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Debt Management Office

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UNITED KINGDOM

DEBT MANAGEMENT OFFICE

Index-linked Gilt Re-design:

Consultation Document

7 September 2001

UK DEBT MANAGEMENT OFFICE

INDEX-LINKED GILT RE-DESIGN: PROPOSALS FOR CONSULTATION

SEPTEMBER 2001

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Introduction

1. In March 2001, HM Treasury announced that the DMO would consult gilts market participants during 2001-02 on whether to adopt a new design for new issues of index-linked gilts[1]. No decision has been taken on whether or not to issue a new design. However, the Treasury's announcement also made clear that, if following this consultation it were decided to issue a new design, any new index-linked gilt would not be issued in the 2001-02 financial year. That would give the market time to make any necessary systems changes.

2. Comments on the proposals set out in this consultation paper should be sent by **31 October 2001** to: Mark Deacon, UK Debt Management Office, Eastcheap Court, 11 Philpot Lane, London EC3M 8UD; telephone 020 7862 6516; fax 020 7862 6509; e-mail mark.deacon@dmo.gov.uk. The DMO will aim to publish a response to the comments received by the end of December, including the decision on whether or not to proceed with a re-design. It is not the DMO's current intention to publish any of the individual responses; but it may be asked to do so, and respondents should accordingly indicate whether they would object to their comments being published in due course. If the decision is taken to proceed with re-design the DMO would not envisage launching a new design bond before the third quarter of 2002 in order to allow the market sufficient time to prepare for the event. The decision on whether to issue a new index-linked gilt in July to September 2002 would then be discussed in June 2002 at the DMO's regular quarterly consultation meetings with the Gilt-edged Market Makers (GEMMs) and representatives of end-investors.

[1] "Debt and Reserves Management Report 2001-02", Her Majesty's Treasury (March 2001), available on the DMO web site at www.dmo.gov.uk/remit/dmr2001_02.pdf.

Index-linked gilt re-design

1) Rationale for the consultation

3. In 1995, HM Treasury conducted a review of the arrangements for the formulation and operation of debt management policy in the UK[2]. This Review highlighted the desire to continue modernising the gilts market to bring it further into line with best practice elsewhere. In particular, innovations in international government bond markets intended to increase liquidity, predictability and transparency were identified as useful features to introduce in the UK. The Report also noted a number of measures which HM Treasury and the Bank of England were considering to improve the liquidity and attractiveness of index-linked gilts. In the period since the Report was published the UK authorities have demonstrated their ongoing commitment to the development of the index-linked sector by a series of reforms including the introduction of auctions and a dedicated market marker list. In the past the Treasury and the DMO have also discussed with the market whether changes could be made to the design of index-linked gilts to make them more attractive.

4. The main reason for considering the issue of instrument design now is that over the last year some market participants have suggested that they would like the DMO to issue a new long maturity index-linked gilt[3]. Although to date such interest has been fairly limited, the DMO thought it advisable to revisit the design issue ahead of wider market interest in issuing a new bond in order to allow sufficient time to consult. Another reason for considering re-designing index-linked gilts is that the recent growth in the international markets for index-linked securities has led to an increasing convergence to a standard instrument design. This design – which was pioneered by the Canadian authorities in 1991 and subsequently adopted in markets such as the US and France – offers a much shorter indexation lag than is currently employed in the UK. As a result, the Canadian structure provides better inflation protection than the current UK design and so is much closer to the ideal concept of a

[2] "Report of the Debt Management Review", Her Majesty's Treasury and the Bank of England (July 1995).
[3] The last new issue of an index-linked gilt was in September 1992 and since then four index-linked gilts have redeemed.

real return bond. A change in the design of index-linked gilts would also be attractive if it were likely to improve the liquidity of the index-linked gilts market by, for example, making cross-market trading more straightforward. Even if the decision is made not to proceed with a full re-design, it may be possible to introduce some improvements to the current design.

5. From HM Treasury's perspective as issuer, there are several attractions to improving the inflation protection afforded by index-linked gilts. In addition to the fact that investors should be prepared to pay more for such debt, it should also offer better insurance against some fiscal outturns. In particular, index-linked debt has a useful role to play in the government debt portfolio because of its deficit-smoothing[4] properties in certain circumstances.

6. Although not strictly speaking a design feature, another potentially attractive feature from other large indexed bond markets is the manner in which the securities are traded, both in terms of the primary and secondary markets. Whilst index-linked gilts trade on a nominal price basis, with the price increasing over time with inflation, indexed bonds in other markets tend to trade on either a real price or a real yield basis, making trading them more intuitive.

7. If the decision is made to proceed with re-design the DMO would initially propose to issue new design index-linked gilts by outright auction alone, with any new bonds first being issued at longer maturities than current index-linked gilts in order to minimise competition between bonds of different design. This should help to reduce the chance of fragmenting liquidity in the index-linked gilts market.

[4] In this context, deficit smoothing refers to the process of changing the composition of the debt portfolio in order to stabilise the deficit. The debt composition which stabilises the deficit will depend on the relationship between interest rates, output and inflation (and on the output and price elasticities of the government deficit).

2) Design characteristics of a new index-linked gilt

Choice of price index

8. One of the main issues that was considered carefully by the Bank of England and HM Treasury before the introduction of index-linked gilts in 1981 was the choice of price index. Although both the GDP deflator and average earnings were considered as potential indices for index-linked gilts, the General Index of Retail Prices (RPI) was adopted, due in part to its frequency of publication and the fact that it is not subject to revision. The RPI was also identified as the index most likely to protect savers against inflation risk and had already been used for the index-linking of state pensions. All index-linked gilt issues have been linked to the RPI.

9. In recent years several alternative measures of UK consumer prices have also become prominent, most notably RPIX[5] (as the official inflation target) and HICP[6]. A measure of European consumer prices is also now available. The DMO would expect that institutional factors in the UK would mean that most market participants would wish to retain the link to the RPI for future index-linked gilt issues. However, it would be interested in hearing views on whether this is indeed the case and if not, the reasons for preferring an alternative price index. Should there be a desire to move to an alternative price index the Treasury would need to consider the fiscal cost and risk implications of such a change. Also, in the event that there was an overwhelming desire to move to either UK HICP or RPIX, primary legislation would first be required in order to extend the current tax treatment for index-linked gilts to bonds with such a linkage. In these circumstances the timetable outlined in the introductory section of this paper would almost certainly have to be extended. As it would not be possible to include index-linked gilts tied to an alternative price index in the current FTSE index-linked gilt indices, FTSE would need to consider establishing a new index for such bonds.

10. All index-linked gilts have a prospectus clause which sets out what would happen in the event of a change in either the coverage or the basic calculation of the RPI. The clause from early bond prospectuses was slightly reworded for index-linked

[5] RPI excluding mortgage interest payments.
[6] Harmonised index of consumer prices.

issues from March 1982 onwards and this was again reworded for the issues dating from 1992. For bonds issued before March 1982, if there was a fundamental change in the RPI that was determined (by the Bank of England) to be materially detrimental to index-linked gilt holders the clause would be triggered and the Treasury would offer holders an opportunity of early redemption at (inflation adjusted) par. The prospectuses for new issues from March 1982 onwards allow for the possibility of switching over to a substitute price index which (so long as it did not result in material detriment to the holders) would avoid the early redemption clauses being triggered. A trigger of the early redemption clause would clearly be disruptive to the index-linked gilts market, and other major markets operate perfectly well without such clauses. Moreover the redemption clause issue is also topical given that the Office for National Statistics (ONS) is currently carrying out a research programme into the methodology used to construct the RPI[7]. Although it will be some time before the ONS completes its research, and still longer before decisions can be made on whether to implement any proposals for change that might emerge, conceivably there could eventually be implications for the index-linked gilts market. For these reasons the DMO believes that now is a sensible time to consider revising the indexation clause for future new issues.

11. As a result, for any new issues the DMO proposes to bring the UK into line with the approach used in other major markets. Instead of making provision for early redemption of stock affected by an index change it places the onus on an independent institution to propose a satisfactory replacement index. Draft wording for the new prospectus would take the following form:

"Index-linked gilts will be indexed to the General Index of Retail Prices (RPI), or any subsequent index that, in the opinion of the Chancellor after consultation with a body that the Chancellor considers to be independent and to have recognised expertise in the construction of price indices, continues the function of measuring changes in the level of retail prices. The selection of the new index by the Chancellor shall be conclusive and binding on all stockholders".

[7] For more details see "Three Year Research Programme on RPI Methodology" in *Economic Trends* No.543 February 1999 Pages 25-29.

12. If the decision is taken to proceed with the introduction of a new design of index-linked gilt the DMO would aim to publish a complete sample prospectus as an annex to its response document.

Indexation lag

13. Index-linked bonds are designed to provide real value certainty to both the issuer and the investor. In order to ensure *complete* real value certainty, all cash flows would have to be corrected for inflation right up to the moment at which they are paid[8]. However, in practice, unavoidable lags between the actual movements in the price index and the adjustment to bond cash flows distort the "inflation-proofing" properties of index-linked bonds. As a result of the lag there is a period at the end of an indexed bond's life when there is no inflation protection at all, counterbalanced by a period of equal length before the bond is issued for which inflation compensation is paid. Therefore the real return on an indexed bond will vary with inflation - the longer the lag, the poorer the instrument's inflation protection.

14. One of the most significant differences in design between UK index-linked bonds and those introduced more recently in other countries is in the length of the indexation lag. At eight months, the lag in the UK is much longer than in most other index-linked markets. There are two factors which contribute to the lag in the inflation adjustment on index-linked gilts. The first is the time taken to compile and publish the RPI, which accounts for two months of the lag. The second, more significant factor is the need to know the nominal size of the next coupon payment at the start of each coupon period for accrued interest calculations. This is because accrued interest in the UK is currently computed as a straight-line or pro-rata share of the next coupon payment. This accounts for the remaining six months of the indexation lag. In markets employing a three-month lag accrued interest is not computed in this fashion, but in a way which removes the need to know the next dividend payment in advance. This is the approach pioneered by the Canadian authorities in 1991 and subsequently adopted in Sweden, the US and France. The

[8] Strictly speaking the bond should also be a zero-coupon instrument in order to remove reinvestment risk and so guarantee the yield to redemption.

next section compares the inflation protection properties of index-linked gilts with equivalent bonds using the Canadian structure.

15. Analysing how the actual cash flows on current (and redeemed) index-linked gilts would have differed had they instead been calculated using either the Canadian three-month lag structure or perfect indexation (i.e. no lag) allows a quantitative assessment to be made of the inflation protection afforded by the different bond designs. The first step in this analysis is to calculate every nominal cash flow for each index-linked gilt under the three scenarios - UK eight-month lag, Canadian three-month lag and perfect indexation (the "ideal"). Differencing the ideal value of each coupon from the corresponding value for each of the other methods produces an "error" term. This indicates how far the coupons under the eight- and three-month lags diverge from those on a bond providing perfect inflation protection. Figures 1 and 2 illustrate this for 2 1/2% Index-linked Treasury Stock 2011 and 2 1/2% Index-linked Treasury Stock 2016 respectively. Here the differences are measured in units of pence per £100 nominal of stock.

Figure 1: 2 1/2% Index-linked Treasury 2011 - Differences in coupon payments under different lags

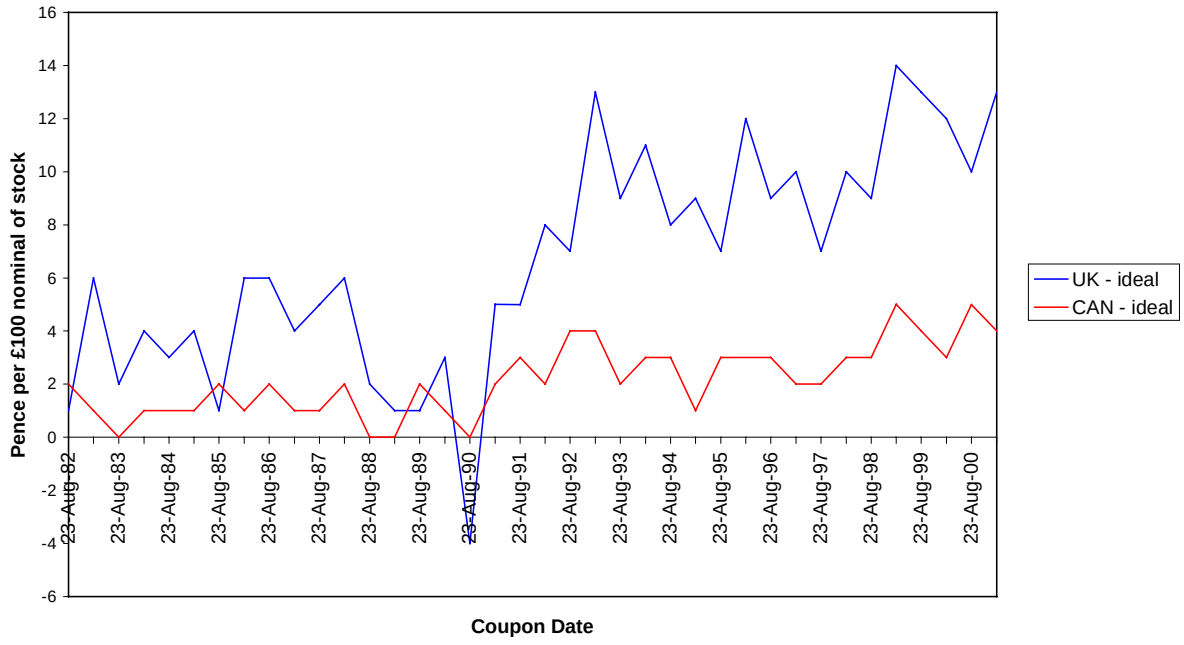
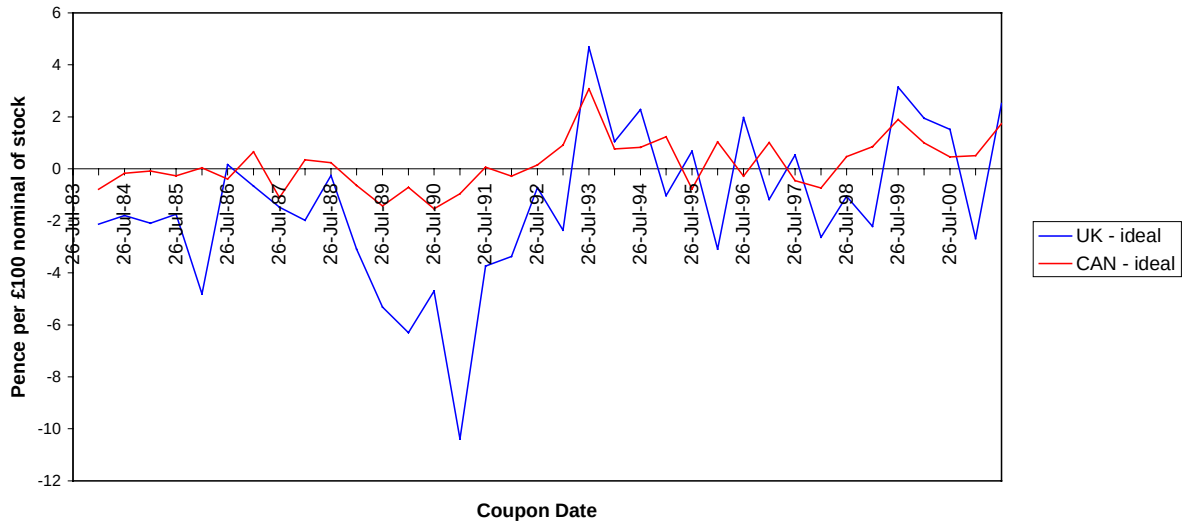


Figure 2: 2 1/2% Index-linked Treasury 2016 - Differences in coupon payments under different lags



16. Table 1 illustrates summary statistics computed from these differentials for each index-linked gilt[9]. Again, only coupon payments are reflected in this table and the differences are measured in units of pence per £100 nominal of stock. In each case the shaded boxes illustrate which of the two cases have "errors" that are of larger magnitude. The summed errors category represents the accumulated coupon cash flow error since each bond was issued. In some cases the accumulated cash flow error over the life of the stock can be significant under the current eight-month lag. For example, in the case of 2% Index-linked Treasury Stock 2006 the accumulated coupon payments made on this bond to date have been over £4 per £100 nominal higher than they should have been under perfect indexation. Under the three-month lag structure this difference would have been reduced to 88 pence per £100 nominal.

[9] NB: 2 1/2% Index-linked Treasury Convertible Stock 1999 was excluded from this analysis since most of this bond was converted out of shortly after it was issued.

Table 1

BOND	MEAN ERROR		STD DEV ERROR		MAX ERROR		MIN ERROR		SUMMED ERRORS	
	8 month	3 month	8 month	3 month	8 month	3 month	8 month	3 month	8 month	3 month
2% IL 1988	2.8	0.5	1.3	0.5	4.7	1.2	1.0	-0.7	34.1	5.9
2% IL 1990	-0.5	0.1	1.6	0.5	1.7	0.9	-3.0	-0.7	-5.4	1.3
2% IL 1992	-1.8	-0.3	2.2	0.6	0.7	0.5	-6.6	-1.4	-17.9	-2.5
2% IL 1994	-0.4	0.9	2.6	1.4	3.1	3.1	-5.1	-2.4	-4.5	10.3
2% IL 1996	4.3	2.9	3.3	0.8	11.0	4.0	-4.0	1.0	134.0	90.0
4 5/8% IL 1998	1.5	-1.6	1.2	1.3	3.5	0.6	-0.4	-3.3	16.6	-17.5
2 1/2% IL 2001	3.5	-1.5	3.3	0.7	9.8	-0.1	-6.5	-3.6	127.2	-52.3
2 1/2% IL 2003	2.8	-1.4	3.6	1.7	9.3	1.8	-6.7	-7.2	97.8	-50.5
4 3/8% IL 2004	1.6	-1.6	1.4	1.2	4.9	0.5	-0.4	-3.7	27.7	-26.9
2% IL 2006	10.4	2.3	4.8	1.3	19.0	5.0	2.0	0.0	406.0	88.0
2 1/2% IL 2009	2.8	-1.4	3.6	1.7	9.3	1.8	-6.7	-7.2	99.3	-52.1
2 1/2% IL 2011	6.6	2.2	4.2	1.3	14.0	5.0	-4.0	0.0	252.0	82.0
2 1/2% IL 2013	1.6	1.5	3.1	1.1	6.5	3.5	-7.7	-0.5	52.2	47.5
2 1/2% IL 2016	-1.4	0.2	2.9	1.0	4.7	3.1	-10.4	-1.5	-50.3	6.7
2 1/2% IL 2020	1.9	-0.6	3.3	1.5	7.5	1.9	-7.5	-5.7	68.1	-19.3
2 1/2% IL 2024	0.3	2.0	2.8	1.1	5.3	4.5	-7.4	-0.1	8.8	55.5
4 1/8% IL 2030	4.8	3.5	2.5	1.2	10.4	6.8	1.1	1.8	81.5	59.0

17. Table 2 compares the redemption values of the index-linked gilts that have redeemed with the equivalent values had they been calculated using either a three-month lag or no lag at all. Again, in some cases there is a significant difference between the redemption values computed under the three different scenarios.

Table 2

BOND	Redemption Payments			Differences	
	Under 8 month lag	Under 3 month lag	Under perfect indexation	8 month lag minus perfect indexation	3 month lag minus perfect indexation
2% IL 1988	135.1736	131.5232	131.0384	4.14	0.48
2% IL 1990	135.8715	136.8884	137.6030	-1.73	-0.71
2% IL 1992	136.8172	136.3238	136.1553	0.66	0.17
2% IL 1994	137.9008	136.6149	135.7410	2.16	0.87
2% IL 1996	221.17	217.52	213.64	7.53	3.88
4 5/8% IL 1998	116.8879	115.2331	116.6427	0.25	-1.41

18. The results from the above analysis demonstrate that in almost all cases an index-linked bond based on the Canadian design would have offered superior inflation protection to that of an indexed bond using the current eight-month lag. Given this, **the DMO would welcome views on whether to adopt a new design for future index-linked gilt issues**, or whether the potential advantages of a new design are outweighed by the likely systems upheaval and the possible disruption to

the market of having two distinct index-linked designs in issue. If the DMO were to proceed with introducing a new design for future index-linked gilt issues, **should this be based on the Canadian three-month lag structure, or is there an alternative more desirable instrument design that should be considered?** Full details of precisely how the Canadian method of indexation would work in practice in the UK are set out in Annex 1.

19. As Annex 1 shows, the (nominal) accrued interest on an index-linked bond of this design would be determined using a daily interpolated price index. Under this approach every month's RPI value would be used in the computation of the accrued interest, unlike the current system where only two RPI values a year are used[10] per gilt. In order to minimise the likelihood of disputes arising in the market over the calculation of the daily price index, the DMO would propose to publish the interpolated values, both on its wire service pages and on its web site. On the last business day of each month the DMO would release the daily figures for the whole month ahead. Market service providers would need to use the DMO's published interpolated price index in their software for computing accrued interest and settlement proceeds, as well as for carrying out price/yield calculations.

Frequency and determination of coupon payments

20. With the exception of three undated bonds, all gilts currently pay coupons on a semi-annual basis. This, coupled with the fact that there is no global standard for coupon frequency (semi-annual payments are the standard in the US and Japanese markets, whilst the majority of EU bond markets pay annual coupons) means that the DMO has no plans to change the frequency of coupon payments for new issues of index-linked gilts. An additional reason for retaining semi-annual coupon payments is that there are credit risk benefits to derivatives and repo markets in having smaller, more frequent coupon payments.

[10] For example, each year 2 1/2% Index-linked Treasury Stock 2024 pays cash flows in January and July, based respectively on the RPI values from the preceding May and November, due to the eight month lag.

21. As part of the prospectus terms for current index-linked gilt issues, both the coupon and the redemption payments are determined and published by the Bank of England. Given the transfer of debt management from the Bank of England to the DMO, the coupon and redemption payments of any new index-linked gilts would be calculated by the DMO[11].

22. Although at present the DMO publishes the (nominal) first dividend amount of new issues (for index-linked and conventional gilts) in the press notice announcing the issue, this would not always be possible were the Canadian method of indexation to be adopted since the (nominal) value would not necessarily be known at the time of issue. However, this would not in anyway hinder trading of the bonds in the market. In cases where it would not be possible to announce the nominal size of the first dividend when the bond is issued the press notice would give the date on which a separate press notice would be published fixing the dividend. Before the introduction of any bonds based on a new design the DMO would publish a paper setting out the formulae for the calculation of non-standard first dividend payments. If the Canadian approach were to be adopted these formulae would be based on the proposed formulae appearing in Annex 2.

23. The DMO would propose to increase the precision of coupon and redemption payments on any new index-linked gilts. Whereas the cash flows for current index-linked gilts are calculated with truncation to either 2 or 4 decimal places[12], for new bonds these will be calculated by nearest rounding to 6 decimal places[13].

Deflation floor

24. In some markets, such as the US and France the issuer guarantees that the redemption payment on index-linked bonds will not be less than the original par

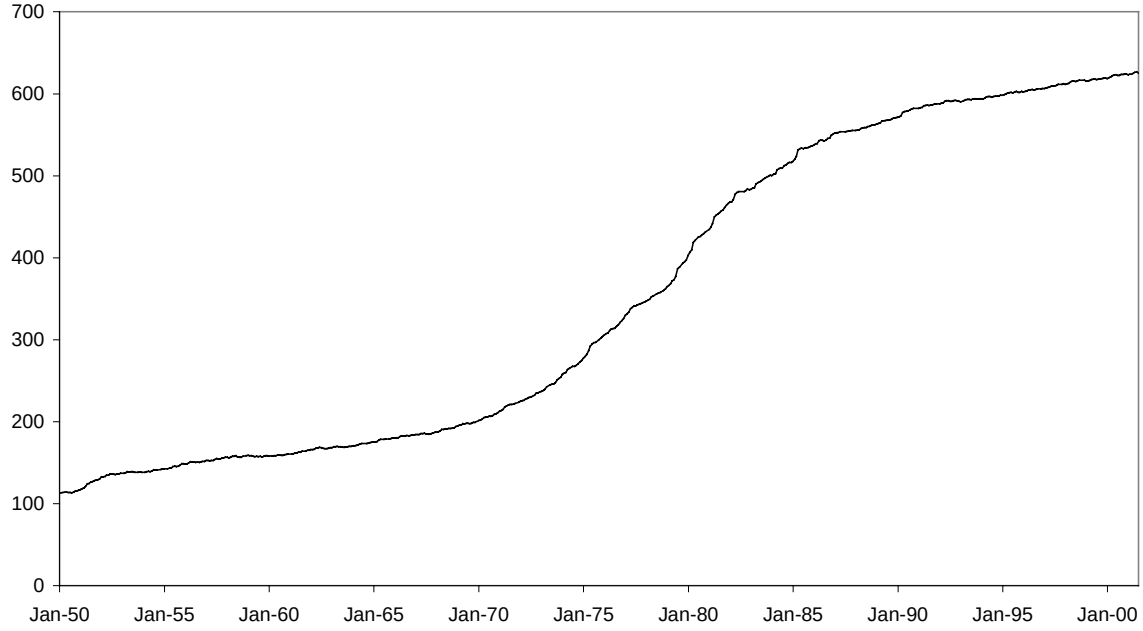
[11] The prospectus wording would state that the cash flows would be determined by the body which has responsibility for domestic debt management in order to retain flexibility should there be a change in the debt management arrangements in the UK in the future.
[12] Only 2% Index-linked Treasury Stock 2006 and 2 1/2% Index-linked Treasury Stock 2011 pay cash flows that are truncated to 2 decimal places. For all other index-linked gilts truncation is to 4 decimal places.
[13] This is consistent with the rounding convention that the DMO employs for the non-standard first dividend payments on conventional gilts.

value; i.e. it protects the nominal value of the principal should deflation occur over the life of the bond. So for example, if a ten-year index-linked bond with a deflation floor was issued today, the deflation floor would only take effect if the level of the RPI in ten year's time is below that of today's RPI level[14]. Whilst inclusion of a deflation floor would ensure consistency with other large indexed bond markets there are several reasons why the DMO would be reluctant to include one in the design of new index-linked gilts. Most notably, a deflation floor would reduce the value to HM Treasury of having index-linked gilts in its debt portfolio by reducing their deficit-smoothing properties in some circumstances. Inclusion of a deflation floor would also require primary legislation in order to amend Section 717 of the Income & Corporation Taxes Act 1998 (ICTA). In addition, it would rule out any possibility of index-linked coupon and principal strip fungibility if this were felt desirable at some point in the future.

25. Although it may have risen with the return to lower and more stable inflation rates, the value that market practitioners might place on the inclusion of a deflation floor is likely to be negligible due to the need for deflation to occur over the lifetime of the bond before it would take effect. Figure 3 shows the RPI series since 1950 and illustrates that had a deflation floor been a feature of any actual or hypothetical index-linked gilts issued in the past 50 years at no point would the deflation floor have taken effect. The longest period of deflation over this period was just 21 months beginning in June 1958 - the RPI level having been 110.2[15] in June 1958 and 109.7 in March 1960, before rising above the June 1958 value to 110.3 in April 1960. In contrast the shortest maturity of a new issue of an index-linked gilt has been just over 5 years, although most issues have had much longer maturities. Whilst historic data is not necessarily a good predictor of the future this analysis provides an indication of the type of environment that would be required for a deflation floor to take effect. It is thought probable that the lower future rate of inflation currently in prospect will not materially alter practitioners' judgement of the value of a deflation floor. Nevertheless, any comments on this conclusion would be welcome.

[14] Save for indexation lags.
[15] Based on setting January 1956's RPI equal to 100.

Figure 3: General Index of Retail Prices



Strippability

26. When the conventional gilts strips market was launched in December 1997 the Bank of England - as debt manager at the time - indicated that it would consider introducing index-linked strips once the conventional strips market had become established. Although in practice there has only been limited use made of the conventional strips facility thus far, the DMO would welcome market participants' views on the usefulness of introducing index-linked strips. As with the conventional strips market, if the DMO decides to proceed with index-linked strippability it would envisage building up the pool of index-linked strippable bonds to a significant size before permitting the bonds to be stripped.

27. It would also be important for the development of index-linked strips to ensure that coupon strips from different strippable bonds were fungible. Although the DMO would not envisage making any new index-linked bonds strippable from issue it is important that any new design permits coupon strip fungibility at a later date. The DMO would propose to use a method for coupon strip fungibility based largely on the

approach used by the US Treasury, but would consult the market separately on the precise details of how this would work. If the Canadian design is adopted, apart from ensuring that new bonds have aligned coupon dates, the only feature that the DMO would propose to incorporate into the instrument design now to allow for the possibility of strip fungibility at a later point would be to round the Index Ratio to a higher number of decimal places than in other markets (see Annex 1). This increased precision over the approach used in the US market would ensure that there would be no difference in the cash flows paid out between a bond held in stripped form and the same bond held in an unstripped form. The DMO would be interested in hearing views on whether it should introduce an index-linked strips facility even if the decision is made not to proceed with re-design.

28. Due to the seasonal pattern in the Central Government Net Cash Requirement (CGNCR) the Exchequer would have a preference for aligned coupon dates in January and July. However, views from market participants on the choice of coupon dates would be welcome.

Tax treatment

29. Implementation of the re-design features discussed above would have implications for the existing framework of taxation provisions as they apply to index-linked gilts. However, with the exceptions of a possible move to a new price index or the introduction of a deflation floor, it should be possible to implement the changes to accommodate a new design of index-linked gilt through secondary legislation.

30. In practical terms, the primary consequence of being able to rely on secondary legislation where necessary, is that the timing constraints associated with any necessary changes to the taxation regime are considerably less than would be the case where primary legislation is required. A change to the price index or the introduction of a deflation floor apart, the measures necessary to accommodate a re-design in line with the proposals here could be implemented within the timetable outlined in this consultation document. The timing associated with any measure that requires primary legislation is inevitably more uncertain.

31. In summary, the various features of re-design featured in this consultation document could be implemented through the following measures:

- *The introduction of a three-month indexation lag:* if this were felt desirable no secondary legislation would be required; a three-month lag could be implemented under the existing Accrued Income Scheme (AIS).

- *Index-linked strippability:* if there is market demand for strippability in response to this consultation exercise, this could be dealt with by an Order made under Section 202 of the Finance Act 1996. However, there would need to be further discussion with the Inland Revenue on the details of a regime for index-linked strippability before any such Order could be finalised ahead of implementation.

- *Introduction of a deflation floor:* if this were felt desirable, primary legislation would be required to amend Section 717 of the ICTA.

- *Replacement of the RPI with an alternative price index:* primary legislation would be required to amend Section 94 of the Finance Act 1994 should there be a move to HICP. Primary legislation would be required to amend Section 717 of the ICTA to accommodate a move to RPIX.

Basis of trading in the primary and secondary markets

32. Index-linked gilts are currently auctioned by the DMO on a nominal price basis (i.e. the price reflects the inflation accrual since the bond was first issued) and this is also the basis on which the majority of trades in the secondary market are executed. However, in most other index-linked bond markets, primary issuance tends to be on a real yield basis, whilst trading in the secondary market is either on a real yield or a real price basis. Since index-linked bonds are a real return asset it would seem attractive to move to a system where trades are carried out on a real rather than a nominal basis[16]. This would facilitate cross-market trading as it would be more

[16] The full value of the index-linked gilt would nevertheless be available for collateral purposes and the DMO would provide CRESTCo with the uplifted values each evening for repo trades.

straightforward for traders to value UK bonds against those in other markets. In line with the approach adopted in Canada, France and the US the DMO proposes that primary issuance of index-linked bonds on a new design would be on a real yield basis and that secondary market trading would be on a real price basis. The DMO would not propose to change the method of auction/trading should it be decided not to proceed with the introduction of bonds of a new design. However, the DMO would welcome views on whether the trading convention should be changed for current index-linked gilts if a decision is made to go ahead with re-design.

33. The DMO would not envisage adopting the US system whereby the coupons on new index-linked bonds are determined from the bids received at auction. As with conventional gilts, the coupons on new index-linked gilts would be set to give a price close to par at the time of the first auction. The issue of whether or not to continue with a uniform price format for index-linked auctions is outside the scope of this consultation paper.

Price/yield formulae

34. In order to be able to auction index-linked bonds on a real yield basis it would be necessary for the DMO to publish a formula for converting a real yield bid at auction into a settlement price. The DMO published formulae for calculating gilt prices from yields in June 1998, to allow a formal settlement convention to be applied to a trade conducted on a yield basis. However, as part of the move to a new instrument design the DMO believes that it is sensible to review the price/yield formulae for index-linked gilts. The price/yield formulae used in the markets that employ the Canadian instrument design are much simpler than that used in the UK because the lag in indexation is ignored, thereby removing the need to make an inflation assumption[17]. Although this approach would provide a less accurate measure of the "actual" real yield it would make the price/yield conversion simpler and more transparent and given the much shorter lag would make less difference than if it

[17] Using the current DMO formulae it is necessary to make an assumption about future inflation over the remaining life of a bond in order to compute its real yield. The current market convention is to assume a 3% inflation assumption.

were applied to bonds with an eight-month lag[18]. Annex 2 sets out the DMO's proposed price/yield formulae, should the decision be made to proceed with a new design based on that of the Canadian index-linked bonds. Both the price/yield formulae and the method for computing accrued interest retain the Actual/Actual daycount convention introduced by the DMO in November 1998. As part of the introduction of a new design of index-linked bond the DMO would update its paper "Formulae for Calculating Gilt Prices from Yields" (published in June 1998) accordingly.

Incorporation in the gilt indices

35. Although under the current FTSE Ground Rules any index-linked gilt of a new design would not ordinarily be included in the current gilt price and yield indices[19], FTSE and the DMO are liaising closely to ensure that it should be possible to include such bonds. However, this would not include bonds linked to a price index other than the RPI. If the decision was made to proceed with bonds tied to an alternative price index FTSE would need to consider establishing a new gilt index for such bonds. In order to include Canadian style bonds in the gilt indices it would be necessary to ensure that they were treated on a consistent basis to the current bonds. For the gilt price indices this would entail using the inflation-adjusted prices of the new design bonds, whilst for the gilt yield indices it would be necessary for FTSE to continue to make assumptions about expected future inflation when computing the bonds' real yields[20]. However, this would not in any way affect the ability of the market to trade the bonds on the basis described earlier.

[18] For example, suppose that a hypothetical 10 year index-linked bond was issued on 1 June 2001, with a real coupon of 2.5% and at a nominal clean price of £100 per £100 nominal of stock. If the bond had a three-month lag the yield computed using a formula incorporating an inflation assumption of 3% would have been 2.53%, whilst the yield based on the less precise formula that ignores the lag would have been 2.50% (a 3 basis point difference). In contrast if the bond had an eight-month lag the yield computed using a 3% inflation assumption would have been 2.43%, compared with the yield of 2.50% based on the less precise formula (a 7 basis point difference).

[19] Section 5.1.4 of the FTSE Ground Rules states "If any index-linked stocks were to be issued with conditions which were significantly different from those of the existing index-linked stocks (e.g. linked to an Earnings Index or to a Limited Price Indexation index), they would be excluded from the indices". The Ground Rules are available on FTSE's web site: www.ftse.com.

[20] FTSE currently publish yield indices based on four different inflation assumptions - 0%, 3%, 5% and 10%.

3) Launch of a new design of index-linked gilt

36. Initially, the DMO would propose to issue new design index-linked gilts by outright auction alone, with any new bonds first being issued at longer maturities than current index-linked gilts in order to minimise competition between bonds of different design. Once the market in bonds of the new design is established the DMO would consider whether to introduce a programme of conversions or switches out of current index-linked gilts into those based on a new design. Although the DMO would hold a separate consultation exercise at the appropriate time on precisely how any such programme would operate, views now on the usefulness of such a programme would be appreciated.

4) Timetable for the introduction of a new index-linked gilt design

37. Responses to this consultation document should be sent to the DMO by 31 October 2001. The DMO will aim to publish a response to the comments received, along with the decision on whether or not to proceed with re-design, by the end of December. If the decision is taken to go ahead with re-design the DMO would not envisage launching a new bond before the third quarter of 2002 in order to allow the market sufficient time to prepare for the event. The decision on whether to issue a new index-linked gilt in July to September 2002 would then be discussed in June 2002 at the DMO's regular quarterly consultation meetings with the Gilt-edged Market Makers (GEMMs) and representatives of end-investors.

5) Questions for market participants

38. The DMO welcomes views on any of the issues raised in this paper. Particular issues that the DMO would appreciate comments on are:

Q1: Should the DMO introduce a new design for <u>new</u> issues of index-linked gilts?

Q2: Should a new design of index-linked gilt retain the linkage to the RPI or would you favour indexation to either RPIX or HICP instead? If you would prefer indexation to either RPIX or HICP please give your reasons.

Q3: Should the design of a new index-linked gilt be based on the Canadian design or is there another instrument structure that you would prefer?

Q4: Would you see any merits in incorporating a deflation floor into the design of a new index-linked gilt? If so, what would your valuation of fair value to the issuer of the deflation floor be at current levels of RPI volatility?

Q5: Do you think that it would be useful to introduce a strips facility for new index-linked gilts? If the decision is made not to proceed with a re-design, should a strips facility be introduced for index-linked gilts of the current design?

Q6: Do you have any preferences for what the coupon dates should be for a new index-linked gilt? If you have identified some preferred coupon dates please indicate why you have a preference for these dates.

Q7: Should any new issues of index-linked gilts be auctioned on a real yield basis or should the current system of auctioning on a nominal price basis be used?

Q8: Should secondary market trading of new issues of index-linked gilts be on a real price basis or should the current system of trading on a nominal price basis be used?

Q9: If a new design of index-linked bond is introduced should the auction/trading convention for current index-linked gilts be changed to a real basis?

Q10: Do you have any comments on the indexation and price/yield equations that the DMO proposes employing (Annexes 1 and 2) should the decision be made to move to a Canadian type instrument design?

Q11: Once the market in the new design bonds is established, should the DMO consider converting or switching current index-linked bonds into those based on the new design? (Should it be decided to proceed with such a programme a separate consultation exercise would be held at the appropriate time).

Annex 1: Proposed new method of indexation

Indexing process

An index ratio is applied to calculate the coupon payments, the redemption payment (i.e. the uplifted principal) and the accrued interest. The Index Ratio for a given settlement date is defined as the ratio of the reference RPI applicable to the settlement date ("$\text{Ref RPI}_{\text{Set Date}}$") divided by the reference RPI applicable to the original issue date of the gilt ("$\text{Ref RPI}_{\text{First Issue Date}}$"), rounded to the nearest 12th decimal place:

$$\text{Index Ratio}_{\text{Set Date}} = \left[\frac{\text{Ref RPI}_{\text{Set Date}}}{\text{Ref RPI}_{\text{First Issue Date}}}\right], \text{ rounded to the nearest } 12^{\text{th}} \text{ decimal place.}$$

The reference RPI for the first day of any calendar month is the RPI for the calendar month falling three months earlier. For example, the reference RPI for 1 June corresponds to the RPI for March, the reference RPI for 1 July corresponds to the RPI for April etc. The reference RPI for any other day in the month is calculated by linear interpolation between the reference RPI applicable to the first day of the month in which the day falls and the reference RPI applicable to the first day of the month immediately following. Interpolated values for $\text{Ref RPI}_{\text{Set Date}}$ should be rounded to the nearest 12th decimal place, as should values for $\text{Index Ratio}_{\text{Set Date}}$.

The formula used to calculate $\text{Ref RPI}_{\text{Set Date}}$ can be expressed as follows:

$$\text{Ref RPI}_{\text{Set Date}} = \text{Ref RPI}_{\text{M}} + \left(\frac{\text{t}-1}{\text{D}}\right)\left[\text{Ref RPI}_{\text{M+1}} - \text{Ref RPI}_{\text{M}}\right]$$

Where:

D = The number of days in the calendar month in which the settlement date falls.

t = The calendar day corresponding to the settlement date.

$\text{Ref RPI}_{\text{M}}$ = Reference RPI for the first day of the calendar month in which the settlement date falls.

Ref RPI_{M+1} = Reference RPI for the first day of the calendar month immediately following the settlement date.

For example, the reference RPI for 20 July 2001 is calculated as follows:

$$\text{Ref RPI}_{20\text{ July }2001} = \text{Ref RPI}_{1\text{July }2001} + \left(\frac{19}{31}\right)\left[\text{Ref RPI}_{1\text{August }2001} - \text{Ref RPI}_{1\text{July }2001}\right]$$

$$= \text{RPI}_{\text{April }2001} + \left(\frac{19}{31}\right)\left[\text{RPI}_{\text{May }2001} - \text{RPI}_{\text{April }2001}\right]$$

$$= 173.1 + \left(\frac{19}{31}\right)\left[174.2 - 173.1\right] = 173.774193548387,$$ when rounded to the nearest 12th decimal place.

The $\text{Ref RPI}_{\text{First Issue Date}}$ for a given bond remains constant over its life. However, different index-linked bonds may have different values for $\text{Ref RPI}_{\text{First Issue Date}}$.

Calculation of coupon and redemption payments

For an index-linked gilt the semi-annual coupon payments per £100 nominal of stock are calculated as the product of the real coupon per £100 nominal of stock and the relevant value of the Index Ratio:

$$\text{Coupon Payment}_{\text{Div Date}} = \frac{c}{2} \times \text{Index Ratio}_{\text{Div Date}}$$

Where: c = (Real) coupon per £100 nominal.

Coupon payments will be rounded to the nearest 6th decimal place per £100 nominal of stock.

Similarly, the redemption payment per £100 nominal of stock is calculated as follows:

$$\text{Redemption Payment} = 100 \times \text{Index Ratio}_{\text{Redemption Date}}$$

Redemption payments will be rounded to the nearest 6th decimal place per £100 nominal of stock.

Annex 2: Formulae for calculating prices from yields

Terminology

For price/yield calculations compounding will occur on quasi-coupon dates. Quasi-coupon dates are the dates on the semi-annual cycle defined by the maturity date, irrespective of whether cash flows occur on those dates (examples of quasi-coupon dates on which cash flows would not occur include the first quasi-coupon date of a new issue having a long first dividend period; the next quasi-coupon date of a gilt settling in its ex-dividend period; and most quasi-coupon dates of a strip). A full (quasi-) coupon period is defined as the period between two consecutive quasi-coupon dates. For example, a gilt settling on its issue date (assuming this is not also a quasi-coupon date) will have a quasi-coupon period which starts on the quasi-coupon date prior to the issue date and ends on the first quasi-coupon date following the issue date. Cash flows and quasi-coupon dates which are due to occur on non-business days are not adjusted for price/yield calculations.

Calculation of the settlement price

The proposed DMO price/yield formula is given by:

Inflation-Adjusted Dirty Price per £100 nominal = Inflation-Adjusted Clean Price per £100 nominal
+ Inflation-Adjusted Accrued Interest per £100 nominal

The components of this equation are defined as follows:

$$\text{Inflation-Adjusted Accrued Interest} = RAI \times \text{Index Ratio}_{\text{Set Date}}$$

$$\text{Inflation-Adjusted Clean Price} = \text{Real Clean Price} \times \text{Index Ratio}_{\text{Set Date}}$$

For trades settling after the <u>first ever</u> ex-dividend date:

$$\text{Real Clean Price} = w^{\frac{r}{s}}\left[\frac{c\left(1-w^{n+1}\right)}{2\left(1-w\right)} + 100w^{n}\right] - RAI, \quad n \geq 0$$

For trades settling on or before the first ever ex-dividend date:

$$\text{Real Clean Price} = w^{\frac{r}{s}}\left[d_1 + d_2 w + \frac{cw^2\left(1-w^{n-1}\right)}{2\left(1-w\right)} + 100w^n\right] - RAI, \quad n \geq 1$$

Where:

c = (Real) coupon per £100 nominal.

r = Number of calendar days from the settlement date to the next quasi-coupon date.

r_1 = Number of calendar days from the issue date to the first quasi-coupon date.

s = Number of calendar days in the full quasi-coupon period in which the settlement date occurs (i.e. between the prior quasi-coupon date and the following quasi-coupon date).

s_1 = Number of calendar days in the full quasi-coupon period in which the issue date occurs.

n = Number of full quasi-coupon periods between the next quasi-coupon date and the redemption date.

ρ = Semi-annually compounded real redemption yield (decimal) i.e. if the real yield is 3% then ρ = 0.03.

$w = \frac{1}{1+\frac{\rho}{2}}$

RAI = Unadjusted (or real) accrued interest per £100 nominal (see section below).

The terms d_1 and d_2 represent the real dividend payments. These are left unrounded since they are not the cash flows actually paid to holders of the bonds. Holders will receive the real dividends multiplied by the relevant Index Ratio and then rounded.

(1) In the case of settlement in a long first dividend period:

(a) If the settlement date is in the first quasi-coupon period:

$d_1 = 0$

$d_2 = \left(1+\frac{r_1}{s_1}\right)\times\frac{c}{2}$

(b) If the settlement date is in the second quasi-coupon period:

$d_1 = \left(1+\frac{r_1}{s_1}\right)\times\frac{c}{2}$

$d_2 = \frac{c}{2}$

(2) In the case of settlement in a short first dividend period:

$$d_1 = \frac{r_1}{s_1} \times \frac{c}{2}$$

$$d_2 = \frac{c}{2}$$

(3) In the case of settlement in a standard first dividend period:

$$d_1 = d_2 = \frac{c}{2}$$

Calculation of the real accrued interest

(1) Standard dividend periods

$$RAI = \begin{cases} \frac{t}{s} \times \frac{c}{2} & \text{if the settlement date occurs on or before the ex - dividend date} \\ \left(\frac{t}{s} - 1\right) \times \frac{c}{2} & \text{if the settlement date occurs after the ex - dividend date} \end{cases}$$

Where all the terms are as above, and:

t = Number of calendar days from the previous quasi-coupon date to the settlement date.

Note: $s = s_1$ for trades settling in the first quasi-coupon period.

(2) Short first dividend periods

$$RAI = \begin{cases} \frac{t^*}{s_1} \times \frac{c}{2} & \text{if the settlement date occurs on or before the ex - dividend date} \\ \left(\frac{t^* - r}{s_1}\right) \times \frac{c}{2} & \text{if the settlement date occurs after the ex - dividend date} \end{cases}$$

Where all terms are as above, and:

t^* = Number of calendar days from the issue date to the settlement date.

(3) Long first dividend periods

$$RAI = \begin{cases} \dfrac{t^{**}}{s_1} \times \dfrac{c}{2} & \text{if the settlement date occurs during the first quasi - coupon period} \\ \left(\dfrac{r_1}{s_1} + \dfrac{r_2}{s_2} \right) \times \dfrac{c}{2} & \text{if the settlement date occurs during the second quasi - coupon period on or before the ex - dividend date} \\ \left(\dfrac{r_2}{s_2} - 1 \right) \times \dfrac{c}{2} & \text{if the settlement date occurs during the second quasi - coupon period after the ex - dividend date} \end{cases}$$

Where all terms are as above, and:

t^{**} = Number of calendar days from the issue date to the settlement date in the first quasi-coupon period (this term only applies if the gilt settles in the first quasi-coupon period).

r_2 = Number of calendar days from the quasi-coupon date after the issue date to the settlement date in the quasi-coupon period in which the issue date occurs (this term only applies if the gilt settles in the second quasi-coupon period).

s_2 = Number of calendar days in the full quasi-coupon period after the quasi-coupon period in which the issue date occurs.