The trend of the national debt in relation to national income

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The historically high central government borrowing requirements of recent years, and the high interest rates at which they have been financed, have focused attention on the indebtedness of the central government with its implications for the tasks of refinancing and servicing the debt. At the same time, the upward trend in inflation since the early 1960s has distorted some of the conventional measures of the debt.

The national debt, strictly speaking, comprises only the liabilities of the National Loans Fund. As such it includes liabilities in foreign currency as well as in sterling; it also includes the considerable amount of the debt which is in the hands of official bodies, such as the Issue Department of the Bank. This overall total of the national debt is thus not a particularly meaningful starting-point for analysing the effects of the debt on domestic incomes and wealth. For the purposes of this article, therefore (as in the regular article on the national debt published in the *Bulletin*), discussion of the national debt will relate to the sterling liabilities of the NLF, together with sterling stocks of the nationalised industries guaranteed by the Government; it will be further restricted to that part of this aggregate which is in market hands.[1] The article thus does not take into account the large and growing amount of local authority market debt.

The existence of the national debt has several implications for the conduct of fiscal and monetary policy. During any financial year the government must raise sufficient funds, either from taxation or other sources of revenue or from further borrowing, to service existing debt. Maturing debt must also be repaid from taxation or other revenues, or be refinanced through the issue of new debt. The scale of this servicing and refinance will be discussed in the first half of this article. Moreover, there are the broader but related questions of policy concerning the methods by which government expenditure is financed. Consideration of these questions requires some assessment of the impact on the economy of changes in indebtedness, stemming either from deficit financing or from the effect of inflation on the real value of outstanding debt. These issues are still the subject of considerable debate among economists, and largely outside the scope of this article; nevertheless, it concludes with a brief discussion of some of the possible economic implications of the changes which have occurred, both in the real value of the national debt and in the costs of its servicing.

Refinancing and servicing the debt

The scale of the refinancing and servicing tasks in any period will be determined by the size of the debt, its maturity, and the nominal interest rates at which it was issued. The first two factors will determine the annual refinancing programme, since the bigger the debt and the shorter its average maturity, the larger will be the maturities each year; while the rate of interest at which different tranches of the debt were issued will determine the annual servicing payments.

The size of the national debt

The nominal value of the national debt in market hands almost

[1] Developments in the total national debt (together with certain other liabilities of the central government and liabilities of local authorities and public corporations) were discussed in an article on public sector debt published in the May 1977 issue of *Economic Trends*.

Table A

Nominal value of the national debt in market hands

£ millions

End-March	Current prices	As percentage of GDP[a]	1970 prices[b]
1963	21,614	*84.6*	29,051
1964	21,630	*78.4*	28,461
1965	21,529	*72.3*	27,391
1966	22,040	*69.5*	26,977
1967	22,693	*67.5*	26,792
1968	24,479	*69.1*	28,104
1969	24,091	*63.6*	26,708
1970	23,424[c]	*58.3*	24,946[c]
1971	23,640	*53.0*	23,109
1972	26,619	*52.6*	23,515
1973	26,343	*45.9*	21,227
1974	27,716	*43.1*	20,470
1975	31,710	*40.3*	19,514
1976	40,407	*41.5*	19,711

[a] GDP in year to end-March.

[b] The GDP deflator has been used throughout the article. It should perhaps be noted that this has been for convenience rather than implying that it is the appropriate deflator in every case.

[c] These figures do not correspond because the current price series is for years to end-March whereas the constant price series is for calendar years.

Table B

Average life of maturity of dated BGS/BGGS in market hands

End-March	Years
1963	13.5
1964	12.9
1965	12.8
1966	12.7
1967	12.9
1968	12.6
1969	13.3
1970	13.1
1971	13.3
1972	13.7
1973	14.5
1974	13.3
1975	12.0
1976	12.4

Source: Articles in the annual series on the national debt published in the *Bulletin*.

doubled between 1963 and 1976 (see Table A), with most of the increase coming after 1971. But the size of the debt in isolation from other measures of aggregate economic activity has little significance. For instance, the national debt has declined very sharply in relation to GDP since the early 1960s. Indeed the ratio of the debt to GDP is now around its lowest point since before the First World War. There are two main reasons for the decline: the economy has grown in real terms over the period, and the real value of the debt has been eroded by inflation. In constant purchasing power terms, the outstanding debt has fallen virtually continuously (see Table A).

In the absence of any marked change in the maturity structure of the debt, this would imply that the real value of maturing debt (i.e. repayment of principal) had also declined sharply.

Maturity of the debt

A partial indicator of the maturity of the national debt is the average life to maturity of dated British government (BGS) and British government-guaranteed stocks (BGGS)[1] in market hands (Table B). The method of calculation is given in the appendix. Except in 1973, the average life to maturity of BGS and BGGS has remained close to 12–13 years, although in the last two years it has fallen to the lowest point of the period. These calculations, however, give only a broad indication of the average life to maturity of the whole of the national debt. For instance, national savings and stocks with no fixed redemption date are omitted. The former are technically repayable on demand, but they account for a relatively small proportion of the debt, and are mostly firmly held by large numbers of small savers. A more important omission is that of the floating debt (predominantly Treasury bills). The extent of residual financing of the central government by issues of Treasury bills varies considerably from year to year, and there are consequently marked fluctuations over time in the proportion of the national debt held in this form. Their inclusion would thus increase the volatility of the maturity series, and reduce the average life to maturity of the debt. It would not however, greatly alter the trend of the statistics in Table B.

Since the maturity of the debt has not varied significantly over the period, the decline in the ratio of the national debt to GDP has been associated with a perceptible fall in the average ratio of redemptions to GDP.

But the repayment of maturing stock is only one aspect of the management and servicing of the debt. Interest payments also have to be met, and in recent years nominal interest rates have risen sharply, reflecting investors' expectations of the future course of inflation.

Interest payments

The upward trend in nominal interest rates has made interest payments an increasingly important element in total debt servicing. For example, whereas £100 million 3% 20-year stock involves total future payments by the Government of £160 million (£100 million repayment of principal plus £60 million interest), a stock of similar size and life but with a 15% coupon would necessitate payments of £400 million (£100 million repayment of principal and £300 million interest). This would occur as maturing debt was refinanced, even if there were no net additions to the national debt. In fact, the impact of rising interest rates has been increased by the rise in net borrowing, particularly in recent years, and this has increased the relative weight of high-coupon issues in the total

[1] These are stocks issued by nationalised industries before 1956 and guaranteed by the Government.

debt. For both these reasons, nominal interest payments have risen more rapidly than nominal debt outstanding.

In an inflationary period, it may be realistic to consider rising interest payments as accelerated repayment of capital. This is because yields at issue include an element of compensation for the anticipated decline in the real value of principal through inflation. As such, interest payments should perhaps be included with repayment of principal in assessing the true maturity of the debt. The 'duration' of a stock can be estimated by taking an average (weighted by the amount of principal outstanding and the sum of interest payments) of the period to maturity and the periodic interest payments. The average duration of the debt as a whole can similarly be estimated by averaging (again weighted by the total payments involved) the durations of individual stocks (see Table C). A more detailed explanation of the method of calculation of the duration statistic, which is a simpler formulation than the standard calculation,[1] is given in the appendix.

The rising trend in interest payments has been associated with a somewhat clearer declining trend in average duration than in average maturity over the last decade.

The combined annual payments to be met on both interest and redemptions have therefore risen more sharply than the simple maturity statistic would suggest. Even so, taking redemptions and interest payments together, the total payments to be met each year by the authorities have still tended to decline relative to GDP (Table D). But a continuation of high interest rates as old low-coupon debt comes to be refinanced, together with a continuing high central government borrowing requirement, would lead to continually rising total payments and, with a moderation of inflation, could reverse the trend relative to GDP.

The substantial changes which have occurred in the real value of the debt, and the shift within the total servicing cost from repayment of principal to interest payments, may have modified the economic behaviour of the private sector. Debt holders may treat their interest receipts in a different way from other income if the receipts are regarded primarily as compensation for inflation, rather than real income. Similarly the decline in the real value of their wealth which has occurred may also have affected their expenditure. It is, therefore, appropriate to raise some of the broader issues which these developments pose for assessing the financial impact of the activities of Government on the economy.

Interest payments and the central government borrowing requirement

Because interest payments contain an element of compensation for inflation, the net new borrowing of the Government (the CGBR) can give a misleading impression of the expansionary impetus of fiscal policy. In the official statistics, interest payments appear as an item contributing to the CGBR, while repayments of principal are treated as a negative financing item.

Given price stability, and in the absence of any marked shift in saving behaviour, repayments of capital are likely to have a very low or perhaps nil expenditure content, because the principal is likely to be reinvested in other financial assets. Interest payments on the other hand are usually regarded as part of real disposable income of the private sector, and will thus (after tax) exert some leverage on the aggregate demand for goods and services (though possibly less powerful leverage than other government

Table C

Average duration of dated BGS/BGGS in market hands[a]

	Years
1963	13.4
1964	13.3
1965	12.8
1966	12.9
1967	13.0
1968	12.6
1969	13.0
1970	12.8
1971	12.5
1972	12.8
1973	13.4
1974	12.6
1975	11.5
1976	11.2

[a] 1963–66 data as at end-December; 1967–76 data as at end-March.

Table D

£ millions

	Nominal interest payments by central government[a]	As percentage of GDP	Redemptions[b]	As percentage of GDP	Total annual payments to be met as percentage of GDP
1963	930	*3.45*	995	*3.69*	*7.14*
1964	937	*3.20*	779	*2.66*	*5.86*
1965	968	*3.10*	587	*1.88*	*4.98*
1966	1,036	*3.13*	1,006	*3.04*	*6.17*
1967	1,105	*3.16*	1,025	*2.93*	*6.09*
1968	1,240	*3.31*	1,033	*2.76*	*6.07*
1969	1,280	*3.24*	1,130	*2.86*	*6.10*
1970	1,298	*2.98*	1,265	*2.91*	*5.89*
1971	1,384	*2.82*	1,949	*3.97*	*6.79*
1972	1,582	*2.88*	1,414	*2.57*	*5.45*
1973	1,770	*2.79*	1,735	*2.73*	*5.52*
1974	2,123	*2.89*	998	*1.36*	*4.25*
1975	2,678	*2.88*	2,019	*2.17*	*5.05*
1976	3,638	*3.38*	2,405	*2.23*	*5.61*

[a] Not directly comparable with payments of interest on the national debt as defined elsewhere in this article. For example, government debt interest excludes payments within the central government, but includes interest on debt payable in external currencies and charges on drawings from the IMF, payments to depositors with the ordinary departments of the National Savings Bank and the trustee savings banks, and accruals of interest on national savings certificates.

[b] Redemptions of British government and British government-guaranteed marketable sterling stocks. Includes redemptions of official holdings.

[1] See, for instance, F. R. Macaulay, *Bond Yields, Interest Rates and Stock Prices* (New York: National Bureau of Economic Research, 1938), page 48.

Table E

£ millions

Surplus + /deficit −

	CGBR	CGBR *less* central government interest payments[a]
1970	+ 670	+1,968
1971	− 634	+ 750
1972	−1,596	− 14
1973	−2,321	− 551
1974	−3,491	−1,368
1975	−8,376	−5,698
1976	−6,776	−3,138

[a] See footnote [a] to Table D.

Table F

Market value of national debt (in market hands)

£ millions

End-March	Current prices	As percentage of GDP	1970 prices
1963	19,314	*75.6*	25,960
1964	19,380	*70.3*	25,500
1965	18,573	*62.4*	23,630
1966	19,006	*59.9*	23,263
1967	20,093	*59.8*	23,723
1968	21,245	*59.9*	24,392
1969	20,005	*52.9*	22,178
1970	19,538[a]	*48.6*	20,807[a]
1971	19,824	*44.5*	19,378
1972	23,561	*46.5*	20,814
1973	21,441	*37.4*	17,277
1974	19,761	*30.8*	14,595
1975	25,031	*31.8*	15,404
1976	33,315	*34.2*	16,251

Source: Bank of England estimates.

[a] See footnote [c] to Table A.

expenditure).[1] But in circumstances where interest payments are mainly, if not wholly, regarded as compensation for inflation, they may perhaps be considered by recipients as repayment of capital, rather than as real disposable income. If the private sector does not suffer from money illusion, interest payments may have an even lower effect on the level of demand in the economy when there is inflation than when prices are stable.

The precise adjustment of the government accounts to reflect this would, however, require the allocation of nominal interest payments between what the recipients regarded as compensation for inflation (repayment of capital), and the real rate of interest (the real income from capital); such an adjustment is fraught with conceptual difficulties. At least since 1970, the rate of inflation has tended to be well above the rate of interest on most categories of government debt. Some rough indication of the possible distortion in the central government borrowing requirement as a measure of fiscal expansion may perhaps be given simply by subtracting interest payments from the CGBR (Table E).[2]

The validity of assuming that, under conditions of inflation, the inflation compensation element of interest payments would have a negligible effect on demand, depends on the absence of money illusion in the private sector. Empirical evidence to resolve this is difficult, if not impossible, to find, and it can only be regarded as a possibility which makes the interpretation of the conventional presentation of the central government borrowing requirement particularly difficult. To some extent, it is part of the general problem of estimating the different impact on demand of various categories of government expenditures and revenues, and only illustrates the difficulty of trying to assess the stance of economic policy by any one indicator.

As well as the problem of measurement associated with the inflation component of interest payments, there is the broader and even more complex question of the possible impact on economic behaviour of the decline in the real value of the debt, even after allowance has been made for higher nominal interest payments. This decline has occurred mainly because the rising trend in nominal interest rates has been insufficient to compensate fully for the rate of inflation either as experienced or, quite possibly, anticipated. This is indeed inevitable because higher nominal rates have only been applied when debt has been refinanced or when new debt has been issued. The national debt still includes many stocks with coupons as low as 5% or less. The best indicator of the value of the debt at any particular time should be its market valuation measured at constant prices. The market value of the debt has fallen much more sharply than its nominal value in relation to GDP, declining (in 1970 prices) from £26.0 billion to £16.2 billion between 1963 and 1976 (Table F).

The economic impact of changes in the real value of the debt

The effects of changes in the real value of the national debt, as

[1] It is sometimes assumed that interest payments on government debt are more likely to accrue to higher than to lower income groups, and that higher income groups have a lower propensity to spend out of income than other income groups. In fact, while their marginal tax rates may be higher (which will reduce the expenditure content of gross interest payments), unless there is a strong desire to bequeath capital to their heirs, there is no reason to suppose that their average propensities to spend out of disposable income over their entire lifetime will be much lower than that of other income groups. On the other hand, a substantial proportion of interest payments accrue to the long-term financial institutions which only pass on the interest payments after a long interval. It is therefore likely that interest payments, at least in the short run, have a considerably smaller effect on final demand than other government expenditures.

[2] Following this argument through suggests that it would be logical to subtract only *net* interest payments, i.e. total interest payments less interest receipts by the central government since these receipts can also be seen largely as accelerated repayments of debt. In fact, however, these interest receipts have been ignored because, for the most part, they accrue to the central government from local authorities and public corporations for whom the central government is the residual provider of finance. Conceptually, therefore, interest receipts by the central government are offset by a corresponding increase in net lending. Thus, if interest payments generally are thought of as repayments of capital, both central government interest receipts and net lending would be reduced by equal amounts, leaving the central government borrowing requirement unchanged. It is thus reasonable, in an article primarily concerned with debt held outside the public sector, to subtract gross interest payments from the central government borrowing requirement.

measured above, are difficult to assess. An increase in the debt brought about through deficit financing makes it probable that future taxes will be higher than they would otherwise be.[1] The economic impact of such deficit financing is the subject of an unresolved academic debate – mainly on the question of how the probable future tax increase is regarded by taxpayers. Similar questions appear to arise in the case of changes in the value of the debt brought about by inflation.

One school of thought argues that 'pure' deficit financing (i.e. borrowing to finance expenditure on current consumption of goods and services, rather than on investment) is deferred taxation, because at some future date taxes will have to be raised to repay the debt, and to finance the interest payments on the borrowing. To the extent that the private sector is aware of this, debt issued to finance consumption does not represent an increase in private wealth as, on this argument, the private sector should discount the burden of future taxes. Deficit financing can, therefore, be regarded as having similar effects on the economy to taxation; there may be distributional effects but not wealth effects. If this were the case, then the decline in the real value of the national debt could be viewed by individuals as a cut in future taxes exactly offsetting the erosion of the real value of debt by inflation. The net effect on final demand would therefore be nil (except for the effects of any redistribution between debt holders and future taxpayers).

The opposing school of thought contest many of these assertions. They argue that the effects follow only if taxpayers fully foresee the future changes in taxation made probable by deficit finance, and take account of it in their own actions in the same way as they would a present increase in taxation. In fact, it is argued, this may not occur, because the private sector may suffer from money illusion, because the probability of higher taxes is spread over the indefinite future, and because no one knows exactly on whom they will fall.

On the second view, though not the first, the erosion of the real value of the national debt by inflation will have reduced private expenditure below what it would otherwise have been, as individuals attempted to restore the real value of their wealth. There is no direct evidence as to how large this reduction might be. Estimates of the effect on consumers' expenditure of the recent decline in the real value of liquid assets held by the personal sector[2] suggest that wealth effects on expenditures, though relatively small, could be significant. So the recent sharp fall in the real value of the national debt could have been an additional factor depressing the level of private sector expenditures in the last few years.

[1] In so far as an increase in the national debt is incurred to finance income-generating investment, taxes need not thereby rise. A large proportion of the debt has in fact been incurred for such purchases. This train of thought leads on to the question of the relative return on public and private investment.

[2] See March 1976 *Bulletin*, page 53.

Appendix

Average maturity

The average life to maturity of BGS and BGGS is calculated by weighting the residual maturity of each dated stock by the nominal amount outstanding in market hands. Stocks with optional redemption dates are assumed to mature on the last possible date.

Formally:

$$\text{Average maturity of } N \text{ redeemable stocks} = \frac{\sum_{j=1}^{N} m_j x_j}{\sum_{j=1}^{N} m_j};$$

where

m_j is the nominal market holding of stock;
x_j is the time to maturity of stock.

Average duration

The duration statistic measures the average life of a stock taking into account not only the time remaining before the principal is repaid (the life to maturity) but also the timing of interest payments. Interest payments occur at regular intervals (normally every six months), and their average life can therefore be considered to be at a point half way to the date at which the stock is finally redeemed. Thus the duration of an individual stock derives, in principle, from an average of:

a the time to maturity;

b the timing of the periodic payments of interest;

weighted by the sum of the principal outstanding and the total remaining interest payments. The precise formula, which calculates interest payments in half-years, is as follows:

$$\text{Duration of } j^{th} \text{ stock} = \frac{\frac{1}{2} r_j m_j (n_j + 2f_j)(n_j + 1)/4 + x_j m_j}{\frac{1}{2} r_j m_j (n_j + 1) + m_j}.$$

This expression reduces to:

$$\frac{\frac{1}{8} r_j (n_j + 2f_j)(n_j + 1) + x_j}{\frac{1}{2} r_j (n_j + 1) + 1};$$

where

r_j is the coupon for stock j;
n_j is the number of complete half-years to maturity for stock j;
f_j is the fractional part of half-year to next dividend for stock j.

For any individual stock, duration must obviously be shorter than life to maturity. It is also evident that, for any given maturity, rising interest rates tend to shorten the duration (because of the increased weight applied to the timing of interest payments).

But the weighting of the duration of all the individual stocks, as in Table C, is based on the sum of principal and total interest payments. The formula is:

$$\text{Average duration over all stocks} = \frac{\sum_{j=1}^{N} [\frac{1}{2} r_j m_j (n_j + 2f_j)(n_j + 1)/4 + x_j m_j]}{\sum_{j=1}^{N} [\frac{1}{2} r_j m_j (n_j + 1) + m_j]}$$

$$= \frac{\sum_{j=1}^{N} [\frac{1}{8} r_j m_j (n_j + 2f_j)(n_j + 1) + x_j m_j]}{\sum_{j=1}^{N} [\frac{1}{2} r_j m_j (n_j + 1) + m_j]}.$$

Thus, other things (i.e. nominal value and interest rates) being equal, long stocks receive a greater weighting than shorts, whereas in the maturity statistic they would have the same weighting. This explains why in the 1960s average duration was often greater than average maturity, despite this being impossible for any individual stock.