cash Requirement (CGNCR) increased from £38.5 billion in 2004-05 to £40.8 billion in 2005-06. Net debt increased to an estimated 36.6% of nominal GDP at end-March 2006, up from 35.0% at the end of the previous financial year.

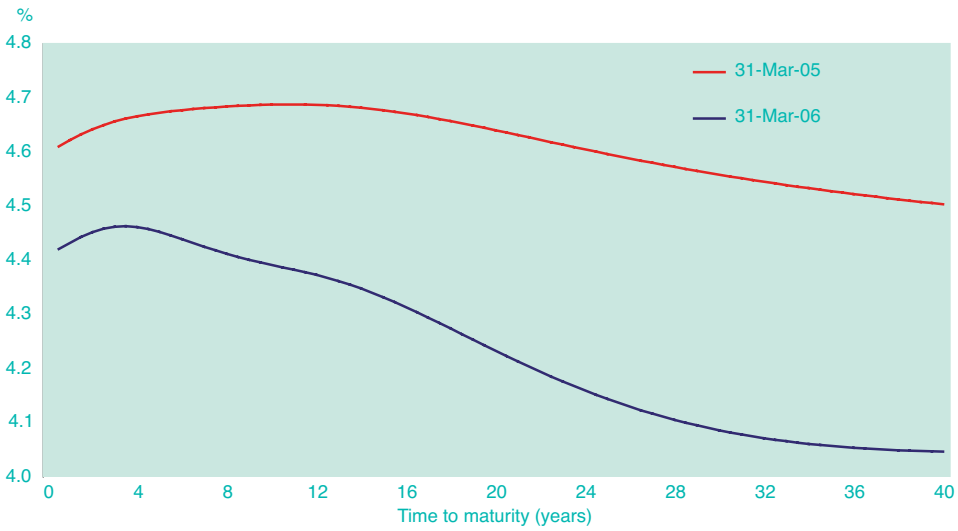
The UK Government continues to enjoy the highest AAA credit rating on its outstanding liabilities.

Gilt market developments

Par gilt yields

Gilt yields fell across the curve in 2005-06, see Chart 1. The long-end of the gilt market outperformed, with yields falling by 47bps at the 30-year maturity, while at the 5-year maturity yields fell by 22bps, and by 30bps at the 10-year maturity. The outperformance at the long-end of the curve has been widely attributed to increased demand by pension funds for longer-dated assets to match their liabilities.

Chart 1
Par gilt yields



Source: DMO

Conventional gilts

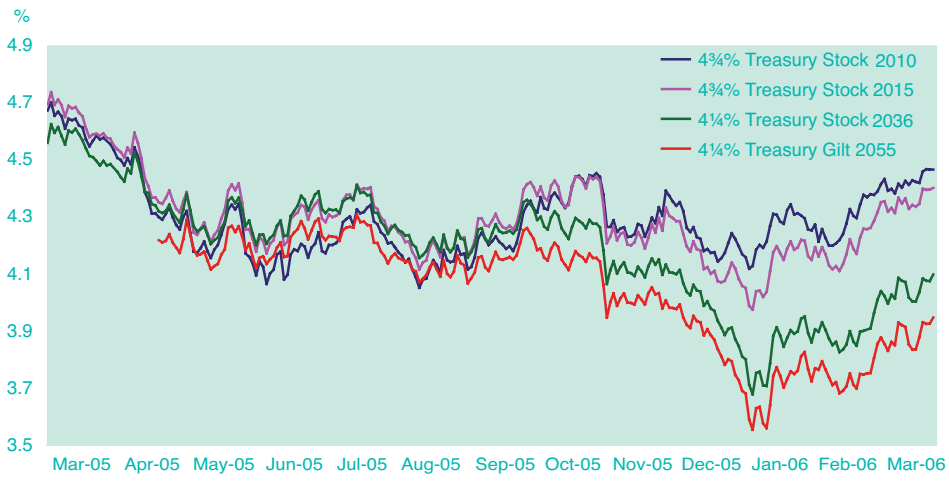
Gilt yields began the financial year resuming the downward trend that had started in mid-2004, reportedly helped by an unexpectedly dovish Inflation Report in May. Yields increased across the curve in July, despite the terrorist attacks on London on 7 July 2005 which prompted a brief flight to quality, but they resumed their downward trend the following month as a result of weaker economic data and oil price spikes in the aftermath of Hurricane Katrina in the United States.

With US oil production resuming post-Katrina, yields in the UK and the rest of Europe began to rise in September, a direction that was seen as being supported by the announced delay to the introduction of Dutch pension reforms. This rising trend continued into October, as market expectations of additional repo rate cuts dissipated. However, as 2005 ended, yields (in particular on long-dated gilts) began to fall – a development attributed by some market participants to structural demand for duration. Yields fell by around 15bps in December.

In early January 2006, the downward trend accelerated and long conventional yields fell to 50 year lows reportedly reflecting sustained purchases of long-dated gilts by the pension industry (seeking long-dated assets to match their corresponding liabilities). Additional demand from hedge funds and active real money managers was also seen as contributing to the downward pressure. Consequently on 18 January 2006, the yields on 4¾% Treasury Stock 2038 and 4¼% Treasury Gilt 2055 reached lows of 3.65% and 3.55% respectively – levels at 30- and 50-year maturities not seen since the 1950s.

At the other end of the curve, short yields began to rise through February and March, as the market priced in an expectation that the Bank of England would keep the repo rate on hold for an extended period. Other factors that might have contributed to the rise in short yields were monetary policy tightening by both the Federal Open Markets Committee (FOMC) and the European Central Bank (ECB), and the Bank of Japan's announcement on 9 March 2006 that, after five years, it was abandoning its quantitative easing policy, as a precursor to the normalisation of interest rates. Long yields also started to recover from their January lows, in part in response to market expectations of significant long-dated gilt supply in 2006-07.

Chart 2
Benchmark gilt yields

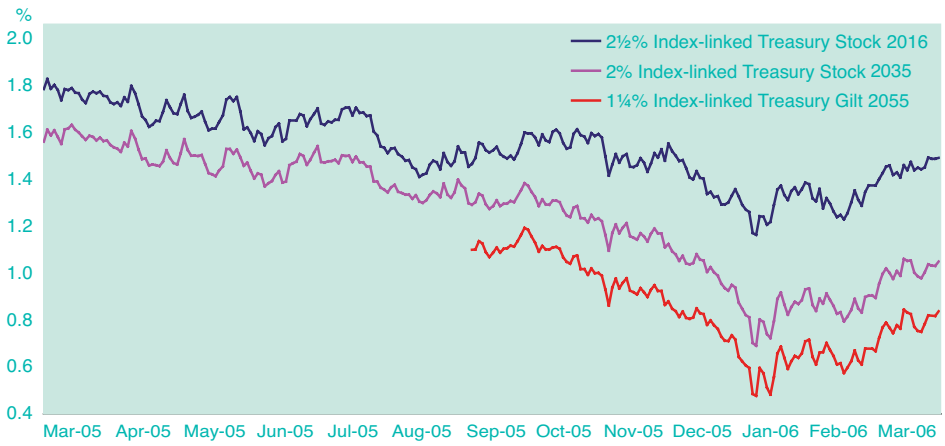


Source: DMO

Index-linked gilts

Yield movements on index-linked gilts in 2005-06 mirrored the trends in conventional gilts, with real yields hitting intra-year lows in January reflecting pension industry purchases. The yields on the 2016, 2035 and 2055 index-linked gilts reached lows of 1.16%, 0.69% and 0.47% respectively on 18 January 2006. Over the year to end-March 2006, the yield on 2½% Index-linked Treasury Stock 2016 fell by 29bps to 1.49%, whilst the yield on 2% Index-linked Treasury Stock 2035 fell by 51bps to 1.04%.

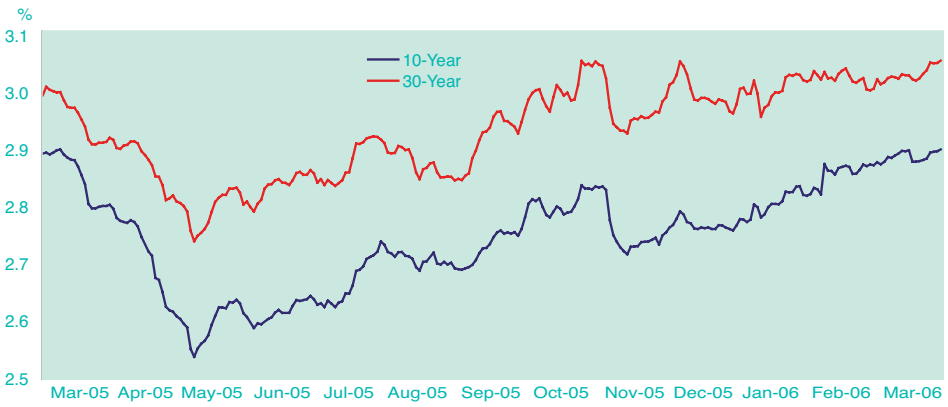
Chart 3
Index-linked gilt yields



Source: DMO

Break-even inflation rates (BEIRs) fell during the first quarter of the financial year as conventional gilts outperformed index-linked gilts. However, for the remainder of 2005, as index-linked yields fell further than conventionals, break-even inflation rates pushed upwards. Despite the rise in index-linked yields in the final quarter of the financial year, BEIRs continued upwards, with the 10-year and 30-year BEIR reaching 2.90% and 3.05% respectively by the end of the financial year.

Chart 4
10-and 30-year breakeven inflation rates

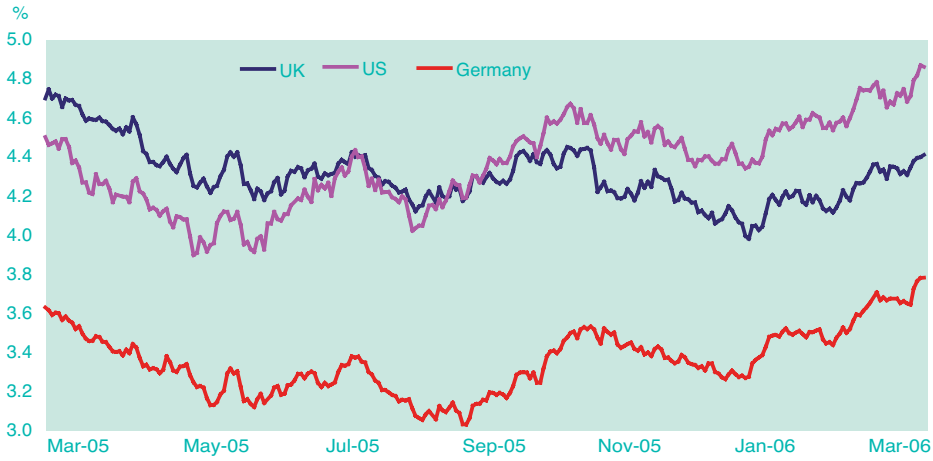


Source: DMO

International comparisons

Chart 5 shows the path of 10-year bond yields in the UK, USA and Germany over the financial year. While gilt yields fell by 28bps over the year, the yields on both US Treasuries and German Bunds rose. The yield on the 10-year Treasury increased by 36bps, while the corresponding Bund yield rose by 15bps over the year, reflecting steadily tightening monetary policy.

Chart 5
UK, US and German 10-year Government bond yields

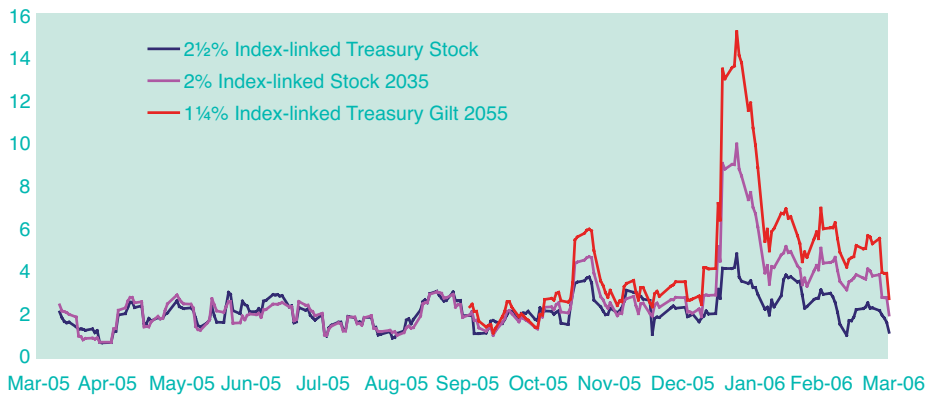


Source: Bloomberg

Index-linked yield volatility

The extreme lows in both nominal and real yields in 2005-06 coincided with an increase in gilt yield volatility, particularly in the index-linked gilt market. Chart 6, which shows the rolling 7-day standard deviation of the daily percentage change in real yields, highlights the sharp increase in gilt yield volatility during January.

Chart 6
Index-linked gilt yield volatility

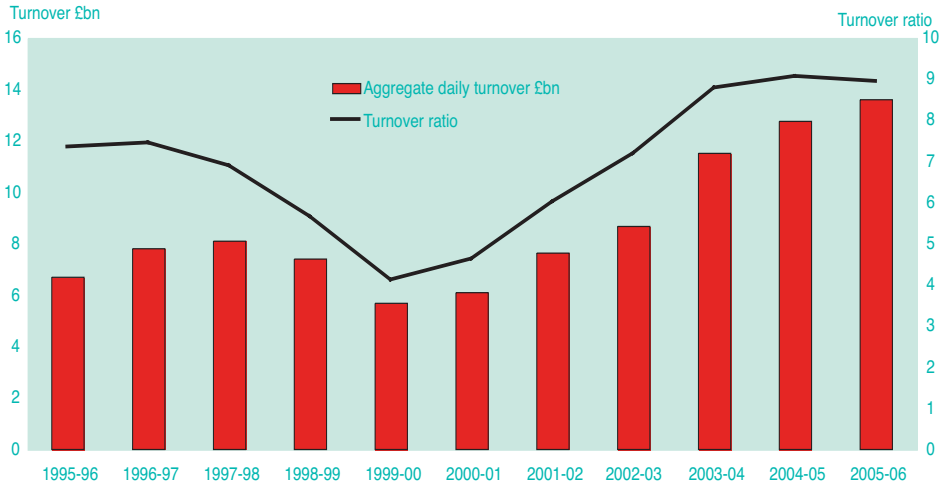


Source: DMO

Gilt market turnover

Turnover in the gilt market increased again in 2005-06, for the sixth consecutive year, continuing to reflect the increase in gilt issuance in recent years, with gross issuance growing to £52.3bn in 2005-06.

Chart 7
Gilt market turnover



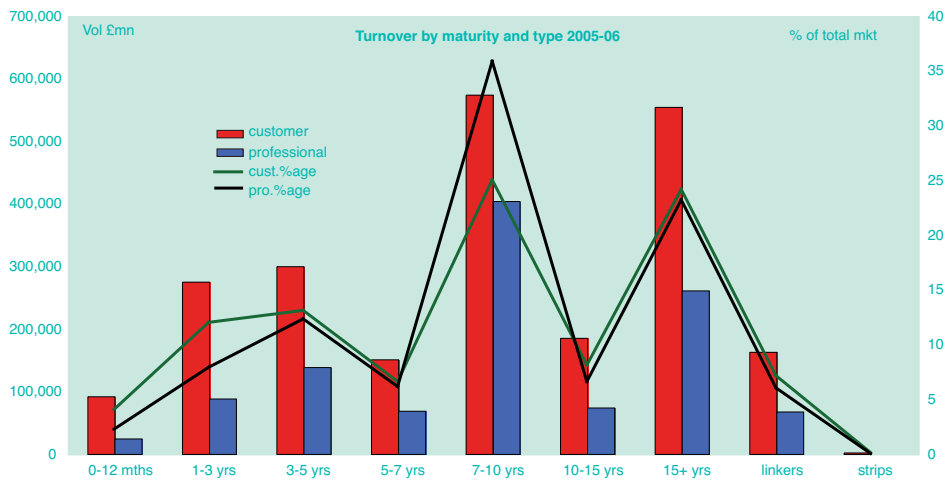
Source: GEMMs/DMO

According to data provided to the DMO by the Gilt-edged Market Makers (GEMMs), aggregate daily turnover in 2005-06 was £13.6bn, an increase of 7% over the previous financial year. Over the same period, trading intensity (as measured by the turnover ratio[1]) fell slightly by 1% to 8.92.

Gilt market turnover was weighted heavily towards the 7-10 year and the over 15-year sectors.

[1] This is a measure of how many times the stock of gilts turns over in the financial year. The turnover ratio for 2005-06 equals the aggregate turnover relative to the market value of the portfolio at the start of the financial year.

Chart 8
Gilt market turnover by maturity and type



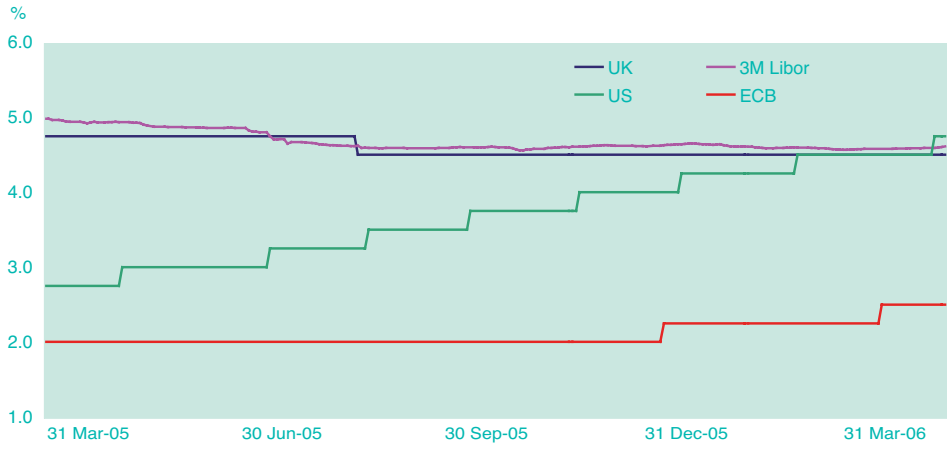
Source: GEMMs

Money markets developments

The financial year began with the money markets anticipating further tightening in monetary policy, to pre-empt inflationary pressures. However, market sentiment soon reversed in the face of weaker economic data. In the UK, 3-month LIBOR[2] began the year 23bps above the Bank of England repo rate, and was on average 14bps above during the first quarter of the financial year. The US Federal Reserve was the first of the major central banks to increase rates in the financial year, by 25bps on 3 May 2005, as it continued its policy of measured tightening following seven increases in the US Federal Funds rate in the previous financial year. At the end of the financial year, the Federal Funds rate stood at 4.75%, having been increased eight times from 2.75% in 2005-06. Meanwhile, the ECB increased the Eurozone rate twice in the financial year, to 2.50%.

The path of official rates (and of 3-month LIBOR in the UK) is shown in Chart 9.

Chart 9
Official interest rates



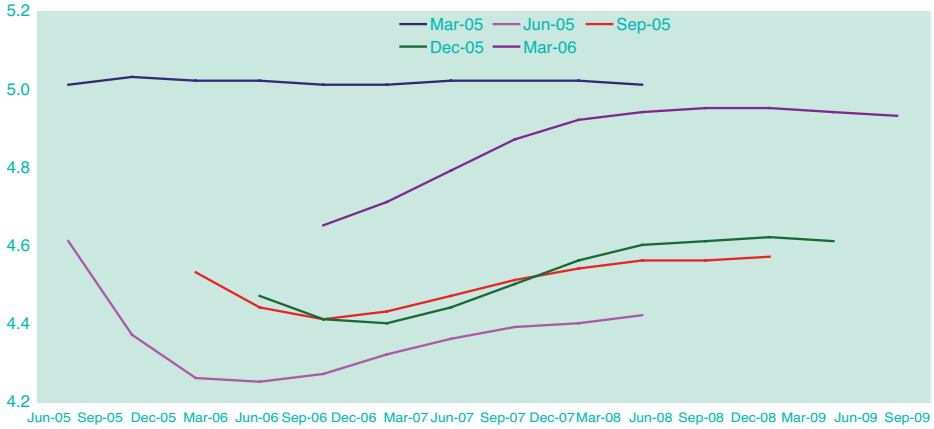
Source: Reuters

[2] London Interbank Offer Rate; the rate at which AA rated banks lend to each other. LIBOR is a key market reference rate.

In the UK, expectations of further interest rate increases were dampened very quickly at the start of the financial year after a series of weaker than expected data releases and the publication of the May Inflation Report by the Bank of England. Ahead of the Bank cutting the repo rate to 4.50% on 4 August 2005, LIBOR had fallen to 13bps below the repo rate. After the reduction by the Bank, LIBOR remained around 8-10bps above the repo rate.

The changing path of future interest rate expectations can be seen in the implied yields of short sterling futures contracts over the course of the financial year. Chart 10 shows the implied curves for the start of the financial year, and the end of each quarter during the year. The first curve shows that interest rate expectations were relatively flat at the start of 2005-06. However, by end-June 2005, the market had priced in expectations of cuts of 50bp in the repo rate. Nonetheless at end-September 2005, after the MPC had cut the repo rate in August, implied expectations of a further cut had weakened. At the end of the financial year, the short sterling curve was upward sloping, the peak being 4.95% for the December 2008 contract, implying nearly two 25bp increases in the repo rate over the contract horizon.

Chart 10
Implied curves from short sterling contracts



Source: Reuters

Chapter 3: Debt Management Operations

Debt management responsibilities and objectives

Objectives of debt management

The UK Government's debt management policy objective is:

"to minimise over the long term, the costs of meeting the Government's financing needs, taking into account risk, whilst ensuring that debt management policy is consistent with the aims of monetary policy."

The debt management policy objective is achieved by:

- pursuing an issuance policy that is open, transparent and predictable;
- issuing benchmark gilts that achieve a benchmark premium;
- adjusting the maturity and nature of the Government's debt portfolio, primarily by means of the maturity and composition of debt issuance and potentially by other market operations including switch auctions, conversion offers and buy-backs;
- developing a liquid and efficient gilt market; and
- offering cost-effective savings instruments to the retail sector through National Savings & Investments (NS&I).

Maturity and composition of debt issuance

In order to determine the maturity and composition of debt issuance, the Government takes account of a number of factors including:

- investors' demand for gilts;
- the Government's own appetite for risk, both nominal and real;
- the shape of both the nominal and real yield curves and the expected effect of issuance policy; and
- changes to the stock of Treasury bills and other short-term debt instruments.

The DMO remit for 2005-06

The DMO remit for 2005-06 was published on 16 March 2005 in the Debt and Reserves Management Report 2005-06 by HM Treasury. On the basis of a forecast Central Government Cash requirement (CGNCR) in 2005-06 of £40.2 billion, and a net financing requirement of £52.5 billion, gilt sales of £53.5 billion were planned[3] (the highest level since 1993-94).

The planned split of sales and the number of auctions, were as follows:

- short conventional gilts: £12.5 billion in 4 auctions
- medium conventional gilts: £11.5 billion in 4 auctions
- long conventional gilts: £18.5 billion in 7 auctions
- index-linked gilts: £11.0 billion in 11 auctions

[3] The gilt sales plans also reflected a planned reduction of £1.0 billion in the Treasury bill stock in 2005-06.

In particular, it was made clear, both in the remit and in a separate formal response to the earlier consultation on ultra-long gilts, that long conventional and index-linked gilt sales could include issuance of ultra-long (up to 50-year maturity) gilts.

Ultra-long gilts

As a result of considering the feedback to the consultation launched in December 2004 on ultra-long gilts (see last year's Annual Review for more details) the DMO and HM Treasury concluded that there appeared to be an ongoing structural demand for such instruments and that it would be possible to issue ultra-long gilts at a favourable cost to the Government, given the inversion at the long-end of the gilt yield curve and the shortage of alternative instruments in this sector of the market. Accordingly, on 16 March 2005 it was announced that:

- from 2005-06, the DMO may issue conventional and index-linked gilts with initial maturities of up to approximately 50 years;
- ultra-long conventional gilts may be issued from the first quarter of 2005-06, but new index-linked gilts (with a 3-month lag) would not be issued before the second quarter;
- decisions on specific maturities and on the total issuance of ultra-long gilts within any quarter will be announced at the end of the preceding quarter as part of the regular quarterly issuance calendar announcements;
- the DMO remit also provided for the option of issuing an ultra-long gilt initially by means of a syndicated offer, but only in cases where HM Treasury was satisfied that this method of issuance would better meet the Government's debt management objective than the usual auction method.

Other elements impacting on financing in 2005-06 were a £3.5 billion contribution by NS&I, the need to refinance £1.3 billion of short-term debt and a planned £1.0 billion run-down of the stock of Treasury bills.

Remit contingencies

As usual the remit included contingencies that could be implemented in the event that the financing requirement changed during the financial year. The published contingencies for 2005-06 were:

> *"Any changes in the published financing requirement will be met: (a) by increasing or reducing planned gilt sales broadly in proportion to the splits planned in the remit; and/or (b) increasing or reducing planned sales of T-bills; and/or (c) adding or cancelling gilt auctions. Adding or cancelling auctions will only be undertaken when changes in the published financing requirement are judged to be sufficiently large to warrant such actions. Decisions to modify gilt and T-bill sales plans or revise the gilt auction calendar will be taken subject to considerations about the debt portfolio and evolving market conditions".*

Adjustment to reflect the outturn of the 2004-05 CGNCR

The contingencies were activated on 20 April 2005 with the publication of the CGNCR outturn for 2004-05 which, at £38.6 billion, was £4.3 billion lower than had been forecast in Budget 2005.

The reduction in the financing requirement for 2005-06 announced on 20 April

2005, however, was £3.9 billion, £0.4 billion less than the reduction in the CGNCR. The change was due to a combination of factors which reduced outturn financing in 2004-05 compared to Budget 2005 (lower outturn gilt sales (£0.2 billion), a lower outturn contribution to financing by NS&I (£0.1 billion) and an adjustment (£0.1bn) to gilt redemptions in 2005-06).

The £3.9 billion reduction in the revised financing requirement for 2005-06 was accommodated by:

- a reduction of £2.4 billion in planned gilt sales, taking them to £51.1 billion. This reduction was split as follows:

		Reduction (£bn)	*Revised plans*
–	conventionals	0.4	12.1
–	medium conventionals	0.4	11.1
–	long conventionals	0.6	17.9
–	index-linked gilts	1.0	10.0

One index-linked gilt auction (on 11 October 2005) was cancelled, reducing the planned number of index-linked auctions to 10. The number of planned conventional gilt auctions remained unchanged at 15.

- A reduction of £1.5 billion in Treasury bill sales taking the planned reduction in 2005-06 to £2.5 billion.

Pre-Budget Report (PBR) 2005

At PBR on 5 December 2005 a new forecast for the CGNCR in 2005-06 was published; at £43.3 billion it was £3.1 billion higher than the Budget 2005 forecast. However, the increase in the net financing requirement to be met by the DMO was £2.6 billion, primarily as a result of an increase in the forecast contribution to financing by NS&I of £0.7 billion to £4.2 billion.[4]

The increase in the financing requirement was met by:

- an increase in planned gilt sales of £1.2 billion, split as follows:

–	short conventionals	£0.2 billion (new total £12.3 billion)
–	medium conventionals	£0.2 billion (new total £11.3 billion)
–	index-linked gilts	£0.8 billion (new total £10.8 billion)

This increase took the total of planned gilt sales to £52.3 billion and required the scheduling of an additional index-linked gilt auction (held on 14 December 2005).

- an increase in planned Treasury bill sales of £1.4 billion, implying a reduction of £1.1 billion in the stock of Treasury bills over the financial year.

Budget 2006

Budget 2006 was published on 22 March 2006; it included a revised forecast for the 2005-06 CGNCR of £40.6 billion and showed gilt redemptions of £14.6 billion

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[4] The increase in the net financing requirement was £2.6 billion, not £2.4 billion, as might be assumed by the NS&I contribution, because of the need to account for the purchase of £0.2 billion of Treasury bills by the DMO in March 2005 which increased the financing requirement for 2005-06 accordingly. See also footnote 5.

(unchanged from PBR). However, following the Budget, state aids clearance was granted for the transfer of certain assets and liabilities between BNFL and the Nuclear Decommissioning Authority which were determined as having taken place before the purchase by the DMO of £0.7 billion of 8½% Treasury Stock 2005 on 1 April 2005. Accordingly, that purchase was no longer deemed to count as a redemption in 2005-06, reducing the redemption total in that year by £0.7 billion to £13.9 billion.

All else being equal the (public sector neutral) revision to the April 2005 net cash requirement would have had the effect of increasing the 2005-06 CGNCR forecast by £0.7 billion to £41.3 billion (at Budget 2006). In effect, therefore, the classification reduced redemptions by £0.7 billion and increased the CGNCR by the same amount – so the classification made no change to the net financing requirement in 2005-06. Table 1 uses the post classification decision numbers for the CGNCR and redemption totals.

Factoring in the impact of the above changes, the CGNCR forecast fell by £2.0 billion between PBR and Budget 2006. With redemptions falling by £0.7 billion, a further increase of £0.6 billion in the contribution to financing by NS&I, offset only by a £0.1 billion increase in debt buy-backs (secondary market purchases of rump gilts) the net financing requirement fell by £3.2 billion between PBR and Budget to £48.0 billion.

However, by Budget 2006 all gilt sales financing for 2005-06 had been completed, so after taking account of a marginal reduction in Treasury bill sales (£0.1 billion) the lower forecast financing requirement was reflected in a higher forecast short-term cash position of £3.3 billion (£3.1 billion above target).

CGNCR 2005-06 outturn

The outturn CGNCR for 2005-06 was published on 24 April 2006; at £40.8 billion it was £0.5 billion lower than the Budget forecast. This had the effect of increasing the DMO's outturn net cash position at end-March 2006 by £0.5 billion to £3.8 billion, or £3.6 billion above target.

The financing arithmetic requires that a surplus at the end of one financial year is run-down in the next, so in this case the 2006-07 net financing requirement fell by an additional £0.5 billion. It was announced on 24 April that this £0.5 billion reduction would be reflected in lower Treasury bill sales in 2006-07.

Table 1
Financing arithmetic 2005-06[5]

Financing arithmetic 2005-06 (£bn)	Budget 2005	April 05 Revision	PBR 2005	Budget 2006	Outturn
CGNCR	40.2	40.2	43.3	41.3	40.8
Redemptions	14.5	14.6	14.6	13.9	13.9
Financing for Reserves	0.0	0.0	0.0	0.0	0.0
Buy-backs	0.0	0.0	0.0	0.1	0.1
Planned short-term financing adjustment[1]	1.3	-2.5	-2.5	-2.5	-2.5
Gross financing requirement	**56.0**	**52.3**	**55.4**	**52.8**	**52.3**
Less:					
NS&I	3.5	3.5	4.2	4.8	4.8
Net financing requirement	**52.5**	**48.8**	**51.2**	**48.0**	**47.5**
Financed by:					
1. Debt issuance by the DMO					
a) T-bills	**-1.0**	**-2.3**	**-1.1**	**-1.2**	**-1.2**
b) Gilt sales	**53.5**	**51.1**	**52.3**	**52.3**	**52.3**
Of which:					
Short conventionals	12.5	12.1	12.3	12.2	12.2
Medium coventionals	11.5	11.1	11.3	11.4	11.4
Long conventionals	18.5	17.9	17.9	17.9	17.9
Index-linked	11.0	10.0	10.8	10.8	10.8
2. Other planned change in short-term debt[2]					
Ways and Means	0.0	0.0	0.0	0.0	0.0
3. Unanticipated change in short-term cash position[3]	0.0	0.0	0.0	3.1	3.6
Total financing	**52.5**	**48.8**	**51.2**	**51.1**	**51.1**
Short term debt levels at end of financial year					
T-bill stock (in market hands)	19.3	18.0	19.2	19.1	19.1
Ways and Means	13.4	13.4	13.4	13.4	13.4
DMO net cash position	0.2	0.2	0.2	3.3	3.8

1. To accommodate changes to the current years financing requirement resulting from (i) publication of the previous year's outturn CGNCR and/or (ii) carry over of unanticipated changes to the cash position from the previous year.
2. Total planned changes to short-term debt are the sum of (i) the planned short-term financing adjustment. (ii) T-bill sales; and (iii) changes to the level of the Ways and Means.
3. A negative (positive) number indicates an addition to (reduction in) the financing requirement for the following financial year.

DMO gilt market financing operations 2005-06

The DMO issued five new gilts in 2005-06.

Table 2
New gilts issued in 2005-06

Gilt		First issue date
Conventional	4¼% Treasury Gilt 2055	27-May-05
	4¼% Treasury Gilt 2011	09-Nov-05
	4% Treasury Gilt 2016	02-Mar-06
Index-linked	1¼% Index-linked Treasury Gilt 2055	23-Sep-05
	1¼% Index-linked Treasury Gilt 2017	08-Feb-06

The new index-linked gilts were the first to adopt a 3-month inflation lag design, first used in the Canadian Real Return Bond market, a design regarded as international best practice. All new index-linked gilts to be issued from 2005-06 will adopt this design. (See the section on twenty-five years of index-linked gilts on pages 22-25).

[5] The data in the first two columns of this table (short-term financing adjustment, T-bill sales and T-bill stocks) have been retrospectively adjusted to account for the purchase of £0.2bn of T-bills by the DMO in March 2005 (the impact of which was first reported at PBR 2005).

In developing the gilt issuance programme to deliver the remit, the DMO consults gilt market participants (GEMMs and end-investors) throughout the year. More formal consultations are held towards the end of each quarter to discuss the gilt issuance calendar for the following quarter. Minutes of the meetings are published on the morning afterwards and in 2005-06 the DMO announced which gilts were to be issued in the following quarters at 3.30pm on 31 March, 30 June, 30 September and 16 December 2005.

The meetings to discuss issuance in the first quarter were held on 21 March 2005. Both the GEMMs and investors favoured issuance of an ultra-long conventional gilt in May – with most favouring a 50 year maturity. 4¾% Treasury Stock 2010 and 4¾% Treasury Stock 2020 were the virtually unanimous choices for short and medium conventional issuance. A wide range of index-linked gilts were mentioned as auction candidates.

The auction calendar for July-September 2005 was discussed at meetings on 20 June 2005. There was continuing interest in long issuance including in particular the launch of a 50-year index-linked gilt with a majority favouring September for the issue. Attendees felt that 5- and 10-year benchmark gilts should not be launched too far ahead (more than 6-9 months) of them becoming true benchmarks.

The next consultation meetings were held on 26 September 2005. Yet again there was strong emphasis on the desirability of long-dated issuance in the quarter (with structural demand for duration in the final quarter of the calendar year cited as supporting the need for two long conventional auctions). Further issuance of the 50-year index-linked gilt was also supported.

Issuance in the final quarter of the financial year was discussed at meetings on 12 December 2005. A strong preference towards issuance at the long-end of the index-linked curve was mentioned by investors, although IL GEMMs mentioned the need for a new shorter-dated index-linked gilt.

Table 3 shows the results of gilt auctions in 2005-06.

Table 3
Gilt auction results 2005-06

Date	Gilt	Amount auctioned	Cover	Average accepted price (AAP)	Yield at AAP	Tail (bp)*
12-Apr-05	2% IL 2035	£800mn	1.52	£116.21	1.65%	na
14-Apr-05	5% 2025	£2,500mn	2.22	£104.64	4.64%	0
28-Apr-05	4¾% 2010	£3,000mn	1.93	£101.03	4.52%	0
24-May-05	2½% IL 2016	£425mn	2.16	£249.65	1.69%	na
26-May-05	4¼% 2055	£2,500mn	1.60	£100.93	4.21%	1
7-Jun-05	4¾% 2020	£2,750mn	1.68	£104.98	4.29%	1
23-Jun-05	4⅛% IL 2030	£450 mn	1.91	£214.80	1.53%	na
14-Jul-05	4¼% 2055	£2,250mn	1.23	£99.50	4.27%	1
26-Jul-05	2½% IL 2020	£400mn	2.72	£252.87	1.66%	na
2-Aug-05	4% 2009	£3,000mn	1.98	£99.18	4.25%	0
6-Sep-05	4¼% 2036	£2,750mn	1.62	£100.66	4.21%	0
27-Sep-05	4¾% 2020	£2,750mn	1.89	£104.59	4.32%	0
13-Oct-05	4¼% 2032	£2,750mn	1.52	£98.60	4.34%	1
25-Oct-05	1¼% IL 2055	£675mn	1.70	£104.61	1.13%	na
8-Nov-05	4¼% 2011	£3,250mn	1.78	£98.98	4.47%	1
24-Nov-05	2½% IL 2013	£525mn	3.26	£227.41	1.58%	na
7-Dec-05	4¼% 2055	£2,250mn	1.95	£104.68	4.03%	0
14-Dec-05	4⅛% IL 2030	£375 mn	2.47	£230.33	1.15%	na
10-Jan-06	4¾% 2020	£2,500mn	1.55	£107.16	4.08%	0
24-Jan-06	1¼% IL 2055	£650mn	1.75	£135.15	0.46%	na
26-Jan-06	4¼% 2011	£3,000mn	1.47	£99.92	4.27%	1
7-Feb-06	1¼% IL 2017	£1,000mn	2.05	£99.72	1.28%	na
16-Feb-06	4¼% 2055	£2,500mn	1.49	£109.43	3.82%	1
1-Mar-06	4% 2016	£3,000mn	2.02	£98.36	4.19%	0
7-Mar-06	2% IL 2035	£625mn	1.98	£139.91	0.91%	na

** Index-linked gilts are issued through a uniform price format*

Launch of 1¼% Index-linked Treasury Gilt 2055 – by syndication

Exceptionally, one new gilt was issued by means other than auction. On 22 September 2005 the first ever syndicated issue of a gilt (1¼% Index-linked Treasury Gilt 2055) was priced and the new gilt was issued on 23 September 2005. The result of the syndicated offer, which raised some £1.3 billion (cash) was:

Amount issued	Subscription	Price	Yield	Spread to 2% IL 2035
£1,250mn	190%	£105.29	1.11%	-19bps

As noted above, the DMO's remit for 2005-06 provided for the initial issue of ultra-long gilts by syndication as opposed to the UK Government's preferred issuance method of auctions. Syndication could only be used, however, in circumstances where HM Treasury agreed that its use would better meet the Government's debt management objectives. It was not felt that this test was met for the launch of the 50-year conventional gilt in May 2005. However, the launch of the 50-year index-linked gilt was seen as an exceptional case. The decision to syndicate the issue was announced by the DMO on 31 August 2005. At the same time it announced that the index-linked gilt auction originally scheduled for 22 September 2005 was cancelled.

The decision to use syndication was based on the unique and innovative characteristics of the new gilt, which was, and remains, the longest-dated sovereign index-linked bond in the world. Of particular relevance was the fact that

the launch represented the opening of a new sector in the sterling market, where few points of comparison existed for the purpose of pricing. The syndication process was considered to be the best way to ensure a fair and transparent price discovery process, benefiting both the investors and the issuer.

The syndicated offering was managed by four Joint Bookrunners: Barclays Capital, Morgan Stanley & Co International Limited, Royal Bank of Scotland and UBS Limited. The syndicate also included ten Co-Lead Managers comprising the other Index-linked GEMMs: CS First Boston Limited, Deutsche Bank (AG), Dresdner Bank (AG), Goldman Sachs International Limited, HSBC Bank PLC, JP Morgan Securities Limited, Lehman Brothers International (Europe), Merrill Lynch International, Royal Bank of Canada Europe Limited and Winterflood Securities Limited. The composition of the syndicate was announced by the DMO on 13 September 2005.

The order book managed by the Joint Bookrunners was opened at 8:30am on 20 September 2005 with a target size of approximately £1 billion and with indicative price guidance for investors at a spread of 14bps to 19bps below the yield on 2% Index-linked Treasury Stock 2035. The value of orders in the book passed £1 billion after four hours. At the close of business on 20 September orders in excess of £1.25 billion had been received and by early on 21 September the price guidance was tightened to a range of 17bps to 19bps below the 2035 maturity index-linked gilt. Given the quality and strength of the orders in the book, it was announced later on 21 September that the final size of the transaction would be £1.25 billion. The book closed at 3:30 pm on that day, containing orders in excess of £2 billion.

The UK domestic investor base provided the main support for the offer, taking around 90% of the allocation. The remaining 10% was mainly placed in continental Europe. In terms of investor type, there was very strong interest from “real money” accounts, reflecting the structural demand for long-dated assets. “Real money”, primarily fund managers, pension funds and insurance companies, took two thirds of the transaction and the remaining one third was placed within GEMM banks and other trading houses.

The DMO reverted to the use of auctions for subsequent issues of this, and all other gilts. The DMO remit for 2006-07 states that there are no plans for a syndicated offering in 2006-07.

Breakdown of gilt sales by maturity 2005-06

Table 4 shows the proportionate breakdown by type and maturity of gilt sales in the original remit of March 2005 and the outturn. It shows that the final shape of issuance remained closely in line with the original plans over the year.

Table 4
Gilt sales by type and maturity[6]

	Remit March 2005		Outturn April 2006	
Type/maturity	**% total issuance**	**% conventional**	**% total issuance**	**% conventional**
Short conventional	23.4	29.4	23.3	29.4
Medium conventional	21.5	27.1	21.8	27.5
Long conventional	34.6	43.5	34.2	43.1
Index-linked	20.6		20.7	

[6] Figures may not sum due to rounding.

The DMO remit 2006-07 and future financing projections

The DMO remit for 2006-07 was published by HM Treasury with Budget 2006 on 22 March 2006. On the basis of a CGNCR forecast of £41.2 billion for 2006-07, the published financing requirement was £68.0 billion (after taking account of gilt redemptions of £29.9 billion and a short term financing adjustment of -£3.1 billion). NS&I were forecast to contribute £3.0 billion to financing, leaving a forecast net financing requirement for the DMO of £65.0 billion. This was to be met by total planned gilt sales of £63.0 billion and Treasury bill sales of £2.0 billion.

Introduction of an element of responsiveness into the remit

The DMO remit for 2006-07 contained an important innovation – a degree of discretionary gilt issuance to be allocated at an even-flow pace on a quarterly basis throughout the year. This was designed to allow the DMO to react to significant changes in market conditions and patterns of demand in-year and came as a reaction to calls from market participants for a greater degree of responsiveness in the DMO remit following the difficult market conditions in late 2005 and early 2006. Such calls were made explicitly at the annual pre-remit setting consultation meetings chaired by the Economic Secretary to the Treasury on 1 February, alongside further calls for long-dated issuance (both conventional and index-linked).

HM Treasury made clear, however, that the greater degree of responsiveness being introduced into the remit for 2006-07, was a response to the unusual conditions experienced by the gilt market particularly in the first quarter of 2006. Acknowledging that such conditions may persist into 2006-07 the element of greater responsiveness was introduced, albeit on a temporary basis, to help the DMO and the gilt market to deal with such potentially challenging circumstances, whilst at the same time retaining the Government's firm commitment to transparency and predictability in debt management policy.

The DMO will seek feedback from market participants during 2006-07 on the impact on the gilt market of the temporary changes to the structure of the remit with a view for informing the Government's decisions on the DMO remit for 2007-08.

The new remit structure

The £63.0 billion total of planned gilt sales will include:

- A minimum pre-committed issuance programme of £53.0 billion and;
- a supplementary issuance amount of £10.0 billion to be allocated on a quarterly basis throughout the financial year (approximately £2.5 billion per quarter). The allocation from the supplementary amount to be issued in Q1 was announced with the publication of the remit and took the form of £2.5 billion of long conventional gilt issuance.

The pre-committed programme announced on 22 March therefore comprised

- At least £10.0 billion short conventional gilt sales in at least 4 auctions;
- At least £10.0 billion medium conventional gilt sales in at least 4 auctions;
- At least £19.5 billion long conventional gilt sales[7] in at least 9 auctions;
- At least £16.0 billion index-linked gilt sales in at least 16 auctions;

The pre-committed (core) programme aims at ensuring predictable and regular issuance across the maturity spectrum throughout the year and at building up benchmarks at key maturities (e.g. 5-year and 10-year for conventional issuance).

The supplementary issuance amount is intended to provide an enhanced ability for the DMO to respond to any substantial changes in demand for gilts. The allocation of the supplementary amount to be issued in each subsequent quarter will be the subject of discussion at the quarterly consultation meetings hosted by the DMO and will be announced as part of the quarterly gilt sales announcements.

Supplementary issuance may comprise additional auctions and/or increases to the sizes of the pre-committed auctions as required.

Frequency and regularity of issuance

The DMO will aim to hold at least one short and one medium conventional gilt auction each quarter and to hold at least two long conventional gilt auctions each quarter.

The DMO will also aim to hold at least one long index-linked gilt auction every month.

These plans are intended to increase the transparency and predictability of the DMO policy of regular and evenly spaced issuance across the financial year.

Earlier dates for quarterly gilt issuance announcements

With the exception of the first quarter, the consultation meetings (and the subsequent quarterly calendar announcements) will be brought forward by one month (to May, August and November) to provide a greater degree of predictability and pre-commitment throughout the year.

Gilt auction calendar

The gilt auction calendar for 2006-07 is set out in Table 5. It includes the decisions about individual gilts sold in the first quarter which were announced on 31 March 2006. The table also includes the calendar for the second quarter which was announced on 31 May 2006 and which included an additional index-linked gilt auction (scheduled for 19 September 2006) as part of the implementation of the supplementary gilt issuance programme.

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[7] Including £17.0 billion from the core programme and £2.5 billion of supplementary gilt issuance in Q1.

Table 5
Gilt auction calendar 2006-07 (updated to reflect position at 31 May 2006)

Date	Gilt/Type
4 April 2006	4¼% Treasury Gilt 2055
11 April 2006	1¼% Index-linked Treasury Gilt 2017
25 April 2006	1¼% Index-linked Treasury Gilt 2027
11 May 2006	4¼% Treasury Gilt 2046
23 May 2006	1¼% Index-linked Treasury Gilt 2055
25 May 2006	4% Treasury Gilt 2016
7 June-2006	4¼% Treasury Gilt 2046
22 June 2006	4¼% Treasury Gilt 2011
27 June 2006	1¼% Index-linked Treasury Gilt 2027
4 July 2006	4¼% Treasury Gilt 2046
11 July 2006	1¼% Index-linked Treasury Gilt 2017
25 July 2006	2½% Index-linked Treasury Stock 2024
1 August 2006	4% Treasury Gilt 2016
23 August 2006	1¼% Index-linked Treasury Gilt 2027
5 September 2006	New 2027 maturity conventional gilt
19 September 2006	1¼% Index-linked Treasury Gilt 2017
21 September 2006	4¼% Treasury Gilt 2011
27 September 2006	2% Index-linked Treasury Stock 2035
3 October 2006	Conventional
12 October 2006	Index-linked
24 October 2006	Index-linked
23 November 2006*	Conventional
28 November 2006*	Index-linked
5 December 2006*	Conventional
6 December 2006*	Conventional
14 December 2006*	Index-linked
9 January 2007	Conventional
18 January 2007	Index-linked
25 January 2007	Index-linked
20 February 2007*	Index-linked
22 February 2007*	Conventional
6 March 2007*	Conventional
15 March 2007*	Conventional
27 March 2007*	Index-linked

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

Future financing projections

Budget 2006 also included forecasts for the CGNCR as a percentage of gross domestic product out to 2010-11. Table 6 sets out the CGNCR projections in £ billions together with current redemption totals to produce illustrative financing projections. Note that these are not gilt sales forecasts - they take no account of possible contributions to financing by NS&I or Treasury bill sales.

Table 6
Budget 2006 – financing projections

Illustrative financing projections ***(figures may not sum due to rounding)***				
£bn	**2007-08**	**2008-09**	**2009-10**	**2010-11**
CGNCR projections	**35**	**30**	**31**	**28**
Redemptions	**29**	**18**	**16**	**23**
Financing requirement*	**64**	**48**	**47**	**51**
CGNCR change since PBR	**-2**	**-1**	**-2**	**-1**

**indicative gross financing requirements*

New financing arithmetic tables

One consequence of the move to a greater degree of responsiveness in the remit has been the need to present the gilt financing arithmetic table in a new way. The format used previously (see Table 1) included specific targets for the three conventional maturity bands and index linked gilt sales, however, this is no longer applicable when supplementary issuance is allocated in-year. The final point targets will only be known when the final quarter's allocation has been announced. So for 2006-07 the financing arithmetic table has been split in two (Tables 7 and 8). The first includes only the total of planned gilt sales. Table 7 shows the main financing arithmetic table as published on 24 April 2006.

Table 7
Financing arithmetic 2005-06 (outturn) and 2006-07 (at 21 April 2006)

Financing arithmetic (£bn)	**2005-06**	**2006-07**
CGNCR	40.8	41.2
Redemptions	13.9	29.9
Financing for Reserves	0.0	0.0
Buy-backs	0.1	0.0
Planned short-term financing adjustment[1]	-2.5	-3.6
Financing requirement	**52.3**	**67.5**
Less:		
NS&I	4.8	3.0
Net financing requirement	**47.5**	**64.5**
Financed by:		
1. Debt issuance by the DMO		
a) T-bills	**-1.2**	**1.5**
b) Gilt sales	**52.3**	**63.0**
2. Other planned change in short-term debt[2]		
Ways and Means	0.0	0.0
3. Unanticipated change in short-term cash position[3]	3.6	0.0
Total financing	**51.1**	**64.5**
Short term debt levels at end of financial year		
T-bill stock	19.1	20.6
Ways & Means	13.4	13.4
DMO net cash position	3.8	0.2

1. To accommodate changes to the current years financing requirement resulting from (i) publication of the previous year's outturn CGNCR and/or (ii) carry over of unanticipated changes to the cash position from the previous year.
2. Total planned changes to short-term debt are the sum of (i) the planned short-term financing adjustment. (ii) Treasury bill sales and (iii) changes to the level of the Ways and Means.
3. A negative (positive) number indicates an addition to (reduction in) the financing requirement for the following financial year.

Allocation of supplementary gilt issuance in Q2

On 31 May 2006, alongside the announcement of the auction calendar for July-September 2006, the DMO also announced that the £2.5 billion of supplementary gilt issuance for Q2 was being split equally between long conventional gilts and index-linked gilts (i.e. £1.25 billion each).

Table 8 shows the split between the core and the supplementary gilt issuance programmes. The supplementary allocation for Q1 was announced with Budget 2006.

Table 8
Financing arithmetic 2006-07, core and supplementary issuance

Planned gilt sales (£bn)	**63.0**	**Q1**	**Q1**	**Q2**	**Q2**
Core issurance programme		**Additional Allocated**	**Updated programme**	**Additional Allocated**	**Updated programme**
Conventional					
Short	10.00		10.00		10.00
Medium	10.00		10.00		10.00
Long	17.00	2.50	19.50	1.25	20.75
	37.00		39.50		40.75
Index-linked	16.00		16.00	1.25	17.25
Total	**53.00**	**2.50**	**55.50**	**2.50**	**58.00**
Gilt sales to be allocated	10.00		7.50		5.00

CGNCR outturn for 2005-06 and subsequent revision to the 2006-07 remit

There are two main events which can trigger revisions to the remit in any financial year:

- the publication, usually in the third week of April, of an outturn to the CGNCR for the previous financial year which differs significantly from that published with the Budget; and/or
- the publication of a significantly different forecast for the current financial year – usually in the PBR.

The first of these events was met on 21 April 2006 when the CGNCR outturn for 2005-06 was published at £40.8 billion, £0.5 billion below the Budget forecast. This had the effect of increasing the amount of implied over-financing in 2005-06, from £3.3 billion to £3.8 billion, and reduced the financing requirement for 2006-07 by the same amount.

Planned total gilt sales were kept unchanged at £63.0 billion, but to take account of the reduced financing requirement the planned increase in the Treasury bill stock was reduced by £0.5 billion to £1.5 billion.

Debt management issues

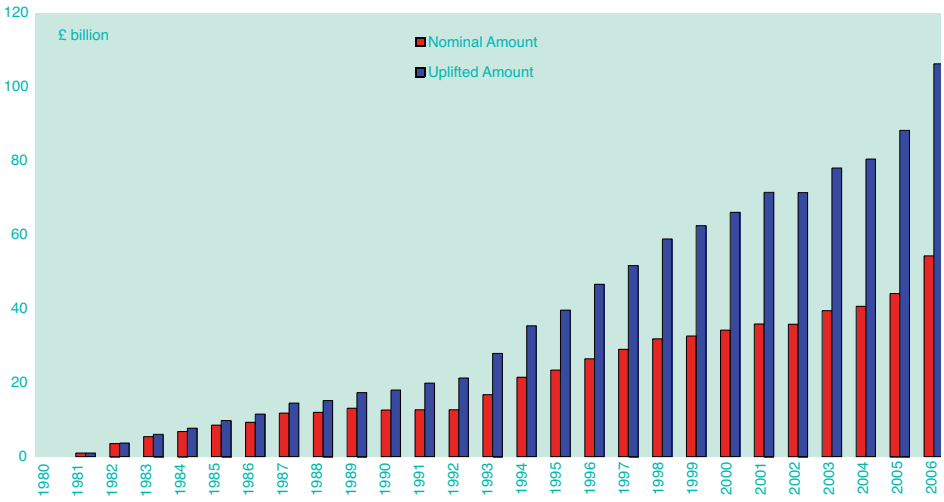
Index-linked gilts: twenty-five years of innovation

Twenty-five years ago the UK Government launched its inaugural index-linked gilt, making it the first G7 country to issue marketable government bonds with cash flows indexed to inflation. Over the ensuing period a further 21 index-linked gilts have been issued and – like the first bond – these have all been indexed to the Retail Prices Index (RPI) and used the capital indexed bond structure, now considered the standard design globally for such instruments. With this structure, both the interest payments and the redemption payment are indexed to inflation.

As Chart 11 shows, the index-linked gilt market has grown significantly since 1981 and by end-March 2006 had a market value of £115 billion, or £106 billion in uplifted nominal terms, representing around 25% of the gilt market and 25% of global government inflation-indexed bond indices. Although only a handful of governments had issued inflation-indexed bonds prior to 1981, over the past ten years, many new countries including all the other members of the G7 have

launched such products (see Table 9). This increase in index-linked issuance globally reflects the value that governments place in having this distinct asset class in their debt portfolio. While issuers of indexed bonds during the eighties and nineties often cited cost saving as a key rationale for establishing index-linked programmes more recently issuers (including the UK) have focussed on the portfolio diversification benefits to be obtained from issuing such products alongside nominal bonds.

Chart 11
Growth of the index-linked gilt market since 1980-81



Source: DMO

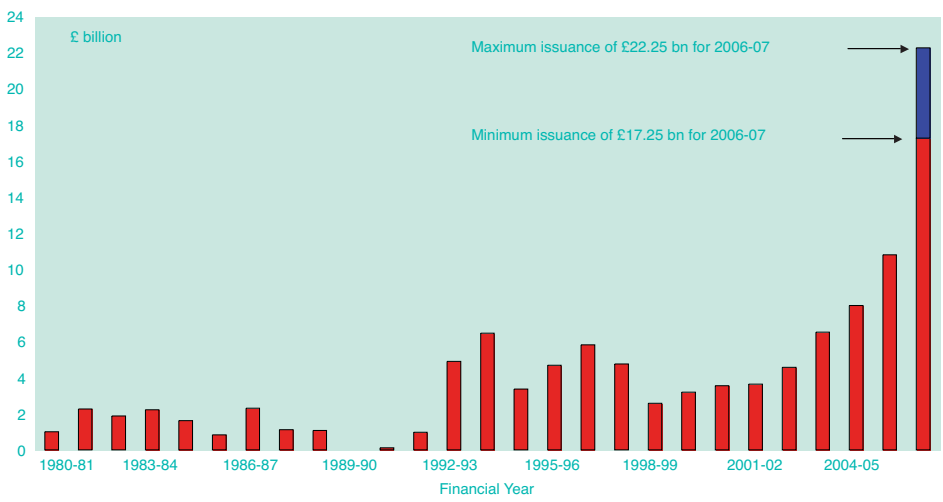
Table 9
G7 Sovereign issuers of inflation-indexed bonds

Year of first issue	Country
1981	United Kingdom
1991	Canada
1997	USA
1998	France
2003	Italy
2004	Japan
2006	Germany

Since November 1998 index-linked gilts have been sold by uniform price auction. The motivation for moving to a pre-announced auction programme from the previous tap issuance of index-linked gilts was that it would improve the predictability and transparency of issuance and lead to a focusing of demand and increased liquidity. As a precursor to this move a specialist index-linked market maker list was established. Initially it consisted of eight investment banks, but this steadily increased to fourteen by end-March 2006[8]. During 2005-06 the DMO raised £10.8 billion cash through index-linked gilt sales – the largest absolute amount of index-linked issuance in any previous financial year and, as Chart 12 shows, during 2006-07 the DMO aims to sell between £17.25 billion and £22.25 billion (cash)[9] of index-linked gilts.

[8] In July 2006 Citigroup became an index-linked GEMM, taking the number of IL GEMMs to fifteen.
[9] The exact amount will depend on how the supplementary gilt issuance for Q3 and Q4 of 2006-07 is assigned. If 100% was allotted to index-linked gilt sales the total cash to be raised from index-linked gilts would be £22.25 billion, while if none of the remaining supplementary issuance was allotted to index-linked gilts the total cash to be raised from the sector would be £17.25 billion.

Chart 12
Cash sales of index-linked gilts since 1980-81



Source: DMO

In 2004-05 the DMO conducted a formal consultation exercise seeking views on whether it should consider issuing ultra-long conventional and index-linked gilts[10]. The DMO analysed responses to the consultation and concluded that it would be possible to issue ultra-long gilts at a cost favourable to the Government, given the inversion at the long-end of the gilt yield curve and the shortage of alternative instruments in this sector of the market. In September 2005, the DMO launched the world's longest-dated (50-year) index-linked sovereign bond (1¼% Index-linked Treasury Gilt 2055). The longest dated index-linked gilt issued prior to that had been 4⅛% Index-linked Treasury Stock 2030 which had a maturity of just over 38 years when launched in 1992. As mentioned on page 16, the 50-year index-linked bond was initially issued by syndication.

The DMO consultation paper on ultra-long gilts also indicated that any new index-linked gilts issued from 2005-06 would adopt the three-month indexation lag design first used in the Canadian Real Return Bond market and not the eight-month lag methodology used for index-linked gilts issued up until that point. Ideally index-linked bonds would be perfectly indexed, with all cash flows being adjusted for inflation right up to the moment at which they are paid. However, in practice, some form of lag is inevitable because of the time that it takes to compile and publish price indices. An eight month indexation lag was originally chosen for index-linked gilts because it ensured that the size of the next coupon payment is always known at the start of each coupon period for accrued interest calculations. By defining the indexation in a different way the three-month lag design does away with the need to know the next dividend in order to be able to calculate the accrued interest, thereby enabling a much shorter indexation lag to be employed. Adopting this design for new index-linked gilts brought the UK into line with international best practice and other G7 issuers.

[10] For more details see the DMO's consultation paper "Issuance of ultra-long gilt instruments" of 2 December 2004.

The first index-linked gilt to use the three-month lag design was 1¼% Index-linked Treasury Gilt 2055, which was launched in September 2005. Two further index-linked gilts with the new design have since been launched - 1¼% Index-linked Treasury Gilt 2017 in February 2006 and 1¼% Index-linked Treasury Gilt 2027 in April 2006. Since April 2005, all new gilts have been referred to as Treasury Gilts, while earlier bonds often had the title of Treasury Stock. As a result, 3-month lag index-linked gilts can be easily distinguished from 8-month lag index-linked gilts as they are all referred to as Treasury Gilts, rather than Treasury Stocks.

Chapter 4: Exchequer Cash Management Operations

Cash remit 2005-06

The DMO's cash management remit for 2005-06, published on 16 March 2005, specified that the Government's cash management objective was:

> *"to ensure that sufficient funds are always available to meet any net daily central Government cash shortfall and, on any day when there is a cash surplus, to ensure this is used to best advantage".*

HM Treasury and the DMO work together to achieve this, with HM Treasury providing information to the DMO about flows into and out of the National Loans Fund (NLF) and the DMO making arrangements for funding and for placing net cash positions, primarily by carrying out market operations on the basis of HM Treasury forecasts.

The DMO's cash management objective

The remit specifies that the DMO's cash management objective is to:

> *"minimise the cost of offsetting the Government's net cash flows over time, while operating in a risk appetite approved by Ministers. In so doing, the DMO will seek to avoid actions or arrangements that would:*
>
> - undermine the efficient functioning of the Sterling money markets; or
> - conflict with the operational requirements of the Bank of England for monetary policy implementation."

Instruments and operations used in Exchequer cash management

In 2005-06 the DMO carried out its cash management objective primarily by a combination of:

- weekly Treasury bill tenders; and
- bilateral market operations with DMO counterparties.

In practice, bilateral market operations (primarily repo and reverse repo transactions) constituted the vast majority of the DMO's cash management operations in 2005-06. However, Treasury bills play an important role in smoothing cumulative cash positions while variations in the stock of bills in market hands can also serve as a financing instrument within short-term debt sales.

Level of Treasury bill stocks

The financing remit for 2005-06 specified that the stock of Treasury bills in market hands should fall by £1.0 billion over the financial year (i.e. adding to the net financing requirement) taking the planned stock of bills to £19.5 billion at March 2006.

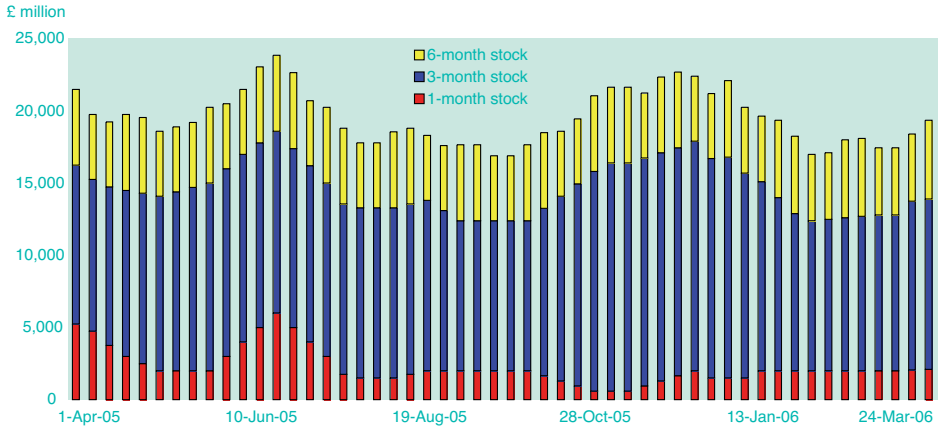
However, on 20 April 2005, the publication of the CGNCR outturn for 2004-05 showed a £4.3 billion reduction in the CGNCR from the budget forecast. Consequently, planned

Treasury bill sales were reduced by a further £1.5 billion (compared to the original remit plans), representing a planned reduction of £2.5 billion year-on-year.

At PBR on 5 December 2005 the forecast for the CGNCR in 2005-06 increased by £3.1 billion compared to the Budget forecast. The net financing requirement for the DMO increased by £2.4 billion and planned Treasury bill sales were increased by £1.2 billion compared to the revised plans announced in April, taking the planned end-March 2006 stock to £19.2 billion (a reduction of £1.1 billion year-on-year).[11]

Planned Treasury bill sales were reduced again, albeit marginally by £0.1 billion, at Budget 2006 taking the stock at end-March 2006 to £19.1 billion (a reduction of £1.2 billion year-on-year). Chart 13 shows the level of Treasury bill stocks in market hands over the course of the financial year and Table 10 sets out the details of the Treasury bill portfolio (in market hands) at end-March 2006.

Chart 13
Treasury bill stocks 2005-06



Source: DMO

Table 10
Treasury bills in market hands at end-March 2006

	Maturity (days)	Amount in issue (£mn)
Treasury bill maturing 03/04/2006	3	1,400
Treasury bill maturing 10/04/2006	10	2,150
Treasury bill maturing 18/04/2006	18	1,400
Treasury bill maturing 24/04/2006	24	1,450
Treasury bill maturing 02/05/2006	32	900
Treasury bill maturing 08/05/2006	38	1,650
Treasury bill maturing 15/05/2006	45	900
Treasury bill maturing 22/05/2006	52	900
Treasury bill maturing 30/05/2006	60	900
Treasury bill maturing 05/06/2006	66	1,650
Treasury bill maturing 12/06/2006	73	900
Treasury bill maturing 19/06/2006	80	900
Treasury bill maturing 26/06/2006	87	900
Treasury bill maturing 10/07/2006	101	1,800
Treasury bill maturing 31/07/2006	122	700
Treasury bill maturing 29/08/2006	151	800
Treasury bill maturing 25/09/2006	178	800
Total		**19,100**

[11] The planned reduction was £1.1 billion, not £1.3 billion as might be inferred from the £2.5 billion reduction announced on 20 April, because of the need to account for the purchase of £0.2bn of T-bills by the DMO in March 2005 which had reduced the end-March 2005 T-bill stock to £20.3bn (not the £20.5bn reported on 20 April 2005). See also footnote 5.

The results of all Treasury bill tenders are reported in Annex E and a comparison of the average yield achieved at each tender with prevailing GC repo rates are reported in Annex F.

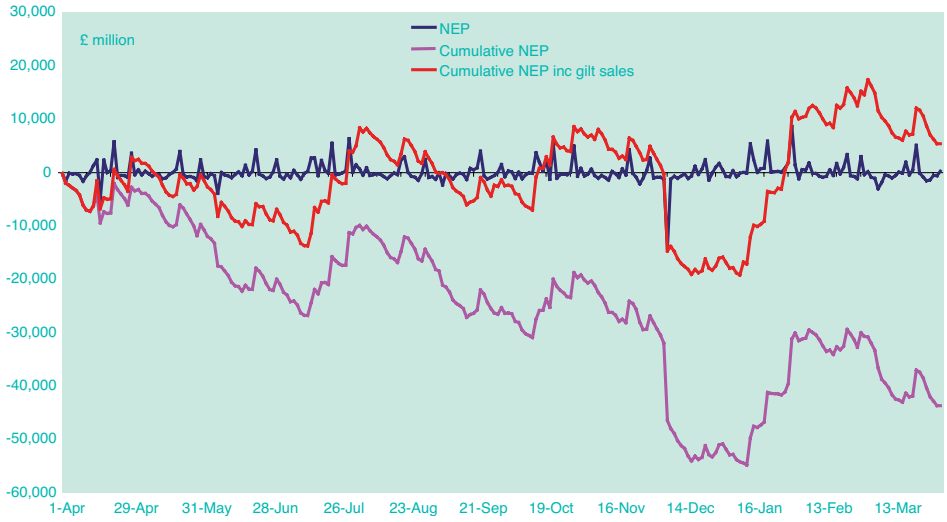
Cash management operations

The DMO's money market dealers borrow from or lend to the market on each business day to balance the position in the NLF. In order to do so the DMO receives forecasts of each business day's significant cash flows into and out of central government from HM Treasury. Additionally, the DMO requires up-to-date intra-day monitoring of cash flows as they occur. The DMO trades only with the purpose of offsetting forecast future government cash flows, subject to agreed risk limits. The DMO does not take interest rate positions except in the course of offsetting forecast future cash flows.

Over the course of a financial year, the Exchequer's cash flow has a fairly regular pattern associated with the tax receipts and expenditure cycles and outflows associated with gilt redemptions and coupon payments.

Chart 14 shows the scale of daily cash flows measured in terms of the Net Exchequer Position (NEP) in 2005-06. It excludes the effects of Treasury bill issuance and NS&I's overall net contribution to government financing, but highlights the contribution of gilt sales to reducing the cumulative deficit in year and, as the chart shows, the NEP ended the financial year in surplus after gilt financing.

Chart 14
Exchequer cash flows 2005-06



Source: HMT/DMO

Box 1: Implementation of recommendations from the Government Cash Management Review

As a result of the DMO's review of its Government cash management function carried out in 2004-05[12], the DMO started to implement improvements to its cash management practice during 2005-06. The key motivations for the Review were: (i) to see if the cash management framework originally implemented in 2002 was still appropriate; and (ii) to explore new ways of measuring the performance of the cash management function. The latter was primarily for public accountability purposes, while also intended to take into account any possible impact from the Bank of England's reforms to the framework for its operations in the Sterling money markets.[13] The Review concluded that, although the way in which Government cash management had been carried out in the past, so-called 'active cash management',[14] continued to work well, some gradual improvements would be desirable. The following provides an update on the implementation of the Review's key recommendations:

- A benchmark approach, capturing the performance of the 'active management' of net Government cash flows against a default strategy, is being transitioned internally. This benchmark approach continues to be evaluated in the light of the Bank of England's reforms and taking into the account forecasts of net Government cash flows. These form an integral part of active cash management and are now available for a longer horizon and with improved timeliness.
- The requisite management information and operational control procedures for the implementation of risk limits have been put into place. This has allowed monitoring of the cash management function in the context of the defined risk appetite. The current risk limits may be calibrated in the coming months as the impact of the Bank of England's reforms on the Sterling money markets becomes apparent.
- The range of cash management counterparties has been widened, including via electronic platforms, in order to ensure competitive price-making to the DMO.[15]
- The use of the interbank, Certificates of Deposit (CD) and Commercial Paper (CP) markets has been made more consistent by extending activity in the interbank market from overnight to two weeks.
- Other potential developments, including the use of hedging instruments such as SONIA and foreign exchange swaps, will be considered during the coming year.

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[12] See Chapter 5 of the 'DMO Annual Review 2004-05', July 2005, published by the DMO.
[13] See 'The Framework for the Bank of England's Operations in the Sterling Money Markets', May 2006, published by the Bank of England.
[14] Carried out principally as a cost minimising rather than profit maximising activity and playing no role in the determination of interest rates. It involves the DMO transacting in a range of instruments and at a range of maturities with money market counterparties as a price taker, with a view to smoothing the DMO's net cash profile to offset expected net government cash flows over time.
[15] See DMO screen announcement 'Use of electronic platforms for Cash Management purposes', 24 April 2006.

Chapter 5: Fund management and local authority lending for Central Government

Fund management

The origins of the Commissioners for the Reduction of the National Debt (CRND) can be traced back directly to the passing of the National Debt Reduction Act of 1786. From their earliest days the Commissioners had associations with the stock market and this led to a diversification of CRND operations, including in particular the responsibility for the investment of major Government funds. This now constitutes the main function of CRND, which has around £49 billion under its control, representing the assets of the various investment accounts.

The investment powers differ to some extent from fund to fund, depending upon the provisions of the relevant Acts of Parliament, but essentially investments are restricted to government and government guaranteed securities. Currently, the largest funds are the National Insurance Fund Investment Account, the Court Funds Investment Account and the National Lottery Distribution Fund Investment Account. During the year CRND assumed responsibility for investing the new Olympic Lottery Distribution Fund, increasing the number of investment accounts managed to ten. The full list of funds under management is as follows:

- Court Funds Investment Account
- Crown Estate
- Insolvency Services Investment Account
- National Endowment for Science, Technology and the Arts
- National Insurance Fund Investment Account
- National Lottery Distribution Fund Investment Account
- National Savings Bank Fund
- Northern Ireland Court Service Investment Account
- Northern Ireland National Insurance Fund Investment Account
- Olympic Lottery Distribution Fund Investment Account

During 2005-06 CRND continued to provide an efficient, value for money service, with the main investment objectives being to maintain sufficient liquidity to meet withdrawals and to protect the capital value of the funds under management. Although the majority of clients are satisfied with the existing cash management and gilt index-tracking options on offer, for those clients seeking a more active style of fund management, CRND continues to investigate the scope for providing this through the private sector.

Lending to local authorities

PWLB responsibilities and objectives

The Public Works Loan Board (PWLB) is an independent statutory body, headed by Commisioners, which dates back to 1793. The PWLB merged with the DMO in July 2002, since when the Board has operated as a unit of the DMO, sharing common services, while retaining its statutory identity. The Secretary to the Board and the

other staff of the Board are all employees of the DMO.

The PWLB's function is to consider loan applications from local authorities and other prescribed bodies and, where loans are made, to collect the repayments. Nearly all borrowers are local authorities requiring loans for capital purposes. Loans, which are automatically secured by statute on the revenue stream of the authority, are sourced from the National Loans Fund (NLF). Rates of interest are determined by HM Treasury, drawing on data provided by the DMO.

The Board's accounts are audited by the Comptroller & Auditor General, whose reports on them are laid before Parliament, to which the Board makes its own statutory report.

PWLB operations in 2005-06

Loans of £9 billion were made during 2005-06, with the key development being the extension, in December 2005, of the maximum loan period out to 50 years. This followed the earlier recommencement of UK Government borrowing at 50-year maturities through new issuance of 50-year maturity conventional and index-linked gilts during 2005.

During a single day in January 2006 £1.3 billion was advanced, following the previous month's increase in the maximum maturity. These advances coincided with historically low long-dated interest rates.

Over the financial year the PWLB's portfolio of loans grew by £5 billion and at end-March 2006, the outstanding balance of principal was £47 billion, with a market value of £56 billion.

Chapter 6: Strategic Debt Analysis (SDA)

Stochastic simulation modelling in debt management

The United Kingdom Debt Management Office is developing a stochastic simulation model that may in future be used to analyse quantitatively the expected cost and risk of various issuance strategies. The purpose of this chapter is to describe succinctly the key features of this model and provide some illustrative results. As the simulation model represents work-in-progress it is not presently being used to inform HM Treasury's decisions about the structure of the debt portfolio and the composition of the annual gilt issuance programme set out in the DMO's financing remit each year. Therefore the contents of this chapter do not describe the current issuance strategy of the Government nor do they define a preferred or optimal strategy for the Government.

Introduction

The UK Government borrows funds to finance the excess of cash payments over receipts, to pay interest on outstanding debt and to refinance maturing debt. The Government issues debt instruments in order to raise the cash it wishes to borrow. Currently, government debt instruments are issued with maturities ranging from one month (for T-bills) to 50 years (for gilts), and with interest payments (on gilts) that are either fixed in nominal terms (conventional gilts) or linked to inflation[16] (index-linked gilts).

The Government can combine these debt instruments in a number of ways to meet its borrowing requirement, but ultimately it has to decide on what it deems to be the best way to borrow these funds. From the Government's fiscal perspective, it would like to borrow funds as cheaply as possible in order to keep down its debt costs and ultimately the cost to the taxpayer. Another consideration for the Government is that the cost associated with a given borrowing strategy should not be too volatile nor expose the Government to unexpected and large increases in debt costs nor should it pose a threat to the attainment of the Government's overall fiscal goals. Hence, what borrowing strategy the Government chooses depends ultimately on these cost and risk considerations.

The consideration of the cost-risk trade-off of borrowing strategies is an important feature of debt management in the UK, as reflected in the Government's debt management policy objective. The Government's debt management policy objective is:

> *"to minimise, over the long term, the costs of meeting the Government's financing needs, taking into account risk, whilst ensuring that debt management policy is consistent with the aims of monetary policy".*[17]

Given this debt management objective, the DMO is developing a stochastic simulation model that it may in future use to analyse quantitatively the expected

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[16] As measured by the Retail Prices Index (RPI).
[17] *Debt and Reserves Management Report 2006-07,* HM Treasury 2006.

cost and risk of various debt issuance strategies. This chapter describes the key features of this model and provides some illustrative results[18].

As the simulation model represents work-in-progress it is not presently being used to inform HM Treasury's decisions about the structure of the debt portfolio and the composition of the annual gilt issuance programme set out in the DMO's financing remit each year. Therefore the contents of this chapter do not describe the current issuance strategy of the Government, nor do they define a preferred or optimal issuance strategy for the Government. In fact, on its own, this simulation model cannot determine what the Government's preferred debt issuance strategy should be. That can only be determined on the basis of information about the Government's cost-risk trade-off preferences and a consideration of the other factors that the UK authorities examine when choosing a given long-term borrowing strategy. Further, the chapter does not express any views about the current stance of the Government's debt management policy nor its likely course in the future. The chapter emphasises the methodological framework of the simulation model and shows how one can employ this framework to compare issuance strategies. As will be discussed later, one limitation of the simulation model is that it does not allow for any changes in the relative supply of bonds to influence their yields. One consequence of this limitation is that the model throws up corner solutions, which are unlikely to be pursued in practice.

In recent years, other OECD debt managers have also developed and used stochastic simulation modelling in their debt management processes (see Box 2). The simulation model presented in this chapter can be viewed as another contribution to this small extant literature on debt strategy stochastic simulation modelling.

Box 2: Stochastic debt strategy simulation modelling in other OECD countries

Given that debt management objectives are similar in many countries, a small body of research has developed that attempts to quantify the cost-risk trade-off of different borrowing strategies. Various quantitative approaches have been adopted by sovereign debt management agencies, but in recent years simulation models have gained in popularity. Some debt managers have made publicly available their research on these models. For example, the simulation model developed by the central bank of Denmark is discussed in Danmarks Nationalbank (2005). The model uses a two-factor Cox, Ingersoll and Ross (CIR) yield curve model for the simulation of the interest rates and then compares debt strategies over a 10-year horizon, taking into account the Government's financing requirement forecasts.

Bergstrom et.al (2000, 2002) describe the simulation model constructed by the Swedish National Debt Office. The model uses a macroeconomic model that is similar in spirit to the one presented here, but in addition, it contains an external sector as Sweden issues foreign currency denominated debt. The yield curve used in the model is a linear interpolation between a short and a long term yield.

[18] A more detailed presentation of the model can be found in A Pick and M Anthony (2006), *"A simulation model for the analysis of the UK's sovereign debt strategy",* UK DMO paper.

Bolder (2002, 2003) describes the simulation model developed by the Bank of Canada. This model is a combined macro-yield curve model using a Markov-switching approach for the real GDP growth rate, a CIR yield curve model for the simulation of the interest rates and an equation that specifies the Government's financing requirement.

A useful overview of stochastic debt strategy simulation modelling in OECD countries can be found in Risbjerg and Holmlund (2005).

The structure of the chapter is as follows. The next section sets out the main features of the simulation model. Next, some illustrative results are presented. The chapter then concludes with some final remarks.

Stochastic simulation modelling of debt cost and risk

Several factors influence the cost of servicing the government debt: the size and composition of the debt portfolio, the state of the real economy, the term structure of interest rates, inflation and the financing requirement of the Government. The simulation model captures in a highly stylised fashion how these factors interact to determine the debt cost of the Government.

The simulation framework consists of three main building blocks: (i) a *macroeconomic model* in which the output gap, the Government's primary net financing requirement, RPI and CPI inflation and the short interest rate are modelled as separate but inter-related equations; (ii) *yield curve models* which provide the specification for both the nominal and real term structure of interest rates; and (iii) the *debt strategy simulation* component, which is used to determine how, under a given debt strategy, the Government meets its total financing requirement (net central government cash requirement plus the refinancing of maturing debt). This latter component of the simulation model is also used to compute the cost and risk measures associated with the respective debt strategies, given the simulated path for the economy, the Government's financing requirement, interest rates and inflation.

Macroeconomic model

The macroeconomic part of the simulation model is made up of a small, trend-deviating model, which is in the spirit of the New-Keynesian models that have been developed for the analysis of monetary policy. The model is comprised of five equations that describe the behaviour of the output gap, the Government's primary net financing requirement, the CPI and RPI inflation, and the short interest rate. For simplicity, the current specification of the model is purely backward looking.

Economic cycle, output gap, and net primary financing requirement

The economic cycle is modelled as a simple two-state Markov switching regime for the output gap – the deviation of actual output from potential output. Hence, the typical behaviour of the economy is expressed as a stylised process with cyclical swings between above trend output and below trend output. The duration of the economic cycle is determined stochastically in the model, and during each period the economy has a given probability of changing from above trend output to below trend output and vice versa. Potential (trend) growth is assumed to be 2.5 percent

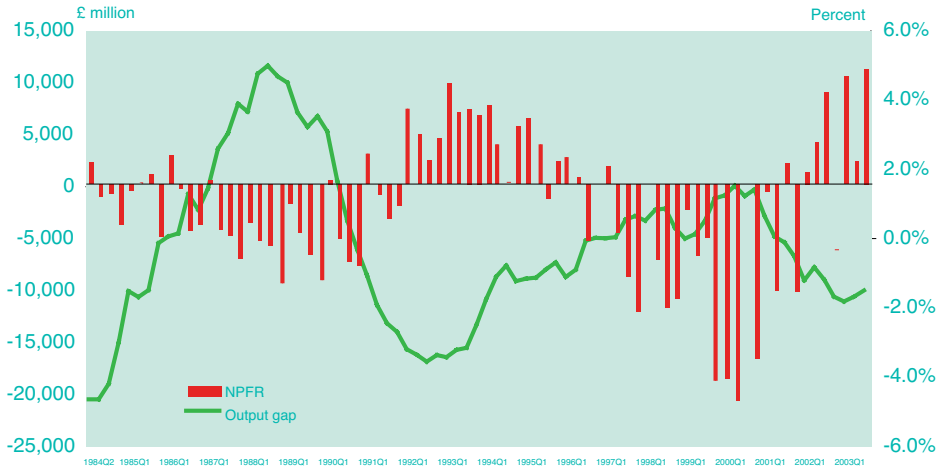
per annum. Specifically, the output gap is expressed as a function of the lagged real short interest rate and the lagged output gap as shown in equation (1) below:

$$y_t = \alpha_t + \rho\, y_{t-1} - \beta\,(r_{t-1}(0) - cpi_{t-1}) + \varepsilon_{y,t},\ \varepsilon_{y,t} \sim N\,(0,\ \sigma_y^2) \qquad (1)$$

where t indicates time and t =1, 2,…,T, y = the output gap, α is a Markov switching intercept with two states or regimes α_1 and α_2 and the transitional matrix A with diagonal elements (0.9, 0.9), r_t (0) = the short interest rate, cpi_t = the CPI inflation and ρ and β are parameters that measure the degree to which the output gap is affected by its previous value and the real short interest rate in the previous period, and $\varepsilon_{y,t}$, is an independent and normally distributed error term with zero mean and constant variance, σ_y^2. The transitional probabilities for the two regimes – above trend output and below trend output – imply that they both have identical average durations of about 2.5 years.

Modelling the economic cycle is important for the analysis of debt strategies because it impacts on the other variables in the economy. For example, the term structure of interest rates tends to vary systematically over the economic cycle. Therefore the *unit costs* associated with the issuance strategies selected to meet the Government's financing requirement vary systematically over the economic cycle.

Chart 15
Net primary funding requirement (NPFR) and the output gap: 1984Q2 - 2003Q4



Source: HM Treasury

Also, as Chart 15 shows the Government's primary net financing requirement varies with the economic cycle. During periods of above trend output the primary net financing requirement tends to be in surplus (or show smaller than average deficits) because the Government's finances tend to be healthier as a consequence of higher tax revenues and lower expenditure. Conversely, in periods of below trend output the primary net financing requirement tends to be in deficit (or display smaller than average surpluses) because the Government's finances tend to be less healthy due to lower tax revenues and higher expenditure. Hence the *quantity* of the Government's financing requirement varies over the economic cycle. In modelling the Government's primary net financing requirement the influence of the economic cycle is therefore incorporated. As the simulation model is intended to reflect the salient features of the UK economy it includes the Government's two fiscal rules – the golden rule and the sustainable investment rule - in the modelling of the primary

net financing requirement[19]. For this reason the Government's primary net financing requirement (as a share of GDP) is modelled as a function of the lagged output gap, lagged primary net financing requirement and the deviation of the lagged debt/GDP ratio from an assumed "long-run" average debt/GDP ratio:

$$f_t = \mu + \nu f_{t-1} - \pi y_{t-1} - \theta (d_{t-1} - d^*) + \varepsilon_{f,t}, \ \varepsilon_{f,t} \sim N(0, \sigma_f^2) \quad (2)$$

where μ is a constant, f_t = the primary net financing requirement, d_{t-1} = the debt/GDP ratio in the previous period, d^* = the long-run average debt/GDP ratio, which is set equal to 0.33 (33 percent), $\varepsilon_{f,t}$ is an error term and ν, π, and θ are the parameters that indicate respectively the extent to which the primary net financing requirement is influenced by its previous value, the output gap in the preceding period and the extent to which the Government has to change its fiscal policy in order to ensure that the debt/GDP ratio does not deviate too far from the long-run average ratio.

It should be pointed out that the above specification for the primary net financing requirement provides a stylised representation of both the golden rule and the sustainable investment rule. There is no explicit current deficit in the model and therefore the golden rule is approximated by the assumption that over the "long-run" (and not necessarily over every economic cycle) the average primary net financing requirement must be in surplus.[20]

The sustainable investment rule is represented in the model by the restriction that the average long-run debt/GDP ratio is equal to the starting debt to GDP ratio. The model maintains the long-run debt ratio, on average, in a symmetrical manner, expressed by the primary net financing requirement adjusting accordingly (through the term $-\theta (d_{t-1} - d^*)$) when the actual debt/GDP ratio diverges from the initial debt/GDP ratio. When the actual debt/GDP ratio exceeds the initial debt/GDP ratio, the Government tightens its fiscal stance and generates a larger primary net financing requirement surplus; conversely when the actual debt/GDP ratio falls below the initial debt/GDP ratio, the Government relaxes its fiscal stance and generates a larger primary net financing requirement deficit.

In contrast, the sustainable investment rule as actually set by the Government is asymmetrical with only an upper limit set for the public sector net debt to GDP ratio[21] over the economic cycle. Moreover, the simulation model identifies economic regimes or states and thus does keep track of the economic cycles through time. The fiscal rules as represented in the net primary financing requirement equation are only observed as long-run properties of the model. To ensure that the fiscal rules are met over the economic cycle would require some form of dynamic programming and that implies a much more complex model framework than the current model.

CPI inflation, RPI inflation and the short interest rate

The simulation model is to be used to examine borrowing strategies that reflect the choice of debt instruments currently available to the Government. The Government issues both nominal gilts and inflation-linked gilts. In order to capture the inflation compensation on both the coupon payment and the outstanding principal payable

[19] The golden rule states that over the economic cycle the Government will only borrow to invest and not to fund current spending; and the sustainable investment rule states that the public sector net debt as a proportion of GDP will be held over the economic cycle at a stable and prudent level. Other things being equal, net debt will be maintained below 40 percent of GDP over the economic cycle (see Pre-Budget Report 2005, HM Treasury 2005).

[20] Technically, this means that the expected or average long-run value of f_t, $E(f_t) = \frac{\mu}{\nu - 1} < 0$ in the primary net funding requirement equation.

[21] The sustainable investment rule is defined in terms of the public sector net debt to GDP ratio. In contrast, the model uses the gross debt ratio.

on inflation-linked bonds, we need to specify the price process.

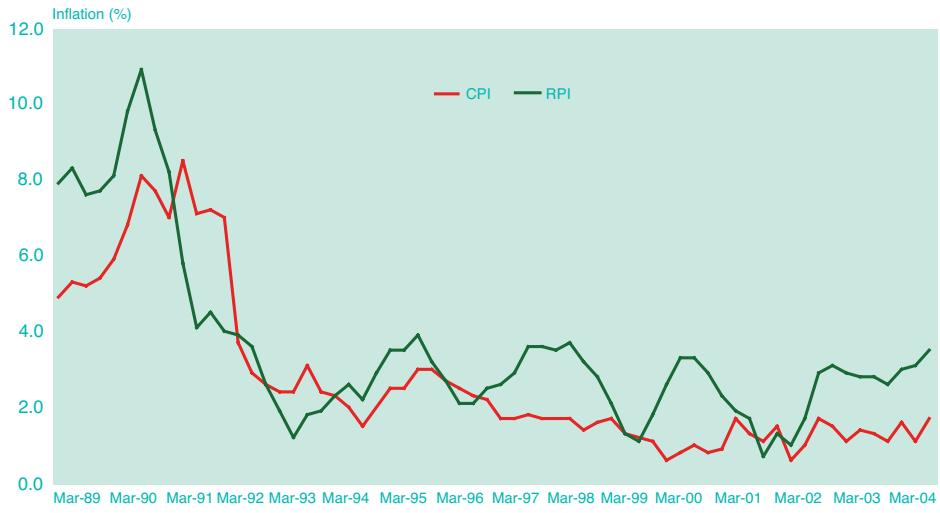
Both CPI and RPI inflation are modelled. In order to reflect the current monetary policy regime CPI inflation is targeted by the central bank. We assume that the CPI inflation target is fully credible, and the expected CPI inflation is set to be consistent with the current Bank of England target of 2%. CPI inflation is modelled as a Phillips curve and it is expressed specifically as a linear function of the lagged output gap and lagged CPI inflation:

$$cpi_t = \zeta(1-\xi) + \xi\, cpi_{t-1} + \Psi\, y_{t-1} + \varepsilon_{cpi,t},\ \varepsilon_{cpi,t} \sim N(0, \sigma^2_{cpi}) \quad (3)$$

where ζ is the inflation target of the central bank, ξ and Ψ are respectively parameters that measure the strength with which CPI inflation is influenced by its previous value and the value of the output gap in the preceding period and $\varepsilon_{cpi,t}$ is an error term.

As inflation-linked bonds are tied to the RPI index, it is necessary to model RPI inflation in order to calculate the inflation compensation on these bonds. It is reasonable to assume that there are systematic differences between CPI inflation and RPI inflation over the economic cycle, as can be seen from Chart 16.

Chart 16
CPI and RPI Inflation: 1989 - 2004



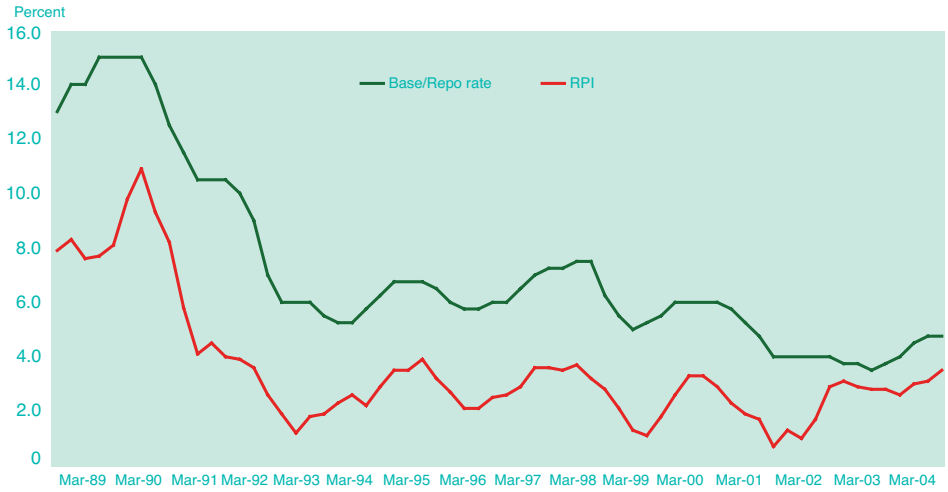
Source: ONS

One reason for this is that changes in the short interest rate made by the central bank in its attempt to stabilise CPI inflation at its target level tend to have an impact on RPI inflation (see Chart 17). One channel through which this effect occurs is via the impact of adjustments in the central bank's policy rate on mortgage interest rates and consequently mortgage interest payments, which are included in the RPI index. RPI inflation is therefore modelled as a function of contemporaneous CPI inflation and the short interest rate:

$$rpi_t = \kappa + cpi_t + l\, r_t(0) + \varepsilon_{rpi,t},\ \varepsilon_{rpi,t} \sim N(0, \sigma^2_{rpi}) \quad (4)$$

where κ is a constant, l indicates the extent to which the short interest rate affects RPI inflation and $\varepsilon_{rpi,t}$ is an error term.

Chart 17
RPI Inflation and Base/Repo rate: 1989 - 2004



Souce: ONS/Bank of England

To complete the macroeconomic part of the simulation model, we specify the evolution of the short interest rate. The short interest rate, from a macroeconomic perspective, is the policy rate under the direct control of the central bank, which varies the rate in pursuit of its objective of stabilising CPI inflation at the 2% target. Another important reason for modelling the short interest rate is that it is an important building block for the interest rates at other maturities, which are risk-adjusted averages of expected future short interest rates. Hence, changes in the short interest rate influence the variations in the interest rates at other maturities. The short interest rate is modelled as a simple Taylor rule, and it is expressed as a function of the lagged output gap and the lagged CPI inflation:

$$r_t(0) = \phi + \omega\, c\, p\, i_{t-1} + \chi\, y_{t-1} + \varepsilon_{r(0),}\, \varepsilon_{r(0),\,t} \sim N(0, \sigma^2_{r(0)}) \qquad (5)$$

where ϕ is a constant, ω and χ respectively show the degree to which the previous period's value of CPI inflation and the lagged value of the output gap cause the central bank to vary the short interest rate and $\varepsilon_{r(0),\,t}$ is an error term.

The values for the parameters of the macroeconomic model are derived from a combination of estimation, theory, and calibration. The estimation uses quarterly data for the UK economy over the period 1992 - 2004. Theoretical restrictions are imposed on the parameters of the model so that, for example, the average CPI inflation is constrained to be equal to the inflation target under the assumption of a credible monetary policy regime and the output gap averages to zero. Therefore, in its parameterisation, the macroeconomic part of the simulation model captures in a highly stylised fashion some of the main features of the UK economy over the recent past. Table 10 summarises the parameterisation of the macroeconomic model.

Table 10
The parameterised equations of the macroeconomic model

$$y_t = \alpha_t + 0.1\, y_{t-1} - 0.05\,(r_{t-1}(0) - c\, p\, i_{t-1}) + \varepsilon_{y,t},$$

$$\varepsilon_{y,t} \sim N(0, 0.0015^2)$$

$$f_t = -0.000000135 + 0.55 f_{t-1} - 0.5 y_{t-1} - 0.02(d_{t-1} - d^*) + \varepsilon_{f,t},$$

$$\varepsilon_{f,t} \sim N(0, 0.0008^2)$$

$$cpi_t = 0.00496(1-0.3) + 0.3 cpi_{t-1} + 0.2 y_{t-1} + \varepsilon_{cpi,t},$$

$$\varepsilon_{cpi,t} \sim N(0, 0.0005^2)$$

$$rpi_t = -0.003 + cpi_t + 0.5 r_t(0) + \varepsilon_{rpi,t},$$

$$\varepsilon_{rpi,t} \sim N(0, 0.0001^2)$$

$$r_t(0) = 0.003 + 1.5 cpi_{t-1} + 0.5 y_{t-1} + \varepsilon_{r(0),t},$$

$$\varepsilon_{r(0),t} \sim N(0, 0.0002^2)$$

where α_t is a Markov switching intercept with two states $\alpha_1 = -0.0025$ and $\alpha_2 = 0.0029952$ and the transition matrix A with diagonal elements (0.9, 0.9). The variances of the error terms in the respective equations, excepting the primary net financing requirement equation, are set such that the variances of the variables in the model are similar to their empirical variances. In addition, the model parameters are set so that the model corresponds to quarterly data. This means, for example, that the CPI inflation target of 2% translates into a model parameterisation of $(1+0.02)^{0.25} - 1 \approx 0.005$.

Yield curve models

As the Government finances its total borrowing requirement by issuing bonds it is required that the interest rates at which it issues these bonds be computed. Further, since the Government can choose between conventional fixed rate bonds and inflation-linked bonds, it is necessary to model the interest rates for each type of bond. In order to price the coupons of the bonds issued, the simulation model requires a yield curve for conventional bonds and one for index-linked bonds. The yield curve for conventional bonds is based on the yield curve function introduced by Nelson and Siegel (1987)[22], and it is specified so as to capture the influence of macroeconomic developments on the evolution of the term structure of interest rates.

The real yield curve is derived from the nominal yield curve under the assumption of fixed inflation expectations. This assumption is fairly plausible because, in the simulation exercises, index-linked bonds are only issued at 10-year and 30-year maturities and expectations for inflation 10 years and beyond within the same credible monetary policy framework are likely to be relatively well anchored, as we have assumed.[23] The nominal and real yield curves are modelled from a combination of theoretical considerations and empirical evidence. Importantly, the yield curves are modelled so that on average they are inverted at the long end

[22] See Nelson and Siegel (1987).

[23] Strictly speaking, the assumed credibility of the monetary regime implies that expectations of future CPI inflation will be well anchored at the central bank's CPI inflation target. For our purposes, we require expectations of RPI inflation to be well anchored also. This we achieve by further assuming that there is a stable relationship between CPI and RPI inflation and therefore well anchored long run expectations of CPI inflation mean also stable long run expectations of RPI inflation.

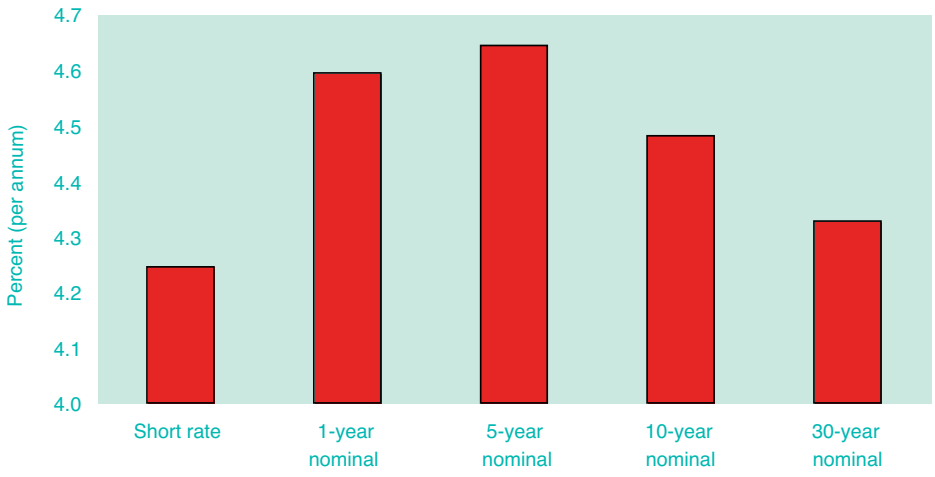
(consistent with the current shape of the UK yield curves). Moreover, as Table 11 and Chart 18 show, the average nominal yields and their volatility are similar to those of the nominal yield curve over the period 1998-2004. The appendix provides further details on the specification and modelling of the yield curves.

The current specification of the yield curve models does not allow for any potential influence on the yields of the respective bonds that would arise from changes to their relative supplies. The implication is that, in the model, issuance strategies can be composed of any combination of bonds without having any consequence for the evolution of yields over time. This is certainly a limitation of the model as it is appears that changes in the relative supply of bonds will tend to influence yields.

Table 11
Actual (1998Q1 – 2004Q4) and simulated interest rates

Interest Rates	Actual		Simulated	
	Mean	Standard Deviation	Mean	Standard Deviation
Short rate	5.0803	1.1786	4.2453	1.1581
1-year	4.6937	0.8560	4.5951	0.6928
5-year	4.9038	0.6572	4.6444	0.6180
10-year	4.8475	0.4280	4.4776	0.3855
30-year	4.5373	0.2144	4.3280	0.1992

Chart 18
Average nominal interest rates in simulation



Cost and risk measures

It is necessary to define what is meant by cost and risk in order to be able to compare debt strategies on the basis of their cost-risk trade-off. The cost of the debt in any given period is defined in cash flow terms and is computed as the sum of all nominal coupon payments (interest payments on nominal bonds plus inflation compensated interest payments on inflation-linked bonds) plus the realised inflation compensation effects on maturing inflation-linked bonds.

We measure debt cost as a proportion of nominal GDP. There are advantages to using this *debt cost ratio* rather than the nominal cost of the debt. First, the debt cost ratio gives a better picture of the Government's financial situation in that it

provides a clearer indication of the debt cost burden to the Government than does the nominal cost of debt on its own. Second, the debt cost ratio is consistent with the Government's fiscal rules, in particular the sustainable investment rule, which relates the public sector net debt to nominal GDP. Third, the debt cost ratio provides a rudimentary way of capturing an asset and liability management (ALM) approach to government debt management in that the cost of the debt is related to the source from which the Government secures its tax revenues, which are its principal asset.

The risk measures we use in the model capture the concept of *financing risk*, the uncertainty in the financing or cash flow cost related to a given borrowing strategy. The financing risk associated with a given debt strategy is evaluated by two statistics. The first statistic is the standard deviation of the debt cost ratio, which measures the volatility of the debt cost ratio. The second statistic is the 95th percentile of the debt cost ratio distribution that gives the largest debt cost ratio, such that it is exceeded by five percent of the debt cost ratio realisations. The latter statistic is in the spirit of the commonly used Value-at-Risk (VaR) approach used in finance and risk management and will accordingly be referred to as the debt cost ratio-at-risk. The debt cost ratio-at-risk is a useful risk measure especially when the Government is concerned about avoiding extremely high debt cost ratios. In contrast, the standard deviation measures risk symmetrically, in that it relates to deviations from the mean debt cost ratio.

Although the model directly measures financing risk, it is clear that this risk is closely related to the wider issue of *budget* or *fiscal* risk, the uncertainty in the budget position associated with the volatility in debt cost emanating from a given borrowing strategy. This is because the debt cost is one of the items of government expenditure and therefore variations in the debt service cost directly impact on the volatility in the Government's financial position. However, another important consideration is the way in which debt service costs co-vary with the primary net funding requirement.

In general, in order to minimise its budget risk, the Government would ideally like to have in its portfolio debt instruments with the following features: (a) debt instruments with low debt service cost variability; (b) debt instruments with debt service costs that co-vary negatively with the debt service costs of other debt instruments in the portfolio (and thus provide insurance against variations in the debt service costs of other debt instruments in the debt portfolio) and (c) debt instruments with debt service costs that co-vary positively with the primary net funding requirement surplus. All other things being equal, feature (c) would imply that a debt portfolio that typically has low costs when the Government finances are strained is deemed less risky overall than a portfolio to which the opposite applies.

Debt strategy simulation and illustrative results

The debt strategy component of the model controls how the Government borrows to meet its total financing requirement in any given period. The total financing requirement for any given period is equal to the sum of the modelled primary net financing requirement, interest payments and redemptions. Interest payments and redemptions are obtained directly from the information on outstanding debt in a given portfolio.

For simplicity, issuance is always composed of new bonds. There is therefore no re-opening of existing bonds in the debt strategy simulation. All bonds are issued at par and thus the yield at issuance is always equal to the coupon. We set coupon payments consistent with the frequency of the simulation model so that they are paid quarterly rather than semi-annually, as is the current convention. This also means that the uplift on interest payments on inflation-linked bonds is on a quarterly basis and lagged one quarter.

The starting debt-to-GDP ratio is set at 0.33 (33% of GDP) and for each borrowing strategy this is converted into an initial debt portfolio that is composed of the bonds in proportions that match identically the overall borrowing strategy. The model is simulated over a period of 125 years (500 quarters) with 2000 replications. We use both the observations in the 500th quarter and the observations over the last 100 quarters of the simulation interval for the analysis.

The debt strategies that are compared are fixed issuance rules that are composed of varying shares of nominal and inflation-linked bonds. Consistent with current issuance practice, nominal bonds are issued with short, medium and long maturities, but the issuance of inflation-linked bonds is restricted to medium and long maturities only.

However, there are several other features of the debt management process that are excluded from the model, but which are important elements of the UK Government's debt management strategy. For example, issuance in the model is not motivated by the need to build up benchmark bonds in order to secure a benchmark premium and thereby lower the long-run cost of funding for the Government.

For illustration, four issuance strategies with varying shares of short, medium and long maturity nominal bonds only are firstly compared. The purpose of this exercise is to highlight how changes to the maturity structure of conventional issuance strategies affect the cost-risk trade-off faced by the Government, under the assumed conditions of the simulation model. The composition of the four conventional issuance strategies is as follows:

- Strategy 1 is made up of 17.5 percent of 1-year bonds, 17.5 percent of 5-year bonds, 30 percent of 10-year bonds and 35 percent of 30-year bonds.
- Strategy 2 is composed of 35 percent of 5-year bonds, 30 percent of 10-year bonds and 35 percent of 30-year bonds.
- Strategy 3 is composed of 50 percent of 10-year bonds and 50 percent of 30-year bonds.
- Strategy 4 comprises only 30-year bonds.

Table 12 summarises the composition of the four issuance strategies.

Table 12
Composition of issuance strategies (in percentages)

	1-year nominal bond	5-year nominal bond	10-year nominal bond	30-year nominal bond
Strategy				
Strategy 1	17.5	17.5	30.0	35.0
Strategy 2		35.0	30.0	35.0
Strategy 3			50.0	50.0
Strategy 4				100.0

Table 13
Summary of simulation results for nominal issuance strategies

	Strategy 1	Strategy 2	Strategy 3	Strategy 4
Debt cost/GDP at t=500 Mean	1.4148	1.4300	1.4072	1.3912
Standard deviation	0.1966	0.2034	0.1959	0.1860
95th percentile	1.7548	1.7636	1.7364	1.7176
Debt cost/GDP over the interval t=400 to t=500				
Mean Mean	1.4155	1.4304	1.4125	1.3887
Mean Standard deviation	0.1962	0.2035	0.1954	0.1897
Mean 95th percentile	1.7327	1.7696	1.7379	1.7097

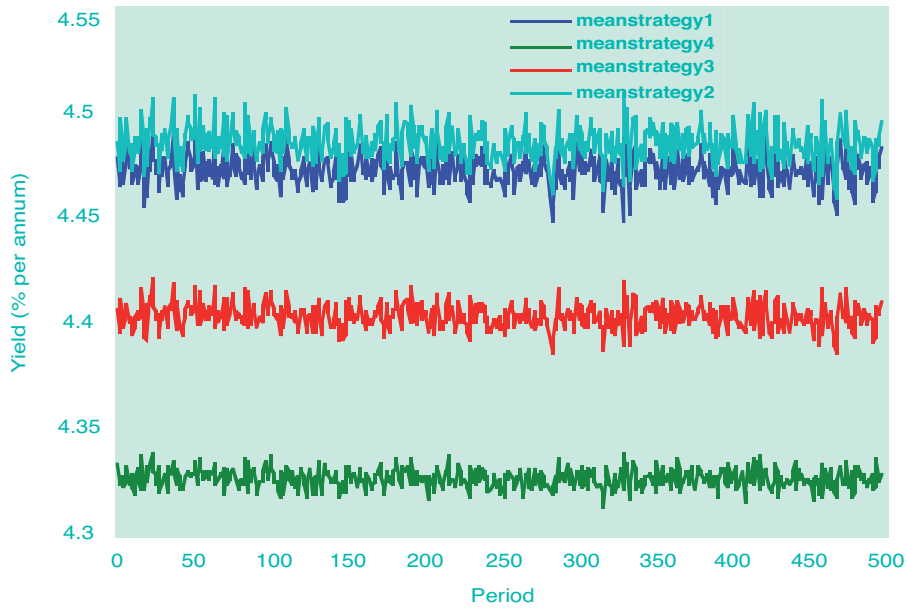
Note: Figures are quarterly, annualised and expressed in percentage points.

Results for nominal issuance strategies

Table 13 presents the statistics on the debt costs associated with the four nominal issuance strategies. It can be seen that as the share of 30-year bonds increases in the issuance strategies the average debt cost falls and that the issuance strategy with only 30-year nominal bonds has marginally the lowest debt cost. This result is unsurprising and it is largely a consequence of the fact that interest rates on long nominal bonds are lower than interest rates on short and medium nominal bonds as Chart 18 and Table 11 show (see page 40).

One way of illustrating the influence of the shape of the yield curve on the average debt cost of the various issuance strategies is to examine what the average cost of £1 of financing requirement would be under each issuance strategy. Chart 19 compares the average interest rates for each of the four strategies and it is clearly evident that the issuance rule that is made up of only 30-year nominal bonds (strategy 4) has the lowest average interest rates.

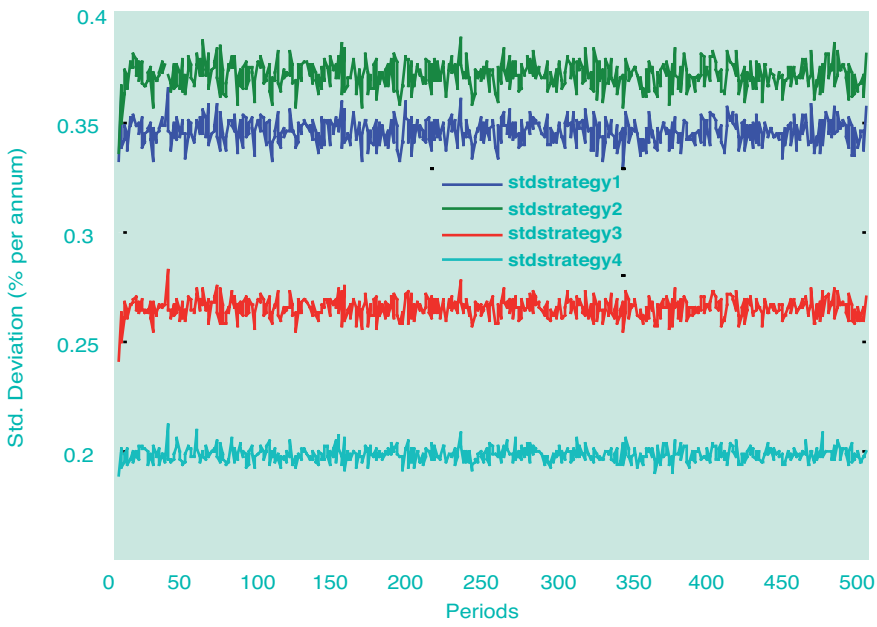
Chart 19
Average nominal yields for issuance strategies



Regarding risk properties (standard deviation and the debt cost ratio-at-risk measure) the long conventional issuance strategy turns out to have both marginally lower standard deviation and cost-at-risk than the other three conventional

strategies. Once again this result is unsurprising and can be partly attributed to the fact that the interest rate on 30-year nominal bonds has the lowest volatility amongst the nominal bonds and therefore an issuance strategy that is composed entirely of 30-year nominal bonds will show lower volatility than any other issuance strategies that contain mixtures of short and medium nominal bonds. This is shown in Chart 20, which compares the volatility of the interest rates for the four nominal issuance strategies.

Chart 20
Volatility of nominal yields on issuance strategies



It is worth emphasising that the foregoing results, as with results from any model, are the outcome of the crucial assumptions made in constructing the model. It is straightforward to show that modifying the assumptions about the term structure of interest rates would lead to different conclusions about the ranking of the issuance strategies. For example, if the yield curve is upward sloping (and there is a positive term spread) then longer dated bonds would be more expensive than shorter maturity bonds and this would lead to different conclusions about the issuance strategy that would have the lowest cost.

To illustrate this point the four nominal issuance strategies are compared assuming that the nominal yield curve is upward sloping (all of the other model assumptions and parameterisations remain unchanged). The average nominal yields and volatilities on the respective bonds for this new nominal yield curve are shown in Table 14a and Chart 21 respectively. Observe that the new nominal yield curve is also more volatile than in the previous example and that the volatility of the interest rates on the respective bonds generally falls with maturity up to the 10-year tenor, but the 30-year nominal yield is slightly more volatile than the 10-year yield.

Table 14a
Simulated interest rates – upward sloping yield curve

Interest Rates	Simulated Mean	Standard Deviation
Short Rate	4.2542	1.1589
1-year	4.3093	1.1122
5-year	4.5017	0.7846
10-year	4.6373	0.6759
30-year	4.6954	0.6856

Chart 21
Average nominal interest rates: upward sloping curve

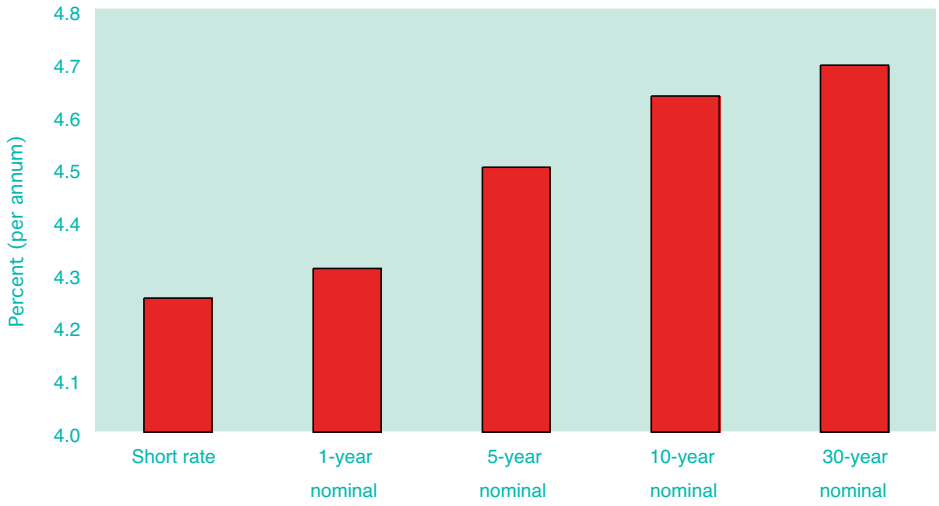


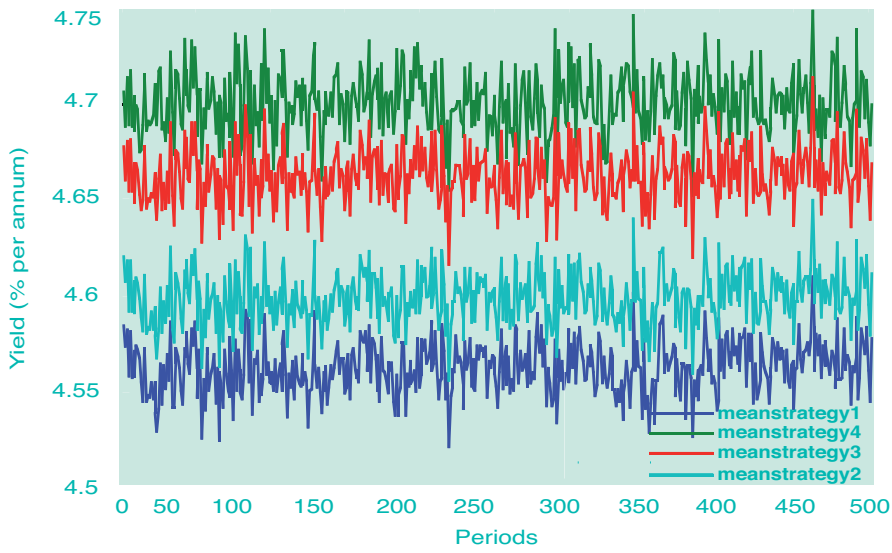
Table 14b shows the results for the four nominal strategies, assuming an upward sloping and more volatile nominal yield curve. The average cost of the debt now rises as the proportion of 30-year nominal bonds in the issuance strategy is increased and strategy 4 – composed of only 30-year nominal bonds – is now the most costly strategy. Note also that the average cost of all four issuance strategies is larger than in the previous example because the average interest rates are now higher. The consequence of changing the yield curve assumptions for the comparison of the issuance strategies is also highlighted in Chart 22, which shows the average interest cost of financing £1 of borrowing requirement for the four issuance strategies. Here, the average interest cost for the issuance strategies increases with the share of 30-year nominal bonds that they contain.

Table 14b
Summary of simulation results for nominal issuance strategies assuming an upward sloping yield curve

	Strategy 1	Strategy 2	Strategy 3	Strategy 4
Debt cost/GDP at t=500				
Mean	1.5040	1.5220	1.5212	1.5668
Standard deviation	0.1832	0.1798	0.1969	0.2136
95th percentile	1.8232	1.8124	1.8588	1.9264
Debt cost/GDP over the interval t=400 to t=500				
Mean Mean	1.5256	1.5048	1.5252	1.5635
Mean Standard deviation	0.1813	0.1786	0.1963	0.2192
Mean 95th percentile	1.8120	1.8068	1.8531	1.9338

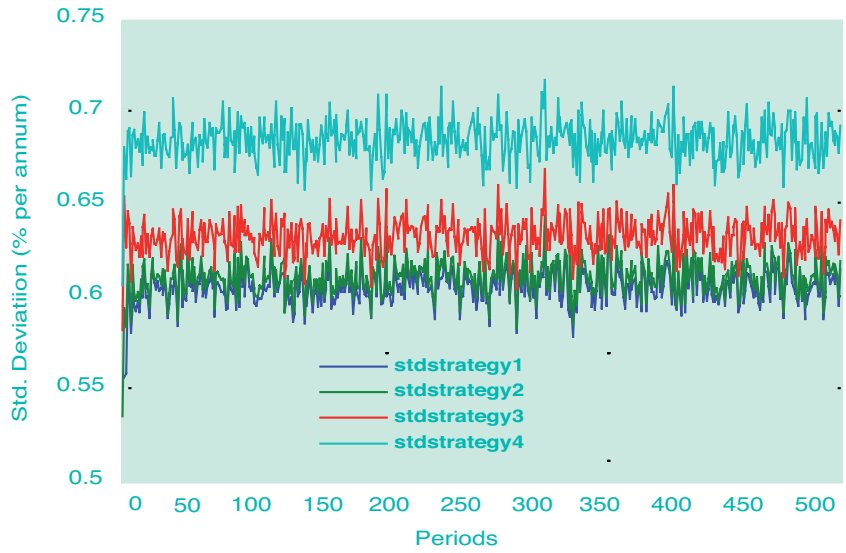
Note: Figures are quarterly, annualised and expressed in percentage points.

Chart 22
Average nominal yields for issuance strategies: upward sloping curve



The risk properties of the issuance strategies worsen as the share of 30-year bonds is increased. Both the standard deviation of the debt cost ratio and the debt cost-at-risk measure are largest for the issuance strategy composed of only 30-year bonds. Chart 23 shows that this result is partly attributed to the relatively higher interest rate volatility associated with 30-year nominal bonds, as issuance strategies with a larger share of these bonds will tend to exhibit correspondingly higher interest rate volatility and debt cost volatility.

Chart 23
Volatility of nominal yields on issuance strategies: upward sloping yield curve



Thus, like any model, the results obtained from the simulation exercises are sensitive to the assumptions made in the modelling process, and in particular the assumptions about the term structure of interest rates, and hence the relative cost of issuing the respective bonds.

Results for issuance strategies with inflation-linked bonds

This section provides cost and risk comparisons for four issuance strategies with varying shares of short and medium maturity nominal bonds and shares of 30-year inflation-linked bonds. The purpose of this exercise is to highlight how changes to the composition of issuance strategies affect the cost-risk trade-off faced by the Government, under the assumed conditions of the simulation model. 30-year inflation-linked bonds in the respective issuance strategies now replace the 30-year nominal bonds in the conventional issuance strategies previously discussed. The composition of the four conventional and inflation-linked issuance strategies is as follows:

- Strategy 5 is made up of 17.5 percent of 1-year nominal bonds, 17.5 percent of 5-year nominal bonds, 30 percent of 10-year nominal bonds and 35 percent of 30-year inflation-linked bonds.
- Strategy 6 is composed of 35 percent of 5-year nominal bonds, 30 percent of 10-year nominal bonds and 35 percent of 30-year inflation-linked bonds.
- Strategy 7 is composed of 50 percent of 10-year nominal bonds and 50 percent of 30-year inflation-linked bonds.
- Strategy 8 comprises only 30-year inflation-linked bonds.

Table 15 summarises the composition of the four issuance strategies.

Table 15
Composition of issuance strategies (in %)

	1-year nominal bond	5-year nominal bond	10-year nominal bond	30-year inflation-linked bond
Strategy				
Strategy 5	17.5	17.5	30.0	35.0
Strategy 6		35.0	30.0	35.0
Strategy 7			50.0	50.0
Strategy 8				100.0

The introduction of inflation-linked bonds raises a few issues for the cost-risk evaluation of the issuance strategies because their cash flow cost comprises two elements: the uplifted coupon payments and the uplift on the principal sum borrowed (see Box 3). The inflation compensated coupon payments are paid in the same manner and at the same time as coupon payments on nominal bonds, but the compensation on the principal is paid at redemption. For any given inflation-linked bond the inflation uplift on the principal will be a relatively large sum in comparison to the inflation uplifted interest payments in any given period. This would tend to make the cash flow debt cost of the inflation-linked bonds more volatile than the coupon payments on the nominal bonds.

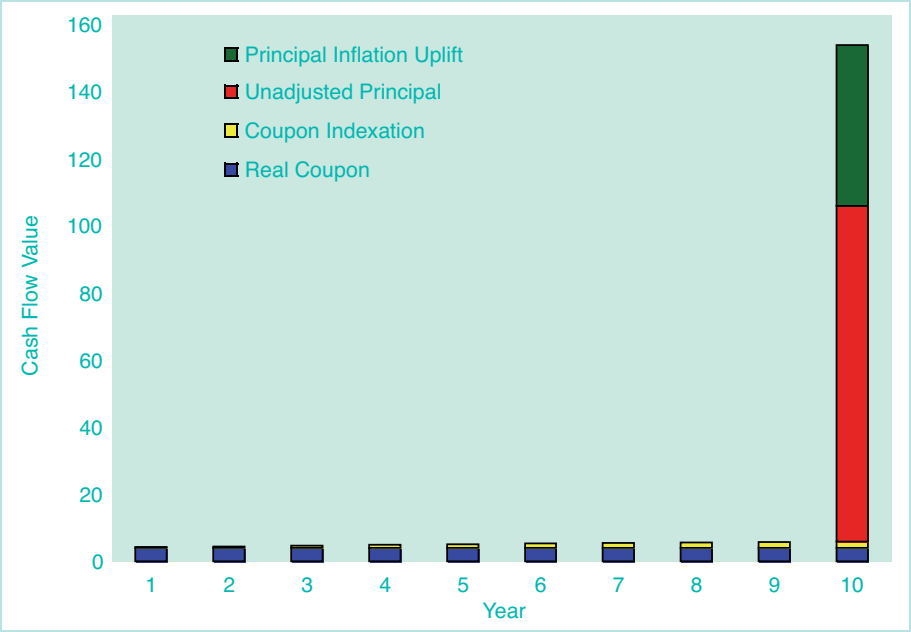
Box 3: Cash flow structure of inflation-linked bonds

The design of inflation-linked bonds, in practice, can have various forms. Inflation-linked bonds issued by the UK Government take the form of a capital indexed bond (CIB). CIBs are, by far, the most popular design of inflation-linked bonds issued by governments. A CIB has a fixed real coupon rate and the nominal principal rises with inflation. The coupon payment in a given period is calculated as the product of the real coupon rate and the inflation-compensated principal. The inflation-compensated principal is paid on the maturity date of the bond when it is redeemed. The cash flow structure of a CIB is illustrated in the chart and table below, which are both reproduced, with the kind permission of Mark Deacon, from the book he has co-authored with Andrew Derry and Dariush Mirfendereski.[24]

An example of Capital Indexed Bond's cash flows

Year	Real Coupon (1)	Inflation (2)	Compounded Inflation (3)	Coupon Indexation (4) = (5) - (1)	Coupon Payment (5) = (1) x (3)	Redemption Payment (6) = 100 x (3)
1	4.00	6.00	1.0600	0.24	4.24	
2	4.00	5.50	1.1183	0.47	4.47	
3	4.00	5.00	1.1742	0.70	4.70	
4	4.00	5.00	1.2329	0.93	4.93	
5	4.00	4.00	1.2822	1.13	5.13	
6	4.00	3.50	1.3271	1.31	5.31	
7	4.00	3.00	1.3669	1.47	5.47	
8	4.00	3.00	1.4079	1.63	5.63	
9	4.00	2.50	1.4431	1.77	5.77	
10	4.00	2.50	1.4792	1.92	5.92	147.92

Capital Indexed Bond's cash flows



[24] See Deacon, Derry and Mirfendereski (2004).

An alternative way of accounting for the inflation compensation on the principal would be to treat it on an accruals basis so that it is added to the inflation uplifted coupon payments over the life of the bond rather than at the maturity date of the bond. Results with both of these forms of accounting for the uplift on the principal are presented. Table 16a contains the results when the inflation uplift on the principal is paid on the maturity date of the bond and Table 16b presents the results when the inflation uplift on the principal is treated on an accruals basis.

Table 16a
Summary of simulation results for issuance strategies with shares of inflation-linked bonds (compensation on principal paid at maturity)

	Strategy 5	Strategy 6	Strategy 7	Strategy 8
Debt cost/GDP at t=500				
Mean	1.5672	2.0852	1.2996	1.2124
Standard deviation	0.3158	0.3267	0.4080	0.8608
95th percentile	2.0984	2.6308	1.9740	2.6500
Debt cost/GDP over the interval t=400 to t=500				
Mean Mean	1.3579	1.3708	1.3571	1.3047
Mean Standard deviation	0.3023	0.2969	0.4000	0.8495
Mean 95th percentile	1.8580	1.8646	2.0297	2.7028

Note: Figures are quarterly, annualised and expressed in percentage points

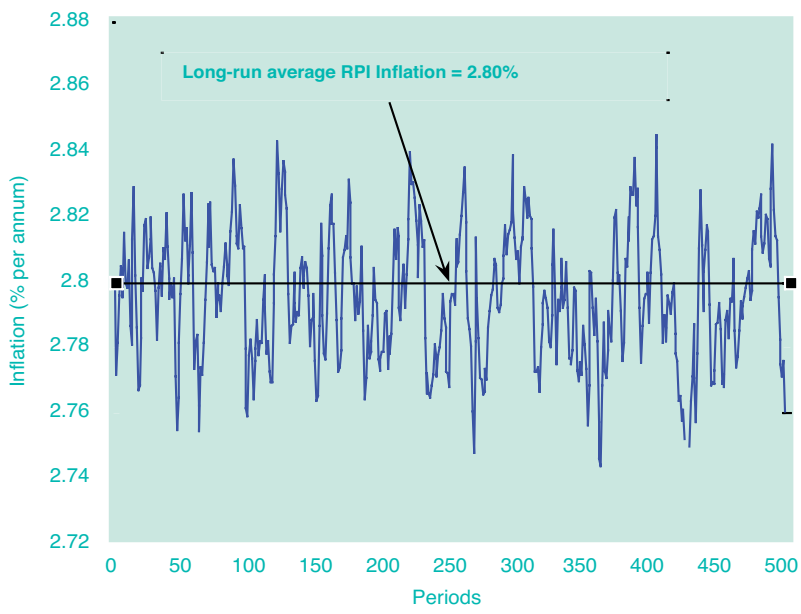
Table 16b
Summary of simulation results for issuance strategies with shares of inflation-linked bonds (with accrued compensation on principal)

	Strategy 5	Strategy 6	Strategy 7	Strategy 8
Debt cost/GDP at t=500				
Mean	1.4200	1.4160	1.4112	1.3752
Standard deviation	0.2136	0.2053	0.2120	0.2740
95th percentile	1.8032	1.7704	1.7860	1.8304
Debt cost/GDP over the interval t=400 to t=500				
Mean Mean	1.4139	1.4189	1.4076	1.3858
Mean Standard deviation	0.2113	0.2060	0.2160	0.2754
Mean 95th percentile	1.7810	1.7743	1.7833	1.8538

Note: Figures are quarterly, annualised and expressed in percentage points

When the inflation uplift on the principal is paid on the maturity date of the bond it is more meaningful to compare issuance strategies using the average statistics computed over the last 100 periods of the simulation rather than comparing statistics from the last period of the simulation as the latter statistics could be unduly influenced by the uplift on the principal in that period. Overall, the results show that issuing 30-year inflation-linked bonds instead of 30-year nominal bonds reduces the debt cost (as a share of GDP) and as the proportion of 30-year inflation-linked bonds is increased in the issuance strategies the debt cost is further reduced. These results are obtained because, on average, 30-year inflation-linked bonds are relatively less expensive than 30-year conventional bonds. This result is partly a consequence of the tendency for the actual RPI index to grow, on average, at a slightly different rate from the expected RPI index which grows at the assumed constant long run average RPI inflation. Chart 24 shows how the simulated average RPI inflation differs from the constant long run average RPI inflation in the model.

Chart 24
Average RPI inflation



In contrast, issuing 30-year inflation-linked bonds instead of 30-year nominal bonds makes the debt cost more risky and the risk profile of the debt strategies worsens as the share of 30-year inflation-linked bonds increases in the issuance strategy. Both the standard deviation of the debt cost ratio and the debt cost ratio-at-risk measure are now larger for all the issuance strategies than they were under all of the conventional issuance strategies. The poorer risk characteristics for these strategies are to be expected because the debt cost is influenced directly by the volatility of RPI inflation. Further, the risk characteristics are also adversely affected by the typically large cash flow payments at redemption related to the uplift compensation on the principal.

Average cost and risk results similar to those described above are also obtained when the inflation uplift on the principal is treated on an accruals basis. Table 16b shows that the average debt costs of all the issuance strategies are lower than those for the conventional issuance strategies and the average cost is lowest when the share of 30-year inflation-linked bonds in the issuance strategy is 100 percent. This result once more follows because, even in the absence of an inflation risk premium on conventional bonds in the model, the behaviour of the actual RPI inflation is, on average, sufficiently different from the assumed constant expected RPI inflation to make 30-year inflation-linked bonds cheaper than 30-year nominal bonds, as was explained above.

The risk characteristics of the issuance strategies are similar to those in the previous example where the inflation uplift on the principal is calculated when the inflation-linked bond matures. Both the standard deviation of the debt cost ratio and the debt cost ratio-at-risk measure are now larger for all the issuance strategies than they were for the conventional issuance strategies, indicating that adding the inflation-linked bonds to the issuance strategies leads to poorer risk characteristics. However, it is worth noting that the risk measures all have lower values relative to the previous example when the inflation compensation on the principal was paid at

redemption. This result follows naturally because the inflation uplift on the principal is now paid over the life of the bond rather than when it matures, thereby smoothing the cash flow payments.

It is useful to reiterate that an important limitation of the simulation model is that it does not incorporate any feedback from the issuance strategies onto the cost of issuance. This is because it is assumed that interest rates on the respective bonds are not sensitive to the relative supplies of the bonds. In practice this is not generally so as alterations in the relative supply of bonds tend to influence their yields. In a simulation model like this, ignoring the feedback of issuance on interest rates has the unfortunate consequence of leading towards extreme outcomes. When it is assumed that the yield curve is inverted at the long end, as is the case in the main examples presented above, the model suggests that it is cheaper to issue only long conventional bonds (when the focus is only on conventional issuance strategies) and long inflation-linked bonds. Future developments of the simulation model will attempt to correct for this shortcoming by incorporating a suitable feedback mechanism that allows interest rates to respond to the relative supply of bonds.

Summary and concluding remarks

This chapter provides a brief summary of the stochastic debt strategy simulation model that the DMO has developed. The model is made up of three main components. The first segment is a macroeconomic model comprising five equations for the output gap, the Government's net primary financing requirement, CPI and RPI inflation and the central bank's policy rate - the short interest rate. The macroeconomic model is fairly simple in its construction and it is intended to capture in a highly stylised fashion some of the main features of the UK economy over the most recent decade or so together with features that are relevant for an analysis of the Government's debt strategies.

Future work will endeavour to make the macroeconomic model more realistic than it currently is. The dynamics of the model are quite simple, with most of the equations having a simple modified auto-regressive structure. Also the purely backward-looking nature of the model can be modified to allow for forward looking terms, in the true spirit of the New-Keynesian models that have been developed and used for the analysis of monetary policy. A further enhancement would be to make the model structure sufficiently flexible to accommodate extreme adverse economic scenarios, such as, for example, a period of deflation or stagflation.

The second component of the simulation model comprises the nominal and real yield curve specifications, which are used to determine the interest rates on nominal bonds and inflation-linked bonds that can be issued by the Government. The Nelson and Siegel functional form is used to model the nominal yield curve and the real yield curve is derived from the nominal yield curve under the assumption of fixed long term inflation expectations. A useful extension of the current specification of the yield curve would be the incorporation of the relative supply of bonds in order to account for the likely influence of changing relative bond supplies on the term structure of interest rates.

The third part of the simulation model is the debt strategy simulation engine through which the Government's borrowing requirement is met by a set of fixed issuance strategies. The debt strategy simulation engine allows these issuance strategies to be compared on the basis of their cost and risk characteristics as it generates the cost distributions associated with each strategy. Assuming that issuance strategies remain fixed over time is clearly a simplification of the debt management process. However examining fixed issuance strategies is a useful starting point in debt strategy simulation modelling because it allows us to understand and illustrate how sensitive simulation results are to variations in some of the important assumptions underpinning the model.

The chapter also illustrates how the simulation model can be used to compare issuance strategies. Importantly, the examples discussed have highlighted how the results obtained are sensitive to crucial assumptions made. In particular, assumptions made about the term structure of interest rates determine the relative cost and risk of the respective bonds and therefore the relative cost and risk of the issuance strategies, which are effectively portfolios of the different bonds. One limitation of the simulation model is the absence of any feedback from issuance strategy to the term structure of interest rates. The consequence of this limitation is that the relative supply of bonds does not affect their yields and therefore there is a tendency for extreme outcomes – all long nominal or inflation-linked bond strategies – to be preferred.

However, this simulation model can be used to illustrate the medium to long-term conditions under which various issuance strategies would lead to desirable outcomes (cheaper and less risky funding) for the Government.

In practice, the debt management process entails the consideration of several factors, which affect the long-term cost and risk of managing the Government's debt portfolio. Further, as part of a prudent debt management strategy the debt management authorities take various steps that contribute to the mitigation of various sources of risk that may adversely affect the Government's issuance programme and, if not contained, could result in higher long-term borrowing costs[25]. Several of these sources of risk are not captured explicitly in the simulation model or are excluded altogether.

One key measure taken is the adoption of an open, transparent and predictable approach to the annual issuance programme. This commitment to transparency and predictability in the issuance programme reflects the Government's judgement that such an approach will reduce the long run borrowing costs of the Government because it lowers the risk premium that investors demand from the issuer as compensation for the unpredictability in issuance supply to the market.

An important assumption that is made when considering the Government's debt strategy is that the Government will continue to borrow in future in a sustainable way and, therefore, its borrowing horizon is indefinite. This implies that the Government will want to ensure that it will be able to raise funds in a sustainable manner into the future. From this perspective, the promotion and maintenance of an efficient and liquid gilt market matters to the Government, as well as having a well-diversified investor base that reflects the prospective demand for gilts under a

[25] DMO Annual Review 2003-04, Chapter 7, pp.31-43 provides a detailed exposition of the UK debt management strategy and the various factors that are taken into consideration when determining the debt management strategy and annual financing remit each year.

variety of conditions. The UK debt management authorities adopt measures, such as for example the maintenance of a well-functioning primary dealership arrangement, the issuance of gilts at key maturities along the yield curve and the building up of gilts to benchmark sizes, in order to promote and maintain a liquid and efficient gilt market and also to reach as broad a spectrum of investors as possible. Even when it may not have a need to borrow funds, for example at times of budgetary surpluses as was the case in financial year 2000-01, the Government may still continue its issuance programme, so as to sustain the gilt market infrastructure and prevent liquidity from drying up altogether in some segments of the gilt market. UK authorities judge that over the long-term these measures together help to lower the Government's financing costs by helping it to capture liquidity and benchmark premia. These important considerations are not captured in the simulation model.

Finally, consideration of the Government's risk preferences is also important when determining the issuance programme. Other things being equal, the Government would like to have a prudent debt portfolio structure such that in the event of adverse shocks to the government finances, the debt portfolio should not exacerbate further the strains on the Government's resources, but should help to mitigate some of those strains. In other words, the Government's debt portfolio should be structured so as to possess adequate fiscal-smoothing properties. The implication of taking into account the Government's risk preferences, as well as the other factors previously discussed, when determining its debt strategy is that the Government naturally has a proclivity to choose issuance strategies and a debt portfolio structure which are diversified both in terms of their maturity structure for nominal gilts and their composition in terms of the proportion of the various debt instruments, which in the present environment means the split between nominal and inflation-linked gilts. Such a well-diversified issuance and portfolio structure provide a prudent risk mitigation approach to debt management as, to the extent that different debt instruments have different risk and cost characteristics, they therefore help to insure the Government in the face of a variety of shocks to its finances. Hence, the preferred issuance strategies suggested by the simulation illustrations will need to be modified in practice. At present the Government has a default issuance strategy for nominal gilts in which issuance across the three maturity brackets – short, medium and long[26] – is split approximately equally. In addition, the debt portfolio is further diversified by the regular issuance of inflation-linked bonds, which account for approximately twenty-five percent of the outstanding stock of marketable government debt.

[26] The maturity brackets are defined as follows: short - 1-7 years maturity, medium - 7-15 years maturity and long - over 15 years maturity.

Appendix: Nominal yield curve

The nominal yield curve is based on the yield curve function introduced by Nelson and Siegel (NS) (1987). Diebold and Li (2006) have recently reinterpreted the NS yield curve function as a three-factor yield curve model and it is this latter re-interpretation that we adopt in the nominal yield curve specification. The real-yield curve is derived from the nominal yield curve under the assumption of fixed inflation expectations, which in this case is not unrealistic as index-linked bonds are currently only issued at medium and long maturities, and expectations for inflation 10 years into the future within the same credible monetary policy framework are likely to be relatively constant.

The use of factor models in yield curve modelling is quite a common practice. There are several reasons for researchers adopting this approach.[27] One important reason is that factor models provide a convenient way of summarising the voluminous yield information contained in the large number of bonds that are traded at any point in time. Another reason is that factor models, in allowing the compression of information, is consistent with the "parsimony principle" which broadly implies that imposing restrictions on models, and thereby constraining them in some way, can be useful for producing good forecasting models.

Following Diebold and Li (2006), the NS yield curve has the following functional form,

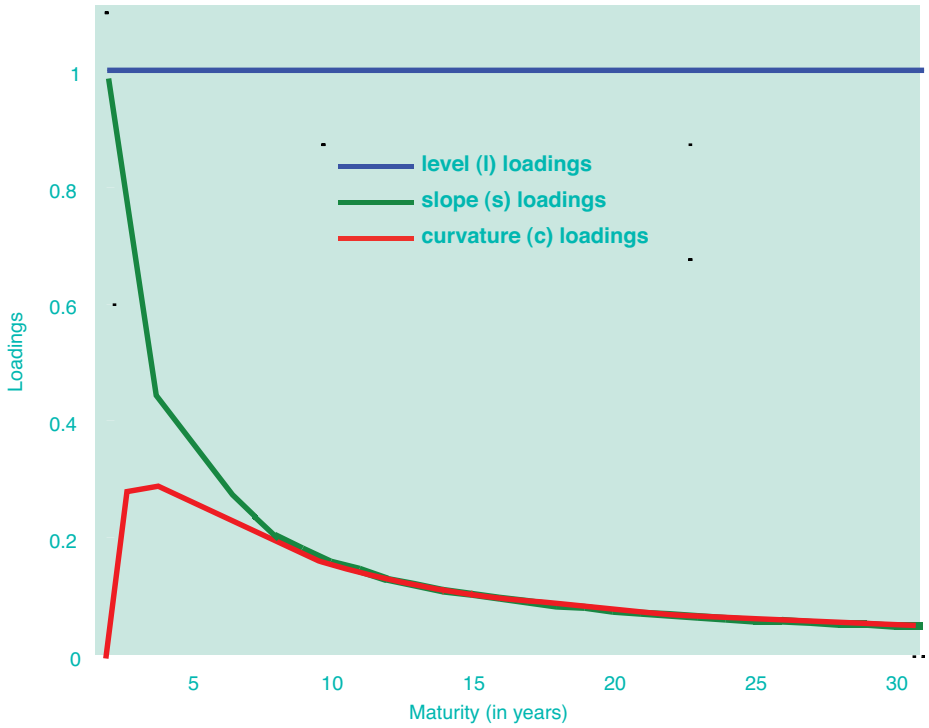
$$r_t(\tau) = l_t + s_t\left(\frac{1-\exp(-\tau/\lambda)}{\tau/\lambda}\right) + c_t\left(\frac{1-\exp(-\tau/\lambda)}{\tau/\lambda} - \exp(-\tau/\lambda)\right) + \varepsilon_{t,\tau}, \quad \varepsilon_t \sim N(0, \sigma_\varepsilon^2) \qquad \text{(A1)}$$

where $r_t(\tau)$ denotes the yield to maturity τ at time t and l_t, s_t, c_t and λ are parameters that determine the shape of the yield curve and $\varepsilon_{t,\tau}$ is an independent and normally distributed error term with zero mean and constant variance, σ_ε^2.

Equation (A1) shows that the yield curve is a linear combination of three functions or factor loadings – 1, $\left(\frac{1-\exp(-\tau/\lambda)}{\tau/\lambda}\right)$ and $\left(\frac{1-\exp(-\tau/\lambda)}{\tau/\lambda} - \exp(-\tau/\lambda)\right)$ - with their corresponding latent or unobserved dynamic parameters or factors l_t, s_t, and c_t. The three latent dynamic factors l_t, s_t, and c_t. are respectively considered level, slope and curvature factors as it can be shown, given their factor loadings, that they influence these three latent elements of the yield curve (see Chart 25). This re-interpretation of the NS model is indeed quite insightful because traditional factor analysis has, since the work of Litterman and Scheinkman (1991), shown that much of the variation in bond yields can be explained by the first three principal components, which have been interpreted as level, slope and curvature factors.

[27] Diebold. et. al. (2005), provide a useful discussion of the merits of a factor approach to modelling bond yields.

Chart 25
Nelson Siegel factor loadings: lambda = 1.45



For our purposes, we are interested in having a yield curve model that can be used to simulate interest rates at different maturities over time and that can also link the evolution of these interest rates to the developments in the economy, so that there is an economic explanation for the behaviour of the yield curve over time rather than a purely statistical one. Diebold and Li (2006) show how one can use the NS model to forecast yields over time and Diebold et. al. (2006) show how to incorporate macroeconomic variables in the three-factor NS model.

In our NS model specification, we link the evolution of the three dynamic latent factors directly to the evolution of the short interest rate ($r_t(0)$), CPI inflation (cpi_t) and the output gap (y_t).

Specifically, the three latent factors, l_t, s_t, and c_t are assumed to be determined by the short interest rate ($r_t(0)$), CPI inflation (cpi_t) and the output gap (y_t):

$$\Gamma f_t = \mu_f + A m_t + \eta_t \qquad \text{(A2)}$$

where $f_t = \{l_t, s_t, c_t,\}$, $m = \{y_t, r_t,(0), cpi,\}$ μ_f is a (3x1) vector, Γ and A are (3x3) matrices of parameters and η_t is a (3x1) vector of error terms.

The parameters are chosen by a combination of theoretical considerations and empirical evidence. Apart from affecting all yields equally l_t is also a long term factor as its loading is unity, a constant and it does not decay to zero in the limit. Hence $r_t(\tau)^{\tau \to \infty} = l_t$. We impose the restriction that l_t is equal to the expected (average) short interest rate, so that $l_t = E(r_t(0))$.

The parameter s_t, as was indicated previously, gives the (negative) slope of the yield curve as $r_t(\tau)^{\tau \to 0} = l_t + s_t$, and $r_t(\infty) - r_t(0) = -s_t$. At maturity $\tau = 0$ the yield curve should be equal to the short interest rate ($r_t(0)$). Hence it can be assumed that $l_t + s_t = r_t(0)$. The relationship for the curvature factor c_t does not have the same theoretical solution as the other two latent factors and it is therefore estimated empirically.

For the simulation the nominal yield curve parameters are generated using the following reduced form equation:

$$\begin{bmatrix} l_t \\ s_c \\ c_t \end{bmatrix} = \begin{bmatrix} E(r_t(0)) \\ -E(r_t(0)) \\ 0.03 \end{bmatrix} + \begin{bmatrix} 0 & 0 & 0 \\ 0 & 1 & 0 \\ 0.7 & -0.6 & -2.2 \end{bmatrix} \begin{bmatrix} y_t \\ r_t(0) \\ cpi_t \end{bmatrix} + \begin{bmatrix} \eta_{lt} \\ \eta^*_{st} \\ \eta_{ct} \end{bmatrix} \qquad \text{(A3)}$$

where the error terms are identical and independent normal distributions with a given variance σ^2_{it} i = *l*, *s*, *c*, and $\eta^*_{st} = \eta_{st} - \eta_{lt}$.

Real yield curve

The real yield curve is derived from the nominal yield curve and is specified as

$$r^r_t(\tau) = r_t(\tau) - rpi^e + l^r_t + s^r_t \left(\frac{1-\exp(-\tau/\lambda)}{\tau/\lambda}\right) + c^r_t \left(\frac{1-\exp(-\tau/\lambda)}{\tau/\lambda} - \exp(-\tau/\lambda)\right) + \varepsilon^r_t(\tau). \qquad \text{(A4)}$$

where rpi^e is the long run expected RPI inflation and l^r_t, s^r_t and c^r_t are respectively the corresponding level, slope and curvature factors for the real yield curve. It is assumed that the nominal and real yield curves only differ by the long run expected RPI inflation rpi^e.

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Chapter 7: The DMO

The DMO was established on 1 April 1998. In institutional terms, the DMO is legally and constitutionally part of HM Treasury, but, as an Executive Agency, it operates at arms length from Ministers. The Chancellor of the Exchequer determines the policy and operational framework within which the DMO operates, but delegates to the Chief Executive operational decisions on debt and cash management, and day-to-day management of the office.

The separate responsibilities of the Chancellor and other Treasury Ministers, the Permanent Secretary to the Treasury and the DMO's Chief Executive are set out in a published Framework Document (available on the DMO website www.dmo.gov.uk), which also sets out the DMO's objectives and its Chief Executive's lines of accountability. The Chief Executive is accountable to Parliament for the DMO's performance and operations, both in respect of its administrative expenditure and the Debt Management Account (DMA).

Business planning

The DMO publishes an annual Business Plan[28]. The plan sets out the DMO's targets and objectives for the year ahead, and the strategies for achieving them. It also reviews the immediately preceding year. The starting point of the Business Plan is the strategic objectives given by the Chancellor of the Exchequer to the DMO and set out in the Framework Document.

Organisation and resources

The DMO is organised flexibly to ensure that resources are available as necessary for the respective requirements of the business areas.

There are two main business areas in the DMO: policy & markets, and operations & resources. These areas are in turn split into a number of teams across which there is substantial cross-team working to ensure that both policy and operational concerns are adequately met; that the relevant skills are bought to bear on tasks or problems; and that important operations are adequately resourced.

The DMO's Managing Board (MB) considers all major strategic decisions and comprises the Chief Executive, the Deputy Chief Executive (also Head of Policy and Markets) and the Chief Operating Officer. The other members in 2005-06 were Colin Price and Brian Larkman (non-executive members) and Sue Owen from HM Treasury. Colin Price is also Chairman of the DMO's Audit Committee.

Within the DMO, most business issues are considered by cross-cutting committees: in particular those on debt management, cash management, and investment. They are supported by a Credit and Risk Committee, which also reports to the Managing Board.

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[28] The DMO Business Plan for 2005-06 was published on 4 April 2005 – it is available from the DMO and via the DMO website www.dmo.gov.uk.

Managing risk

The processes the DMO employs to manage its risks are subject to continual review and development to ensure their continued effectiveness. Of particular note during the year were:

- An independent review of office-wide risk reporting arrangements led to the implementation of changes to improve focus on key risks and risk ownership.
- Further work was completed to enhance the DMO's capacity to quantify market risks, particularly regarding cash management operations.
- The processes for sign-off of new business initiatives prior to their introduction were strengthened.

Budget

The DMO's operating budget reflects a need for both skills and systems that are not available elsewhere in Government. The DMO's net operating cost for 2005-06 was £7.5 million. This represented an increase of £0.6 million from the previous year and remained within the DMO's voted expenditure limit. The DMO's operating budget is financed as part of the budget for HM Treasury as a whole.

ANNEX A: Gilts in issue at 31 March 2006

Total amount in issue (inc. IL uplift): £411.57 billion (nominal)

Conventional gilts	Redemption date	Dividend dates	Amount in issue (£mn nom)	Amount held in stripped form	Central Govt holdings (DMO & CRND)
Shorts: (maturity up to 7 years)					
7¾% Treasury Stock 2006	8-Sep-06	8 Mar/Sep	4,064	-	548
7½% Treasury Stock 2006	7-Dec-06	7 Jun/Dec	12,394	190	862
4½% Treasury Stock 2007	7-Mar-07	7 Mar/Sep	12,071	13	596
8½% Treasury Loan 2007	16-Jul-07	16 Jan/Jul	4,869	-	601
7¼% Treasury Stock 2007	7-Dec-07	7 Jun/Dec	11,655	110	795
5% Treasury Stock 2008	7-Mar-08	7 Mar/ Sep	14,928	11	872
4% Treasury Stock 2009	7-Mar-09	7 Mar/Sep	16,974	40	754
5¾% Treasury Stock 2009	7-Dec-09	7 Jun/Dec	12,006	114	927
4¾% Treasury Stock 2010	7-Jun-10	7 Jun/Dec	12,774	7	539
6¼% Treasury Stock 2010	25-Nov-10	25 May/Nov	5,205	-	725
4¼% Treasury Gilt 2011	7-Mar-11	7 Mar/Sep	6,250	15	1
9% Conversion Loan 2011	12-Jul-11	12 Jan/Jul	5,664	-	473
5% Treasury Stock 2012	7-Mar-12	7 Mar/ Sep	14,009	155	898
Mediums: (maturity 7 to 15 years)					
8% Treasury Stock 2013	27-Sep-13	27 Mar/Sep	6,489	-	694
5% Treasury Stock 2014	7-Sep14	7 Mar/Sep	13,699	4	706
4¾% Treasury Stock 2015	7-Sep-15	7 Mar/Sep	13,647	133	655
8% Treasury Stock 2015	7-Dec-15	7 Jun/Dec	7,744	179	539
4% Treasury Gilt 2016	7-Sep-16	7 Mar/Sep	3,000	-	1
8¾% Treasury Stock 2017	25-Aug-17	25 Feb/Aug	8,136	-	765
4¾% Treasury Stock 2020	7-Mar-20	7 Mar/Sep	10,743	0	248
Longs: (maturity over 15 years)					
8% Treasury Stock 2021	7-Jun-21	7 Jun/Dec	17,573	310	1,178
5% Treasury Stock 2025	7-Mar-25	7 Mar/Sep	16,188	132	945
6% Treasury Stock 2028	7-Dec-28	7 Jun/Dec	12,340	214	893
4¼% Treasury Stock 2032	7-Jun-32	7 Jun/Dec	17,326	491	998
4¼% Treasury Stock 2036	7-Mar-36	7 Mar/Sep	15,668	337	672
4¾% Treasury Stock 2038	7-Dec-38	7 Jun/Dec	14,958	143	715
4¼% Treasury Gilt 2055	7-Dec-55	7 Jun/Dec	9,602	0	104
3½% War Loan	Undated	1 Jun/Dec	1,939	-	31

Index-linked gilts	Index lag (months)	Base RPI	Redemption date	Dividend dates (£mn nom)	Amount in issue	Nominal including inflation uplift	Central Govt holdings (DMO & CRND)
2% I-L Treasury Stock 2006	8	247.1	19-Jul-06	19 Jan/Jul	2,109	5,877	109
2½% I-L Treasury Stock 2009	8	310.7	20-May-09	20 May/Nov	3,304	8,063	280
2½% I-L Treasury Stock 2011	8	294.1	23-Aug-11	23 Feb/Aug	4,631	11,939	359
2½% I-L Treasury Stock 2013	8	351.9	16-Aug-13	16 Feb/Aug	7,347	15,830	530
2½% I-L Treasury Stock 2016	8	322.0	26-Jul-16	26 Jan/Jul	7,696	18,123	636
1¼% I-L Treasury Gilt 2017	3	193.72500	22-Nov-17	22 May/Nov	1,000	998	0
2½% I-L Treasury Stock 2020	8	327.3	16-Apr-20	16 Apr/Oct	6,350	14,710	451
2½% I-L Treasury Stock 2024	8	385.3	17-Jul-24	17 Jan/Jul	6,133	12,069	493
4⅛% I-L Treasury Stock 2030	8	135.1	22-Jul-30	22 Jan/Jul	5,021	7,143	347
2% I-L Treasury Stock 2035	8	173.6	26-Jan-35	26 Jan/Jul	8,064	8,928	466
1¼% I-L Treasury Gilt 2055	3	192.00000	22-Nov-55	22 May/Nov	2,613	2,630	38

Base RPI for the 2017, 2030, 2035 and 2055 maturities is based on Jan 1987 RPI =100. The base RPI for all other index-linked gilts is based on Jan 1974 RPI =100.

Rump gilts are not available for purchase

Rump gilts	Redemption date	Dividend dates	Amount in issue (£mn nom)	Central Govt holdings (DMO & CRND)
9¾% Conversion Stock 2006	15-Nov-06	15 May/Nov	1	0
5½% Treasury Stock 2008-2012	10-Sep-08	10 Mar/Sep	843	13
9% Treasury Loan 2008	13-Oct-08	13 Apr/Oct	514	0
8% Treasury Stock 2009	25-Sep-09	25 Mar/Sep	241	1
7¾% Treasury Loan 2012-2015	26-Jan-12	26 Jan/Jul	487	22
9% Treasury Stock 2012	6-Aug-12	6 Feb/Aug	227	0
12% Exchequer Stock 2013-2017	12-Dec-13	12 Jun/Dec	18	0
2½% Treasury Stock	Undated	1 Apr/Oct	458	0
4% Consolidated Loan	Undated	1 Feb/Aug	285	0
2½% Consolidated Stock	Undated	5 Jan/Apr/Jul/Oct	200	1
3% Treasury Stock	Undated	5 Apr/Oct	44	0
3½% Conversion Loan	Undated	1 Apr/Oct	19	5
2½% Annuities	Undated	5 Jan/Apr/Jul/Oct	2	0
2¾% Annuities	Undated	5 Jan/Apr/Jul/Oct	1	0

**It is assumed that double-dated gilts (which have not been called) currently trading above par will be redeemed at the first maturity date.*

ANNEX B: List of GEMMs and Inter Dealer Brokers at 31 March 2006

(*indicates additional IL GEMM status)

GEMM	Website
ABN Amro Bank NV 250 Bishopsgate London EC2M 4AA	www.abnamro.com
Barclays Capital* 5 The North Colonnade Canary Wharf London E14 4BB	www.barcap.com
Citigroup Global Markets Limited*[29] Citigroup Centre 33 Canada Square London E14 5LB	www.citigroup.com
Credit Suisse Securities* One Cabot Square London E14 4QJ	www.csfb.com
Deutsche Bank AG (London Branch)* Winchester House 1 Great Winchester Street London EC2N 2DB	https://dm-secure.db.com
Dresdner Bank AG (London Branch)* PO Box 52715 30 Gresham Street London EC2P 2XY	www.drkw.com
Goldman Sachs International Limited* Peterborough Court 133 Fleet Street London EC4A 2BB	www.gs.com
HSBC Bank PLC* 8 Canada Square London E14 5HQ	www.hsbcgroup.com
JP Morgan Securities Limited* 125 London Wall London EC2Y 5AJ	www.jpmorgan.com

[29] Citigroup became an IL GEMM on 3 July 2006.

Lehman Brothers International (Europe)* www.lehman.com
25 Bank Street
Docklands
London E14 5LE

Merrill Lynch International* www.ml.com
Merrill Lynch Financial Centre
2 King Edward Street
London EC1A 1HQ

Morgan Stanley & Co. International Limited* www. msdw.com
20 Cabot Square
Canary Wharf
London E14 4QW

Royal Bank of Canada Europe Limited* www.royalbank.com
Thames Court
One Queenhithe
London EC4V 4DE

Royal Bank of Scotland PLC* www.rbsmarkets.com
135 Bishopsgate
London EC2M 3UR

UBS Limited* www.ubs.com
1 Finsbury Avenue
London EC2M 2PP

Winterflood Gilts Limited* www.wins.co.uk
The Atrium Building
Cannon Bridge
25 Dowgate Hill
London EC4R 2GA

Inter Dealer Brokers

ICAP Electronic Broking Limited
2 Broadgate
London
EC2M 7UR

BGC International
One Churchill Place
Canary Wharf
London
E14 5RD

Dowgate
6th Floor
Candlewick House
120 Cannon Street
London
EC4N 6AS

ICAP WCLK Limited
2 Broadgate
London
EC2M 7UR

Tullet Prebon Gilts
155 Bishopsgate
London
EC2N 3DA

ANNEX C: Performance

Gilt issuance counterfactuals

The DMO has been publishing the results of its measurement of auction performance against counterfactuals in its Annual Review since 2001 and, over time, has extended the range of the counterfactuals which are designed to indicate whether different non-discretionary issuance patterns during the year would have resulted in higher or lower costs of financing (measured by comparing the cash weighted average yield of issuance).

The cash weighted average yield of actual issuance at the 25 gilt auctions and one syndicated offer in 2005-06 was 4.274% (see Table 17).

Table 17
Cash weighted average yield of gilt issuance 2005-06

Weighted ave yield of outright issuance: 2005-06				
Auction date	**Gilt**	**Real yield**	**Nom yield**	**Cash £mn**
12-Apr	2% IL 2035	1.65	4.65	929.3
14-Apr	5% 2025		4.64	2,616.0
28-Apr	4¾% 2010		4.52	3,026.8
24-May	2½% IL 2016	1.69	4.69	1,060.5
26-May	4¼% 2055		4.21	2,522.7
07-Jun	4¾% 2020		4.29	2,886.3
24-Jun	4⅛ % IL 2030	1.53	4.53	966.3
14-Jul	4¼% 2055		4.27	2,238.1
26-Jul	2½% IL 2020	1.66	4.66	1,011.1
02-Aug	4% 2009		4.25	2,966.8
06-Sep	4¼% 2036		4.21	2,767.6
22-Sep*	1¼% IL 2055	1.11	4.10	1,316.1
27-Sep	4¾% 2020		4.32	2,873.0
13-Oct	4¼% 2032		4.34	2,711.4
25-Oct	1¼% IL 2055	1.13	4.12	707.2
08-Nov	4¼% 2011		4.47	3,216.7
24-Nov	2½% IL 2013	1.58	4.58	1,193.6
07-Dec	4¼% 2055		4.03	2,355.2
14-Dec	4⅛ % IL 2030	1.15	4.14	863.4
10-Jan	4¾% 2020		4.08	2,678.7
24-Jan	1¼% IL 2055	0.46	3.44	884.1
26-Jan	4¼% 2011		4.27	2,997.1
07-Feb	1¼% IL 2017	1.28	4.28	997.0
16-Feb	4¼% 2055		3.82	2,734.9
01-Mar	4% 2016		4.19	2,949.6
07-Mar	2% IL 2035	0.91	3.90	874.2
			4.274	**52,344**

** Syndicated Offer.*

The counterfactuals

The actual average yield is compared with yields calculated using two main counterfactuals:

Counterfactual 1 assumes that:

- *for conventional issuance,* the total cash raised (£41.54 billion) was achieved through sales split equally between 4% 2009, 5% 2014 and 4¼% 2036, using the average close of business (cob) yield of each of the gilts over the financial year; and

- *for index-linked issuance,* the total cash raised (£10.8 billion) was achieved by sales of equal amounts of all index-linked gilts of 2011 maturity or longer using the average of the cob yield of the relevant gilts over the financial year.

The counterfactual yield on this basis was 4.282%, so actual issuance out-performed counterfactual 1 by 0.8bps. See Table 18.

Table 18
Yields for counterfactual 1

Counterfactual 1		
	Cash	**Nom yield**
Conventional	41,540.9	4.259
Index-linked	10,802.8	4.369
	52,343.7	**4.282**

Counterfactual 2 assumes that:

- *for conventional issuance,* the cash amounts of the auctions are raised at the average of the close of business yields of three counterfactual gilts (4% 2009, 5% 2014 and 4¼% 2036) at:

  a) the day before the auction; and
  b) the day of the auction; and

- *for index-linked issuance,* the cash amounts of the auctions are raised at the average close of business yields of all index-linked gilts of 2011 maturity or longer at:

  a) the day before the auction; and
  b) the day of the auction.

The results are shown in Table 19. Actual issuance out-performed counterfactual 2a and 2b by 1.8bps and 2.4bps respectively. See also the summary in Table 20.

Table 19
Yields for Counterfactual 2

Counterfactual 2a				
		Real yield	Nom yield	Cash £mn
12-Apr	ILG	1.73	4.73	929.3
14-Apr	Conv		4.61	2,616.0
28-Apr	Conv	1.63	4.63	3,026.8
24-May	ILG		5.07	1,060.5
26-May	Conv		4.27	2,522.7
07-Jun	Conv		4.24	2,886.3
24-Jun	ILG	1.58	4.58	966.3
14-Jul	Conv		4.26	2,238.1
26-Jul	ILG	1.58	4.58	1,011.1
02-Aug	Conv		4.32	2,966.8
06-Sep	Conv		4.13	2,767.6
22-Sep	ILG	1.40	4.40	1,316.1
27-Sep	Conv		4.25	2,873.0
13-Oct	Conv		4.29	2,711.4
25-Oct	ILG	1.43	4.43	707.2
08-Nov	Conv		4.38	3,216.7
24-Nov	ILG	1.37	4.37	1,193.6
07-Dec	Conv		4.23	2,355.2
14-Dec	ILG	1.31	4.31	863.4
10-Jan	Conv		4.09	2,678.7
24-Jan	ILG	1.03	4.02	884.1
26-Jan	Conv		4.07	2,997.1
07-Feb	ILG	1.17	4.17	997.0
16-Feb	Conv		4.13	2,734.9
01-Mar	Conv		4.13	2,949.6
07-Mar	ILG	1.19	4.19	874.2
			4.291	**52,344**

Counterfactual 2b				
		Real yield	Nom yield	Cash £mn
12-Apr	ILG	1.74	4.74	929.3
14-Apr	Conv		4.60	2,616.0
28-Apr	Conv		4.49	3,026.8
24-May	ILG	1.61	4.61	1,060.5
26-May	Conv		4.3	2,522.7
07-Jun	Conv		4.21	2,886.3
24-Jun	ILG	1.55	4.55	966.3
14-Jul	Conv		4.28	2,238.1
26-Jul	ILG	1.59	4.60	1,011.1
02-Aug	Conv		4.33	2,966.8
06-Sep	Conv		4.16	2,767.6
22-Sep	ILG	1.37	4.37	1,316.1
27-Sep	Conv		4.26	2,873.0
13-Oct	Conv		4.35	2,711.4
25-Oct	ILG	1.46	4.46	707.2
08-Nov	Conv		4.35	3,216.7
24-Nov	ILG	1.32	4.32	1,193.6
07-Dec	Conv		4.27	2,355.2
14-Dec	ILG	1.29	4.29	863.4
10-Jan	Conv		4.11	2,678.7
24-Jan	ILG	1.02	4.02	884.1
26-Jan	Conv		4.14	2,997.1
07-Feb	ILG	1.20	4.20	977.0
16-Feb	Conv		4.10	2,734.9
01-Mar	Conv		4.12	2,949.6
07-Mar	ILG	1.19	4.19	874.2
			4.298	**52,344**

Table 20
Comparison of actual and counterfactual yields

		Difference (bps)
Weighted average issuance yield (actual)	**4.274**	
Counterfactual 1	4.282	0.8
Counterfactual 2a	4.291	1.8
Counterfactual 2b	4.298	2.4

Auction concession analysis

Table 21 compares the (nominal) yield of all auction gilts at the close of business (cob) on the day before the auction and on the day of the auction itself, with the yield at the average accepted price at the auction. This gives an impression of the extent of any concessions around the auctions. On average, cob yields on the day before auctions were just 0.9bps below the auction yields themselves (exactly the same result as last year). The average cob yield on the day of the auction itself were 1.5bps lower (0.6bps lower last year).

Within the averages, there was a significant range of results, reflecting the prevailing market conditions at the time of the auctions. The largest pre-auction concession was 3.9bps on the 2% Index-linked Treasury Stock 2035 auction on 12 April 2005, whereas the yield at the 1¼% Index-linked Treasury Gilt 2055 auction on 24

January 2006 was 4.7bps below that on the cob the night before. The largest post-auction concession was 5.9bps on the auction of 4¼% Treasury Gilt 2055 on 16 February 2006, whereas the yield at the auction of 1¼% Index-linked Treasury Gilt 2017 on 7 February 2006 was 2.4bps below the cob yield on that day.

Table 21
Movement in yields around gilt auctions in 2005-06

Auction date	Gilt	Yield cob day before (%) auction	Nominal auction yield (%)	Yield cob auction day (%)
12-Apr	2% IL 2035	4.61	**4.65**	4.63
14-Apr	5% 2025	4.65	**4.64**	4.63
28-Apr	4¾% 2010	4.53	**4.52**	4.50
24-May	2½% IL 2016	4.71	**4.69**	4.68
26-May	4¼% 2055	4.19	**4.21**	4.17
07-Jun	4¾% 2020	4.31	**4.29**	4.27
24-Jun	4⅛% IL 2030	4.51	**4.53**	4.48
14-Jul	4¼% 2055	4.25	**4.27**	4.25
26-Jul	2½% IL 2020	4.63	**4.66**	4.64
02-Aug	4% 2009	4.24	**4.25**	4.25
06-Sep	4¼% 2036	4.18	**4.21**	4.21
27-Sep	4¾% 2020	4.32	**4.32**	4.32
13-Oct	4¼% 2032	4.31	**4.34**	4.36
25-Oct	1¼% IL 2055	4.09	**4.12**	4.10
08-Nov	4¼% 2011	4.44	**4.47**	4.41
24-Nov	2½% IL 2013	4.59	**4.58**	4.54
07-Dec	4¼% 2055	4.02	**4.03**	4.03
14-Dec	4⅛% IL 2030	4.17	**4.14**	4.14
10-Jan	4¾% 2020	4.08	**4.08**	4.10
24-Jan	1¼% IL 2055	3.49	**3.44**	3.46
26-Jan	4¼% 2011	4.25	**4.27**	4.29
07-Feb	1¼% IL 2017	4.28	**4.28**	4.30
16-Feb	4¼% 2055	3.79	**3.82**	3.76
01-Mar	4% 2016	4.18	**4.19**	4.16
07-Mar	2% IL 2035	3.89	**3.90**	3.86
	Average	**4.268**	**4.277**	**4.262**

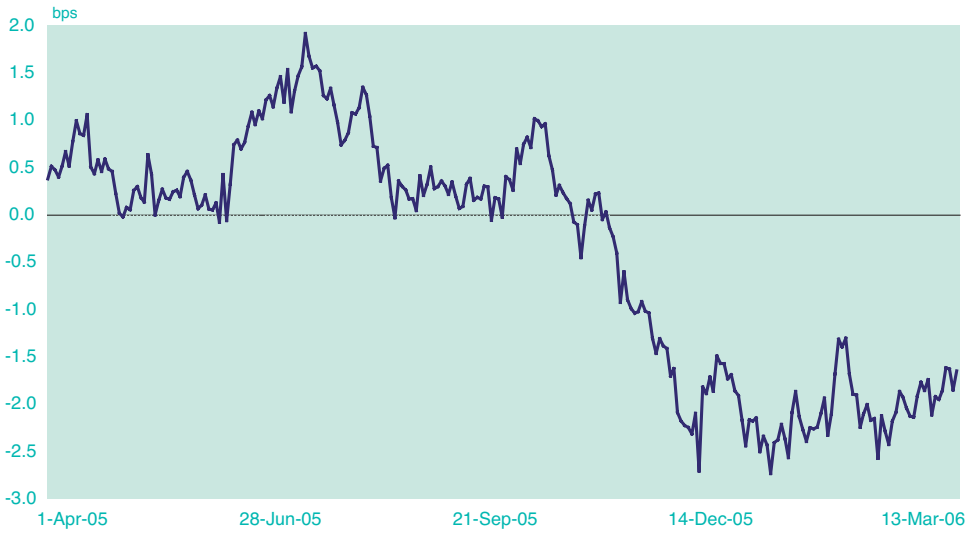
Benchmark premia

One of the ways in which the DMO seeks to deliver its debt management objectives is to issue gilts that deliver a benchmark premium, i.e. they acquire a premium relative to adjacent gilts on the yield curve by virtue of their size and liquidity. Chart 26 shows how the yield spread between the gilt issued to become the 5-year benchmark (4¾% Treasury Stock 2010) moved relative to a previous 5-year benchmark (5¾% Treasury Stock 2009).

At the start of 2005-06, 4¾% Treasury Stock 2010 yielded some 0.5bps more than 5¾% Treasury Stock 2009 and moved in a range of flat to +2bps in the first half of the financial year. However, in the second half of the financial year, its benchmark status became more pronounced as it moved to 2.5bps under 5¾% Treasury Stock 2009; it ended 2005-06 1.7bps below 5¾% Treasury Stock 2009.

The modest evidence of benchmark premia reported above is likely to reflect a combination of factors, in particular that the conventional gilt yield curve is now predominantly made up of benchmark issues, and the shape of the curve itself.

Chart 26
Spread between the yields of 4¾% 2010 and 5¾% 2009



Annex D: Gilt redemptions and the gilt portfolio

Gilt redemptions

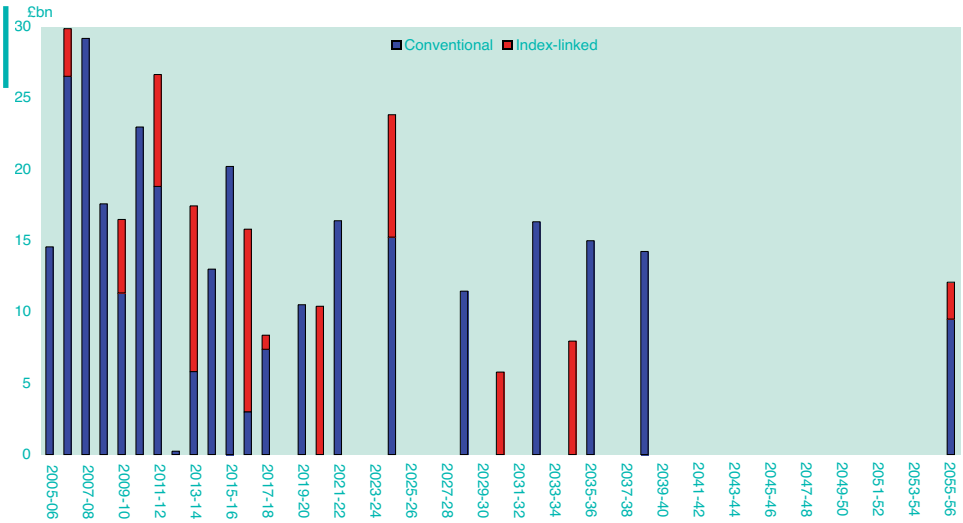
£14.55 billion of gilts in market hands redeemed in 2005-06, as detailed in Table 22.

Table 22
Gilt redemptions 2005-06

Gilt	Redemption date	Amount in issue £ mn	Government Holdings £ mn	Redemption to market £ mn
9½% Conversion Stock 2005	18-Apr-05	4,469	95	4,374
10½% Exchequer Stock 2005	20-Sept-05	2	0	2
8½% Treasury Stock 2005	07-Dec-05	10,486	310	10,176
Total				**14,552**

The future profile of gilt redemptions at end-March 2006 is shown in Chart 27.

Chart 27
Gilt redemption profile at end-March 2006



Source: DMO

The gilt portfolio

The key statistics of the gilt portfolio at end-March 2006 compared to the position at the end of the previous financial year are shown in Table 23.

Table 23
Key portfolio statistics

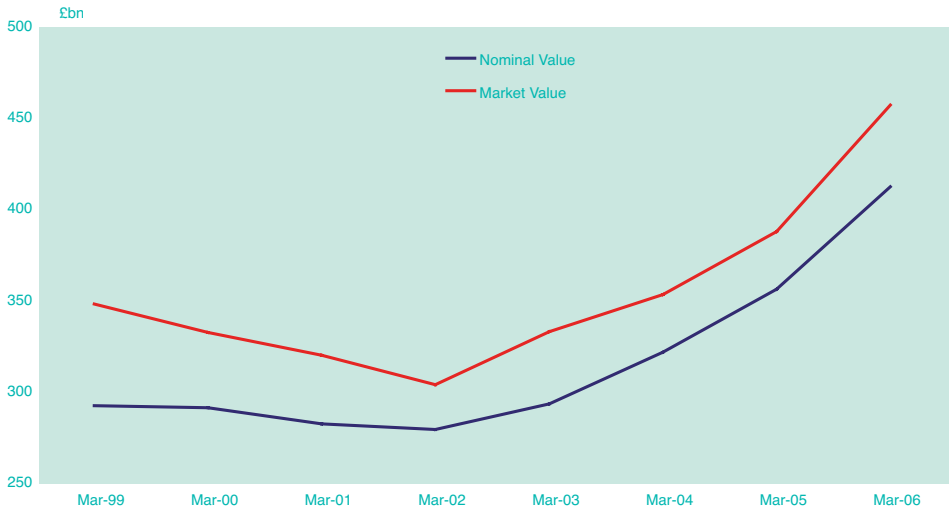
Gilt Portfolio Summary Statistics	end-March 2005	end-March 2006
Nominal value of the gilt portfolio (£):	355.55 billion	£411.57bn
Market value of the gilt portfolio (£):	387.08 billion	£456.27bn
Weighted average market yields		
conventional gilts:	4.65%	4.34%
index-linked gilts:	1.72%	1.40%
Portfolio average maturity	11.96 years	13.09 years
conventional gilts:	11.50 years	12.77 years
index-linked gilts:	13.34 years	13.95 years
Weighted average modified duration		
conventional gilts:	7.45 years	7.97 years
index-linked gilts:	10.85 years	11.95 years
Average amt outstanding of largest 20 (£):	12.89 billion	14.46 billion

The nominal value of the gilt portfolio rose by £56.02 billion (15.8%) as gross gilt issuance greatly exceeded gilt redemptions (see above). The market value of the portfolio rose by £69.2 billion (17.9%).

The rise in nominal and market values of the portfolio continued the trend of the previous few financial years reflecting the step change in levels of gilt issuance since 2002-03.

Chart 28 shows the nominal and market values of the gilt portfolio at end-March in each year since 1999.

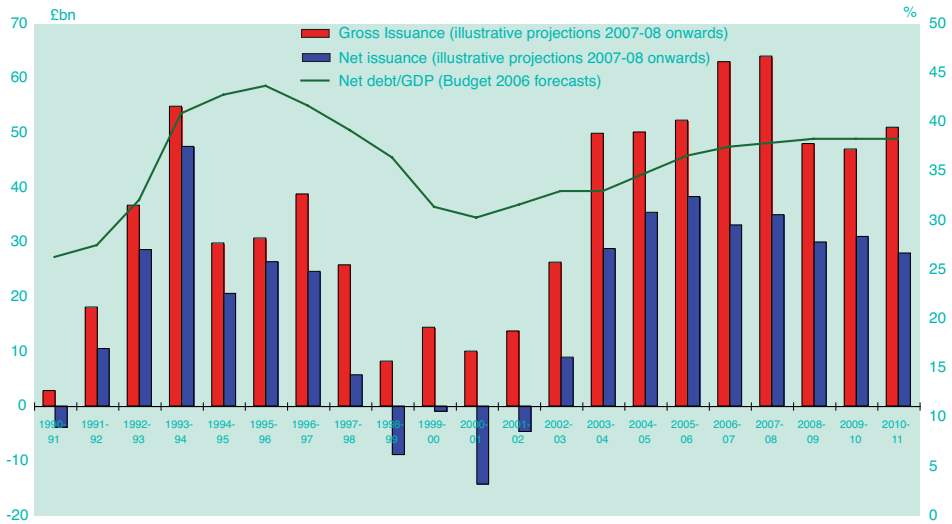
Chart 28
Nominal and market values of the gilt portfolio (as at end-March 2006)



Source: DMO

On the basis of future financing projections, the trend of rising nominal values can be expected to continue. Chart 29 shows past and projected gross and net gilt issuance levels (and net debt/GDP data).

Chart 29
Gross and net issuance history and projections



Source: HMT/DMO

Breakdown of the gilt portfolio (in nominal terms) by type and maturity

Table 24 and Chart 30 show the evolution of the gilt portfolio by type and maturity since March 1999. They show the steadily rising proportion of long conventional gilts (from 15% to 25% of the portfolio), and until 2003-04 an increasing proportion of index-linked gilts, currently accounting for 26% of the gilt portfolio.

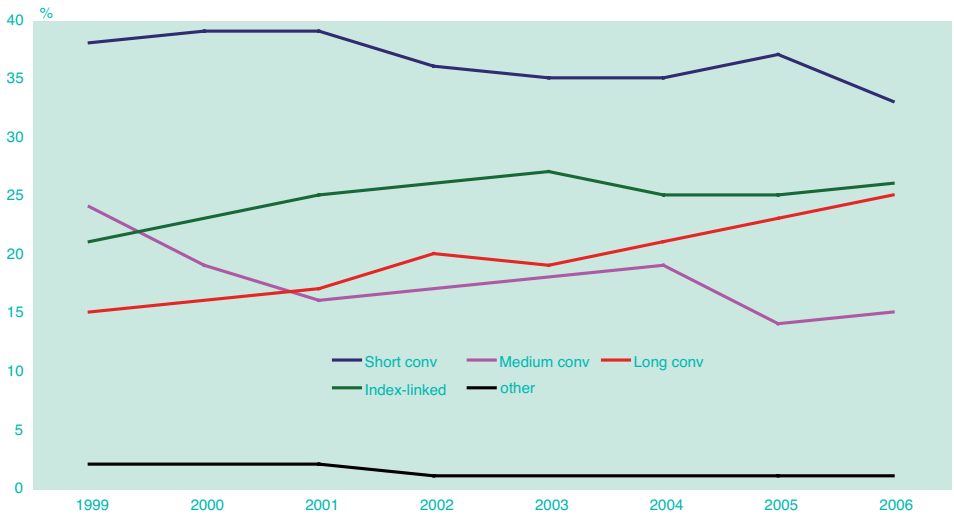
Table 24
Portfolio composition 1999-2006

At end-March	1999	2000	2001	2002	2003	2004	2005	2006
Conventional								
0-3 years	16	17	17	18	16	16	20	19
3-7 years	22	22	22	18	19	19	17	14
7-15 years	24	19	16	17	18	19	14	15
Over 15 years	15	16	17	20	19	21	23	25
Total Conventional	**76**	**75**	**73**	**73**	**73**	**74**	**74**	**73**
Index-linked*	**21**	**23**	**25**	**26**	**27**	**25**	**25**	**26**
Undated	1	1	1	1	1	1	1	1
Floating rate	1	1	1	0	0	0	0	0

*including index-linked uplift
(Figures may not sum due to rounding)

Chart 30 includes both the 0-3 year and 3-7 year data within the "short conventional" category, and undated and floating rate gilts in "other".

Chart 30
Gilt portfolio – breakdown proportion by maturity and type



Source: DMO

Annex E: Treasury bill tender results 2005-06

Table 25
One-month tender results

Date	Maturity date	Size £mn	Cover	Avg Yield %	Avg price £	Yield tail (bps)
01-Apr-05	03-May-05	1,000	6.21	4.7282	99.6257	0
08-Apr-05	09-May-05	1,000	8.66	4.7200	99.6392	0
15-Apr-05	16-May-05	500	4.69	4.7299	99.6385	0
22-Apr-05	23-May-05	500	6.21	4.7177	99.6394	2
29-Apr-05	31-May-05	500	5.87	4.7316	99.6383	1
06-May-05	06-Jun-05	500	8.42	4.7379	99.6379	2
13-May-05	13-Jun-05	500	7.65	4.7135	99.6397	1
20-May-05	20-Jun-05	500	6.01	4.7206	99.6392	1
27-May-05	27-Jun-05	500	6.27	4.7288	99.6514	1
03-Jun-05	04-Jul-05	1,500	5.86	4.7223	99.6390	0
10-Jun-05	11-Jul-05	1,500	4.89	4.7165	99.6395	1
17-Jun-05	18-Jul-05	1,500	3.74	4.7290	99.6385	0
24-Jun-05	25-Jul-05	1,500	3.26	4.7310	99.6384	1
01-Jul-05	01-Aug-05	500	6.68	4.6874	99.6417	0
08-Jul-05	08-Aug-05	500	6.25	4.6945	99.6412	2
15-Jul-05	15-Aug-05	500	4.44	4.6500	99.6446	0
22-Jul-05	22-Aug-05	250	6.08	4.5926	99.6489	1
29-Jul-05	30-Aug-05	500	5.81	4.5181	99.6423	2
05-Aug-05	05-Sep-05	500	7.74	4.4795	99.6575	0
12-Aug-05	12-Sep-05	500	7.61	4.4684	99.6584	1
19-Aug-05	19-Sep-05	500	6.53	4.4701	99.6583	1
26-Aug-05	26-Sep-05	500	6.89	4.4666	99.6707	0
02-Sep-05	03-Oct-05	500	7.01	4.4697	99.6583	1
09-Sep-05	10-Oct-05	500	6.79	4.4790	99.6576	0
16-Sep-05	17-Oct-05	500	6.29	4.4887	99.6568	0
23-Sep-05	24-Oct-05	500	6.62	4.4802	99.6575	1
30-Sep-05	31-Oct-05	500	6.26	4.4864	99.6570	0
07-Oct-05	07-Nov-05	500	4.96	4.4763	99.6578	0
14-Oct-05	14-Nov-05	150	6.89	4.4741	99.6580	2
21-Oct-05	21-Nov-05	150	7.02	4.4625	99.6588	1
28-Oct-05	28-Nov-05	150	6.99	4.4755	99.6578	0
04-Nov-05	05-Dec-05	150	9.33	4.4517	99.6597	0
11-Nov-05	12-Dec-05	150	11.77	4.4480	99.6599	0
18-Nov-05	19-Dec-05	150	6.30	4.4745	99.6579	1
25-Nov-05	28-Dec-05	500	4.98	4.4672	99.6342	0
02-Dec-05	03-Jan-06	500	5.35	4.4400	99.6485	0
09-Dec-05	09-Jan-06	500	5.24	4.4491	99.6599	0
16-Dec-05	16-Jan-06	500	3.93	4.4900	99.6567	1
30-Dec-05	30-Jan-06	500	4.04	4.4970	99.6684	0
06-Jan-06	06-Feb-06	500	8.34	4.4696	99.6583	0
13-Jan-06	13-Feb-06	500	7.31	4.4499	99.6598	1
20-Jan-06	20-Feb-06	500	5.83	4.4548	99.6594	2
27-Jan-06	27-Feb-06	500	5.08	4.4688	99.6584	2
03-Feb-06	06-Mar-06	500	6.07	4.4697	99.6583	0
10-Feb-06	13-Mar-06	500	7.12	4.4342	99.6610	2
17-Feb-06	20-Mar-06	500	5.21	4.4471	99.6600	0
24-Feb-06	27-Mar-06	500	6.11	4.4412	99.6605	1
03-Mar-06	03-Apr-06	500	7.86	4.4397	99.6606	0
10-Mar-06	10-Apr-06	500	6.97	4.4242	99.6618	3
17-Mar-06	18-Apr-06	500	5.68	4.4475	99.6479	1
24-Mar-06	24-Apr-06	550	6.91	4.4415	99.6604	1
31-Mar-06	02-May-06	550	4.47	4.4391	99.6485	0

Table 26
Three-month tender results

Date	Maturity date	Size £mn	Cover	Avg Yield %	Avg price £	Yield tail (bps)
01-Apr-05	04-Jul-05	1,000	6.24	4.8165	98.8134	0
08-Apr-05	11-Jul-05	1,000	5.78	4.7786	98.8226	1
15-Apr-05	18-Jul-05	1,000	7.40	4.7611	98.8269	1
22-Apr-05	25-Jul-05	1,000	7.12	4.7519	98.8292	0
29-Apr-05	01-Aug-05	800	7.60	4.7499	98.8423	0
06-May-05	08-Aug-05	800	5.88	4.7489	98.8299	1
13-May-05	15-Aug-05	800	8.53	4.7100	98.8394	0
20-May-05	22-Aug-05	800	5.74	4.7050	98.8406	2
27-May-05	30-Aug-05	800	7.44	4.7025	98.8412	2
03-Jun-05	05-Sep-05	1,500	6.74	4.6988	98.8421	0
10-Jun-05	12-Sep-05	1,500	5.13	4.6955	98.8429	0
17-Jun-05	19-Sep-05	800	5.00	4.7143	98.8383	1
24-Jun-05	26-Sep-05	800	4.90	4.6786	98.8470	1
01-Jul-05	03-Oct-05	800	7.62	4.5694	98.8736	1
08-Jul-05	10-Oct-05	800	5.09	4.5419	98.8803	1
15-Jul-05	17-Oct-05	800	5.96	4.5236	98.8848	1
22-Jul-05	24-Oct-05	800	6.92	4.4988	98.8908	1
29-Jul-05	31-Oct-05	800	5.61	4.4800	98.8954	1
05-Aug-05	07-Nov-05	800	6.41	4.4673	98.8985	0
12-Aug-05	14-Nov-05	800	5.87	4.4617	98.8999	1
19-Aug-05	21-Nov-05	800	6.44	4.4590	98.9005	1
26-Aug-05	28-Nov-05	800	7.23	4.4299	98.9195	0
02-Sep-05	05-Dec-05	800	6.41	4.4484	98.9031	1
09-Sep-05	12-Dec-05	800	7.07	4.4470	98.9035	0
16-Sep-05	19-Dec-05	800	6.25	4.4716	98.8975	0
23-Sep-05	28-Dec-05	800	7.37	4.4479	98.8794	0
30-Sep-05	03-Jan-06	800	6.92	4.4498	98.8909	1
07-Oct-05	09-Jan-06	800	5.76	4.4133	98.9117	1
14-Oct-05	16-Jan-06	2,000	5.60	4.4507	98.9026	1
21-Oct-05	23-Jan-06	2,000	6.12	4.4664	98.8987	1
28-Oct-05	30-Jan-06	2,000	5.68	4.4731	98.8971	1
04-Nov-05	06-Feb-06	2,000	5.66	4.4841	98.8944	1
11-Nov-05	13-Feb-06	1,400	6.38	4.4758	98.8964	0
18-Nov-05	20-Feb-06	800	7.26	4.4553	98.9014	1
25-Nov-05	27-Feb-06	800	6.16	4.4491	98.9029	0
02-Dec-05	06-Mar-06	800	5.28	4.4629	98.8996	1
09-Dec-05	13-Mar-06	800	4.16	4.4736	98.8970	1
16-Dec-05	20-Mar-06	900	3.61	4.4882	98.8934	1
30-Dec-05	03-Apr-06	900	3.97	4.4760	98.9084	0
06-Jan-06	10-Apr-06	900	7.98	4.4467	98.9035	1
13-Jan-06	18-Apr-06	900	7.64	4.4355	98.8944	0
20-Jan-06	24-Apr-06	900	6.09	4.4245	98.9089	1
27-Jan-06	02-May-06	900	5.48	4.4511	98.8905	1
03-Feb-06	08-May-06	900	6.26	4.4515	98.9023	1
10-Feb-06	15-May-06	900	7.14	4.4299	98.9076	0
17-Feb-06	22-May-06	900	6.65	4.4109	98.9123	1
24-Feb-06	30-May-06	900	6.44	4.4376	98.8939	1
03-Mar-06	05-Jun-06	900	6.07	4.4394	98.9053	0
10-Mar-06	12-Jun-06	900	5.46	4.4372	98.9058	1
17-Mar-06	19-Jun-06	900	5.55	4.4406	98.9050	1
24-Mar-06	26-Jun-06	900	5.08	4.4444	98.9041	1
31-Mar-06	03-Jul-06	1,000	3.97	4.4597	98.9004	1

Table 27
Six-month tender results

Date	Maturity date	Size £mn	Cover	Avg Yield %	Avg price £	Yield tail (bps)
04-Mar-05	26-Sep-05	750	5.63	4.8642	97.6447	4
22-Apr-05	24-Oct-05	750	6.94	4.8039	97.6607	1
20-May-05	21-Nov-05	750	6.39	4.6901	97.7148	1
17-Jun-05	19-Dec-05	750	5.35	4.6894	97.7151	1
15-Jul-05	16-Jan-06	750	6.66	4.4047	97.8509	1
12-Aug-05	13-Feb-06	750	6.23	4.4276	97.8400	1
09-Sep-05	13-Mar-06	750	6.20	4.4049	97.8508	0
07-Oct-05	10-Apr-06	750	5.73	4.3682	97.8683	0
04-Nov-05	08-May-06	750	6.48	4.4920	97.8092	1
02-Dec-05	05-Jun-06	750	5.54	4.4609	97.8240	1
06-Jan-06	10-Jul-06	800	8.65	4.4068	97.8499	1
27-Jan-06	31-Jul-06	800	5.53	4.4571	97.8259	1
24-Feb-06	29-Aug-06	800	6.51	4.4399	97.8224	1
24-Mar-06	25-Sep-06	800	5.59	4.4778	97.8160	1

Annex F: Treasury bill tender performance

Table 28 and Charts 31-33 compare the results (in terms of the average yield) of all Treasury bill tenders in 2005-06 with the average fixing of the relevant GC repo rate on the day of the settlement of the tenders. On average over the financial year, the yields at tenders of bills at all maturities out-performed the average of GC repo fixings by 0.8 to 1.1bps.

Table 28
Comparison of average tender yields with GC repo fixings in 2005-06

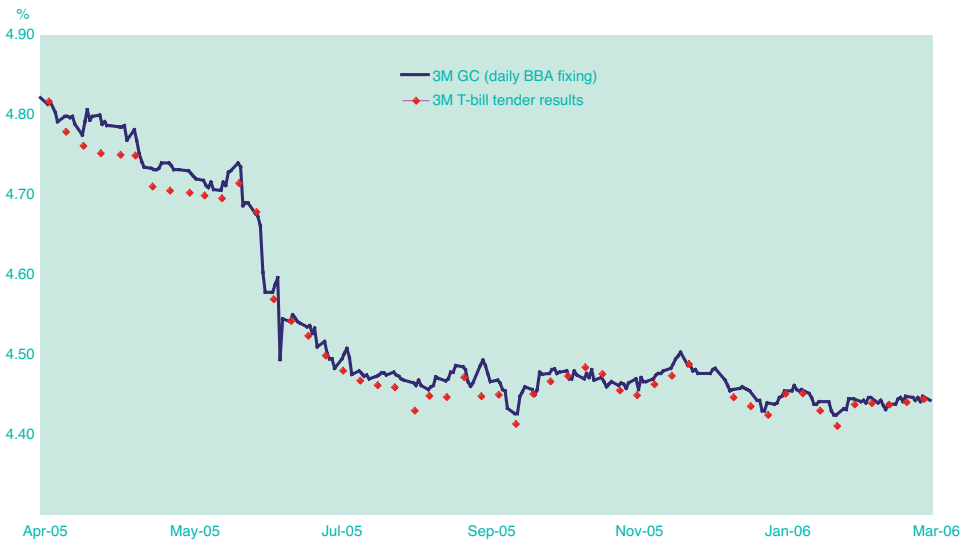
Average Treasury bill tender yields compared to average GC fixings on settlement of tenders in 2005-06

Maturity	Average tender yield (%)	Average GC repo fix (%)	Relative performance (bps)
One-month	4.545	4.556	–1.1
Three-month	4.530	4.538	–0.8
Six-month	4.510	4.517	–0.8

Chart 31
One-month tender yields vs GC repo fixings in 2005-06

Source: DMO/BBA

Chart 32
Three-month tender yields v GC repo fixings in 2005-06



Source: DMO/BBA

Chart 33
Six-month tender yields v GC repo fixings in 2005-06

Source: DMO/BBA

United Kingdom
Debt Management Office

Eastcheap Court
11 Philpot Lane
London EC3M 8UD