# Yield curves for gilt-edged stocks: further investigation

*A research article prepared in the Bank's Economic Section, largely by J. P. Burman*

## Introduction

An article in the December 1972 *Bulletin*[1] introduced a new method of fitting time yield curves to the yields on gilt-edged stocks. A feature of the new system is that for the first time it makes specific allowance for the effect of coupon on yield. Low-coupon stocks in general command a lower gross redemption yield, because they offer a larger tax-free capital gain to most investors. The calculated curve indicates the nominal rate of interest appropriate for a stock of any given maturity priced at 100. This is called a 'par' yield curve. Since December, some evidence has accumulated that the method employed is not a satisfactory representation of the relation between coupons and yields of stocks with nearly equal maturity.

As explained below, the present model implies a linear relation between coupon and price at the same maturity; so that, if, for example, it predicts that a 5% stock should stand at 80 and an 8% stock at 90, then a 9½% stock should be at 95. This is what would be expected in a market where gross investors choose between the whole range of coupons on the basis of gross redemption yields, and net investors do the same on the basis of net redemption yields.[2]

But the price differences associated with a difference of (say) 1% in the coupon among high-coupon stocks are often greater than those among low-coupon stocks. This means that differences in gross redemption yields are proportionately less among high-coupon stocks than among low-coupon stocks; which in turn suggests some segmentation within the market for stocks with widely different coupons. It is probable that many net investors consider investment only in low or medium-coupon stocks and so have a much smaller influence on prices of high-coupon stocks. The converse could be true of many gross investors.

An illustration of this is provided by the behaviour of the following three stocks: 3½% Treasury Stock 1977/80, 5¼% Funding Loan 1978/80 and 8½% Treasury Loan 1980/82. Because the third stock matures a year and a half after the others,

| | (1) Low-coupon stock | (2) Difference | (3) Medium-coupon stock | (4) Difference | (5) High-coupon stock (a) | (6) Ratio (4)/(2) |
|---|---|---|---|---|---|---|
| Coupon | 3½% | 1¾% | 5¼% | 3¼% | 8½% | 1·86 |
| Price (b) at | | | | | | |
| 1972 Apr. 4 | 83·42 | 7·58 | 91·00 | 14·34 | 105·34 | 1·89 |
| July 3 | 75·56 | 7·90 | 83·46 | 16·37 | 99·83 | 2·07 |
| Oct. 2 | 75·44 | 7·46 | 82·90 | 16·80 | 99·70 | 2·25 |
| 1973 Jan. 1 | 74·56 | 7·40 | 81·96 | 15·83 | 97·79 | 2·14 |
| Apr. 2 | 73·70 | 6·47 | 80·17 | 15·10 | 95·27 | 2·33 |

(a) Price adjusted to redemption in 1980, except at 4 April 1972 when it is assumed already to reflect redemption at its earlier date.

(b) Net of accrued interest.

1 J. P. Burman and W. R. White "Yield curves for gilt-edged stocks", Bank of England *Quarterly Bulletin*, December 1972, pages 467–86.

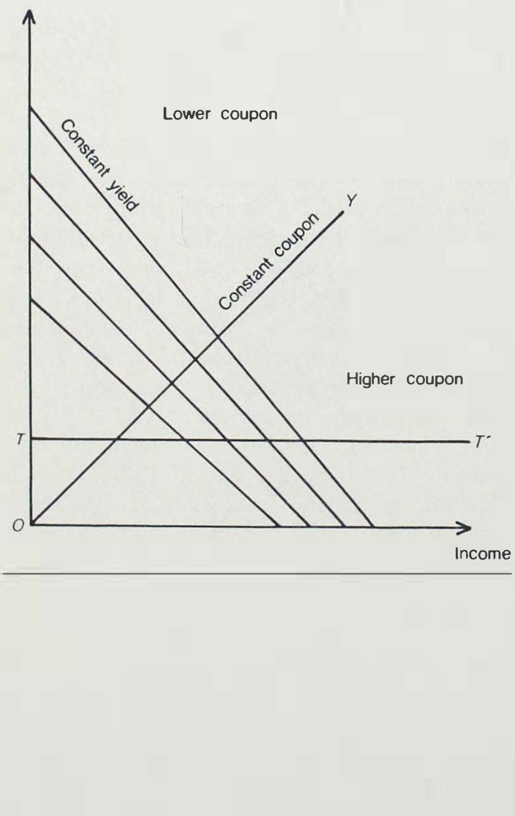
2 Gross investors in gilt-edged stocks are those who pay no tax on either interest receipts or capital gains, or who pay tax on both. Net investors are those whose interest is taxed but whose capital gains (on stocks held for over a year) are exempt.

its yield has been adjusted to allow roughly for the slope of the yield curve, and the corresponding price for the shorter maturity has been estimated. In the table it is then possible to compare, at five recent dates, the prices of a low, a medium, and a high-coupon stock of the same maturity [columns (1), (3) and (5)] and their differences [columns (2) and (4)]. The ratio of the coupon differences is 1·86 and the ratios of the price differences shown in the last column can be compared with it. Thus at 4th April 1972 the relation between coupon and price was nearly linear, but after this it became increasingly curved.

This article develops, with the aid of diagrams, a more general relation between the par curve and yields on stocks with differing coupons. The mathematical exposition is available on application to the Economic Intelligence Department at the address given on the reverse of the contents page.

**Chart A**

Capital-income diagram




**The capital-income diagram**

In a recent article Clarkson[1] suggested a very helpful way of examining the differences between stocks with differing coupons at the same maturity. Suppose a stock has a coupon $r$ and price $P$ per £100 nominal. The flat yield or income on an investment of £1 cash is £$r/P$, and the nominal stock bought and the capital sum at redemption are both £$100/P$. Stocks with different coupons and prices at the same maturity may be represented by points on a diagram of capital sum and income, as shown in Chart A. The capital gain or loss is $(100/P)-1$, represented by the distance above or below $TT'$, the line where the price is at par. A given coupon corresponds to a line through the origin, such as $OY$; the higher the coupon, the less the slope.

The definition of redemption yield for $n$ years is that it is the rate of discount which makes the following equation true:

Price = coupon x present value of annuity of £1 for $n$ years
+ present value of £100 at redemption

where price and coupon are as defined above and present values are calculated with the redemption yield as the discount rate. This means that, for a constant yield, price is a linear function of coupon, and hence (dividing through by price) income is linearly related to the capital sum at redemption. Consequently, points representing stocks with the same redemption yield lie on a straight line in the diagram. The lines corresponding to different yields are not parallel, but those towards the right, that is for higher yields, are steeper.

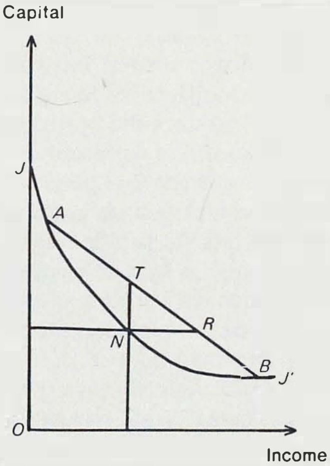
Clarkson points out that stocks with different coupons and the same maturity will form a curve in the capital-income diagram — the coupon indifference line. Because a higher income must be paid for by a smaller capital gain, and vice versa, the indifference line falls from left to right, as in Chart B. Moreover, Clarkson says, in considering possible shapes for any piece of the indifference line, it can be shown that in a rational market one of these cannot exist for any length of time. Thus in Chart B (i) the indifference line $JJ'$ is convex towards the origin. But if an investor holds a stock with coupon and price corresponding to the point $N$, and he replaces this with a mixture of two stocks, $A$ with a lower coupon and $B$ with a higher coupon, the new investment corresponds to a point on $AB$. If $NT$ and $NR$ are drawn

1 **R. S. Clarkson** "Discussion on Mr Pepper's paper [G. T. Pepper and G. R. Silkin: Mathematical applications in the gilt-edged market]", *Mathematics in the Stock Exchange*, pages 74–8 (The Institute of Mathematics and its Applications, October 1972).

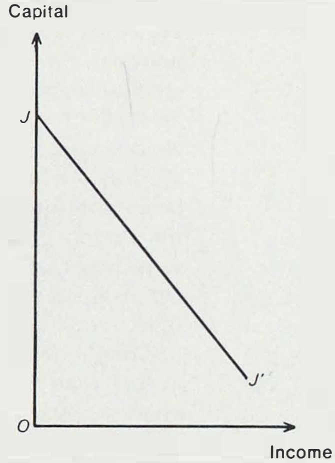
**Chart B**

Coupon indifference lines

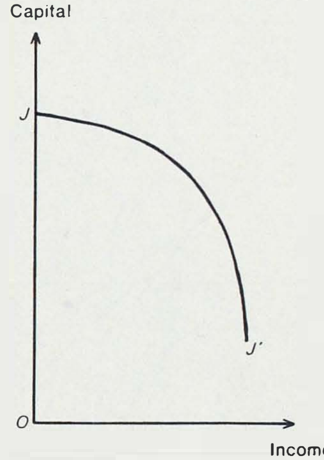
(i)




(ii)




(iii)




vertically and horizontally, any mixture between $T$ and $R$ improves both income and capital gain. This shape of indifference curve should quickly disappear in an active market through switching out of the stock at $N$ until the indifference line becomes straight or concave towards the origin everywhere. It might appear that the switching argument could also be applied to the concave curve, Chart B (iii); but this would entail the investor initially holding two stocks at the same – or nearly the same – maturity, which is not likely to occur very often.

As explained below, the present model for the yield curve assumes a straight indifference line, as in Chart B (ii), but this assumption may not give a good fit, if investors, because of their tax status, have a 'preferred coupon habitat'.

**Existing assumptions**

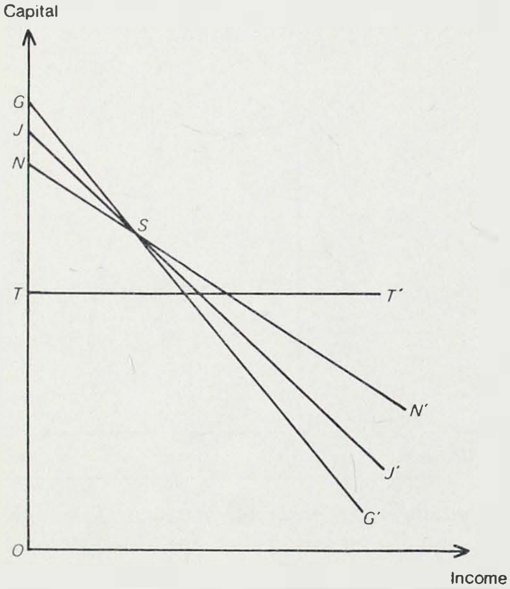
To recapitulate, the model presented last December assumes that for a market in which there is perfect arbitrage all stocks will have the same holding period, will give the same expected return over the holding period up to the horizon, and will have the same expected yield at the horizon.[1] More specifically, in a market consisting of gross investors alone, it assumes that all stocks will have the same gross yield at the horizon and the same gross expected return; and in a market of net investors alone (paying income tax at the same rate), all stocks will have the same net yield at the horizon and the same net expected return. To achieve a satisfactory fit, it was found necessary also to assume the existence of two (overlapping) segments in the market, with horizons of one year and four years and with expectations that need not be the same.

Just as the current relation between coupons and prices can be described on a capital-income (C–I) diagram, so can the relation between coupons and expected prices at the horizon be described on another C–I diagram. Thus, for a market of gross investors, stocks of different coupon should have the same gross yield at the horizon. On this assumption, if the relation between price and coupon quoted above is applied to prices at the horizon, the

[1] Ignoring risk, which is discussed in the earlier article.

**Chart C**

Gross and net indifference lines




present values will be the same. Hence there is a linear relation between price and coupon, that is, the indifference line at the horizon is straight. Similarly the current price, which depends on the common expected return on stocks of different coupon up to the horizon, is the sum of two parts representing income (proportional to coupon) and capital realised on sale (price at the horizon). Thus the current price is related in linear fashion to coupon, as represented by the indifference line $GG'$ in Chart C. Similarly, for a market of net investors the horizon C—I diagram would have a straight indifference line corresponding to the net yield at the horizon; and in the current C—I diagram there would be another linear relation between price and coupon — in Chart C the straight line $NN'$, which is less steep than $GG'$. It may seem surprising that $GG'$ and $NN'$ cross: in fact, this simply means that net investors would offer less than gross investors for high-coupon stocks at or above par, because of the expected capital loss.

When interest rates are expected to rise, $GG'$ slopes more steeply than the lines of constant yield that it crosses (shown in Chart A); and in the converse case $GG'$ slopes less steeply. This is a graphical description of the point made in the previous article,[1] namely that, were there no taxation, high-coupon stocks would yield less than low-coupon ones when interest rates were expected to rise; and vice versa when interest rates were expected to fall.

Last time[2] the assumption was made that the behaviour of the actual market could be represented by a weighted average of the behaviour of gross investors and net investors (having the same expectations). It was also assumed[3] that gross and net investors take account of each other's presence in producing yield differences at the horizon between stocks with different coupons. This shifts $GG'$ and $NN'$ in the current C—I diagram towards each other. The final effect is an indifference line for a mixed market which is a weighted average of $GG'$ and $NN'$ ($JJ'$ in Chart C) passing through $S$ (the intersection of $GG'$ and $NN'$). The horizontal line $TT'$ represents the par yield curve at the relevant maturity and may be above or below $S$.

**Generalisation**

The next stage is to modify the existing assumptions by allowing the relative influences of net and gross investors on prices to vary with coupon, as suggested in the introduction above. Suppose that net investors' preference for capital gain and gross investors' indifference between interest receipts and capital gain[4] cause the former to have a greater weight in the determination of the price of low-coupon stocks; and conversely that gross investors have a greater weight in the determination of the price of high-coupon stocks. This implies partial segmentation in the model between high and low-coupon stocks, similar to the segmentation previously found between the short-dated and long-dated markets.

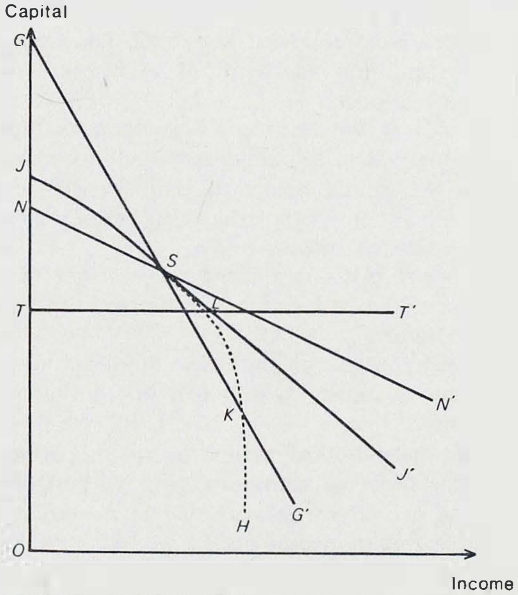
The simplest version of this assumption — that the relative influence of net investors declines linearly as the coupon increases — leads to a second degree indifference curve like $JKH$ in Chart D (i). If the net investors' line $NN'$ is defined to refer to the basic rate of income tax (currently 30%), it is possible for the indiffer-

*1* Page 474, first paragraph.
*2* Page 473, last paragraph.
*3* Page 474, second paragraph.
*4* In fact some gross investors seem to have a preference for interest receipts.

**Chart D**

Curved indifference lines

(i) Rising yield curve




(ii) Falling yield curve

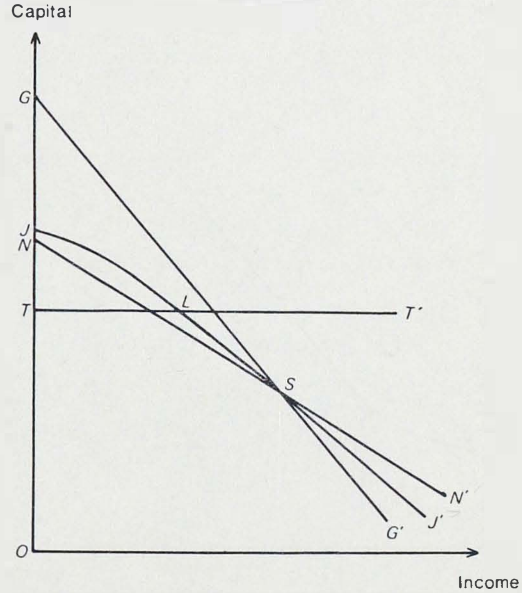
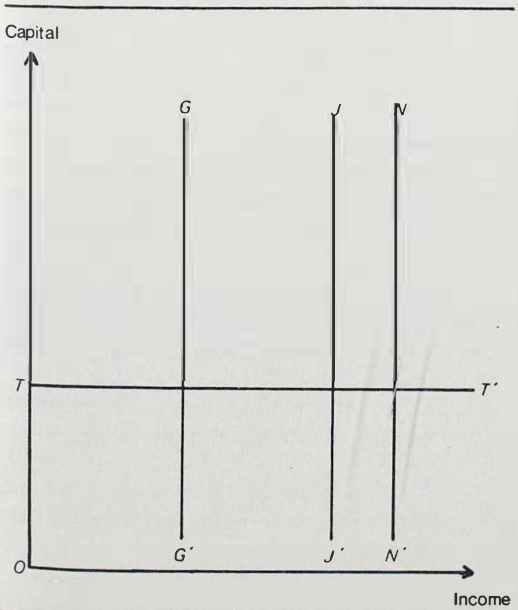



**Chart E**

Indifference line (undated stocks)




ence curve to enter the area below $NS$ or above $SN'$, because of the influence of those paying tax at higher rates. But even if net investors have no influence at all, it is not possible for the indifference curve to lie above $GS$ or below $SG'$; so the portion $KH$ must be deleted. A simple way of doing this, which avoids any convexity in the indifference curve, is to assume that below $S$ it becomes a straight line $SJ'$, the tangent at $S$ to the curve $JS$. Thus an indifference curve is obtained which is shaped something like a walking stick, $JSJ'$. The indifference line at the horizon is assumed to have the same 'walking stick' shape.

The point $S$ is above $TT'$, as in Chart D (i), when the par yield curve is rising (sloping upward). When the par yield curve is falling, the point $S$ is below $TT'$, as in Chart D (ii). As time to maturity increases, $S$ moves away from $TT'$ until it is an infinite distance away for the undated stocks. But it turns out that the model as now formulated generates convex instead of concave indifference lines when $S$ drops below the income axis. As noted earlier, convex lines are unrealistic. It has therefore been assumed instead that the indifference lines are straight in this case.

Furthermore, when the undated stocks are reached, for the case in Chart D (i) the lines $GG'$ and $NN'$ become vertical and the indifference line becomes another vertical straight line $JJ'$ lying between them (see Chart E). This is consistent with the view that the coupon of an undated stock has no effect on its price. The same should therefore be true for the case in Chart D (ii). To satisfy this condition, and to produce the straight indifference lines when $S$ is below the income axis, it was found necessary to assume that the indifference line $JLSJ'$ is in this case straight below $L$, rather than below $S$.

The foregoing discussion on the indifference line can now be translated into the more familiar relation between price and coupon (Chart F). The curved part of the indifference line [$JS$ in

**Chart F**

Price/coupon diagram

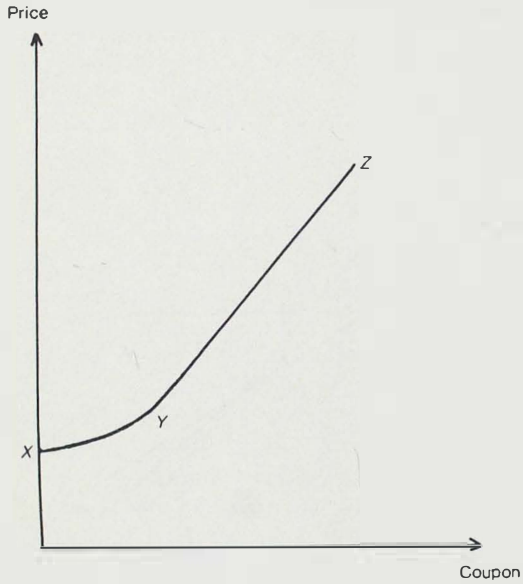



Chart D (i), $JL$ in Chart D (ii)] corresponds to the curve $XY$; and the straight part ($SJ'$ or $LJ'$) corresponds to $YZ$. Thus the curve $XY$ refers to stocks with low and medium coupons, and $Y$ is on or below the par curve.

The modified model now comprises the following assumptions:

(i) There is an expected horizontal par yield curve at the horizon, the resultant of gross and net investors' expectations.

(ii) Yields at the horizon of stocks with higher or lower coupons than this are determined by an indifference line on the capital-income diagram for each maturity. This line is either wholly straight, or partly straight and partly concave towards the origin.

(iii) Current prices are weighted averages of hypothetical prices determined for gross and for net investors separately.

(iv) The hypothetical prices for the gross investor give the same expected gross return up to the horizon on all stocks.

(v) The hypothetical prices for the net investor give the same expected net return up to the horizon on all stocks (the net return being related to the gross return by the basic rate of income tax).

(vi) The weights in (iii) depend upon the coupon of each stock and upon an indifference curve — the same one as assumed in (ii).

The improbability of a convex indifference line occurring rests on the profit offered through a switch of investments. But this profit is only certain if the stocks into which the switch is made are held to maturity. However, the model described above assumes that investors' attitudes to switches are governed by the expectation of profit or loss at a relatively near horizon. If the anomaly of a convex indifference line is expected to disappear before the horizon, then it will be removed by arbitrage now. But if the anomaly is created, and market opinion believes that it will persist, there is still an opportunity for profitable arbitrage with a short horizon.

An example should make this clear. Suppose there are three stocks maturing in ten years with coupons of 3%, 6% and 9%; and that their prices are 70, 86 and 98. The ratio of the price differences is 0·75, the ratio of coupon differences is 1, and 0·75/1 = 0·75 is therefore a measure of the anomaly (anomalies as large as this have recently occurred). The three redemption yields are 7·27%, 8·07% and 9·31%. Suppose also that the yields of the 3% and 9% stocks are expected to remain the same while their lives shorten, whereas the price of the 6% stock moves in such a way as to keep the anomaly constant. Then a holder of the 6% stock who switches into that mixture of the other two which produces the same total amount of interest could make a capital gain after one year of 1·46%, compared with 1·16% if he did not.

Anomalies of this type thus appear to be essentially unstable, because they must either continually increase or disappear.

### Curve fitting

In order to test the hypothesis that the coupon indifference lines are curved, it has to be assumed that these curves are in some sense similar at different maturities. As has been seen, the curves can be defined in terms of the relative weights of gross and net investors in determining prices. And, because these weights have been assumed to change linearly with coupon up to a certain point, it is only necessary to specify them for two distinct coupons. The weights and hence the indifference curve will then be given for all coupons. The natural points to choose for these two are the extreme cases: a zero-coupon stock (providing capital gain but no interest income) and a stock lying on the par curve (giving interest income but no capital gain). These are the points $J$ and $L$ in Charts D (i) and (ii).

In the previous version of the model, the influence of net investors in the short and long-dated segments of the market was defined by two parameters (the effective tax rates). Now three or possibly four parameters are necessary to define the indifference curves in the two segments of the market. In practice the number and variety of stocks is insufficient to determine so many parameters. The simplifying assumption has been made that the influence of net investors in determining the prices of stocks on the par curve is the same in both segments.

Test runs with the revised model, using quarterly data for 1971 and 1972, gave rather disappointing results. For most dates there was only a slight reduction in the average size of the differences between actual and calculated yields on individual stocks, and not enough to justify introducing the extra parameter resulting from the new model (see appendix). Indeed, for 30th June 1972, the best fit is obtained with the completely straight indifference lines of the unmodified model. This finding contrasts with Clarkson's, using some 1972 data, but his formulation of the yield curve differs substantially from that described in the December 1972 *Bulletin.*

On the other hand, weekly data from 3rd January to 30th May 1973 support the hypothesis that the indifference lines were becoming increasingly curved (especially after the Budget). In fact, later in the period the influence of net investors on the prices of stocks standing close to par was not significantly different from zero. In other words, for any stocks with prices close to par, their yields were almost independent of their coupons.

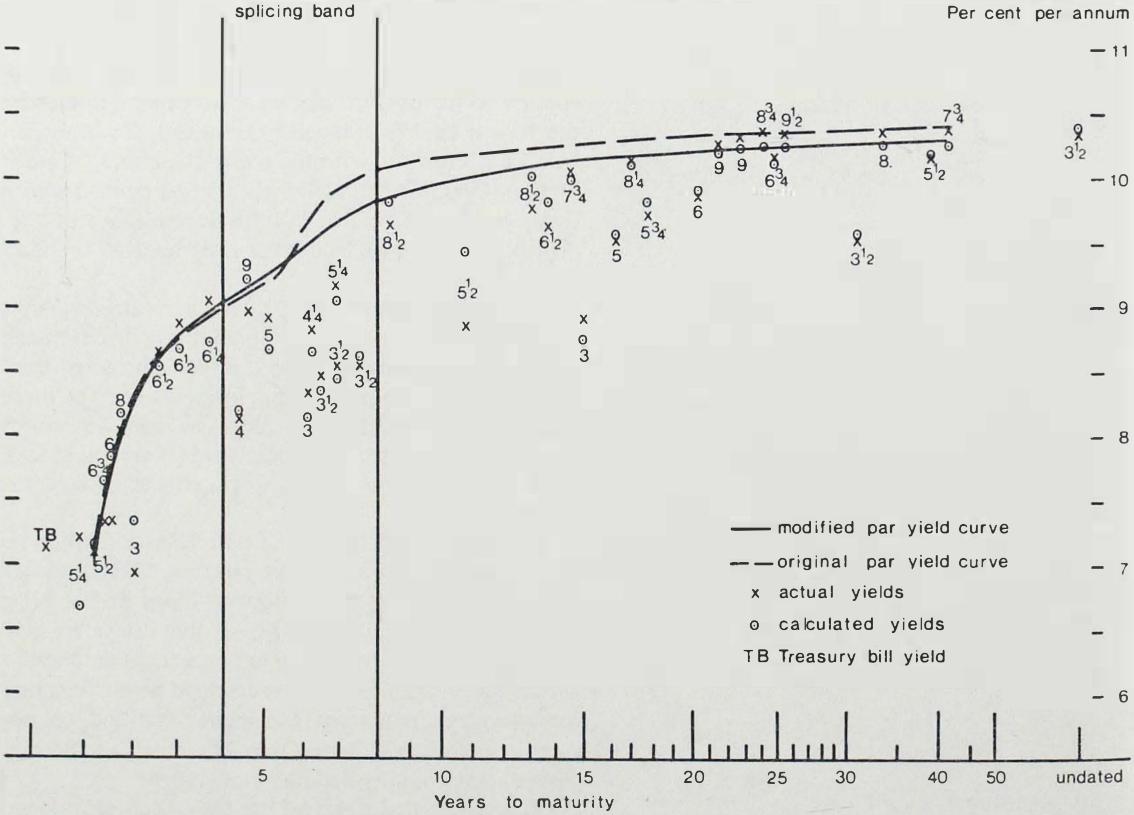
The apparent emergence of a curvilinear relation between price and coupon in 1973 is rather puzzling. A very tentative explanation may be along the following lines. Prices fell considerably during 1972 and early 1973, so that there are now no stocks standing above or even close to par, except among those maturing within five years. The model described here offers no opportunity for curvilinear relations between price and coupon of stocks standing above or close to par. Therefore, as the market fell, the curvilinearity could become more evident.

On a number of dates which have been examined for the past two and a half years, the modified par curves are of very similar shape to those introduced in December, though usually showing slightly lower yields all the way along. For example, the yields on the new curve at five and ten years were each only 0·09% lower on 29th December 1972, though by 11th April these differences had grown to 0·21% and 0·17%. The contrast between the results for 1973 to date and those for the previous two years is confirmed by the comparison of prices for the three stocks given in the table in the introduction. Another triplet of stocks exists at eleven—thirteen years which exhibits strong curvilinearity in the price-coupon relation, even in 1972, and this curvilinearity has steadily increased. However, there are triplets at other maturities which show no departure from linearity up to now. This diversity of behaviour shows that the assumption of similar indifference curves for all maturities is an oversimplification. And it explains both why the improvement actually achieved in goodness of fit of the model is small, and why the estimates of the parameters which define the indifference curves are imprecise.

It was decided that a switch to the use of the modified curve could only be justified for 1973, so the series has not been revised back before the beginning of this year. Two further amendments to the method of estimation have been made, and these are described below. The original and revised par curves at 29th June 1973 are shown in Chart G, together with the actual and predicted yields on the individual stocks used in the fitting of the curve.

**Chart G**

British government stocks: curves of gross redemption yields at 29.6.73




### Minor changes

As already mentioned, the three parameters which define the effect of coupon on price, that is, which define the indifference lines, are not precisely determined and are therefore somewhat variable from week to week. All the parameters are re-estimated each week, but the yield curve is now estimated a second time, fixing the three ill-determined parameters as weighted averages[1] of their present and several previous weeks' values.

1 Exponential weights with a common ratio of 0·8.

In December, mention was made of the uncertain shape of the par curve below about two years as a result of the omission of stocks maturing in less than one year, about which the model made no predictions. Such a curve varies a good deal from week to week at the short end, if either the life of the first stock included is considerably beyond one year, or a stock drops out as its life reaches one year. As a partial remedy for this, it is now assumed that the longest stock below one year is held to maturity and the proceeds reinvested in Treasury bills at the current rate for the remainder of the year. If the expected return on this investment over the whole year is equal to that on the stocks with a life of more than a year, a price can be predicted for it. The stock in question is given a proportionately smaller weight in the fitting process than the stocks beyond one year, the weight diminishing to zero when the next longer stock reaches one year. As a result of this alteration, the short end of the par curve has become much more stable.

**Conclusion**

Recent evidence suggests that the relation between coupon and price of government stocks of the same maturity is not linear, as previously assumed. A modified par yield curve has been constructed, allowing for a partly curvilinear relationship — the price rising at an accelerating pace from low to medium coupons and only increasing in linear fashion as it approaches or exceeds par. This provides a more satisfactory fit in 1973, but for the two previous years the difference between the two versions is so small as to make revision unnecessary. Should the curvilinear relationship disappear again, the modified par curve would be indistinguishable from the one produced by the previous method (because the linear relation is a special case of the curvilinear one). The modified curves imply somewhat lower yields, though their shapes are similar to the earlier ones.

## Appendix

Various numerical results are given below. Throughout, the risk premium referred to in the December *Bulletin* has been taken as 1%.

Table A compares the goodness of fit of the original and the modified models. The sum of squares of the 'errors' — the differences between actual and calculated yields of stocks used in fitting the par curve — must be smaller when more parameters are used. Both $\bar{R}^2$ and the root mean square errors take account of the number of degrees of freedom (the number of observations minus the number of parameters), and the results in 1971 and 1972 show that the introduction of the extra parameter was not justified statistically. The figures set out in Table A for the 'original' method are in fact slightly different, for 1971 and 1972, from those given in the December 1972 *Bulletin*. This is because the curves have been refitted to take account, as described above, of a stock with a life of less than one year.

**Table A**

**Goodness of fit**

| | Original method | | Modified method | |
|---|---|---|---|---|
| | *RMS* error (%) | $\bar{R}^2$ | *RMS* error (%) | $\bar{R}^2$ |
| Last working days | | | | |
| 1971 Mar. | ·224 | ·950 | ·222 | ·951 |
| June | ·206 | ·974 | ·220 | ·970 |
| Sept. | ·201 | ·972 | ·205 | ·971 |
| Dec. | ·228 | ·969 | ·247 | ·964 |
| 1972 Mar. | ·181 | ·981 | ·207 | ·975 |
| June | ·176 | ·960 | ·173 | ·960 |
| Sept. | ·219 | ·932 | ·220 | ·932 |
| Dec. | ·145 | ·949 | ·152 | ·944 |
| Wednesdays | | | | |
| 1973 Jan. 3 | ·146 | ·946 | ·155 | ·940 |
| „ 10 | ·189 | ·928 | ·194 | ·924 |
| „ 17 | ·194 | ·937 | ·204 | ·930 |
| „ 24 | ·202 | ·928 | ·208 | ·924 |
| „ 31 | ·229 | ·915 | ·223 | ·920 |
| Feb. 7 | ·233 | ·907 | ·229 | ·910 |
| „ 14 | ·230 | ·906 | ·228 | ·908 |
| „ 21 | ·247 | ·899 | ·234 | ·910 |
| „ 28 | ·238 | ·902 | ·230 | ·909 |
| Mar. 7 | ·270 | ·878 | ·254 | ·892 |
| „ 14 | ·251 | ·896 | ·230 | ·913 |
| „ 21 | ·293 | ·873 | ·279 | ·885 |
| „ 28 | ·284 | ·877 | ·263 | ·894 |
| Apr. 4 | ·275 | ·880 | ·260 | ·892 |
| „ 11 | ·279 | ·886 | ·271 | ·892 |
| „ 18 | ·283 | ·886 | ·271 | ·895 |
| „ 25 | ·272 | ·898 | ·261 | ·906 |
| May 2 | ·261 | ·911 | ·252 | ·917 |
| „ 9 | ·261 | ·913 | ·248 | ·922 |
| „ 16 | ·245 | ·928 | ·230 | ·937 |
| „ 23 | ·266 | ·924 | ·245 | ·936 |
| „ 30 | ·257 | ·929 | ·235 | ·941 |

Table B compares the estimated influence of net investors in price formation in the original and modified models. In the original version, this influence was assumed constant for all coupons within a segment, varying only between the short segment (1—4 years) through the intermediate region (4—8 years) to the long segment (over 8 years). In the modified model the influence of net investors on prices varies with coupon and, to a small extent, with maturity: the first two columns measure their influence on a 3% stock maturing in five or ten years, and the last column measures it on the par curve — where it is assumed the same for all maturities. Tables A and B are based on the first stage of the curve fitting, with all parameters freely determined and not yet fixed at their moving average values.

**Table B**

**Tax/coupon parameters**

**Key**

The estimated weight of net investors in the determination of prices is represented as follows:

$W_S$ = weight in the short-dated segment

$W_L$ = weight in the long-dated segment (these were previously specified in terms of effective tax rates)

$W_5(3)$ = weight for 3% stock with 5 years to maturity

$W_{10}(3)$ = weight for 3% stock with 10 years to maturity

$W(PC)$ = weight for stock on the par curve (all maturities)

| | Original method | | Modified method | | |
|---|---|---|---|---|---|
| | $W_S$ | $W_L$ | $W_5(3)$ | $W_{10}(3)$ | $W(PC)$ |
| Last working days | | | | | |
| 1971 Mar. | ·546 | ·731 | ·570 | ·612 | 0 |
| June | ·532 | ·782 | ·610 | ·672 | ·437 |
| Sept. | ·498 | ·957 | ·607 | ·815 | ·192 |
| Dec. | ·454 | ·952 | ·623 | ·762 | ·445 |
| 1972 Mar. | ·228 | ·900 | ·482 | ·748 | ·391 |
| June | ·755 | ·750 | ·701 | ·701 | ·701 |
| Sept. | ·398 | ·669 | ·467 | ·604 | ·280 |
| Dec. | ·586 | ·870 | ·668 | ·822 | ·623 |
| Wednesdays | | | | | |
| 1973 Jan. 3 | ·489 | ·671 | ·673 | ·820 | ·630 |
| „ 10 | ·639 | ·681 | ·793 | ·822 | ·547 |
| „ 17 | ·601 | ·676 | ·767 | ·821 | ·633 |
| „ 24 | ·718 | ·880 | ·759 | ·823 | ·589 |
| „ 31 | ·854 | ·883 | ·846 | ·811 | ·372 |
| Feb. 7 | ·740 | ·887 | ·758 | ·807 | ·214 |
| „ 14 | ·697 | ·894 | ·741 | ·817 | ·241 |
| „ 21 | ·843 | ·892 | ·844 | ·816 | ·168 |
| „ 28 | ·804 | ·891 | ·820 | ·822 | ·211 |
| Mar. 7 | ·786 | ·898 | ·781 | ·817 | 0 |
| „ 14 | ·942 | ·894 | ·901 | ·830 | ·107 |
| „ 21 | ·959 | ·875 | ·916 | ·808 | ·164 |
| „ 28 | ·884 | ·847 | ·864 | ·787 | 0 |
| Apr. 4 | ·856 | ·842 | ·852 | ·786 | ·078 |
| „ 11 | ·797 | ·846 | ·801 | ·790 | ·083 |
| „ 18 | ·740 | ·854 | ·757 | ·796 | 0 |
| „ 25 | ·733 | ·869 | ·768 | ·814 | ·123 |
| May 2 | ·707 | ·878 | ·760 | ·829 | ·189 |
| „ 9 | ·717 | ·852 | ·767 | ·794 | ·112 |
| „ 16 | ·578 | ·864 | ·694 | ·805 | ·041 |
| „ 23 | ·654 | ·843 | ·751 | ·786 | 0 |
| „ 30 | ·622 | ·833 | ·732 | ·778 | 0 |

In Table C the estimates of 5, 10, and 20-year yields, as previously published, are set alongside the modified ones. (The latter are given for later dates in Table 31 of the statistical annex.) The results from the second stage of the curve fitting have been used in 1973, that is, with the ill-determined parameters fixed at their moving average values.

**Table C**

**Calculated redemption yields**

per cent per annum

| | Original method | | | Modified method | | |
|---|---|---|---|---|---|---|
| | 5 years | 10 years | 20 years | 5 years | 10 years | 20 years |
| Last working days | | | | | | |
| 1971 Mar. | 7·32 | 8·62 | 9·09 | 7·20 | 8·46 | 9·04 |
| June | 6·83 | 8·51 | 9·16 | 6·81 | 8·41 | 9·13 |
| Sept. | 6·40 | 7·82 | 8·50 | 6·37 | 7·78 | 8·51 |
| Dec. | 5·80 | 7·32 | 8·10 | 5·83 | 7·31 | 8·13 |
| 1972 Mar. | 6·05 | 7·59 | 8·38 | 5·84 | 7·61 | 8·40 |
| June | 8·40 | 8·91 | 9·27 | 8·47 | 8·87 | 9·28 |
| Sept. | 8·67 | 9·10 | 9·42 | 8·44 | 9·01 | 9·36 |
| Dec. | 9·38 | 9·49 | 9·75 | 9·29 | 9·40 | 9·71 |
| Wednesdays | | | | | | |
| 1973 Jan. 3 | 9·34 | 9·43 | 9·70 | 9·16 | 9·20 | 9·58 |
| " 10 | 9·26 | 9·39 | 9·67 | 9·08 | 9·17 | 9·56 |
| " 17 | 9·07 | 9·30 | 9·62 | 8·92 | 9·13 | 9·53 |
| " 24 | 9·10 | 9·30 | 9·61 | 9·00 | 9·14 | 9·53 |
| " 31 | 9·15 | 9·38 | 9·69 | 9·02 | 9·22 | 9·60 |
| Feb. 7 | 9·24 | 9·48 | 9·75 | 9·11 | 9·31 | 9·66 |
| " 14 | 9·20 | 9·48 | 9·74 | 9·08 | 9·31 | 9·64 |
| " 21 | 9·16 | 9·50 | 9·75 | 9·02 | 9·34 | 9·65 |
| " 28 | 9·17 | 9·53 | 9·77 | 9·03 | 9·37 | 9·67 |
| Mar. 7 | 9·66 | 9·94 | 10·12 | 9·50 | 9·76 | 10·00 |
| " 14 | 9·65 | 9·95 | 10·13 | 9·44 | 9·77 | 10·00 |
| " 21 | 9·69 | 9·96 | 10·13 | 9·46 | 9·79 | 10·02 |
| " 28 | 9·68 | 9·93 | 10·13 | 9·48 | 9·79 | 10·02 |
| Apr. 4 | 9·55 | 9·76 | 9·98 | 9·34 | 9·62 | 9·88 |
| " 11 | 9·45 | 9·81 | 10·01 | 9·28 | 9·66 | 9·90 |
| " 18 | 9·55 | 9·84 | 10·06 | 9·38 | 9·68 | 9·95 |
| " 25 | 9·48 | 9·87 | 10·09 | 9·32 | 9·70 | 9·98 |
| May 2 | 9·35 | 9·85 | 10·09 | 9·21 | 9·68 | 9·98 |
| " 9 | 9·34 | 9·97 | 10·19 | 9·24 | 9·81 | 10·09 |
| " 16 | 9·09 | 9·88 | 10·11 | 9·03 | 9·71 | 10·00 |
| " 23 | 9·07 | 9·93 | 10·13 | 9·02 | 9·78 | 10·04 |
| " 30 | 8·98 | 9·86 | 10·09 | 8·94 | 9·71 | 10·00 |