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# A GUIDE TO PUBLIC SECTOR DEBT AND DEFICITS

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# ABSTRACT

The paper presents a theoretical and empirical survey of three common concerns about public sector debt and deficits. The first is based on the view that sooner or later, public sector deficits must be monetized and will therefore lead to inflation. The second concerns the possibility of explosive debt-deficit spirals and ultimately default or repudiation of the public debt. The third relates to "financial crowding out," the decline in interest-sensitive or real exchange rate-sensitive private and foreign spending resulting from the substitution of borrowing for current taxes. The final section updates the now 12-year old lament of Blinder and Solow about the misuse of various "model-free" measures of fiscal stance.


Willem H. Buiter, "A Guide to Public Sector Debt and Deficits"

# A GUIDE TO PUBLIC SECTOR DEBT AND DEFICITS*

## 1. Introduction 1/

Public sector deficits and the burden of the public debt are once again at the centre of macroeconomic policy debate. In Britain the rhetoric and, to a somewhat lesser extent, the reality of the Medium-Term Financial Strategy (MTFS) adopted and pursued since 1980, emphasized the primacy of fiscal orthodoxy and sound money, the former being viewed as a precondition for the latter. In continental Europe, countries as diverse as the German Federal Republic, France, Italy, the Netherlands, and Belgium have felt compelled to make the control and reduction of public sector financial deficits a (often the) cornerstone of macroeconomic policy design, overriding traditional concerns with the use of fiscal policy and budgetary deficits as cyclical stabilization devices. In the United States, widespread professional concern about steadily growing structural federal deficits is now beginning to be shared by the administration and a major political battle to contain and cut back the deficit through spending cuts and/or tax increases is under way.

The concern about public sector debt and deficits is most easily understood when one first considers the extremely rarified set of conditions under which the magnitude of public sector debt and deficits would be irrelevant. Right away, it should be emphasized that "debt neutrality" or non-neutrality refers to the absence or presence of real effects from alternative ways of financing a given program of spending on real goods and services (or "exhaustive" spending program). Changes in the amount and/or composition of the real exhaustive spending program will

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(almost) always have real effects. The only exception would be when public consumption or investment is a perfect substitute for private consumption or investment (see Buiter [1977]). In what follows the principal focus of attention are the consequences of substituting bond financing (or borrowing) for tax financing of a given real exhaustive spending program. The scope for and consequences of money financing are also considered in some detail. "Debt neutrality" will prevail when: (a) private agents can lend and borrow on the same terms as the government; (b) private agents are able and willing to undo any government scheme to redistribute real income between successive generations by making offsetting voluntary intergenerational transfers (bequests or gifts to the younger generation); and (c) there are no distortionary taxes, transfers or subsidies, i.e., all taxes, transfers, and subsidies are "lump-sum" (Barro, [1974]).

For (b) to hold, private agents either must live forever or achieve the economic equivalent of eternal life by being endowed with operative intergenerational gift and bequest motives. Retired parents must, e.g., be willing and able to return, through increased bequests to their working children, the income the government is redistributing from the children to the parents by means of national insurance contributions by the children that are used to finance the parents' pensions. In reality, private decision horizons are finite and frequently quite short both because of the nature of private tastes and objectives and because of binding constraints encountered in a variety of financial and capital markets. As regards the former, not everybody is a bearer of intergenerational goodwill. Even among those who love their parents and children, the probability of childlessness in the current and future generations will raise the effective intergenerational discount rate applied by households. As regards the latter, capital market imperfections are an important restraint on the ability of households (and many private firms) to make intertemporal transfers of resources. Credit rationing, liquidity constraints, large spreads between borrowing and lending rates, and public sector borrowing rates that are significantly below private borrowing rates are an established empirical fact in most industrialized countries. There also exists a rich and varied theoretical literature which can explain such capital market imperfections and the often associated non-Walrasian equilibria in ways that do not imply the wholesale abandonment of cherished notions of rationality. The new and burgeoning literature on asymmetric information and the implications of moral hazard and adverse selection for equilibrium behavior in private financial markets is especially illuminating in this regard. 2/ Even if there were no uncertainty about the exogenous environment or the characteristics of other economic agents, abandoning the assumption of price-taking or passive competitive behaviour by one of game-theoretic or active competitive behaviour may be sufficient to yield (inefficient) credit rationing as an equilibrium outcome in a wide range of plausible market settings. 3/

Even if private agents have operative intergenerational gift and bequest motives and face perfect capital markets, the non-lump sum, distortionary nature of taxes, transfers, and subsidies may lead to non-neutrality of the substitution of borrowing for current taxation. Such "second order" non-neutralities (Barro [1979]) can, under certain restrictive assumptions, lead to a prescription of tax "smoothing" or constant (expected) tax rates over time. Temporary deficits or surpluses would in general be associated with the pursuit of policies that minimize the excess burden, efficiency loss, or collection costs of the tax system.

Absent debt neutrality, alternative modes of financing a given programme of "exhaustive" public spending will have real consequences in the short run and in the long run. In the short run, the substitution of borrowing for taxation increases ex-ante private consumption and reduces private investment. 4/ (Under debt neutrality, an increase in the public sector financial deficit due to a tax cut would induce a matching increase in private saving.) In the long run, the reduction in private investment lowers the path of the capital-labour and capital-output ratios. In an open economy, bond-financed tax cuts are likely to lead to a deterioration of the current account in the short run and to an increase in the external debt burden in the long run. These are the familiar short run and long run "crowding out" consequences of public sector deficits. Together with some less familiar forms of financial crowding out they are surveyed in Section 5. Whether or to what extent a tax cut and the associated ex-ante increase in private consumption imply an ex-post reduction in total domestic (private and public) saving depends on the "regime" under which the economic system operates. If output is demand-constrained, the tax cut will, by boosting consumption demand, raise output and employment through the familiar Keynesian demand multiplier mechanism. Total domestic saving need fall only a little. If real wage rigidity, real resource bottlenecks or other "classical" constraints are binding, the ex-ante and ex-post stories are the same and "crowding out" is inevitable.

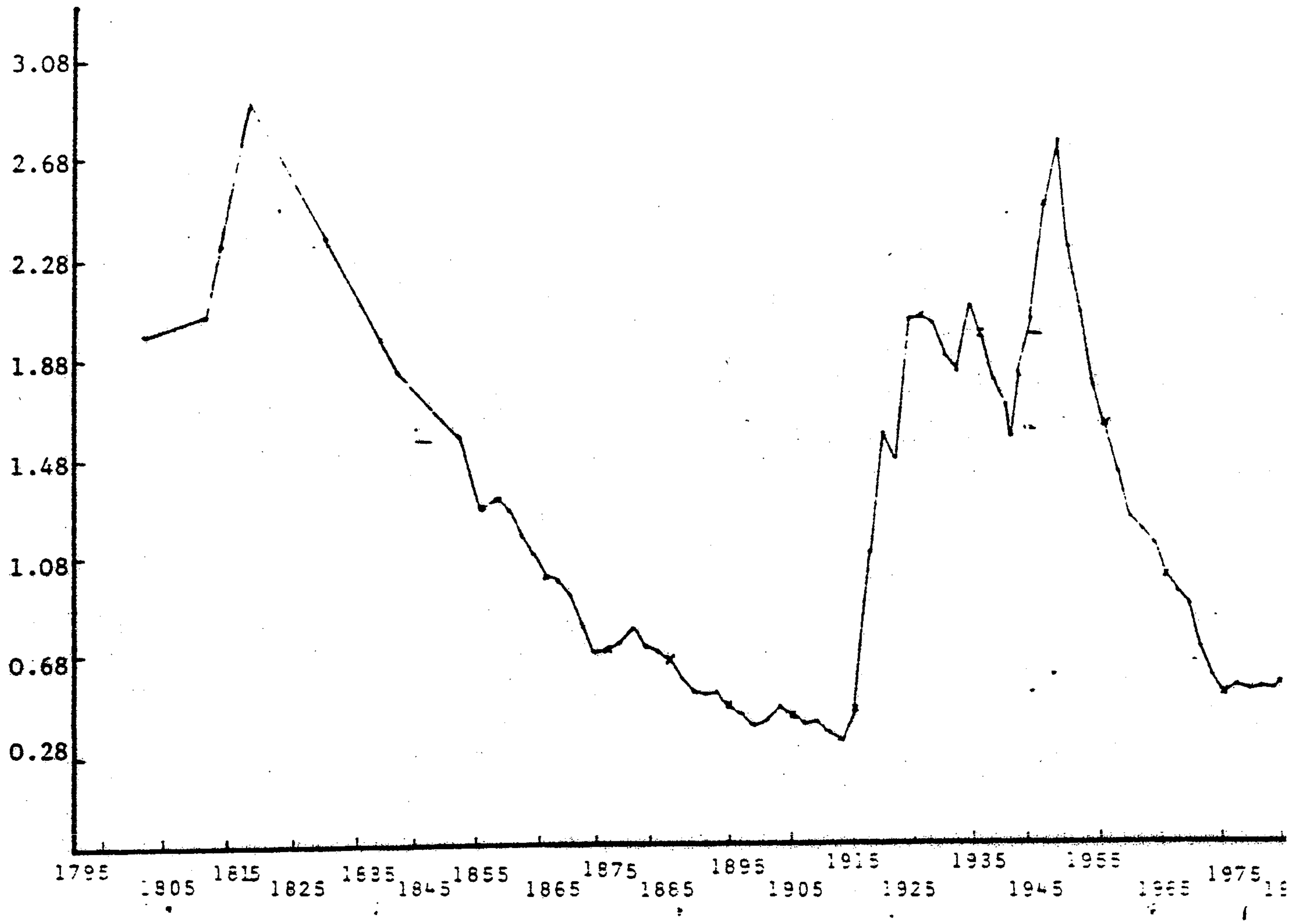
Besides crowding out fears, there are two other reasons why public sector deficits have a bad reputation. The first is based on the view that sooner or later, public sector deficits must be monetised and will therefore lead to inflation. This proposition is analysed in Section 3. The second fear relates to the doomsday scenario which envisages the possibility of explosive debt-deficit spirals and ultimately repudiation of the public debt. The threat of bankruptcy of the Exchequer is analysed in Section 4. The last section of the paper, Section 6, draws conclusions from the preceding sections concerning the meaning and relevance of various measures of fiscal stance that have been proposed.

## 2. Public Sector Debt and Deficits in the United Kingdom: Some Statistical Facts

The main facts about the behaviour of the public sector deficit and debt in the United Kingdom are given in Figures 1 to 4 and in Tables 1 to 4 below. Figures 1 and 2 display very long-time series for the debt-GDP ratio and the debt service-GDP ratio respectively. Figure 1 brings out the familiar fact that governments incur most of their debt during or immediately following major wars and use peacetime conditions to reduce the debt-output ratio. The data since 1801 show that the period following the Napoleonic Wars saw the all-time peak of the debt-GDP ratio at 2.88 in 1821. From there on until the beginning of the First World War, the debt-GDP ratio declined with only slight interruptions, reaching an all-time low of 0.29 in 1914. This reduction in the debt-output ratio between 1820 and 1914 was brought about partly by debt-retirement (from a peak value of £844.3 million in 1819 to a low of £620.2 million in 1912). A remarkable feature of this period is, however, that this decline in the debt-GDP ratio was accompanied by a steady, if gentle, decline in the general price level. It was real output growth rather than "amortisation" through inflation that accounted for the bulk of the reduction in the debt-GDP ratio during the century before World War I. After World War I the debt-GDP ratio reached a "local" peak of 2.09 in 1924. It then declined steadily through the stagnation of the late twenties and the onset of the Great Depression until it had reached 1.79 in 1930. From 1931 it increased to 2.07 in 1934 after which it fell again until 1940. The Second World War and its aftermath brought a new local peak of 2.72

FIGURE 1

U.K. national debt-GDP ratio 1801-1983

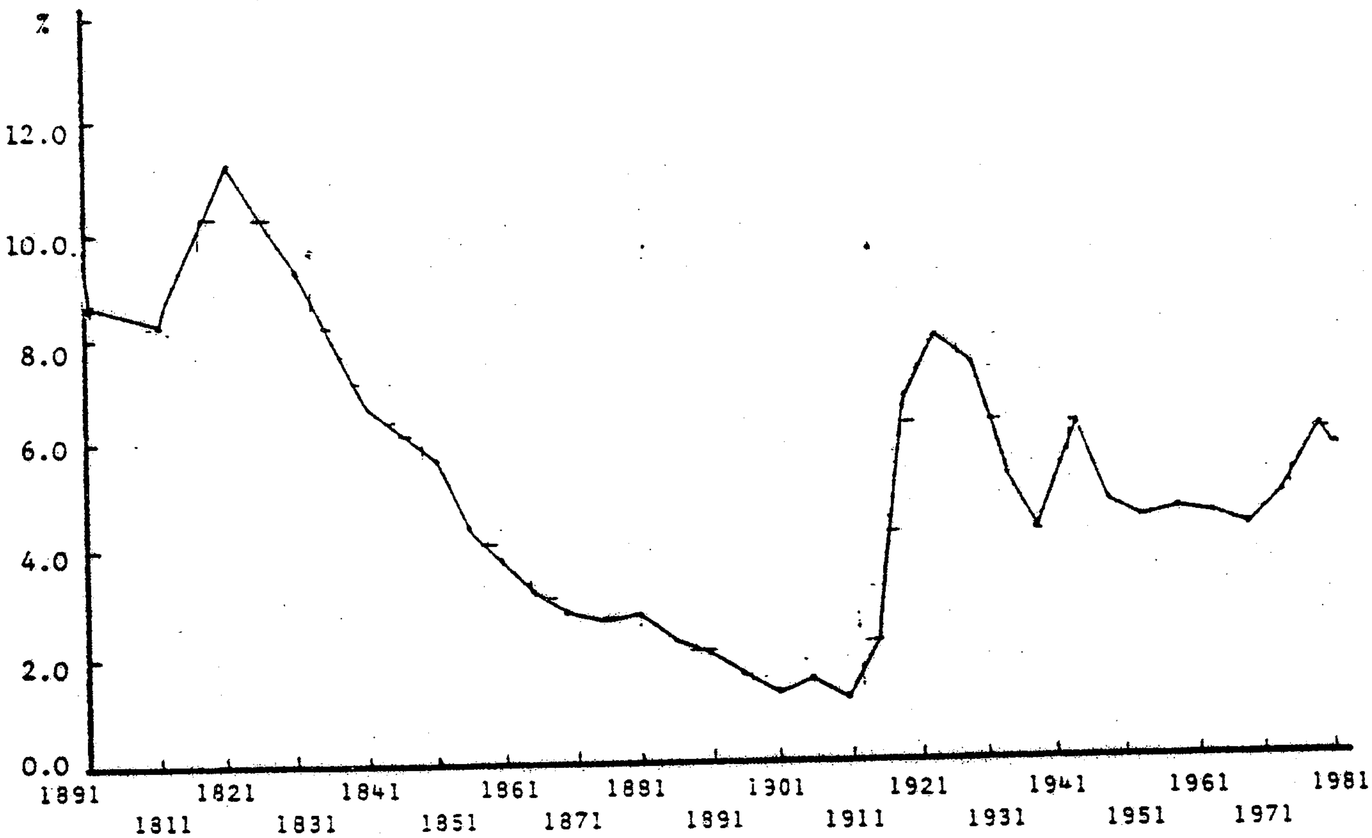



Source: National debt: B.R. Mitchell and P. Deane, 1962 Abstract of British Historical Statistics, Cambridge University Press; B.R. Mitchell and H.G. Jones (1971), Second Abstract of British Historical Statistics, Cambridge University Press; Annual Abstract of Statistics and Financial Statistics, various issues.

GDP: 1801-51: Mitchell and Deane (1962), p.366. 1855-83: Mitchell and Dean (1962), p.367 and Economic Trends, various issues.

FIGURE 2

U.K. debt service-GDP ratio 1801-1983




Note: Pre-1861 estimate of GDP is Total Gross National Income from Mitchell and Deane (1962), p.366. It applies to Great Britain rather than the U.K. and omits various services. It is therefore likely to understate GDP. The debt-service GDP ratio is consequently likely to be somewhat biased upwards before 1861.

in 1947. The ratio then declined steadily until 1975 when it reached 0.48. Since the mid-seventies it has remained roughly stationary around 0.50.

Figure 2 shows that the behaviour of the debt-service-GDP ratio for the United Kingdom parallelled that of the debt-GDP ratio from 1821 until 1941. The local peak reached in 1947 was, however, below that of the second half of the 20s. Debt service declined by less than 2 percentage points of GDP between 1947 and 1973 after which it rose again to its 1946-47 level of 6 percent of GDP in 1981 with a small decline since then. The stability of the debt-service ratio between 1951 and 1971 relative to the decline in the debt ratio is accounted for in large measure by the increase in the nominal interest rates over the period. Real interest rates were negative for much of the 60s and 70s.

A comparison of the U.K.'s debt-GDP ratio and of its public debt-service-GDP ratio with that of the other OECD countries is given in Table 1 and Figure 3.

It shows that, as regards the debt-GDP ratio of the general government (Federal, State and Local), the United Kingdom in 1970 (with 86.2 percent) was well above the average for the major seven OECD countries (39.6 percent) and the average for the OECD as a whole. By 1983, the U.K. ratio, at 54.2 percent, was in line with the major seven countries average (50.8 percent) and the OECD average of 50.7 percent. The United Kingdom was the only major industrial country to achieve a significant reduction in its debt-GDP ratio between 1970 and 1983. Japan, Germany, and Italy

TABLE 1

Debt service burden on the general government sector
(as percentage of nominal GNP/GDP)

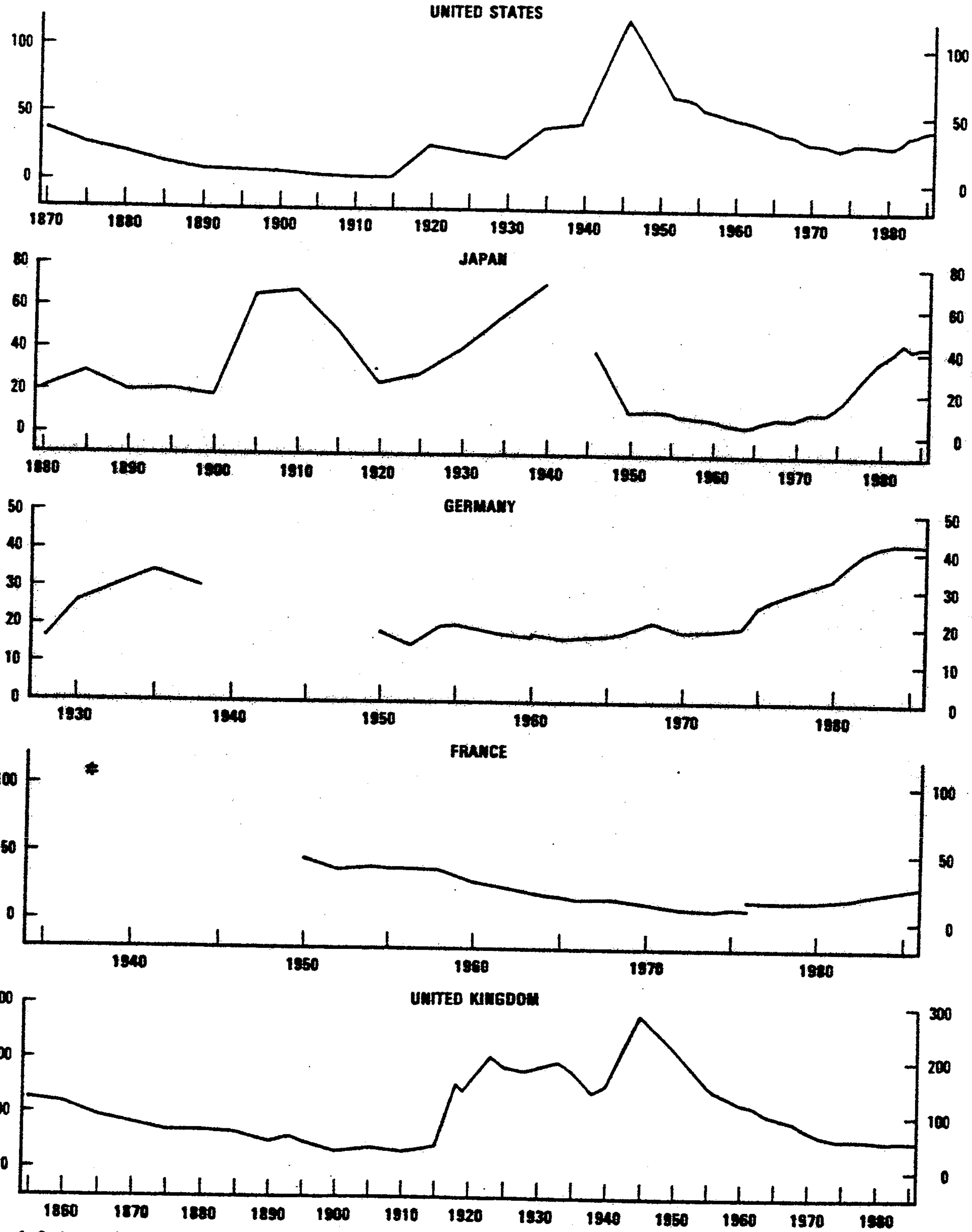
| | Debt outstanding | | Debt interest payments | | | | |
|---|---|---|---|---|---|---|---|
| | 1970 | 1983 | 1970 | 1975 | 1980 | 1983 | 1984[a] |
| United States[c] | 46.2 | 45.8 | 2.2 (1.2) | 2.5 (1.2) | 3.3 (1.3) | 4.6 (2.1) | 4.9 (2.4) |
| Japan | 12.0 | 66.8[d] | 0.6 | 1.2 | 3.2 | 4.4 | 4.6 |
| Germany | 18.4 | 41.1 | 1.0 | 1.4 | 1.9 | 3.0 | 3.0 |
| France | 29.4 | 32.6[d] | 1.1 | 1.3 | 1.6 | 2.6 | 3.0 |
| United Kingdom | 86.2 | 54.2[d] | 3.9 | 4.0 | 5.6 | 4.9 | 4.7 |
| Italy | 44.4 | 84.5 | 1.7 | 4.0 | 6.3 | 9.1 | 9.6 |
| Canada | 53.7 | 55.5[d] | 3.8 | 4.0 | 5.6 | 7.2 | 7.6 |
| Total major seven countries[e] | 39.6 | 50.8 | 1.9 | 2.3 | 3.4 | 4.6 | 4.9 |
| Australia | 41.7 | 24.8[d] | 2.5 | 2.1 | 3.2 | 4.0 | 4.5 |
| Austria | 19.4 | 44.5[d] | 1.0 | 1.3 | 2.5 | 3.1 | 3.3 |
| Belgium | 73.3 | 115.6[d] | 3.4 | 3.5 | 6.1 | 9.5 | 9.8 |
| Denmark | 11.3 | 63.0 | 1.4 | 1.2 | 3.9 | 8.1 | 9.5 |
| Finland | 15.5 | 19.4[d] | 1.0 | 0.7 | 1.0 | 1.5 | 1.7 |
| Greece | 21.3 | 41.9 | 1.0 | 1.4 | 2.4 | 2.9 | 2.9 |
| Netherlands | 51.4 | 61.4[d] | 2.9 | 3.9 | 3.7 | 5.7 | 6.2 |
| Norway | 48.4 | 44.6[d] | 1.8 | 2.1 | 3.9 | 3.9 | 3.8 |
| Spain | 14.4 | 31.3 | 0.6 | 0.5 | 0.8 | 1.3 | 2.1 |
| Sweden | 30.7 | 66.9[d] | 1.9 | 2.2 | 4.2 | 7.7 | 7.7 |
| Total smaller countries[e] | 34.8 | 49.6 | 1.9 | 2.0 | 3.1 | 4.6 | 5.0 |
| Total of above countries[e] | 38.9 | 50.7 | 1.9 | 2.3 | 3.4 | 4.6 | 4.9 |

Source: O.E.C.D. Economic Outlook, December 1984.

Notes:
a. OECD Forecasts
b. OECD projections based on the mechanical assumptions indicated in footnote in the text.
c. Figures in brackets correspond to net interest payments.

FIGURE 3

## HISTORICAL PUBLIC DEBT/GNP RATIOS FOR FIVE MAJOR OECD COUNTRIES (1)




1. Scales vary from country to country.
* Single pre-war observation.
Source: National sources, OECD estimates.

Note: Breaks represent missing data (Japan, Germany, France) or changed definitions (United States, France, Germany).

Source: OECD Economic Outlook,37, June 1985, p.7

saw large increases while the United States was about constant over that period (but rising rapidly, and even explosively towards the end of the period). All major industrial countries saw a rise in the debt-service ratio between 1970 and 1984. The increase was monotonic for all but the United Kingdom whose debt-service ratio peaked (at 5.6 percent) in 1980 and has since fallen to 4.7 percent, slightly below the major country and overall OECD average of 4.9 percent.

In Table 2, I present a decomposition of the change in the U.K. debt-output ratio since 1948 into three parts: the part "due to" the public sector deficit; the part "due to" inflation; and the part "due to" real output growth. Note that this is a purely arithmetic, ex-post accounting exercise. Letting L denote the nominal value of the public debt, p the general price level, and Y real output, it follows that:

$$\Delta\left(\frac{L}{pY}\right) \approx \frac{\Delta L}{pY} - \frac{\Delta P}{P}\frac{L}{pY} - \frac{\Delta Y}{Y}\frac{L}{pY}$$

| change in debt-GDP ratio | ≈ | deficit as a fraction of GDP | - | erosion of the debt-GDP ratio due to inflation | - | erosion of the debt-GDP ratio due to real output growth |
|---|---|---|---|---|---|---|

From Table 2 (where column 2 corresponds to $\Delta(\frac{L}{pY})$, column 3 to $\frac{\Delta L}{pY}$, column 4 to $-\frac{\Delta p}{p}\frac{L}{pY}$, and column 5 to $-\frac{\Delta Y}{Y}\frac{L}{pY}$), we see that the total change in the debt-GDP ratio between 1948 and 1984 of -1.944 can be almost exactly accounted for by the effect of inflation on the real value of the outstanding nominal government debt. The cumulative contribution of the deficits was to increase the ratio by 1.06, while real growth lowered the ratio by 0.98. The fact that <u>ex-post</u> inflation accounted for virtually

TABLE 2

Decomposition of changes in U.K. debt-output ratio 1949-1983

| Year | Debt-output ratio | Δ Debt-output ratio | Contribution of deficits | Contribution of inflation | Contribution of output growth |
|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) |
| 1949 | 2.282 | -0.185 | -0.041 | -0.066 | -0.071 |
| 1950 | 2.249 | -0.033 | 0.056 | -0.004 | -0.084 |
| 1951 | 2.029 | -0.220 | 0.009 | -0.177 | -0.041 |
| 1952 | 1.856 | -0.173 | -0.002 | -0.136 | -0.027 |
| 1953 | 1.731 | -0.126 | 0.011 | -0.056 | -0.076 |
| 1954 | 1.671 | -0.060 | 0.034 | -0.029 | -0.063 |
| 1955 | 1.578 | -0.093 | 0.021 | -0.057 | -0.052 |
| 1956 | 1.465 | -0.114 | 0.006 | -0.087 | -0.028 |
| 1957 | 1.379 | -0.085 | -0.002 | -0.055 | -0.026 |
| 1958 | 1.333 | -0.047 | 0.011 | -0.061 | 0.004 |
| 1959 | 1.274 | -0.059 | 0.007 | -0.021 | -0.043 |
| 1960 | 1.213 | -0.061 | 0.016 | -0.021 | -0.054 |
| 1961 | 1.155 | -0.058 | 0.021 | -0.037 | -0.040 |
| 1962 | 1.123 | -0.032 | 0.017 | -0.035 | -0.013 |
| 1963 | 1.099 | -0.024 | 0.044 | -0.022 | -0.045 |
| 1964 | 1.026 | -0.073 | 0.013 | -0.031 | -0.053 |
| 1965 | 0.966 | -0.059 | 0.007 | -0.039 | -0.025 |
| 1966 | 0.939 | -0.028 | 0.027 | -0.036 | -0.018 |
| 1967 | 0.906 | -0.032 | 0.018 | -0.025 | -0.025 |
| 1968 | 0.899 | -0.008 | 0.060 | -0.028 | -0.040 |
| 1969 | 0.849 | -0.050 | -0.005 | -0.030 | -0.013 |
| 1970 | 0.752 | -0.097 | -0.020 | -0.056 | -0.015 |
| 1971 | 0.668 | -0.084 | 0.007 | -0.070 | -0.017 |
| 1972 | 0.641 | -0.028 | 0.044 | -0.062 | -0.009 |
| 1973 | 0.565 | -0.076 | 0.016 | -0.043 | -0.044 |
| 1974 | 0.535 | -0.030 | 0.049 | -0.083 | 0.004 |
| 1975 | 0.484 | -0.051 | 0.066 | -0.118 | 0.003 |
| 1976 | 0.497 | 0.013 | 0.099 | -0.067 | -0.019 |
| 1977 | 0.520 | 0.023 | 0.089 | -0.060 | -0.006 |
| 1978 | 0.533 | 0.012 | 0.088 | -0.059 | -0.016 |
| 1979 | 0.508 | -0.024 | 0.047 | -0.062 | -0.009 |
| 1980 | 0.478 | -0.030 | 0.044 | -0.082 | 0.009 |
| 1981 | 0.518 | 0.040 | 0.088 | -0.051 | 0.005 |
| 1982 | 0.502 | -0.016 | 0.023 | -0.032 | -0.007 |
| 1983 | 0.496 | -0.006 | 0.038 | -0.027 | -0.017 |
| 1984 | 0.523 | 0.027 | 0.055 | -0.022 | -0.008 |
| Sum | | -1.944 | 1.061 | -1.947 | -0.98 |

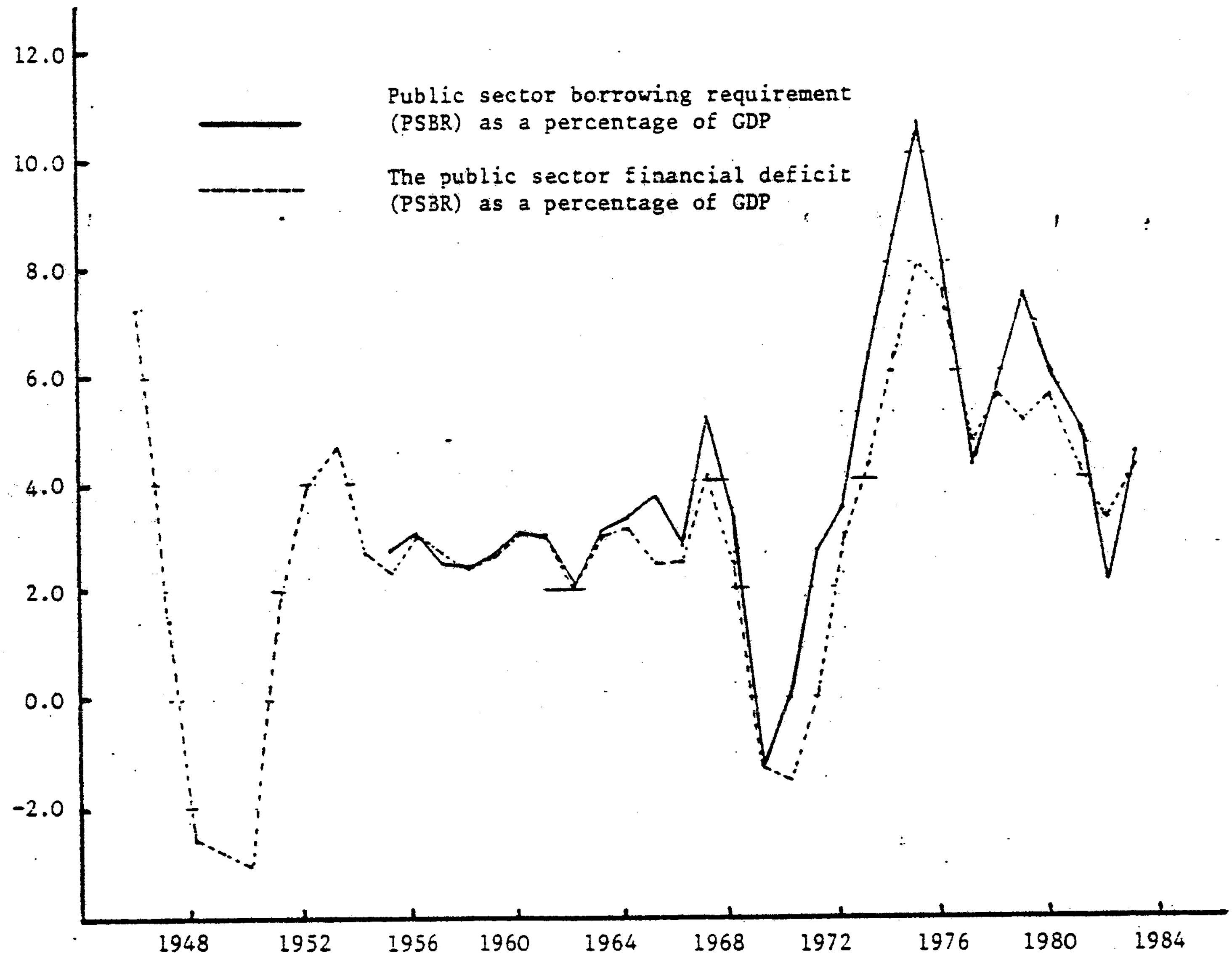
Source: See Figure 1.

all of the reduction in the debt-output ratio since 1948 should not lead one to conclude that the way further to amortise the public debt is to have another bout of inflation. A conjunction of higher inflation, higher real interest rates, low real growth, and large public sector deficits is not unthinkable; and it would result in higher inflation going hand-in-hand with a rising debt burden. Inflation, the debt burden, and real growth are jointly endogenous variables, and, depending on the values of the "deep" structural paramters and the nature of the exogenous disturbances driving the economic system, almost any pattern of covariation between them could be generated. 5/

Figure 4 shows the U.K. public sector financial deficit (PSFD) as a proportion of GDP since 1946 and the public sector borrowing requirement (PSBR) since 1955. Of the two, the PSFD is the more informative, as the PSBR puts "above the line" (counts as current receipts) the proceeds from certain categories of asset sales which the PSFD properly puts "below the line" (i.e., counts as financing). Table 3 reproduces the Bank of England's "inflation corrections" to the PSBR, i.e., an estimate of what the PSBR would have been if debt service had been costed at ex-post real interest rates. 6/ The PSBR explosion from 1975 (an increase in the PSBR-GDP ratio by 11.75 percentage points) is reduced to an increase in the inflation-corrected PSBR-GDP ratio of only 3.5 percentage points (moving from a 5.1 percent surplus to a 1.6 percent surplus). The cumulative inflation-corrected PSBR between 1967 and 1983 (as a percentage of GDP) is a 19.2 percent surplus.

FIGURE 4

The public sector deficit-GDP ratio in the U.K.




Source: Economic Trends, various issues.

TABLE 3

The "inflation-corrected" PSBR in the U.K. since 1967

| Year | PSBR £ Billion | "Inflation correction" £ Billion | "Inflation-corrected" PSBR £ Billion | "Inflation-corrected" PSBR as a proportion of GDP at market prices |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) % |
| 1967 | 1.8 | -0.8 | 1.0 | 2.5 |
| 1968 | 1.3 | -1.2 | 0.1 | 0.2 |
| 1969 | -0.5 | -1.9 | -2.4 | -5.1 |
| 1970 | -0.0 | -2.7 | -2.7 | -5.2 |
| 1971 | 1.3 | -3.2 | -1.9 | -3.3 |
| 1972 | 2.0 | -3.1 | -1.1 | -1.7 |
| 1973 | 4.1 | -4.0 | 0.1 | 0.1 |
| 1974 | 6.4 | -9.3 | -2.9 | -3.4 |
| 1975 | 10.2 | -11.9 | -1.7 | -1.6 |
| 1976 | 9.0 | -7.5 | 1.5 | 1.2 |
| 1977 | 5.5 | -9.4 | -3.9 | -2.7 |
| 1978 | 8.5 | -6.7 | 1.8 | 1.1 |
| 1979 | 12.7 | -14.9 | -2.2 | -1.1 |
| 1980 | 11.8 | -13.1 | -1.3 | -0.6 |
| 1981 | 10.6 | -12.3 | -1.7 | -0.7 |
| 1982 | 5.0 | -7.3 | -2.3 | -0.8 |
| 1983 | 11.6 | -5.9 | 5.7 | 1.9 |

Source: Bank of England Quarterly Bulletin, June 1980 and June 1984.

Note: Column 2 - Sectoral net monetary assets x percentage of change in consumers' deflator (an exchange rate correction is applied to assets and liabilities denominated in foreign currency).

## 3. Deficits, Debt and Inflation

The fear that public sector deficits eventually will be monetized and thus lead to inflation is a deep-rooted one among economic policy makers, officials of treasuries, central banks, international organizations, and among the public at large. There are two distinct but not mutually exclusive views of the debt-deficit-inflation nexus. The first emphasizes the incentive for a government to reduce the real value of its outstanding stock of interest-bearing, nominally-denominated (i.e., non-index-linked) debt through an unexpected burst of inflation. The second, recently restated by Sargent and Wallace [1981], emphasizes the long-run inflationary consequences of a short- or medium-term switch from money or tax financing to debt financing of a given public spending programme. This second view does not require inflationary surprises in order to be valid.

### a. Amortizing the public debt through inflation

There are four ways through which governments can reduce the real value of their debt. 7/ First, at a given general price level and a given nominal price of bonds, they can run a budget surplus. Second, they can attempt to reduce the real value of the outstanding stock of debt, at a given general price level, by pursuing or announcing policies that cause a drop in bond prices. Third, an inflationary policy can reduce the real value of the inherited stock of debt, even with a balanced budget and given nominal bond prices. Finally, a government can formally repudiate part or all of its debt. The discussion of this final option is left to the next section.

Why should governments wish to reduce the real value of their debt? We can distinguish distributional and efficiency reasons. The distributional issues are fairly straightforward. Those who hold the debt and those who pay the taxes that service the debt are not the same people. Typically, debt is owned (directly or indirectly through pension funds and other financial institutions) by people who are, on average, both older and richer than the representative taxpayer. The recurrent caricature of the toiling workers supporting the idle (retired?) rentiers is an exaggerated version of this distributional conflict. In the short run, debt debasement favours labour, and the young in general, at the expense of rentiers and older people. The efficiency argument focuses on the role of public debt in crowding out private saving and capital formation. If the authorities judge the domestic rate of capital formation to be less than the optimal rate, one possible remedy is to stimulate private saving by reducing the real value of the financial claims of the private sector on the public sector. Provided this can be achieved without a Keynesian slump in effective demand, such a policy will stimulate both private saving and investment.

A systematic view of the deficit-debt-inflation nexus starts from the consolidated government budget identity given in equation (1).

$$(1)\quad \frac{1}{P}[\dot{M} + \dot{B}^S + p^L\dot{B}^L - e\dot{Z}] \equiv G - T + \frac{i^S B^S + cB^L}{P} \quad \underline{8/}$$

$M_t$ is the stock of high-powered money or base money outstanding at the beginning of period t. For simplicity, the entire maturity structure of the debt is summarized by its two extremes. Very short debt, with a fixed nominal market price (set equal to unity) and a variable interest rate $i^S$, is outstanding in an amount $B^S_t$. Very long debt, perpetuities or consols with a fixed nominal coupon, c, and a variable market price $P^L_t \equiv c/i^L_t$ is outstanding in amount $B^L_t$. $i^L_t$ is the long nominal rate of interest or the coupon yield on consols. $Z_t$ is the stock of official foreign exchange reserves, and $e_t$ the price of foreign exchange. 9/ $G_t$ is the real value of "exhaustive" public spending on goods and services, $T_t$ the real value of taxes net of transfers, and $p_t$ the general price level.

Equation (1) is often referred to as the government budget "constraint" or (worse) as the budget "restraint." Budget identity much more accurately reflects the nature of (1). It is an identity linking all public sector sources of funds and uses of funds together. The constraint lies not in (1) but in the limits we set, implicitly or explicitly, on the government's ability to borrow (i.e., on the real stock of debt or the debt-output ratio), in the lower bound we impose on the stock of foreign exchange reserves and in the constraints, political or through the demand for real money balances, imposed on the real value of the resoures that the government can appropriate through seigniorage: $\dot{M}/P$. This issue will be reviewed below when the solvency of the government is analysed.

We define the primary deficit, D, to be the deficit exclusive of interest payments and other debt-service

$$(2) \quad D \equiv p(G - T)$$

Equation (1) states the well-known fact that the primary deficit plus interest payments on the outstanding debt must be financed by borrowing short or long, by printing money or by running down foreign exchange reserves. While even in the post-Bretton Woods era purchases and sales of official foreign exchange reserves have not disappeared, I shall for simplicity of exposition ignore fluctuations in official foreign exchange holdings.

Equation (1) then simplifies to

$$(1') \qquad \dot{M} + \dot{B}^s + p^L \dot{B}^L \equiv D + i^s B^s + cB^L$$

The change in the real value of the debt, $b \equiv \frac{B^s + p^L B^L}{P}$, is the sum of the real value of the budget deficit $\frac{D + i^s B^s + cB^L}{p}$, net of the amount of money financing or seigniorage (in real terms) $\dot{M}/P$, and the increase (reduction) in the real value of the outstanding stock of debt due to a falling (rising) general price level, p, and/or a rising (falling) price of bonds, $p^L$.

$$(3) \qquad \dot{b} \equiv \frac{D + i^s B^s + cB^L}{p} - \frac{\dot{M}}{p} - \frac{\dot{p}}{p} b + \frac{\dot{p}^L}{p^L} \left(\frac{B^L p^L}{p}\right)$$

Let $\mu$ denote the single-period or instantaneous proportional rate of growth of the nominal money stock; $\mu \equiv \dot{M}/M$, $m \equiv M/p$, the real stock of high powered money, and $d \equiv D/p$, the real primary deficit. The presentation of the results is facilitated greatly if we assume that the short and long interest rates are related to each other through the "expectations hypothesis" of the term structure. With risk-neutral operators in financial markets this implies that the expected rate of return on long bonds (including any expected capital gain or loss due to changes in the price of long bonds) must equal the yield on short bonds, or, letting $E_t$ denote expectations formed at time t:

$$(4) \qquad i_t^s = \frac{c}{p_t^L} + E_t\left(\frac{\dot{p}^L(t)}{p^L(t)}\right)$$

We can then write the expected or planned change in the real value of the public debt as:

$$(5) \qquad E(\dot{b}) \equiv d + r^s b - \mu m$$

If $U_t$ denotes the surprise or unexpected value at time t, then ex-post, the actual value of the change in the real stock of debt is given by

$$(6) \qquad \dot{b} = E(\dot{b}) + U(\dot{b}) = d + r^s b - \mu m - bU\left(\frac{\dot{P}}{P}\right) + \frac{B^L p^L}{P} U\left(\frac{\dot{p}^L}{p^L}\right)$$

Equation (6) shows that a correctly anticipated policy of inflation will not affect the real stock of public debt outstanding unless it affects the real primary deficit, d, the ex-ante short real interest rate, $r^s$, or the real revenue from money creation (real seigniorage) $\mu m \equiv \dot{M}/P$. An unanticipated inflation policy may in addition lower the real value of the public debt by causing private bondholders to underpredict the inflation rate ($U(\dot{p}/p) > 0$) or overpredict the increase in the price of long-dated debt ($U(\dot{p}_L/p_L < 0$).

The theoretical and empirical case for an effect of a fully anticipated and well-understood inflation policy on the ex-ante real interest rate is open. 10/ A reasonable benchmark is to assume that higher expected inflation is fully reflected in nominal interest rates, leaving the real rate unaffected.

The extent to which the real primary deficit is affected by inflation depends on the institutional, legal, administrative, and political framework governing the determination of public spending and taxation. E.g., with a progressive and incompletely indexed tax system, there will be an increase in the real tax burden through "bracket creep" when the general price level rises. Depending on the way in which they are implemented, a system of "cash limits" may lead to an (unexpected) reduction in the real value of public spending when there is an (unexpected) increase in the price level. 11/

The implications of a more inflationary policy for real seigniorage revenue are quite straightforward. If we limit ourselves to the case of a sustained increase in the rate of inflation, this higher rate of inflation is likely to be associated with an equal increase in the trend rate of growth of base money. Let the demand for real money balances, $m^d$, be a decreasing function of the short nominal interest rate and of the rate of inflation, $\pi$, and an increasing function of real national income, y, i.e.

$$m^d \;=\; l(i^s, \quad, y) \qquad l_{i^s} < 0; \;\; l \;\; < 0; \;\; l_y > 0$$

The effect of a higher rate of growth of the nominal money stock on real seigniorage  m, if inflation changes one-for-one with money growth and if real output and the real interest rate are invariant under changes in the rate of inflation, is given by:

(7) $$\frac{\partial(\mu m)}{\partial\mu} = m + \mu(l_{i^s} + l_{\pi})$$

Real seigniorage, therefore, increases with the rate of money growth if and only if the (absolute value of the) total (direct and indirect through $i^s$) inflation elasticity of demand for real money balances is less than $\pi/\mu$. If the natural rate of growth is not too large, this becomes the familiar condition that higher inflation increases real seigniorage if the inflation elasticity of demand for high-powered money is below unity.

I estimated a simple demand for high-powered money function for the United Kingdom using annual data from 1948 to 1984. The dependent variable was M/P, the real monetary base (the wide monetary base deflated by the GDP deflator at factor cost). Independent variables were a constant, a time trend, current and lagged values of real output, y (real GDP at factor cost), a short nominal interest rate, $i^s$ (the three-month Treasury Bill yield after 1960, the three-month Treasury Bill discount rate up to 1960), a long nominal interest rate, $i^L$ (the yield on consols or the British government securities long dated (20 years) yield), the rate of inflation $\dot{p}/p$ (the proportional rate of change of the GDP deflator at factor cost), and lagged values of the real monetary base.

The best estimate in terms of residual autocorrelation, parameter stability, and goodness of fit is given below in equation (8). (Figures in brackets below coefficient estimates are absolute values of t statistics.)

$$(8)\ \ln(\tfrac{M}{P}) = \underset{(10.0858)}{-3.47271} - \underset{(9.91106)}{.0253356t} + \underset{(10.2741)}{.955959\ln y} - \underset{(12.4063)}{.515961}\frac{\dot{P}}{P} + \underset{(16.8825)}{.669274}\ln(\tfrac{M}{P})_{-1}$$

SSR = .00415094; SER - .0115716; $R^2$ = .9916; $\bar{R}^2$ = .9905;

DW = 1.8253; No. of observations = 36; 1948-84; F(4, 31) = 912.194

When the inflation rate was included as a regressor, neither the short interest rate nor either of the two long rates were significant. The semi-elasticity of the demand for real base money with respect to the inflation rate has a long-run value of -1.56. The estimated long-run income elasticity of demand for high-powered money is an implausibly high 2.89. The estimate of the annual trend decline in the demand for base money is 7.66 percent. Ideally, the trend should capture the consequences of institutional changes in the financial, monetary, and payments mechanisms that were responsible for the secular increase in money base velocity over the sample period. It seems likely that current income captures mainly cyclical effects on velocity and that part of the effect of trend or permanent income is picked up by the trend term. I tried to allow for this by more general lag structures for y (as well as for the other regressors), and by adding private consumption (or the sum of private and public consumption) as a better proxy for permanent income, but this did not yield more plausible results. Specifying the relationship in per capita terms worsened things, i.e., the point estimates of the long-run income elasticity of high-powered money demand and of the long-run annual trend decline in money demand both increased. Simultaneity problems may well arise in connection with equation (8), through the output and inflation terms. Re-estimating (8) using an instrumental variable estimator (with public spending on goods and services, the volume of world trade, a measure of the world price level and the U.S. three-month Treasury Bill rate as instruments) did not lead to significantly different coefficient estimates but worsened the residual autocorrelation properties.

From (8) a value of -1.5 for the inflation semi-elasticity would be reasonable. The annual inflation rate would have to exceed 67 percent for a further increase in the rate of inflation to yield a reduction in real government revenue from money creation. 12/ While historical and foreseeable inflation rates would seem to place the British economy in the range where higher inflation rates still boost total revenue from the "inflation tax," the amounts involved are small. Table 4 shows the historical insignificance of seigniorage revenue in the British economy. It would have taken an increase in the tax burden of only 0.55 percent of GDP in order to do away with the need for revenue from seigniorage altogether. It therefore seems implausible to base a positive theory of inflation for Britain on the perceived need of successive governments to extend the tax base and find a further source of revenue. I would go further and argue that the fact that we have experienced (and are still experiencing) any inflation at all in the United Kingdom and the other industrial countries (albeit at rates well below the seigniorage-maximizing

TABLE 4

Seignorage as a source of revenue in the U.K. 1948-1983

| Year | Change in money base as a % of GDP | Change in money base as a % of total tax receipts* | Change in money base as a % of general government taxes and N.I. contributions | Money-base as a % of GDP |
|---|---|---|---|---|
| | (1) | (2) | (3) | (4) |
| 1948 | -1.04 | -2.43 | -2.59 | 16.57 |
| 1949 | 0.13 | 0.29 | 0.31 | 15.73 |
| 1950 | 0.00 | 0.00 | 0.00 | 15.12 |
| 1951 | 0.47 | 1.15 | 1.24 | 14.05 |
| 1952 | 0.52 | 1.32 | 1.41 | 13.38 |
| 1953 | 0.67 | 1.81 | 1.96 | 13.07 |
| 1954 | 0.65 | 1.79 | 1.94 | 13.02 |
| 1955 | 0.63 | 1.71 | 1.86 | 12.77 |
| 1956 | 0.51 | 1.45 | 1.59 | 12.32 |
| 1957 | 0.44 | 1.24 | 1.36 | 12.06 |
| 1958 | 0.38 | 1.03 | 1.13 | 11.93 |
| 1959 | 0.42 | 1.16 | 1.29 | 11.77 |
| 1960 | 0.52 | 1.48 | 1.65 | 11.59 |
| 1961 | 0.44 | 1.23 | 1.36 | 11.28 |
| 1962 | 0.12 | 0.32 | 0.35 | 10.92 |
| 1963 | 0.24 | 0.66 | 0.73 | 10.51 |
| 1964 | 0.57 | 1.56 | 1.73 | 10.26 |
| 1965 | 0.59 | 1.52 | 1.69 | 10.19 |
| 1966 | 0.51 | 1.25 | 1.40 | 10.12 |
| 1967 | 0.28 | 0.67 | 0.74 | 9.86 |
| 1968 | 0.49 | 1.11 | 1.23 | 9.64 |
| 1969 | 0.33 | 0.69 | 0.77 | 9.49 |
| 1970 | 0.32 | 0.67 | 0.74 | 8.96 |
| 1971 | 0.65 | 1.45 | 1.67 | 8.53 |
| 1972 | 0.43 | 0.99 | 1.11 | 8.06 |
| 1973 | 0.82 | 1.97 | 2.22 | 7.72 |
| 1974 | 0.76 | 1.70 | 1.91 | 7.42 |
| 1975 | 0.83 | 1.86 | 2.07 | 6.69 |
| 1976 | 0.69 | 1.57 | 1.76 | 6.33 |
| 1977 | 0.61 | 1.38 | 1.54 | 6.18 |
| 1978 | 0.81 | 1.90 | 2.12 | 6.17 |
| 1979 | 0.72 | 1.62 | 1.81 | 6.09 |
| 1980 | 0.41 | 0.89 | 1.00 | 5.63 |
| 1981 | 0.32 | 0.66 | 0.74 | 5.47 |
| 1982 | 0.04 | 0.09 | 0.10 | 5.10 |
| 1983 | 0.27 | 0.55 | 0.60 | 4.94 |

Note: * Taxes, N.I. contributions, trading income, rent, royalties, interest etc.

level) cannot be rationalized in terms of the optimal trade-off between seigniorage and the other sources of revenue. Instead it seems likely that the increasing inflation rates and rates of monetary growth of the sixies and seventies were the byproduct of policies aimed at maintaining capacity utilization rates and unemployment rates in the face of deteriorating supply-side conditions, and/or of attempts to exploit a non-existent long-run employment-inflation trade-off, regardless of the revenue implications of the increasing rates of monetary growth. In other words, the data support the screw-up theory of inflation rather than the optimal seigniorage theory of inflation.

Not only has seigniorage historically been an insignificant source of government revenue in the United Kingdom, my estimate of the demand for narrow money in equation (8) suggests that the maximum possible yield of this tax is also small. With a constant semi-elasticity of -1.5, the seigniorage-maximizing annual inflation rate is 67 percent and the maximal seigniorage in mid-sample 1967 is 2.74 percent of GDP. Earlier work yielded a seignoriage-maximizing annual inflation rate of 50 percent and maximal seigniorage in mid-sample of 1.9 percent of GDP. Both estimates lead one to conclude that <u>expected</u> inflation appears to be a costly way of raising additional government revenue. These calculations are no more than recreational and should be taken as indicative, at most, of orders of magnitude.

Seigniorage revenue, defined here as revenue from the <u>expected</u> inflation tax is of course but one part of the total inflation tax.

Unanticipated inflation is potentially the most important means by which a government can reduce the real value of its nominally denominated debt other than through formal repudiation or default. From equation (6) it can be seen that unanticipated inflation reduces the real value of all debt (other than index-linked debt) and that an unexpected decline in the price of long debt further reduces the real value of debt with longer maturities. Even moderate unexpected changes in the rate of inflation can have dramatic effects on the market value of long-dated non-indexed debt, if these changes are expected to persist. This can be seen as follows.

If the expectations theory of the term structure holds, and if short nominal interest rates are expected to be the same in the future as they are today, the price of consols will be related to the current short rate as in equation (9). 13/

$$P^L(t) = \frac{c}{i^s} \tag{9}$$

If the rate of inflation goes up by one percentage point and if the short real interest rate is unaffected by the rate of inflation then the price of consols will fall by $(i^L)^{-1}$ percentage points. E.g., with $i^L = 0.10$, a 1 percentage point increase in the rate of inflation will cause a 10 percent drop in the price of consols. More generally, with long bonds characterized by a constant coupon c, time remaining to maturity T-t, and a redemption value of $P^B(T)$, the price $P^B$ is related to the current short interest rate if short rates are expected to remain constant as follows: 14/

(10) $$p^B(t) = \frac{c}{i^s} + (p^B(T) - \frac{c}{i^s})\, e^{-i^s(T-t)}$$

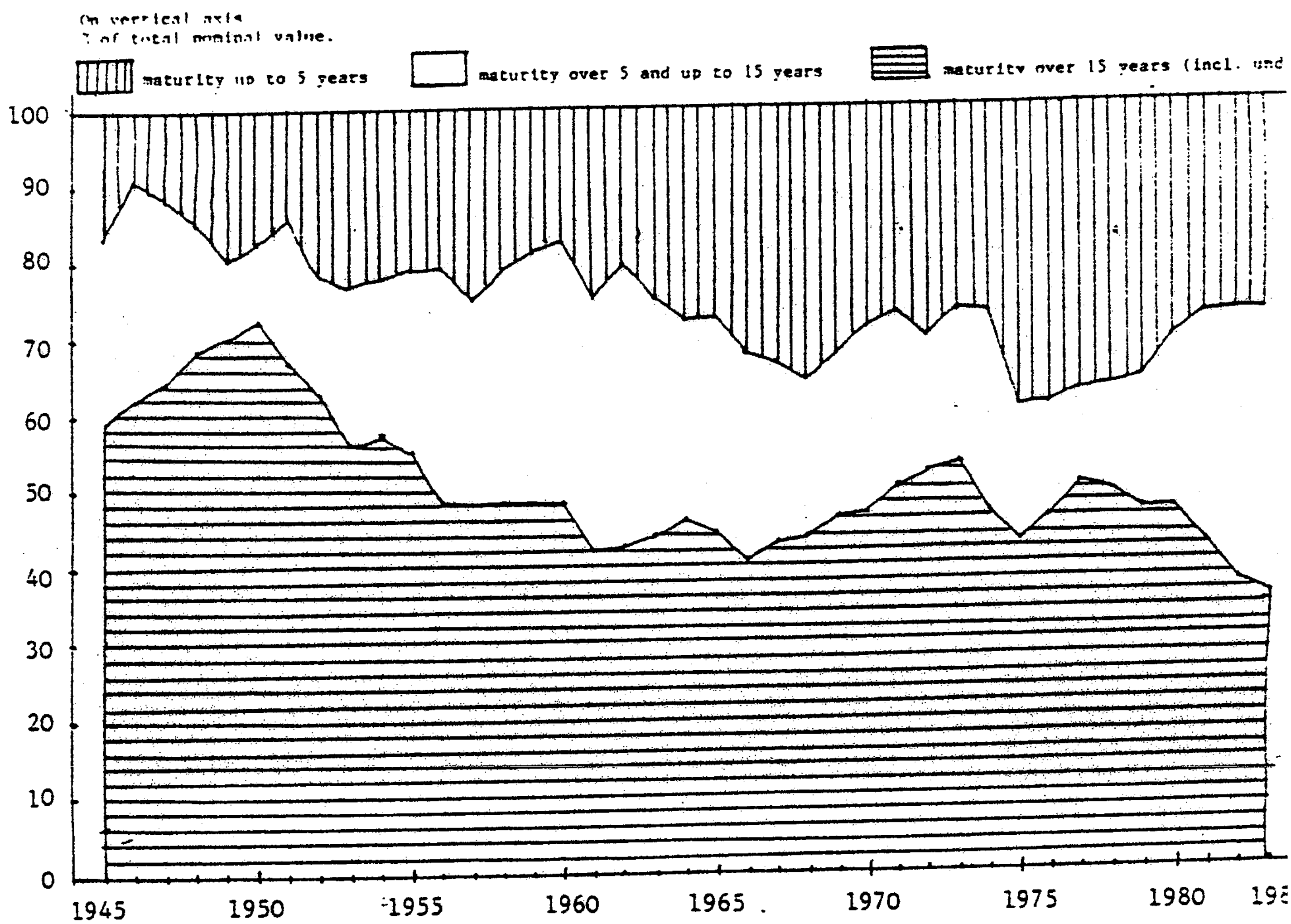
The effect of an increase in the current and expected future short rate on the price of long bonds of any maturity is easily seen to be negative. 15/ Higher current and expected future short nominal interest rates associated with higher expected future inflation, which was unanticipated at the time that the longer maturity nominal debt was issued, will not be reflected in the coupon rate or the issue price of these long-term bond issues. This will therefore lead to a fall in the market value of this debt, and effectively serve as an unexpected levy on bondholders. In the bondholders' balance sheet this will show up as a capital loss. From the government's point of view it is akin to amortization of part of its long-term debt.

In principle, even very short-term debt can be amortized this way, if it is possible to engineer an unexpected instantaneous discrete jump in the general price level. Unlike the price of government debt instruments, which are traded in an organized and (technically) highly efficient set of financial markets, the general price level (e.g., the CPI or the GDP deflator) does not, pace the New Classical Macroeconomics, behave like an asset price set in an efficient auction market. In an open economy it may be possible to "jump" the price level on an unsuspecting private sector (through an unexpected discrete devaluation of the exchange rate) to the extent that the relevant domestic price index moves with the exchange rate; but for a country like Britain this is not an attractive option. 16/ With very short maturity debt, floating rate debt (and of course index-linked debt) the scope for governments to lower the ex-post real rate of return on their debt significantly below the ex-ante expected real rate, is quite limited. Figure 5 shows the reduction in the average maturity of the British public debt that has taken place since 1945.

The data have their problems. They reflect nominal values rather than market values, which may be a serious matter in the case of long debt, and the maturity classification is very coarse. There could be considerable changes in average maturity due to changes in maturity structure within each of the three categories which would not be picked up by our Chart. Finally, index-linked debt should, for our purposes, be taken out of the totals. 17/ This shortening of the debt structure (which has also occurred in the United States) has made unexpected inflation less effective as a means of liquidating real debt. Note that merely observing (ex-post) a decline in the nominal market value (and therefore a fortiori the real value) of long-dated, non-index-linked debt during inflationary periods is not sufficient to conclude that the government was cheating the bondholders. A smooth, continuous decline in nominal bond prices (as opposed to a discrete, discontinuous drop in bond prices) is perfectly consistent with the unfolding of an inflation scenario that was fully anticipated right from the time the long bonds were first issued. Neither are negative ex-post, realized rates of return on government debt necessarily evidence of a government welshing on its

FIGURE 5

The maturity structure of the U.K. public debt* 1945-1983




Source: Annual Abstract Statistics, various issues.

Note: * British government and government guaranteed marketable securities. Nominal values at 31st March. Non-official holdings.

implicit debt obligations. There is no economic law to ensure that ex-ante, anticipated real rates of return should be positive. Evidence of governmental dishonesty requires independent measurement of both ex-ante and ex-post rates of returns on public debt and the demonstration that deliberate government actions contributed to the private sector over-estimating the returns from holding public debt.

By issuing only index-linked debt, governments would lose the option of reducing the real value of their debt by unexpected inflation. Seigniorage revenue, the expected inflation tax, could of course still be extracted. By reducing the benefits to the government from unexpected inflation, the indexation of the public debt (and indeed of the tax-transfer and exhaustive spending rules) might make a government commitment to a policy of stable prices more credible and time-consistent.

b. Debt, deficits, and monetization

The recurrent notion that deficits will, eventually, have to be monetized, has been formalized fairly recently in a paper by Sargent and Wallace [1981] (see also Buiter [1982] and Sargent [1983]). In a nutshell, the argument can be put as follows. Public sector deficits are financed either by printing money or by borrowing. After some date, T, the debt-output ratio $\tilde{b} \equiv b/y$ is kept constant: $\tilde{b}(t) = \bar{\tilde{b}}(T)$, $t > T$. With an exogenously given real primary deficit, money financing then becomes endogenous. It is the residual financing mode. The real interest rate $r^s$ is assumed to be fixed and to exceed the trend rate of growth of real output, n. With the debt-output ratio constant after T, new issues of debt are just sufficient to offset the downward effects of inflation and real output growth on the debt-output ratio. Money growth after T is therefore given by:

$$(11) \quad \mu(t) \equiv v(t)[\tilde{d}(t) + (r^s - n)\bar{\bar{b}}(T)] \qquad t > T$$

v is the income velocity of circulation of money and $\tilde{d}$ the primary deficit as a proportion of output.

To estimate the eventual monetization implied by the fiscal stance one must therefore calculate the "inflation-and-real-growth-corrected" deficit as a proporation of GDP: $\tilde{d} + (r^s - n)\bar{\bar{b}}$. Note that the debt-output ratio $\bar{\bar{b}}$ in this calculation is a sustainable and sustained debt-output ratio. Care must be taken not to indentify it with the currently observed ratio of the market value of the public debt to output, when one wishes to estimate the inflation-and-real-growth-corrected deficit that would be observed if a lower rate of inflation were to be achieved unexpectedly. Assume such an unexpected reduction in inflation leaves $r^s$ unchanged and reduces current and expected future $i^s$ one-for-one. At a given general price level, the real value of nominally denominated, long-dated debt will increase as a result of the decline in current and expected future short nominal interest rates (see equations (9) and (10) and the discussion of this issue in the previous subsection.) $(r^s - n)(B^s/pY + p^L B^L/pY)$ will therefore increase even if $r^s$, n, $B^s$, $B^L$, p and Y are unchanged, because $p^L$ will increase. In order to stabilize the debt-output ratio at its current value, surpluses (measured conventionally) will have to be run to couteract the increase in the real value of long-dated nominal debt as inflation declines. 18/

A number of conclusions can be drawn from equation (11). First, if the real interest rate exceeds the real growth rate, a higher debt-output ratio will be associated with a higher proportional rate of growth of the nominal money stock, unless velocity falls (the demand for money per unit of output increases) so as to offset the higher debt service burden. If the real interest rate instead of being constant increased with the debt-output ratio, these conclusions would be reinforced (see W.H. Buiter [1982]). Thus, any financing policy prior to T that leads to increased debt accumulation (a higher value of $\tilde{\bar{b}}(T)$), will require higher real seigniorage $\mu\tilde{m}$ after T, and thus, if money demand is less than unit elastic with respect to the inflation rate, a higher rate of growth of nominal money and, sooner or later, more inflation.

We saw before that the (steady-state) revenue from seigniorage is maximized when the inflation elasticity of money demand equals (approximately) unity. If inflation is a "bad," no rational government would permit inflation to rise above the seigniorage-maximizing level, i.e., operate on the wrong side of the "seigniorage Laffer curve."

In Britain, the income-velocity of circulation of high-powered money has risen steadily since the end of World War II, from 5.00 in 1946 to 20.24 in 1983. Even in the most favourable case where velocity is constant rather than increasing with the rate of inflation, a British government would be unlikely to choose to finance an increase in debt service due to a higher debt-output ratio by printing money rather than by raising explicit taxes. With a constant velocity of 20 and a real interest rate that is 2 percentage points above the trend growth rate of output, an extra 10 percentage points on the debt-output ratio would require a 4.0 percent increase in the rate of money growth and thus in the long-run rate of inflation. 19/ To finance the increased debt service at an unchanged rate of inflation by raising taxes would require an increase in taxes (or cut in transfer payments) equal to one-fifth of one percent of GNP only. 20/ It would be very unlikely for an economy like the United Kingdom, with a well-developed financial system (reflected in a high money base velocity) and a reasonably broad tax base, to choose "secular" money financing over tax financing. The situation is of course quite different for a number of third world countries. Many of them have relatively rudimentary internal financial systems, reflected, among other things, in a much lower money base velocity. Many also have a very narrow tax base and the administrative and political constraints on raising taxes and cutting public spending may be more severe than in the industrialized countries. Even in Britain in the immediate post-World War II years, when money base velocity was about 5, the cost of a 10 percentage point increase in the debt-output ratio would (with a constant velocity) only have been a 1 percent rise in the inflation rate. Note that the relative atractiveness of seigniorage versus explicit taxation is not affected if we recognize that the real interest rate is likely to increase with the debt-output ratio, as this affects the amounts to be raised through seigniorage or taxation equally.

## 4. Deficits, Debt and Solvency

The ultimate nightmare of every Chancellor of the Exchequer must be the notion of state bankruptcy, of a default by the government on some or all of its liabilities. We get some idea of what such a doomsday scenario implies by disaggregating the government budget identity (1') as in (12)

$$(12)\qquad p^{-1}[\dot{M} + \dot{B}^{s} + p^{L}\dot{B}^{L} - p_{N}\dot{N}^{G}] \equiv$$

$$c^{G} + \delta K^{G} + \dot{K}^{G} - T + \frac{i^{s}B^{s} + cB^{L}}{p} - \rho_{K}K^{G} - \rho_{K}K^{G} - \rho_{N}N^{G}$$

Total government exhaustive spending is broken down into consumption spending, $c^G$; depreciation of the public sector capital stock, $\delta K^G$, where $\delta$ is the depreciation rate and $K^G$ the public sector capital stock; and net public sector investment, $\dot{K}^G$, i.e., $G \equiv c^G + \delta K^G + \dot{K}^G$. There are two further sources of government revenue. The first is income from capital $\rho_K K^G$, where $\rho_K$ is the rate of return on public sector capital appropriated by the government. This could of course be negative and need bear no relation to the social rate of return on public sector capital. The second is the income accruing to the government from its ownership of natural resource property rights $\rho_N N^G$. North Sea oil revenue would fall into this category for Britain. On the left-hand side of (12) one further financing mode is recognized: the sale by the government of its assets, specifically of its ownership claims on natural resources which are sold at a price $p^N$. All sales of existing assets properly belong to the "financing" category. They are put "below the line" or on the left-hand side of (12). As noted, the public sector financial deficit (PSFD) in principle conforms with the left-hand-side of (12), the PSBR does not. It includes certain financing items (such as the sale of public sector assets when this involves a loss of public sector majority ownership) as current revenue (above the line). The reasons for this uniformative way of presenting the data are lost in history. $\dot{K}^G$ on the right-hand-side of (12) represents net investment spending on currently produced capital goods only. The privatization of British Telecom belongs on the left-hand-side. Foreign assets and liabilities are omitted for simplicity.

While the statistics contain seris for $c^G$, $\rho K^G$, and $\dot{K}^G$, the mapping of the statistical aggregates into the economic categories of consumption, depreciation, and capital formation is very unsatisfactory. Current expenditure on education and health is classified as final consumption rather than (in part) as human capital formation or as depreciation. Law and order and defense should not be classified as consumption but either as spending on intermediate goods (i.e., not counted directly in value added at all) or as a form of capital expenditure.

a. <u>The solvency constraint</u>

If expected (ex-ante) rates of return on all assets are equalized, we can solve (sum or integrate) the government's current period budget identity over time and obtain the public sector's intertemporal budget identity given in (13)

$$(13) \quad PV(c^G, t, r^s) \equiv p_K(t)K^G(t) + p_N(t)N^G(t) - \left(\frac{B^s(t) + p^L(t)B^L(t)}{p(t)}\right) + PV(T, t, r^s) + PV(\frac{\dot{M}}{p}, t, r^s) + PV((p_K-1)\dot{K}, t, r^s) + \Omega(t)$$

$PV(c^G, t, r^s)$ denotes the present value, at time t, of the government's planned or expected real consumption spending programme, from now until Kingdom Come, when $r^s$ is the instantaneous discount rate. 21/ Similarly, $PV(T, t, r^s)$ is the present value of the government's real tax-transfer programme and $PV(\dot{M}/P, t, r^s)$ the present value of future real seigniorage. Equation (13) states that the present value of the government's consumption programme (on the left-hand-side) should equal its "net worth," the excess of the value of its assets over its liabilities (on the right-hand-side). Its assets are partly tangible (and potentially marketable) and partly intangible (and non-marketable). The stock of publicly-owned capital is valued by the present value of the future quasi-rents accruing to the public sector, i.e., $p_K(t) \equiv PV(\rho_K, t, r^s)$ and natural resource property rights are valued by the present value of the income accruing from their exploitation, $p_N(t) \equiv PV(\rho_N, t, r^s)$.

Note again that $p_K(t)$ (and/or $P_N(t)$) could be negative, if the public capital stock (natural resource endowment) is operated at a loss. There are two intangible assets in the government's balance sheet: the present value of future taxes net of transfers $PV(T, t, r^s)$; and the present value of future seigniorage $PV(\dot{M}/p, t, r^s)$. On the liability side, there are the two interest-bearing financial debt instruments $B^s$ and $B^L$. 22/

Government net worth is an increasing (decreasing) function of the size of the future public sector capital formation programme to the extent that the shadow price of public sector capital ($p_K$) exceeds (falls short of) its opportunity cost which, without loss of generality, we set equal to 1. If, at the margin, public and private sectors use capital with an equal degree of inefficiency, public sector capital formation does not alter public sector net worth. By the same token, privatization of public sector assets or nationalization of private assets (on private market terms) affects public sector net worth only to the extent that the assets are used with different degrees of efficiency in the public and private sectors. $PV((p_K-1)\dot{K}, t, r^s)$ measures the present value of the future planned public sector capital formation programme.

The last item in the intertemporal budget identity finally permits us to turn it into an intertemporal budget constraint or solvency constraint. It is easily checked that $\Omega_t$ is the present value of the government's expected net terminal tangible liabilities. 23/ The solvency constraint is $\Omega(t) = 0$, which gives us (14) as the public sector's intertemporal present value budget constraint.

$$(14) \quad \frac{B^S(t) + p^L(t)B^L(t)}{p(t)} - p_K(t)K^G(t) - p_N(t)N^G(t) \equiv PV[T - c^G + (p_K-1)\dot{K}, t, r^s] + PV(\frac{\dot{M}}{p}, t, r^s),$$

The solvency constraint sets a limit on the growth, in the very long run, of the government's planned or expected net marketable or tangible liabilities.

If the real interest rate $r^s$ exceeds the natural rate of growth of output, n, the terminal or transversality condition $\Omega(t) = 0$ is implied by the weak and rather reasonable requirement that the ratio of net marketable public sector debt to trend output remains bounded. 24/ If the real interest rate lies below the natural growth rate, honest Ponzi games (servicing existing debt through further borrowing) are perfectly feasible and the conditoin $\Omega(t) = 0$ is arbitrary and ad-hoc. There exist well-known theoretical models that can be characterized by dynamically inefficient competitive equlibria with $r^s < n$. The post-World War II experience until the late seventies provides ample evidence of a multi-year run of (ex-post) real rates of interest below the natural growth rate.

Following established practice, I'll assume in what allows that, at any rate in the long run, $r^s > n$, and impose $\Omega(t) = 0$ as the government's solvency constraint.

Equation (14) states that the market value of the government's net non-monetary debt has to be matched by the present value of the expected future primary current surpluses and the present value of expected future seigniorage. It can be rewritten as in (14')

$$(14') \quad \frac{B^S(t) + p^L(t)B^L(t)}{P(t)Y(t)} - p_K(t)\frac{K^G(t)}{Y(t)} - p_N(t)\frac{N^G(t)}{Y(t)} \equiv$$

$$PV\left(\frac{T - cG + (p_K - 1)\dot{K}}{Y}, t, r^s - n\right) + PV\left(\frac{\dot{M}}{PY}, t, r^s - n\right)$$

Equation (14') expresses the same relationship in terms of net debt-output ratios, future primary current surpluses as a share of GNP and seigniorage as a proportion of GNP. The relevant discount rate in this second set of present value calculations is the real interest rate minus the natural rate of growth. Note that the appropriate primary deficit is the government's current account deficit. Public capital formation is netted out. Only if the value of public sector capital differs from its opportunity cost should allowance be made for public sector capital formation.

Six short points should be made about the formalism of the solvency constraint before we turn to the theory and practice of repudiation.

First, equations (14) and (14') discount real values at real interest rates. An equivalent expression can be derived by discounting nominal values at nominal interest rates. 25/ Discounting real values at nominal interest rates would be an irrational procedure, although Modigliani and Cohn [1981] have argued that such behavior accounts for the undervaluation of the stock market in inflationary periods.

Second, consider what would happen if, contrary to my assumption, $n > r^s$. Using the simplified budget constraint $\dot{b} \equiv G + r^s b - T$, where all public spending G is current, all bonds are short, index-linked bonds, and there is no money, it is easily seen that the forward-looking present value budget identity is not defined. However, the debt-output ratio is perfectly well-behaved for any finite primary deficit as a proportion of output, $\tilde{d}$.

$$\tilde{b}(t) = \tilde{b}(t_0)e^{(r^s-n)(t-t_0)} + \frac{\tilde{d}}{n-r^s}[1-e^{(r^s-n)(t-t_0)}].$$ 26/

The steady-state value of the debt-output ratio, $\tilde{b}$ is given by

$$\tilde{b} = \frac{\tilde{d}}{n-r^s}$$

There is no solvency constraint for this government. There are, obviously, "physical" constraints such as the condition that, in a closed economy, $0 < \tilde{G} < 1$. The choice of borrowing versus taxation depends exclusively on distributional criteria and on the relative efficiency costs of debt versus tax financing. In spite of a positive share of public spending in national income, taxes need never be levied and may indeed be negative forever. 27/

Third, the solvency constraint permits us to take a forward-looking view of the "eventual monetization" implied by the fiscal-financial programme, discussed in the previous section. From (14') we get, holding $\dot{M}/M$ and $pY/M = v$ constant:

$$(15) \quad \frac{\dot{M}}{M} \equiv v\tilde{R}(t) \left[PV\left(\frac{c^G - T + (1-P_K)\dot{K}}{Y}, t, r^s-n\right) + \frac{B^s(t) + p^L(t)B^L(t)}{p(t)Y(t)} - \frac{p_K(t)K^G(t)}{Y(t)} - \frac{p_N(t)N^G(t)}{Y(t)}\right]$$

Equation (15) solves for the constant rate of growth of base money that is implied, as a residual, to satisfy the solvency constraint, by the current and prospective future plans for the primary deficit and the initial stock of non-monetary debt. The "net liability" on the right-hand-side of (15) is annuitized using the long real interest rate net of the rate of growth of output $\tilde{R}$. 28/ If the policies summarized in (15) are inconsistent with a constant velocity, we can rephrase the question in terms of the constant (permanent) share of seigniorage in GNP $\dot{M}/pY$ that is implied by the current spending and taxation plans and by the already outstanding net debt obligations. This amounts simply to dividing both sides of (15) by v.

Fourth, the various items in the solvency constraint are unlikely to be behaviourally independent of each other. The nature of these interdependencies is of course model-specific. For a Keynesian world, e.g., a cut in the spending programme $PV(c^G, t, r^s)$ will reduce effective demand and output, reduce the tax base and, at given tax rates and interest rates, reduce $PV(T, t, r^s)$. Changes in the rate of inflation, brought about through changes in the seigniorage programme $PV(\dot{M}/p, t, r^s)$ may alter the future capital intensity of production and thus the tax base. Many other linkages can be thought of.

Fifth, the government's assets net of its liabilities were referred to as government "net worth," W. It might be argued that this involves a certain abuse of language. $W \equiv p_K K^G + p_N N^G + PV(T, t, r^s) + PV(\dot{M}/p, t, r^s) + PV\left((p_K - 1)\dot{K}, t, r^s\right) - \left[\frac{B^s(t) + p^L(t)B^L(t)}{p(t)}\right]$ is to a large extent a choice variable of the government (even ignoring the possibility of default), as the government can choose, within bounds, its tax-transfer programme, its monetary growth targets, and its capital formation programme. Whether or not we wish to use the term "net worth," with its connotation of something parametric to the agent, in connection with W, the mutual consistency of the consumption programme and W, $PV(c^G, t, r^s) \equiv W(t)$ represents a valid solvency constraint.

Sixth, it is easily checked that after-tax rates of interest should be used to discount future flows of revenues and expenditures (see Buiter [1984]). The stream of current and future taxes net of transfers T that enters into the present value calculations should be total taxes net of transfers minus the receipts from income and capital gains taxes on the assets and liabilities appearing in the solvency constraint.

There has been no empirical attempt to implement the comprehensive balance sheet accounting outlined here. In a recent paper, John Hills [1984] presented estimates of some of the less conventional assets and liabilities. His "full" balance sheet of the public sector is presented below in Table 5.

It includes estimates of $P_K^G K^G$ (physical assets, but excluding much of the social infrastructure (roads, sewers, etc.); since very few of these social overhead assets yield any cash return to the public sector, omission is not a serious matter for the purpose of constructing the public sector comprehensive balance sheet.) $P_N N^G$ is measured by future oil reserves and a subset of $PV(T, t, r^s)$ is included (corporate deferred tax and pensions deferred tax component, state pension, unfunded public service pensions). Omitted are the rest of $PV(T, . , . )$, the present value of taxes net of transfers, subsidies etc., $PV(\dot{M}/P, . , . )$, the present value of future seigniorage and $PV((P_K-1)\dot{K}, . , . )$, the present

TABLE 5

## John Hills' estimated "full" balance sheet of the U.K. public sector

(£ billion, cost terms, 31 March 1982 prices)

| | 1957 (end Dec) | 1966 (end Dec) | 1975 (end Dec) | 1982 (end Mar) |
|---|---|---|---|---|
| *Assets* | | | | |
| Physical (including shares and land)[1] | 130 | 220 | 415 | 420 |
| Financial[1] | 35 | 40 | 45 | 35 |
| Future oil revenues[2] | — | — | 70 | 105 |
| Corporations' deferred tax[3] | — | — | 10 | — |
| Pensions — deferred tax component[4] | 10-15 | 20 | 35-45 | 60-65 |
| *TOTAL* | 175-180 | 280 | 575-585 | 620-625 |
| *Liabilities* | | | | |
| Financial[1] | 195 | 195 | 150 | 135 |
| State Pension[5] | | | | |
| — Basic | 235 (max) | 340 (max) | 390 | 390-415 |
| — Earnings Related | — | — | — | 40 |
| Unfunded Public Service Pensions[6] | 20 | 30 | 90-115 | 120-140 |
| *TOTAL* | 450 (max) | 565 (max) | 630-655 | 685-730 |
| *NET LIABILITY*[7] | 275 (max) | 285 (max) | 55-70 | 65-105 |

(All figures rounded to nearest £5 billion)

1 Figures for physical and financial assets and financial liabilities from Table 1.7.

2 Figures for value of future oil revenues supplied by IFS North Sea Oil Revenue project. See Devereux and Morris (1983) for description of oil revenue model. Present value of future revenues derived using 3% real discount rate. Oil price assumed to increase in real terms by 3% per annum from level at date for which estimate is made. Further details in Hills (1984), Section G.

3 Value of Corporations' deferred tax liability taken to be twice allowance made by 67 of the 100 largest UK companies (see page 15 above).

4 Liability at standard/basic rate on 75% of rights in funded schemes, earnings-related State pensions and unfunded public service pensions. See Hills (1984), Section F.

5 Value of public sector's liability for basic pensions at end-1975 is based on Government Actuary's estimates given in Diamond Commission (1976), Table 38 for 31 March 1976. Estimate includes graduated pension rights. Lower limit for basic pensions at end-March 1982 based on *Inland Revenue Statistics 1983* estimate for mid-financial year 1981-82. For derivation of other estimates see Hills (1984), Section E.

6 1957 and 1966 figures from Roe (1971). For other estimates see Hills (1984), Section E.

7 Ranges given in 1975 and 1982 allow for interdependence of asset and liability figures relating to pensions.

value of the "excess returns" (if any) from future planned public sector capital formation if public sector capital is used more efficiently, at the margin, than private capital. While one can quarrel with each and every one of Hill's figures, the need to go through an exercise of this kind in order to evaluate the feasibility and consistency of public sector fiscal-financial-monetary plans is beyond doubt.

If we take e.g. Hill's 1982 figure of a net liability of between 65 and 105 billion £'s (at March 1982 prices) at face value, this means that for solvency the remaining items in the comprehensive balance sheet but not in the Hills calculations, should add up to a net asset of 65 to 105 billion £'s. These items are: (1) the present value of future seigniorage; (2) the present value of future taxes net of transfers, excluding debt service and the taxes and transfers already considered by Hills (oil revenues, state and public service pensions, etc.); (3) minus the present value of public sector consumption; and (4) the present value of any excess returns from future public sector investment.

With annual velocity constant at 20, a non-inflationary future (with $\dot{M}/M = .03$, say) and a real interest rate of 3 percent per annum would (in 1982) have given us a present value of future seigniorage figure of 13.9 billion £'s. Doubling this or halving this, it remains small beer (a mere 0.15 percent of GDP in the illustrative example). The remainder amounts to £51.1 billion to £91.1 billion in 1982. With the real interest rate 2 percentage points above the trend real growth rate, this represents the need for a "residual" 29/ permanent primary surplus of between

0.37 and 0.66 percent of GDP. Adding back in the annuitized value 30/ of future oil revenues, the deferred tax component of pensions and taking out the annuitized value of public sector pension liabilities, raises the required total permanent primary surplus to between 3.1 and 3.7 percent of GDP. Interest payments on the public debt were 5.3 percent of GDP in 1982. 31/ A conventionally measured public sector financial deficit of between 1.63 and 2.2 percent of GDP in 1982 would therefore have been "sustainable" according to these back-of-the-envelope calculations. One can contrast this with the kind of sustainability calculation that ignores all intangible assets and liabilities and proceeds as follows. Interest-bearing public debt is 50 percent of annual GDP in the United Kingdom. The trend growth rate of real GDP is, say, 2.5 percent per year. Assume inflation is to be stabilized at, say, 5 percent per year. The interest-bearing debt-output ratio will therefore be stabilized when new bond issues are 3.75 percent of GDP. With the income velocity of circulation of base money constant at 20, say, the sustainable PSFD as a proportion of GDP would be 4.1 percent. If a zero inflation scenario is envisaged, the sustainable PSFD as a proportion of GDP (ignoring any effects of lower inflation on the debt-output ratio and on velocity) would be 1.4 percent.

b. Sustainable fiscal-financial-monetary plans

The "balance sheet" solvency constraint in (14) or (14') in one sense tells us all there is to know about solvency. Feasible or consistent fiscal, financial, and monetary plans should satisfy this identity. Any particular set of plans or projections may, however, fail to satisfy this identity. If a government attempted to implement its spending, tax-transfer and monetization programme, insolvency, i.e., debt repudiation would occur to satisfy, ex-post, the constraint that was violated ex-ante. There are a number of alternative ways of measuring the extent or magnitude of the departure from solvency, each one of which emphasizes a feature of the plans already implicit in the balance sheet solvency constraint. Such measures of inconsistency can be expressed, for instance, as flow deficits or deficits as a proportion of output. This brings out the sustained or permanent changes in spending programmes, revenue raising programmes, or seigniorage plans that are required to eliminate the ex-ante discrepancy in the government's comprehensive balance sheet.

c. <u>The "permanent deficit"</u>

Consider an inconsistent or infeasible fiscal-financial-monetary plan. This is characterized by $PV(c^G, t, r^s) - W(t) \not\equiv 0$. Such an excess or shortfall of spending over resources will not, of course, be observed ex-post. Something will give to re-establish ex-post equality, whether this takes the form of changing $PV(c^G, t, r^s)$ or $W(t)$ or both.

The "permanent deficit," F, is the real perpetuity equivalent or annuity value of the discrepancy in the government's ex-ante comprehensive balance sheet. It is given by:

$$(16) \quad F(t) \equiv R(t)\,[PV(c^G, t, r^s) - W(t)]$$

R(t) is the coupon yield on an index-linked ("real") consol or the long real rate of interest. 32/

$\tilde{F}$, the "permanent deficit share" measures the constant fraction of trend GNP, $\overline{Y}$, that corresponds to the balance sheet discrepancy. It is given by (17).

$$(17) \quad \tilde{F}(t) \equiv \tilde{R}(t) \left[\frac{PV(c^G, t, r^s) - W(t)}{\overline{Y}(t)}\right]$$

While these ex-ante "permanent deficits" will not materialize ex-post, let alone be permanent, they do represent the permanent adjustment that must be made, to spending, to receipts, or to seigniorage, in order to achieve solvency.

Two further informative deficit measures are the constant net worth deficit, $F^W$, and the permanent income deficit, $F^P$. It is easily checked that the expected rate of change of public sector net worth is given by

$$(18) \quad E_t\dot{W}(t) = r^s(t)W(t) - c^G(t)$$

The current level of public sector consumption spending can be said to be sustainable if it keeps net worth constant (ex-ante). This will be the case when real public sector consumption equals $r^sW$, the current expected real rate of return times public sector net worth. The constant net worth deficit is then given by

$$(19) \quad F^W(t) \equiv -E_t\dot{W}(t) = c^G(t) - r^s(t)W(t)$$

If one's criterion for the sustainability of current consumption involves the maintenance of a constant (ex-ante) ratio of public sector net worth to capacity output, the sustainable consumption level is given by $(r^s-n)W$. The constant net worth share deficit is then defined as

$$(20) \qquad \tilde{F}^{W}(t) \equiv \frac{c^{G}(t) - (r^{s}(t) - n)W(t)}{\bar{Y}(t)}$$

The level (share) of public sector consumption consistent with constant net worth (or a constant net worth share) will be subject to anticipated fluctuations over time if the short real interest rate varies over time. A permanent income approach to the sustainability of public sector consumption plans has been proposed by Miller (Miller [1983], Miller and Babbs [1983]). The highest indefinitely sustainable constant level of public sector consumption (or public sector permanent income) is given by $R(t)W(t)$. The anticipated rate of change of permanent income is given by $R(t)[R(t)W(t) - c^{G}(t)]$. The permanent income deficit can then be defined as

$$(21) \qquad F^{P}(t) = c^{G}(t) - R(t)W(t)$$

Finally, if a constant share of public sector consumption in trend output is taken as one's criterion for the sustainability of current consumption, the <u>permanent income share deficit</u> is the appropriate measure

$$(22) \qquad \tilde{F}^{P}(t) = \frac{c^{G}(t) - \tilde{R}(t)W(t)}{\bar{Y}(t)}$$

Each of these "permanent deficits" measures the magnitude of the long-run inconsistency, expressed as a flow of spending or income, in the government's fiscal, financial, and monetary plans, according to some notion of long-run sustainability. As presented here, the measures singled out current public current spending on goods and services (public consumption) from all other outlays and receipts. It should, however, be clear that the sustainability of any public spending programme can be evaluated simply by transferring the present value of the relevant outlays (e.g., transfer payments plus subsidies) to the left-hand-side of the present value budget constraint. The augmented public spending measure, $G^A$, its present value $PV(G^A, t, r^s)$, and the corresponding augmented public sector net worth measure, $W^A$, can then be put through their paces as in equations (16), (17), and (19)-(22).

None of these measure convey any information about the short-run or long-run stance of fiscal policy as regards its effect on aggregate demand. To obtain measures of fiscal stance or fiscal impact on the economy, an explicit model of the economy is required. The solvency constraint and the various permanent deficit measures are merely a useful accounting framework for organizing facts and plans about fiscal, financial, and monetary policy, and for evaluating the mutual consistency of spending and revenue projections, public sector debt objectives, and monetary targets. It behavioral content is limited to the (restrictive) assumption of certanty equivalence that permitted us to equate ex-ante expected rates of return on all non-monetary assets. To make the forecasts of future tax receipts, transfer payments and real interest rates required to implement the present value and permanent deficit calculations, some model of the economy will of course in general be necessary.

d. Debt repudiation

What happens if current plans, projections, and expectations add up to a violation of the solvency constraint and $PV(c^G, t, r^s) > W(t)$? The government could achieve a consistent set of plans by cutting spending

($PV(c^G, t, r^s)$) or by raising taxes ($PV(T, t, r^s)$). It could also try to fill the hole in its balance sheet by increasing the revenue brought in from seigniorage ($PV(\dot{M}/P, t, r^s)$). An increase in the revenue accruing from the public ownership of capital would also help close the gap. (This would be an increase in $p_K$ in equation (14')). Finally, if at the maring, public sector investment yields cash returns in excess of (below) its opportunity cost, an increase (decrease) in the scale of the public sector investment programme could do the trick ($PV((p_K - 1)\dot{K}, t, r^s)$). If a corrective combination of such policy measures is not implemented, the residual item in the present value budget constraint, the real value of public sector debt, $\frac{B^s(t) + p^L(t)B^L(t)}{p(t)}$, will have to give.

We already reviewed the option of reducing the real value of debt and debt service by inflation. This leaves the option of cutting real debt and debt service by repudiation or special taxation (capital levies, forced loans or conversions, and special levies on government debt). Arithmetically, repudiation (partial or complete) would seem to be a means for reconciling otherwise inconsistent spending and revenue plans. Why then don't governments make use of it more frequently? One reason is that repudiation or a massive capital levy is perceived as a breach of public faith and is politically and electorally unattractive. The point is well-made by the Committee on National Debt and Taxation (1927, p. 295-296).

> "We do not suggest that a levy would necessarily arouse feelings of the most violent kind. We are convinced, however, that it would be strongly resented ... exceptional circumstances are required to reconcile the owner of capital wealth to the levy idea. The opposition is no doubt founded partly on political suspicion and on prejudice: to impose a capital levy would be, as Mr. Keynes expressed, to insult a set of very strong irrational feelings in men, and such grounds of opposition are exceedingly difficult to overcome. It is possible that time may bring a change of ideas."

Second, repudiation or a major capital levy would not just represent a redistribution of wealth from rentiers to tax-payers, but would also be likely to have serious consequences for the private financial system. The enforceability of private contracts will be in doubt when the government is openly or effectively in breech of contract (implicit or explicit). Finally, if a government considers it likely that it may wish to borrow again at some stage in the future it will (since the terms on which it will be able to do so will reflect its reputation) weigh the advantages of current repudiation against the enhanced future cost of debt service should it repudiate now. Using the analysis made familiar in the literature on (Third World) external debt and repudiation, the rate of return payable on the public debt will include a risk premium reflecting the probability of default. Beyond some point, however, a further increase in the risk premium payable on the debt may make repudiation so much more attractive to the debtor that a rational lender would prefer not to increase his exposure. Credit rationing results: the government cannot borrow more on any terms. 33/ 34/

The preceding considerations make it seem unlikely that a government in one of the major industrialized countries would resort to wholesale repudiation of domestically-held public debt under peace-time conditions. In the aftermath of a war or following a major change in the political regime, however, rough treatment of private holders of public debt has not been uncommon.

In France in 1770, when the government faced the financial consequences of its participation in the American War of Independence, Abbé Terray effectively repudiated one-fifth of French government debt through a forcible refunding operation (see C. Kindleberger [1984, p. 217]).

Ricardo, in the years following the Napoleonic wars, advocated a capital levy, and in Parliament said that such a tax was the best, in fact the only, way of handling the burden of accumulated wartime debt (Kindleberger [1984, p. 62]). This proposal was not taken up, however.

More recently, Germany has had two monetary reforms in the last 62 years, both of which involved a form of capital levy. After the hyper-inflation in 1923, a mortgage on agricultural and industrial land served as backing for the new currency, the Rentenmark. The German monetary reform of 1948 consisted of a conversion of all money and debts at 10:1 (except for the first 60 Reichsmarks of currency per capita). Since private debtors had, for the most part, paid all their private creditors by then, the conversion involved mainly public debt. A further capital levy (or Lastenausgleich) of 50 percent on the value of all real property and equity holdings was intended to correct at least in part the inequity as between owners of debt (which suffered a reduction in value of 90 percent) and owners of real assets and shares of corporations. For political reasons, the capital levy was introduced in September 1948 separately from (and slightly later than) the conversion. 35/

For Italy, a capital levy to reduce the burden of the debt has been advocated recently by Basevi and Giavazzi [1983]. The distinction between "legitimate" or conventional tax increases and confiscatory capital levies is of course one of degree rather than kind and inevitably involves an element of subjective judgement. There would seem to be no economic or moral grounds for giving priority to safeguarding the owners of government debt against unexpected levies in preference to owners of real industrial and human capital. As regards Britain, with a debt burden that is low by historical standards, with a safe middle-of-the-pack position among the major industrialized countries in terms of the level, and a uniquely favourable position as regards the trend of the debt-output ratio, the spectre of de jure or de facto repudiation should not haunt the holders of the British public debt. Most other industrialized countries would seem to be in a similar position, although the high and rising debt burdens of Italy and Belgium (see Table 1) might be a cause for concern to those with a high propensity to worry.

"Selective" repudiation of the public debt (e.g., through an open-ended Ponzi-style rescheduling of externally-held debt) has been more common. The Latin American foreign debt repudiations of the 30s and the recent de facto external insolvency of Poland, Zaire, and a number of the smaller Latin American countries are reminders of the possibility of sovereign default. All the more so since none of these defaults involved the kind of dramatic political upheaval and change of regime that led to the repudiation of the Tsarist debt by the new Soviet regine and of the Batista debt by the Castro government in Cuba. Nevertheless, the conditions, whether political or economic, that have historically been associated with repudiation of externally-held public debt, seem sufficiently different from those faced by today's industrialized countries that even such "selective" debt repudiations seem rather unlikely.

5. Crowding Out

Even if there is no fear of eventual monetization of the deficit and if the government can credibly commit itself to the pursuit of a fiscal financial-monetary policy mix that does not imply explosive and unsustainable growth of the debt-output ratio, there may still be objections to policies involving larger deficits and debt-output ratios. The argument against debt-financed fiscal expansion is often cast in terms of the "crowding out" of private economic activity by fiscal policy actions. I shall continue to focus my discussion of crowding out on an analysis of the consequences of substituting public borrowing for tax financing of a given exhaustive public spending programme. These consequences include the effect on private saving, investment, and the current account of the balance of payments in the short run, and on the capital intensity of production and the country's net external asset position in the long run. Much of what I shall be saying can be applied (with obvious modifications) to the analysis of bond-financed increases in exhaustive public spending or even to tax-financed increased in exhaustive public spending (i.e., balanced-budget fiscal expansions). With lump-sum taxes, perfect capital markets, and effectively inifitely-lived private households, the substitution of borrowing for tax-financing has no effect on any real (or nominal) economic variable. To avoid such implausible debt neutrality features while retaining the optimizing approach so dear to economists, it is sufficient to adopt the overlapping generations model 36/ (without operative gift and bequest motives) or the uncertain lifetimes model. 37/

Institutional or information constraints on lending and borrowing activities of private agents further shorten their effective decision horizons through a variety of liquidity constraints, cash-flow constraints, large spreads between lending and borrowing rates and other capital market imperfections. The models underlying the discussion of crowding out in this section all rely on differences between public and private sector opportunity sets as regards the terms and conditions of access to capital markets. Frequently this dependence is, as with the familiar Keynesian demand multiplier, only implicit. The non-lump sum nature of taxes will at times be important in the discussion that follows.

a. Old-Fashioned Keynesian Short-Run Crowding Out

The "short run" of old-fashioned Keynesian or classical crowding out refers to the assumption that changes in the outstanding stocks (private non-human wealth, dometic capital, government debt, high-powered money, and net foreign assets) brought about by the flows (private saving, investment, government borrowing, monetization, and foreign investment) over the period under consideration are very small relative to the stocks and can be ignored. Expectations (of future interest rates, exchange rates, prices or demand) are also taken as given, i.e., ignored.

"Crowding out" in what follows refers only to what I have called elsewhere "indirect crowding out." "Direct crowding out" occurs when government instruments (especially public spending) are arguments in private utility functions or production possibility sets. "Indirect crowding out" refers to the effects on the level and composition of output of tax cut or a spending increase, without these government controls directly affecting utility or production, but only through effects on budget constraints, interest rates, exchange rates, wages, or prices (Buiter [1977]).

"Keynesian" means that demand effects only are considered. In terms of the familiar IS-LM, aggregate demand-aggregate supply analysis, we consider the horizontal shift of the aggregate demand schedule (at a given price level) and the composition of that change in terms of changes in investment, consumption, or the current account balance. Supply constraints are assumed to be non-binding (the aggregate supply schedule is horizontal over the relevant range).

The closed economy version of this model is givey in equations (23) to (27).

$$C(Y_d, W) + I(r) + G = Y \qquad 0 < C_{y_d} < 1;\ C_W > 0 \quad I' < 0 \qquad \text{(IS)} \tag{23}$$

$$\ell(r, Y, W) = \frac{M}{P} \qquad \ell < 0;\ \ell_y > 0;\ 1 > \ell_W > 0 \qquad \text{(LM)} \tag{24}$$

$$Y_d \equiv Y + r\frac{B}{P} - T \tag{25}$$

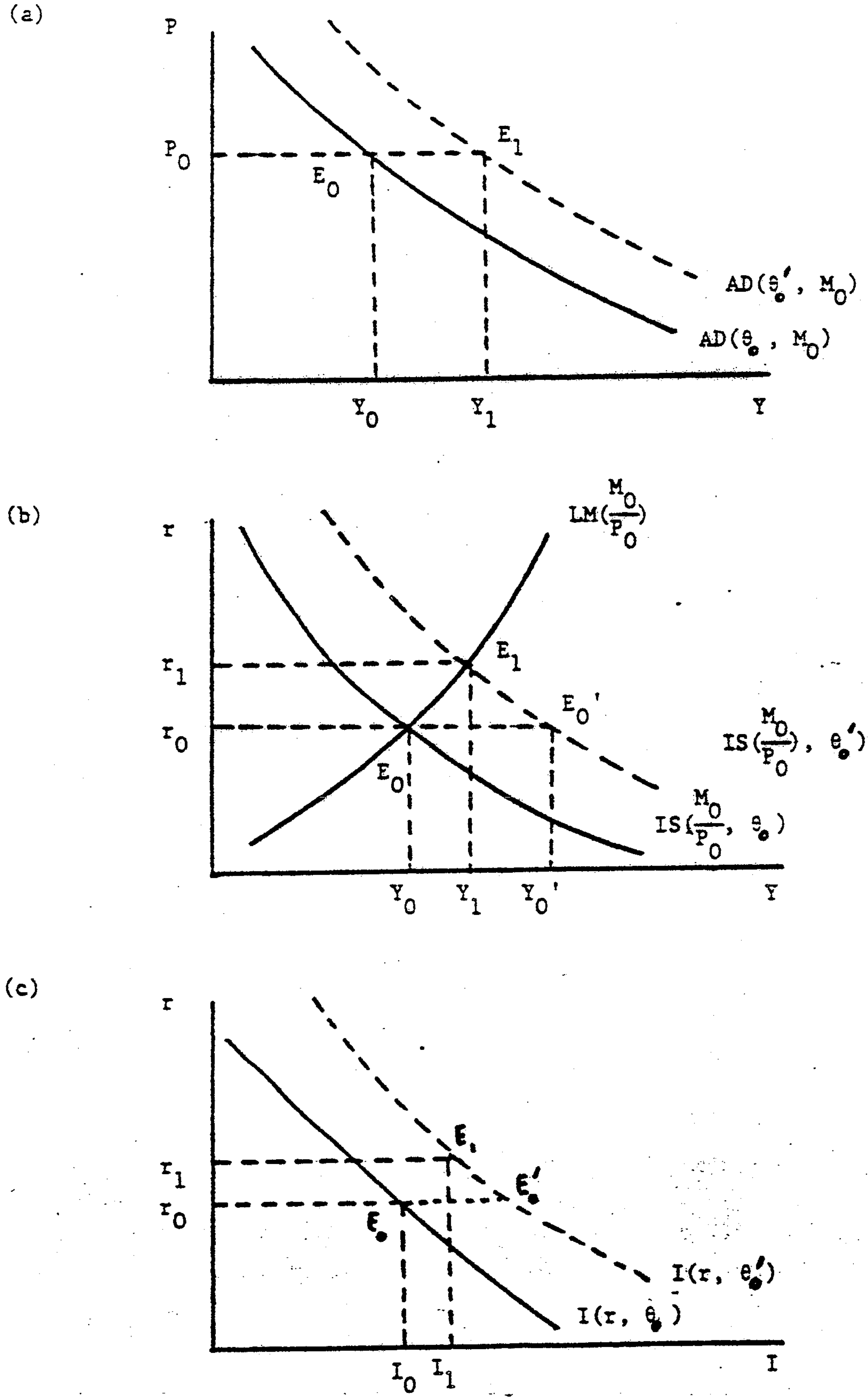
$$W \equiv \frac{M + B}{P} \tag{26}$$

$$T = \theta_0 + \theta_1 Y + \theta_2 r\frac{B}{P} \qquad 0 < \theta_1 < 1;\quad 0 < \theta_2 < 1 \tag{27}$$

A tax cut (say a reduction in $\theta_0$) will shift the IS curve to the right in Figure 6a. At the initial interest rate, and the initial price level, the new income-expenditure equilibrium moves from $E_0$ to $E_0'$. The income-related demand for money increases and since monetary policy is non-accomodating (the nominal money stock is fixed) interest rates rise and a

FIGURE 6

Effect of an investment subsidy $(\theta_0' < \theta_0)$



new IS-LM equilibrium is established at $E_1$. The movement from $E_0$ to $E_1$ represents "crowding out." Whether this crowding out should be attributed to the fiscal stimulus or to the unwillingness of the monetary authorities to expand the money supply in an accommodating manner to keep r from rising above $r_0$ is a semantic question. Given the path of the money stock, the degree of crowding out varies inversely with the interest sensitivity of money demand.

What is crowded out? In the closed economy represented in Figure 6, it is either C or I. The conventional story runs in terms of income tax cuts. With current disposable income an argument in the consumption function, and investment a decreasing function of the interest rate and independent of (or only weakly increasing with) the level of economic activity, private consumption at $E_1$ is higher than at $E_0$ and private investment is lower.

A different picture emerges when the tax cut takes the form of an investment subsidy. This case is represented in Figure 6c. Now both private consumption and private investment are increased at $E_1$. Of course private investment is lower at $E_1$ than it would ahve been at $E_0'$ (at the lower level of interest rates) but it is higher than at $E_0$. 38/

What could make the demand mulitplier negative? Mankiw and Summers [1984] have argued that taxes may enter the money demand function directly. Output, Y, according to their argument, is a very inappropriate transactions variable and should be replaced by consumption or disposable income. While one can agree with their characterization of current output or income as an inadequate measure of transactions demand, the same objections would seem to apply to current consumption or current disposable income. These too ignore intermediate transactions (which add up to a total several times larger than transactions in final goods and services) and transactions in existing assets (which dwarf all other transactions). It also takes money to pay taxes or to save (i.e., to acquire non-monetary assets). Finally, the alternative motivation of the scale variable in the money demand function, associated with Milton Friedman, is in terms of permanent income or wealth rather than current "work to be done" or transactions needs. This suggests permanent disposable income as a scale variable, not current disposable income, except to the extent that current realizations are a good proxy for unobservable permanent values.

Algebraically, the Mankiw-Summers theory simply involves the substitution of (24') for (24)

$$(24') \quad \ell(r, Y_d, W) = \frac{M}{P} \qquad \ell_r < 0; \ \ell_{Y_d} > 0; \ 0 < \ell_W < 1$$

It is clear that, since a tax cut shifts the IS curve to the right and the LM curve to the left, the net effect on output is qualitatively ambiguous. 39/ The interest rate of course rises unambiguously. A strong effect of disposable income on money demand and a strong response of investment to the rate of interest make a negative multiplier more likely, a higher marginal propensity to consume and interest sensitivity of money demand make it less likely. 40/ The balanced budget multiplier always equals unity.

In an open economy with a freely floating exchange rate and perfect capital mobility, fiscal policy cannot affect the level of output. A tax cut boosts private consumption (or investment) and crowds out the current account surplus through an appreciation of the nominal and real exchange rate. The IS curve (23) is replaced by (23'). X denotes the trade balance surplus, e the nominal exchange rate, r* the exogenous world interest rate, and p* the exogenous world price level.

(23') $C(Y_d, W) + I(r) + G + X\left(\frac{ep^*}{p}\right) = Y \qquad X' > 0$

(28) $r = r^*$

b. <u>Old-Fashioned Classical Short-Run Crowding Out</u>

In a closed economy setting, classical crowding out refers to the inevitability of public spending crowding out private spending or of tax cuts crowding out one category of private spending at the expense of another when resources are utilized fully. In the simplest version, perfect wage and price flexibility produce a vertical aggregate supply schedule. If the "full employment" level of employment and output is independent of tax rates and public spending, 100 percent crowding out is inevitable, regardless of the government's monetary policy. While in a Keynesian setting crowing out can always be viewed as evidence of badly managed monetary policy (or perhaps more fairly as evidence of insufficient coordination of monetary and fiscal policy) this is not true at full employment. Any boost to demand will raise wages and prices but leave output and employment unchanged. The incentive, or allocative effects of tax cuts and spending increases may of course alter labour supply or demand and thus alter the full-employment level of output and employment even in the short run. In the open economy versions (equations (23'), and (24)-(28), with $Y = \overline{Y}$ and p flexible), expansionary fiscal policy again cannot affect global (domestic and foreign) demand for home goods. The price level will remain constant (just as the level of output remained unchanged in the Keynesian regime) and the exchange rate will appreciate to crowd out the current account surplus. Intermediate regimes with an upward-sloping aggregate supply schedule give outcomes that, not surprisingly, lie between the pure Keynesian and pure classical regimes.

c. Old-Fashioned Keynesian Long-Run Crowding Out

The recognition that bond-financed public sector deficits imply a cumulative growth of the outstanding stock of debt and that this "intrinsic" dynamic would shift the LM and IS curves, if wealth effects on money demand and consumption demand are present and if government debt is perceived as net worth at least to some extent, generated the "government budget constraint literature" (Christ [1968], Blinder and Solow [1973], Tobin and Buiter [1976]). The simplest models ignored asset accumulation other than through public sector deficits (e.g., private capital accumulation and foreign wealth dynamics through the current account of the balance of payments). The Keynesian version continued to treat the price level as given and output as determined by effective demand. The government budget identity (29) augments the closed economy model of equations (22) to (27).

(29) $$\frac{\dot{M} + \dot{B}}{P} \equiv G + \frac{rB}{P} - T$$

Consider the case of bond-financed deficits ($\dot{M} = 0$). Regardless of the nature of the fiscal policy action (or other exogenous shocks) that causes a deficit or surplus, as long as the deficit (surplus) persists, the IS curve will be shifting to the right (if $C_W > 0$) and the LM curve to the left (if $\ell_W > 0$). Solving the IS and LM equations for r and Y as functions of B, M, and the fiscal parameters, we get the short-run reduced form or IS-LM solutions for r and Y:

(30a) $$r = H(M, B, \theta_0, \theta_1, \theta_2, G) \qquad H_M < 0;\ H_B > 0;\ H_{\theta_i} < 0,\ i=1,2,3;\ H_G > 0$$

(30b) $$Y = F(M, B, \theta_0, \theta_1, \theta_2, G) \qquad F_M > 0;\ F_B \gtrless 0;\ F_{\theta_i} < 0,\ i=1,2,3;\ F_G > 0$$

Substituting this into the budget identity and linearizing around a long-run stationary equilibrium, we find that the model will be stable if

(31) $$(1-\theta_2)(r + H_B B) - \theta_1 F_B P < 0$$

Left to themselves, deficits feed on themselves. First consider the case where taxes and transfer payments do not adjust to changes in the debt-service component of the budget ($\theta_2 = 0$). The stability condition (31) is now easily interpreted. Higher debt means higher debt service at any given interest rate ($r > 0$) and a higher interest rate for any level of debt ($H_B B > 0$). Only if debt issues, through a strong wealth effect on consumption ($C_W >> 0$) raise the tax base (Y) by enough to raise income-related taxes ($\theta_1 Y$) by more than the total increase in interest costs, can this economy ever settle down in a balanced budget equilibrium after a disturbance. Explosive debt growth is certainly possible with this particular (and perhaps rather implausible) specification of the fiscal policy rule: fixed values of G, $\theta_0$, $\theta_1$, and $\theta_2$ with $\theta_2 = 0$.

Stability or instability is, however, a function both of the parameters describing the behavior of the private economy and of the parameters describing government behavior. If, e.g., the authorities had a fiscal decision rule which raised taxes (lowered transfer payments) whenever $r(B/P)$ increased, stability would become much more likely. With a positive short-run effect of bonds on output ($F_B > 0$), a value of $\theta_2 < 1$ will stabilize the debt-deficit process. Even if $F_B < 0$, there exists a value of $\theta_2$ (greater than 1 in this case), which will smother the debt explosion. 41/ There are many alternative debt-stabilizing tax-transfer functions, and the addition of exhaustive public spending G to the arsenal of potential debt-stabilizing instruments only reinforces the conclusion that an explosive debt-deficit spiral is a policy choice rather than a deep structural property of the economy.

One can check that, with $\theta_2 = 0$, if the model is stable, a bond-financed tax cut has a stronger expansionary effect on output in the long run than a money-financed tax cut. 42/ I don't consider this result, due to Blinder and Solow, to have much policy relevance. It amounts to a restatement of the (very strict) stability conditions for this model under the given specification of the public spending and revenue functions. If this model is to be stable under bond financing, then endogenous income-related tax revenues must outstrip the explosive intrinsic debt dynamics. This can only happen if a larger stock of bonds raises demand (and thus output) to such an extent that tax revenues grow faster than debt service.

The major weakness of this class of models is that the significance of a dynamic analysis (and a comparison of stationary equilibria) which extends into the long run the assumptions of nominal wage and/or price rigidity and demand-constrained output of the short-run Keynesian model, is not too apparent. A further problem has been that the focus on fixed price, zero-trend real growth models has at times led to the identification of stationary equilibria with balanced budget equilibria. Stationary equilibria are more generally characterized by stationary stock-flow and stockstock ratios. Nominal asset stocks can grow (shrink) at the sum of the growth rates of the general price level and the level of capacity output. These shortcomings have been rectified in a number of places (e.g., Buiter [1979]) by adding some version of an augmented Phillips curve to the Blinder-Solow model and thus combining short-run nominal rigidity with long run nominal wage and price flexibility.

It should be intuitively obvious that adding an exogenous capacity constraint or full-employment output constraint to the IS-LM-government budget constraint model, worsens the prospects for stability under the usual specification of the taxation and public spending functions. The reason is that the tax base (the exogenous level of real income) cannot expand in the long run to offset the effect of higher interest payments on the deficit. Stability can now be achieved only if a larger stock of debt raises the general price level by enough to lower the real value of debt interest payments r(B/P) even though their nominal value increases. 43/ If full-employment output is endogenous in the long run, say through private capital formation, prospects for stability under the given tax-transfer and spending rules are even dimmer. This is because debt-financing almost certainly raises short- and long-term real interest rates and, except in a Keynesian demand-constrained regime, lowers Tobin's "marginal q" and thus the incentive to invest. There will be downward pressure on the tax base through this channel and thus a greater likelihood of debt-deficit instability. The lasting insight from the government budget constraint literature is that it made it very clear that questions such as "what is the effect on output of an increase in public spending by an amount x," are badly (because incompletely) worded. One must specify both the financing mode and the run (impact, steady-state or "real time" over some given horizon) to which the question applies. Answers take the form of a financing mode-contingent sequence of dynamic multipliers.

The open economy versions of the Keynesian budget constraint literature (see e.g., Branson [1975], [1976], and HIE(2) [1985]) added much that is of interest, but for our purposes the essentials of debt-dynamics in Keynesian models are represented adequately by the closed economy models. Rather than spending any time on old-fashioned classical long-run crowding out (see e.g., Buiter [1979] and Tobin [1976]), the important insights of the classical perspective will be discussed within a rational expectations setting.

d. Portfolio Crowding Out

Tobin [1961, 1969] extended the Keynesian two-asset (money-banks) model with its implicit assumption of perfect substitutability in private portfolios between bonds and claims on capital to a general three-asset (money-bank-capital) model. The effect on investment of an increase in the stock of debt will depend on the relative degrees of substitutability of bonds vis-à-vis money and bonds vis-àvis capital. When bonds and capital are closer substitutes, an increase in debt will raise the required rate of return on capital along with the interest rate. When bonds and money are closer substitutes, an increase in debt will lower the required rate of return in capital although the interest rate will still rise. Friedman [1985] and Frenkel [1983] have provided empirical evidence, using U.S. data and a capital-asset pricing version of the money-bonds model, on the effect of changes in the stock of debt on the yield differentials between bonds and capital. In general, these will be a function of asset supplies, the degree of risk aversion, and the perceived correlation of asset returns. Frenkel finds negligible effects of relative asset supplies on yield premia. Friedman finds statistically significant and small but non-negligible effects. Their evidence, however, relates to the relative required rates of return on bonds and capital. The effect of debt onthe overall level of rates of return is not analyzed. A zero effect of realtive asset supplies on the bond-capital return differential (the traditional Keynesian perfect-substitutes case) is of course quite consistent with a strong crowding out effect of debt through the level of common required rate of return on bonds and capital. [See also Friedman [1984] and Vance Roley [1983].)

e. Rational Expectations-Augmented Keynesian Crowding Out

Within the Keynesian tradition, the incorporation of forward-looking rational expectations of endogenous variables has made an important contribution to our understanding of the effects of fiscal policy on aggregate demand. Intertemporal speculation or arbitrage entered the Keynesian models in two ways. First, in closed economy models, through an arbitrage condition linking short and long interest rates (or short interest rates and a stock market-index) and second, in open economy models, through an arbitrage condition linking the exchange rate and domestic-foreign interest differentials. Not only must the financing mode and the run be specified before an answer to any question concerning the effects of tax or spending changes can be given, but the manner in which information about the policy instruments (and about all other exogenous "fundamentals") accrues to and is absorbed by private agents must be detailed. Inthe certainty-equivalent world inhabited by most linear or log-linear rational expectations macro-models (where expectations can be viewed as being held with complete subjective certainty), the model cannot be solved unless one knows whether the behaviour of the exogenous variable (s) is: (a) unanticipated or anticipated (and if the latter, when); and, (b) perceived as permanent, transitory, or reversible. 44/ The structure of the model and the current, past, and expected future values of the exogenous varibles determine the current behaviour of the economy. It is impossible to study the short-run behaviour of the model without at the same time and as part of the same exercise, solving for the entire future (expected) behaviour of the model, including its long-run steady-state properties.

The easiest way to see what this implies for the crowding out debate is to modify the IS function in the model of equations (23) to (27) in the spirit of Blanchard [1981] as follows:

$$(23'') \quad C(Y_d, W) + I(R) + G = Y \qquad I' < 0$$

Investment depends inversely on the long interest rate, R. The demand for money depends inversely on the short interest rate. The long and short rates are linked by assuming that the expectations hypothesis of the term structure holds:

$$(32) \quad r = R - \frac{E\dot{R}}{R}$$

In this model, the effect of an unanticipated, immediate and permanent cut in taxes (or increase in spending) is the same as it is in the simplest Keynesian model where the short rate enters both the money demand function and the investment function. (Note that debt-deficit dynamics are not included.) What is different is that in this model the impact effect of the unexpected announcement (at $t_0$) of a <u>future</u> expansionary fiscal policy move (a cut in taxes or increase in spending at $t_1 > t_0$) is contractionary. The intuition is clear. Between the <u>announcement date</u> ($t_0$) and the <u>implementation date</u> ($t_1$) there is not yet any direct stimulus to demand from higher spending or lower taxes. Investors in financial markets do, however, take into account the future outward shift of the IS curve (after $t_1$). Short-term interest rates are therefore expected to be higher after $t_1$, when the fiscal boost gets under way.

The current long rate ($R(t_0)$ can be viewed as a forward-looking moving average of future expected short rates. 44/ At the announcement date, $t_0$, therefore, the long rate increases in line with the higher expected future short rates. This will shift the IS curve to the left in (r-Y) space, lowering output and the short rate of interest. The behaviour of taxes, output, and of long and short rates is sketched below in Figure 7. The main point is that the announcement effect of an anticipated future fiscal expansion will result in a negative impact multiplier. When the fiscal stimulus finally occurs at $t_1$, output will of course rise in the manner indicated by the traditional short run IS-LM model.

A role very similar to that played by the long rate of interest in the closed economy model is played by the (real) exchange rate in the rational expectations version of the open economy model with perfect capital mobility and a freely floating exchange rate. As before, we use the open economy IS curve (23'). Equation (28) is now, however, replaced by the uncovered interest parity condition:

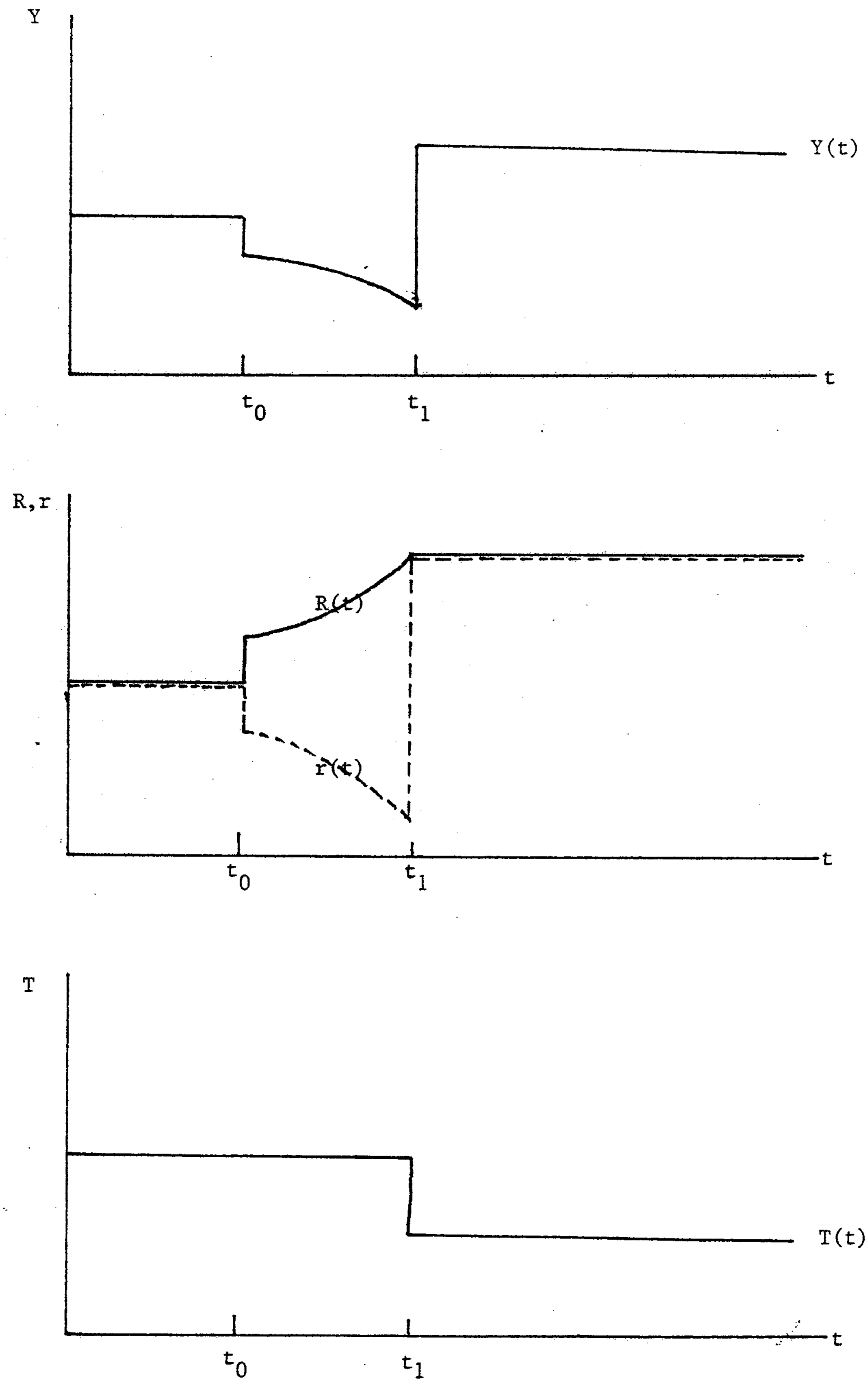
$$(28') \quad r = r^* + E_t\frac{\dot{e}}{e}$$

The nominal exchange rate at time t is therefore given by the long run equilibrium exchange rate times the exponent of the integral (sum) of all future expected foreign-domestic nominal interest differentials: 45/

The real exchange rate, $c \equiv \frac{ep^*}{p}$, can also be seen to be given by the long-run equilibrium real exchange rate times the exponent of the integral (sum) of all future expected foreign-domestic real interest differentials. 46/

Figure 7

The effects of an anticipated future tax cut



A fiscal expansion which is immediate, permanent, and unanticipated raises all current and expected future domestic interest rates; given foreign interest rates, the nominal exchange rate will "jump" appreciate: e falls. Given r* and the domestic and foreign price levels, the real exchange also jump-appreciates. In this case, it is easily checked that there will be full crowding out: output does not increase as the fiscal stimulus is negated by a loss of competitiveness. An anticipated future fiscal expansion will be contractionary as the exchange rate appreciates, because of the expectation of future higher domestic interest rates, before the demand stimulus from the fiscal expansion occurs.

Both these examples of negative fiscal announcement impact multipliers have nothing to do with deficits per se. They would occur even if the fiscal stimulus were of the balanced-budget variety and indeed as a result of any anticipated private or public, domestic or foreign shock that shifts future IS curves to the right. To highlight the role of deficits in a rational expectations setting, we revert to the closed-economy model with long and short interest rates, and the budget constraint.

$$(23'') \quad C(Y + r\frac{B}{P} - T, \frac{M+B}{P}) + I(R) + G = Y$$

$$(24) \quad \ell(r, y, \frac{M+B}{P}) = \frac{M}{P}$$

$$(33) \quad r - E_t\frac{\dot{P}}{P} = R - E_t\frac{\dot{R}}{R}$$

(29) $\frac{\dot{M}+\dot{B}}{P} = G + r\frac{B}{P} - T$

(34) $\frac{\dot{P}}{P} = \psi(y - \bar{y}) + \mu$

The price lvel is predetermined, i.e., given at a point in time, and output is demand-determined. Over time, however, the price level adjusts to excess demand or supply according to an augmented Phillips curve. Full employment output is exogenous. The long real interest rate (R) is linked to the short real rate, $r - \dot{P}/P$, through the expectations hypothesis (equation (33)). To keep the dynamic analysis simple, I assume that the government uses a combination of money financing and bond financing which keeps the shares of money and bonds in total government debt ($\alpha$ and $1-\alpha$ respectively) constant, i.e.,

(35a) $M = \alpha\Delta$

(35b) $B = (1-\alpha)\Delta$

(35c) $\Delta = M + B$

The augmentation term in the price-Phillips curve (equation (34)) is the policy-determined proportional rate of growth of total nominal government liabilities.

(35d) $\mu = \dot{\Delta}/\Delta$

The specification of the monetary-fiscal-financial decision rules in this example is: exogenous G, $\alpha$ and $\mu$. Taxes are therefore endogenously determined. An increase in $\mu$, given G, can only be brought about by a tax cut. Let $\delta = \Delta/p$, the real stock of money plus bonds. $r = H(R, \delta; G$ $\mu, \alpha)$ and $y = F(R, \delta; G, \mu, \alpha)$ are again the IS-LM solutions for r and y.

In the neighborhood of a steady-state equilibrium $\bar{R}$, $\bar{\delta}$, the behavior of this economy can be described by equation (36).

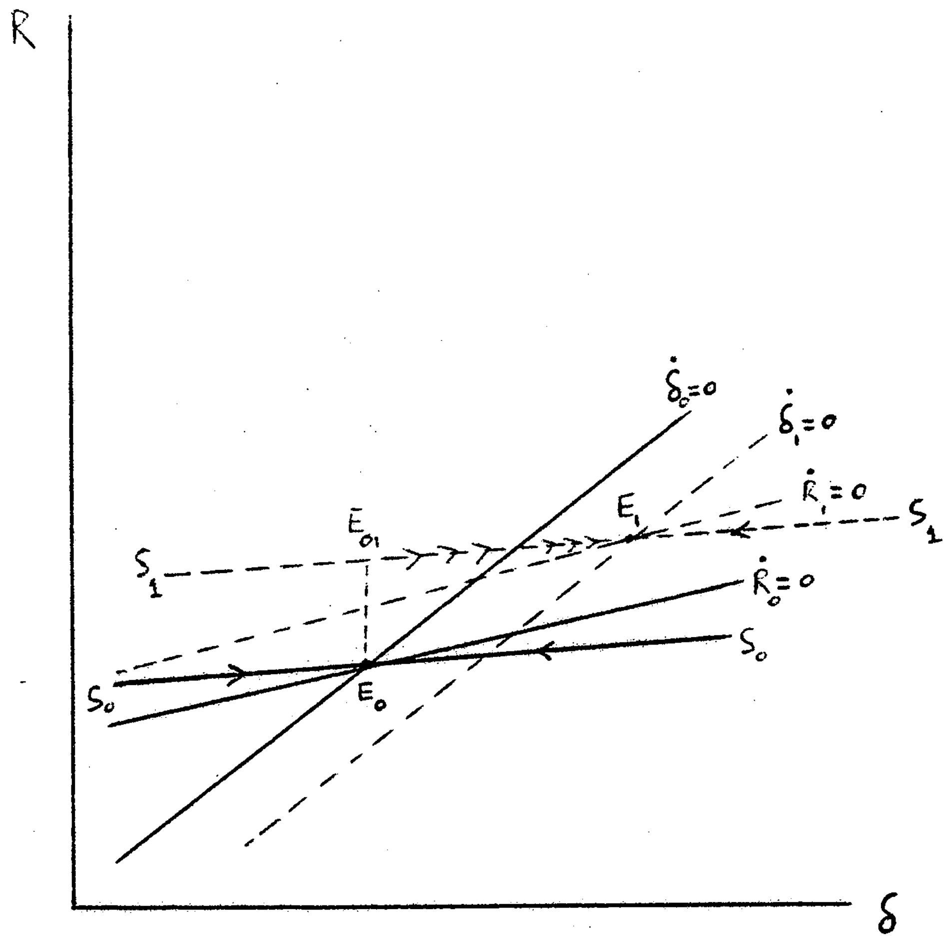
$$(36)\quad \begin{bmatrix} \dot{R} \\ \dot{\delta} \end{bmatrix} = \begin{bmatrix} \bar{R}(1-H_R + \psi F_R) & -\bar{R}(H_\delta - \psi F_\delta) \\ -\psi F_R & -\psi F_\delta \end{bmatrix} \begin{bmatrix} R-\bar{R} \\ \delta-\bar{\delta} \end{bmatrix} +$$

$$\begin{bmatrix} -\bar{R}(H_G - \psi F_G) & \bar{R}(1-H_\mu + \psi F_\mu) & -\bar{R}(H_\alpha - \psi F_\alpha) \\ -\psi F_G & -\psi F_\mu & -\psi F_\alpha \end{bmatrix} \begin{bmatrix} G-\bar{G} \\ \mu-\bar{\mu} \\ \alpha-\bar{\alpha} \end{bmatrix}$$

If government debt is net wealth, the IS curve shifts to the right in r-y space when $\delta$ increases. (Note that since investment depends on R and not on r, the IS curve is vertical in r-y space.) An increase in $\delta$ also increases the demand for money (if $\ell_w > 0$) which tends to shift the LM curve to the left. A fraction $\alpha$ of the increase in the government's liabilities is in the form of money issues. This lends to shift the LM curve to the right. Thus, while $F_\delta > 0$, an increase in $\delta$ will raise the short interest rate, r, if $\alpha$ is small (in a high-debt economy) but lowers it if $\alpha$ is sufficiently large (a low-debt economy), 47/ i.e., $H_\delta$ will be positive for small $\alpha$ and negative for large $\alpha$. For reasons of space, only the high-debt economy is considered in what follows. The system described in (36) has one predetermined state variable $\delta$ and one non-predetermined one, R. For there to exist a unique convergent saddle-point equilibrium, it is necessary and sufficient that $F_\delta(1-H_R) + F_R H_\delta > 0$. In the low-debt economy (which behaves more or less like an economy under pure money financed deficits) this condition is always satisfied. In the high-debt, low $\alpha$ economy, which behaves approximately like an economy under pure bond financing, explosive behavior cannot be ruled out a priori. If there exists a convergent saddlepoint equilibrium, it is likely to have the configuration shown in Figure 8, with an upward-slopoing saddlepoint SS'. 49/

The long-run effect of an increase in $\mu$ is a larger real volume of total government debt ($\delta$ increases) and a higher R (and r). 50/ An unexpected, immediate and permanent increase in $\mu$ (which implies a short-run and long-run tax cut) causes the long real interest rate to jump immediately from $E_0$ to $E_{01}$, onto $S_1S_1$, the convergent saddlepath through the new long-run equilibrium at $E_1$. There will, however, be a recession during the entire adjustment process. We know this because the real stock of government liabilities rises throughout the adjustment process. This can only happen if the rate of inflation is below the nominal rate of growth of these liabilities $\mu$. From the Phillips curve it is clear that this requires $y < \bar{y}$. It is therefore not impossible to come up with examples in which even immediately implemented "expansionary" fiscal policy (e.g., a permanent tax cut) will have a depressing effect on real economic activity because the anticipated future deficits and the bias towards bond financing (low $\alpha$) raise the long real interest rate by

Figure 8.




The adjustment to an unexpected permanent tax cut in the rational expectations-augmented Keynesian model with gradual price adjustment: an example of super crowding out.

enough to induce more than 100 percent crowding out of private interest-sensitive spending in the short run and throughout the adjustment process. Because capacity output is exogenous, crowding out aross steady states is of course 100 percent.

Other ways of generating a negative impact-demand multiplier is through confidence effects. If private agents are unsure about the sustainability of the government's fiscal policy stance, and more specifically, if there is some probability of explosive debt accumulation, and eventual repudiation, a risk premium will be added both to short and long interest rates. Formally, this works pretty much like an increase in R in the previous two models.

There is little, if any, direct or indirect evidence on the likelihood of negative mulitpliers in the circumstances faced by the major industrialized nations today.

f. Rational Expectations -- Augmented Classical Crowding Out and the Impossibility of Cutting Taxes

This is a suitable point to bring out one of the consequences of the government having to satisfy its intertemporal budget constraint. Given the real exhaustive spending programme, and given the revenues from future seigniorage, a tax cut today requires, on average, a tax increase tomorrow if the government is to satisfy its solvency constraint. We should therefore talk of an intertemporal reallocation or redistribution of taxes and transfer payments. Consider the following very simple government budget identity. There is no money, one real short government bond, B, public spending G, and taxes net of transfers T.

(37) $\dot{B}(t) \equiv G(t) + r^s(t)B(t) - T(t)$

The solvency constraint is

$$\lim_{\tau \to \infty} B(\tau) e^{-\int_t^\tau r^s(u)du} = 0$$

or

(38) $B(t) + PV(G, t, r^s) \equiv PV(T, t, r^s)$

B(t) is inherited from the past. $PV(G, t, r^s)$ is not automatically given when the entire current and future path of G is given, because current and expected future real interest rates need not be invariant under the changes in fiscal policy that are being considered. The simplest case is the small open economy whose external terms of trade are exogenous and constant and whose internal rate of interest is determined exclusively by the exogenously given world rate of interest $r^*$. 51/ This makes $PV(G, t, r^s)$ independent of any changes in the policy mix. The authorities merely reshuffle a given present discounted value of taxes over time. A current tax cut must imply a future tax increase of equal present value. That is not to say that such a reallocation of taxes towards the future will have no effects. In a classical, rational expectations model such as Blanchard's [1985], uncertain lifetimes cause the private sector to discount future income and taxes at a rate higher than the government's discount rate, $r^s$. A sequence of early tax cuts followed by a later tax increase of equal present value when discounted at $r^s$, will represent a net reduction in the present value of current and future taxes when discounted at the higher rate $r^s - \lambda$, where $\lambda > 0$ is the premium of the private discount rate over the government's discount rate. 52/ This boost to private sector human capital will have the familiar result of boosting consumption, lowering private saving in the short run, reducing the current account surplus, and reducing private non-human wealth in the long run. In the small open economy, the capital-output ratio is held in place by the world interest rate, and long-run crowding out takes the form of a reduction in the country's financial claims on the rest of the world.

In a closed economy or an open economy large enough to influence the terms of trade or the world interest rate, the path of $r^s$ will be a function of the government's financing policy. In Blanchard [1984, 1985] and Buiter [1984] it is shown that it is still true that an early tax cut requires a later tax increase (if the public spending programme is held constant) or a later exhaustive spending cut (if the tax-transfer programme is held constant except for the early cuts). The real interest rate rises immediately and stays high even when in due course the tax cuts are reversed. The reason is that in the meantime, a sequence of government budget deficits has added to the total outstanding stock of debt, which keeps interest rates high at home and abroad. Investment declines at home and abroad in the short run and in the long run the capital intensity of production is lowered. Domestic public debt thus crowds out capital formation at home and abroad. It also results in a domestic current account deficit and a long-run reduction in the home country's net external asset position. 53/

At the risk of stating the obvious, I would like to pont out a pitfall in the interpretation of steady-state analysis. Let G and T be constant in the steady state. Assume for simplicity that the long-run growth rate of real output is zero. The long-run or steady-state government budget identity is

$$(39) \qquad B = \frac{T - G}{r^s}$$

Assume $r^s > 0$. Equation (39) appears to suggest that the way to reduce the outstanding stock of government debt in the long run is to cut taxes or raise public spending. This of course is nonsense. Consider the case where $r^s$ is constant and tax receipts do not respond to variations in economic activity. It is clear that the budget identity (37) describes unstable, explosive behaviour of the public debt. A tax cut implies higher borrowing in the short run and therefore higher debt and increased debt service and yet higher borrowing in the long run. The correct interpretation of (39) is that if a country wishes to have lower taxes (or higher exhaustive public spending) in the long run, it will have to reduce its debt service burden. In a small open economy, this means that the country has to achieve a transition to a lower stock of debt. (In a closed economy or a large open economy, the reduction in debt service could be eased by achieving a lower interest rate in addition to a lower debt volume). Given G, the "traverse" from a high value of B to a low value of B will be achieved by tax increases, generating budget surpluses that, over time, permit a lower value of debt service. Only then can taxes be cut to achieve a long-run equilibrium with a lower volume of debt and a lower value of taxes.

The same caution in interpreting steady-state multipliers is required when one considers the long-run net foreign asset position of a country. The current account identity is given in (40). Its steady-state version is given in (41). F denotes net claims on the rest of the world (yielding $r^* > 0$).

$$(40) \qquad \dot{F} \equiv Y + r^*F - (C + I + G)$$

$$(41) \qquad F \equiv \frac{C + I + G - Y}{r^*}$$

Equation (41) could be misinterpreted as indicating that in order to increase one's long-run holdings of net foreign assets, one should boost absorption (C + I + G) relative to income. What it means instead is that if a country wishes to increase its long-run absorption relative to its domestic income, it should acquire foreign assets. In real time, the process of foreign investment requires a lowering of real absorption relative to domestic income.

There are two qualifications to these results concerning the intertemporal reallocation of taxes (of primary surpluses more generally). First, the models of Blanchard [1984, 1985], Buiter [1984], and Frenkel and Razin [1984] are full employment models. The cost-benefit analysis of an intertemporal tax reallocation programme may be very different if the initial situation is one of Keynesian unemployment, as it is then possible, in principle, to boost private consumption in the short run without this requiring the crowding out either of private domestic capital formation or of net foreign investment, as domestic output is demand-constrained.

Second, real world taxes are not lump-sum but typically take the form of a tax rate (or schedule of rates) applied to a tax base such as value added, wages, profits, or sales revenue. Consider again the simplest case where tax receipts are an linear function of value added, Y. For example,

$$T = \theta_0 + \theta_1 Y \qquad 0 < \theta_1 < 1$$

While it is still true that (given spending) a cut in total taxes (T) now requires an increase in total taxes later, it is not necessarily the case that a cut now in either $\theta_0$ or $\theta_1$ will require a future increase in either $\theta_0$ or $\theta_1$. The tax base, Y, could increase sufficiently as a result of the early tax rate cut (or incrase in thresholds) to permit the higher required future taxes to be raised at an unchanged (and conceivably even lower) tax rate and an unchanged (or higher) threshold. The contributions of Blinder and Solow [1973], and Tobin and Buiter [1976], discussed earlier, analyzed this possibility in a Keynesian fixed-price setting, 54/ and in the case of Tobin and Buiter, in a full-employment, flexible price setting. No stable Keynesian model that I know, however, has the property that a cut in $\theta_0$ or $\theta_1$ will boost output on impact to such an extent that total tax receipts actually increase and deficits fall in the short run. That feat, as we saw, can only be achieved in the long run if the positive wealth effect on consumption demand of a larger stock of public debt outweighs the effect on money demand by enough to generate an increase in taxable income that is sufficient to service the increase in debt at the new lower tax rates.

The classical version of the Keynesian super-multiplier is the Laffer effect; lower tax rates lead to a reduction in distortions and misallocations and boost incentives to work, save, invest, and innovate to such an extent that "full employment" output increases by enough to generate increased tax revenues at a lower tax rate. I know of no empirical evidence to support the proposition that (the absolute value of) the elasticity of the tax base with respect to the tax rate is greater than unity. It goes without saying that even without the extreme versions of the Keynesian demand multiplier and Laffer's supply multiplier being relevant, careful attention to both the demand-(de)stabilizing properties and the (mis)-allocative effects of tax changes is essential for economic policy design.

## 6. Measures of Fiscal Stance

The discussion of Section 5 should have made it clear that in order to obtain a measure of the effect of the stance of fiscal policy on aggregate demand, one needs: (a) a model of the economy; and (b) a benchmark or reference specification for policy. As regards the first, I can only restate the conclusion reached by Blinder and Solow [1974] that there are no "model-free" measures of fiscal impact on aggregate demand. Different views on how the economy works will give rise to conclusions about the demand effect on fiscal policy measures (whether they be isolated changes in the values of certain instruments or changes in the parameters describing fiscal and financial decision rules) that may differ not only in magnitude but even in direction. The need for a benchmark or reference path is equally obvious. "Expansionary (or contractionary) relative to what?" should the immediate response be to the question as to whether the stance of fiscal policy is expansionary or contractionary. If total tax receipts increase, is this a discretionary move to tighten fiscal policy (the reference point is the pre-existing level of taxes) or the automatic resonse of tax receipts to endogenous fluctuations in economic activity, according to an unchanged tax rule such as $T = \theta_0 + \theta_1 Y$, $\theta_1 > 0$ (the benchmark is the original parameters of the tax function). As long as one is explicit about the benchmark reference path or "origin" for one's comparison, there should be no confusion on this account.

Certain conclusions about much-abused fiscal indicators are worth stating explicitly:

1) There is no existing model of the economy that yields the public sector deficit, the change in the public sector deficit, its share in GDP or the change in its share in GDP as a measure of fiscal impact on demand, short-run, long-run, or real-time.

2) There is no existing model of the economy that yields the cyclically corrected (full employment) deficit, the change in this deficit, its share in GDP or the change in its share in GDP as a measure of fiscal impact on aggregate demand in any run.

3) There is no existing model of the economy that yields the cyclically and inflation-corrected deficit (its change, share in GDP or change in its share in GDP) as a measure of fiscal impact on aggregate demand in any run.

   From (2) and (3) it follows e.g., that both the OECD's and the IMF's fiscal impulse measures are uninformative as measures of fiscal impact on demand (see IMF [1985] and OECD [1982, 1985]).

4) There is no existing model of the economy that yields the level or change in the debt-GDP ratio as a measure of fiscal impact on aggregate demand in any run.

What would a proper measure of fiscal impact on aggregate demand look like? Basically, it involves a comparison of two simulations (or two sets of stochastic simulations) of an economic model with different sets of parameter values in certain fiscal and financial decision rules. Sometimes, with very simple models, this can be done analytically. In the old-fashioned static, expectations-innocent, closed-economy Keynesian model of equations (23) - (27) with the specific benchmark policy $G = \overline{G}$ (exogenous) and $T = \theta_1 + \theta_1 Y$, the (impact) effect on aggregate demand of fiscal policy given an accommodating monetary policy (r constant) is

$$\text{(42a)} \qquad dy = K[dG - C_{y_d} d\theta_0 - C_{y_d} Y d\theta_1]$$

$$\text{(42b)} \qquad K = \frac{1}{1 - C_{y_d}(1-\theta_1)}$$

The (impact) effect of fiscal policy on aggregate demand under a non-accommodating monetary policy (M constant) for this model is:

$$\text{(43a)} \qquad dY = K'[dG - C_{y_d} d\theta_0 - C_{y_d} Y d\theta_1]$$

$$\text{(43b)} \qquad K' = [(1 - C_{y_d})(1 - \theta_1)\ell_r + \ell_y(I' + C_{y_d} B)]^{-1}$$

Notice that the fiscal parameters $dG$, $d\theta_0$, and $d\theta_1$ are multiplier-weighted and that these weights are evaluated at the actual (not necessarily the cyclically-corrected) level of output:

Contrast (42ab) and (43ab) with the measure of fiscal impact that comes out of Blanchard's classical model with rational expectations and uncertain lifetimes (Blanchard [1985]).

The effect of public spending on goods and services and lump-sum taxes on consumption demand (at given current and expected future interest rates) denoted $f(t)$ is given by:

$$\text{(44)} \qquad f(t) = G(t) - (\lambda + \rho)E_t \int_t^{\infty} G(z) e^{-\int_t^s (r(u)+\lambda)du} ds + (\lambda+\rho)\left(B(t) + E_t \int_t^{\infty} (G(s) - T(s)) e^{-\int_t^s (r(u)+\lambda)du} ds\right)$$

$\lambda$ is the instantaneous probability of death, $\rho$ the private sector's rate of time preference and B(t) the outstanding real shock of interest-bearing debt. The first two terms on the right-hand-side of (44) give the effect of balanced-budget (tax-financed) exhaustive spending. Spending on goods and services by the government only boosts demand if current spending exceeds its "permanent" or average future expected value. When $\rho = r$, e.g., a constant level of spending has no effect on demand. The third term on the right-hand-side of (44) is zero if private decision horizons are infinite ($\lambda = 0$). It is positive if horizons are finite ($\lambda > 0$). This presents the effect of debt-financing. Bonds are "wealth" if $\lambda > 0$ and consumption demand is an increasing function of the outstanding stock of bonds. Note how in (44), unlike in (42a) and (42b), expectations of future spending, taxes, and interest rates must be modelled to obtain the current demand effect of fiscal and financial policy.

While these two illustrative fiscal stance measures are at opposite ends of the modeling universe, they do convey the right flavour of the range of views on the fiscal stance that different economists (or even the same economist at different times) can hold.

It is informative to look at some of the indices that have been (ab)used as measures of fiscal stance. Figure 9a graphs five measures of fiscal stance for the United States and Figure 9b does the same for the United Kingdom. For both countries the change in the actual general government financial deficit as a percentage of GNP is shown and two measures of the change in the cyclically-corrected (full employment or structural) deficit as a percentage of GNP, one constructed and published

FIGURE 9b

Five general government fiscal impulse measures: UK .

(Change in (adjusted) deficit as a percentage of actual or potential GNP).

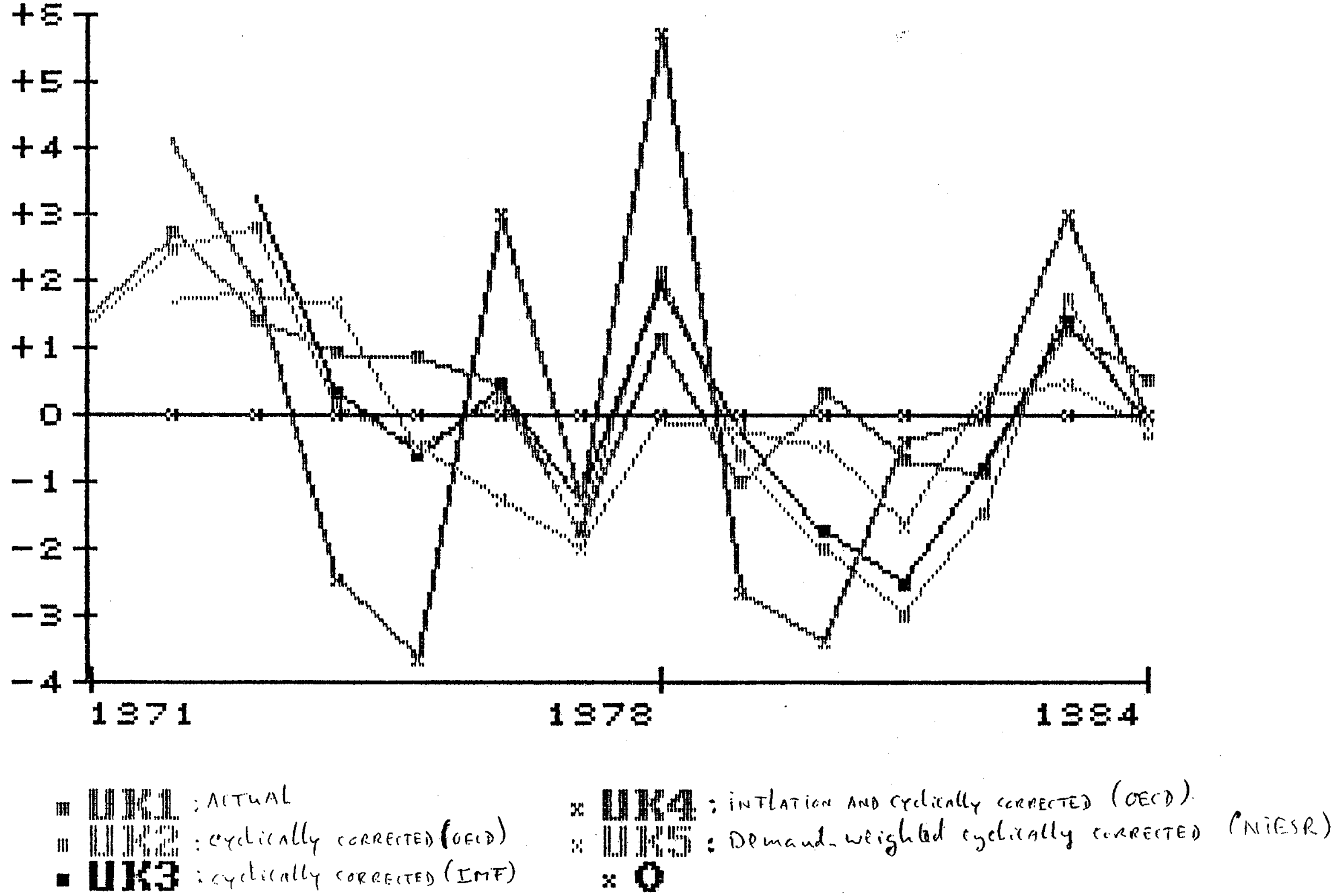
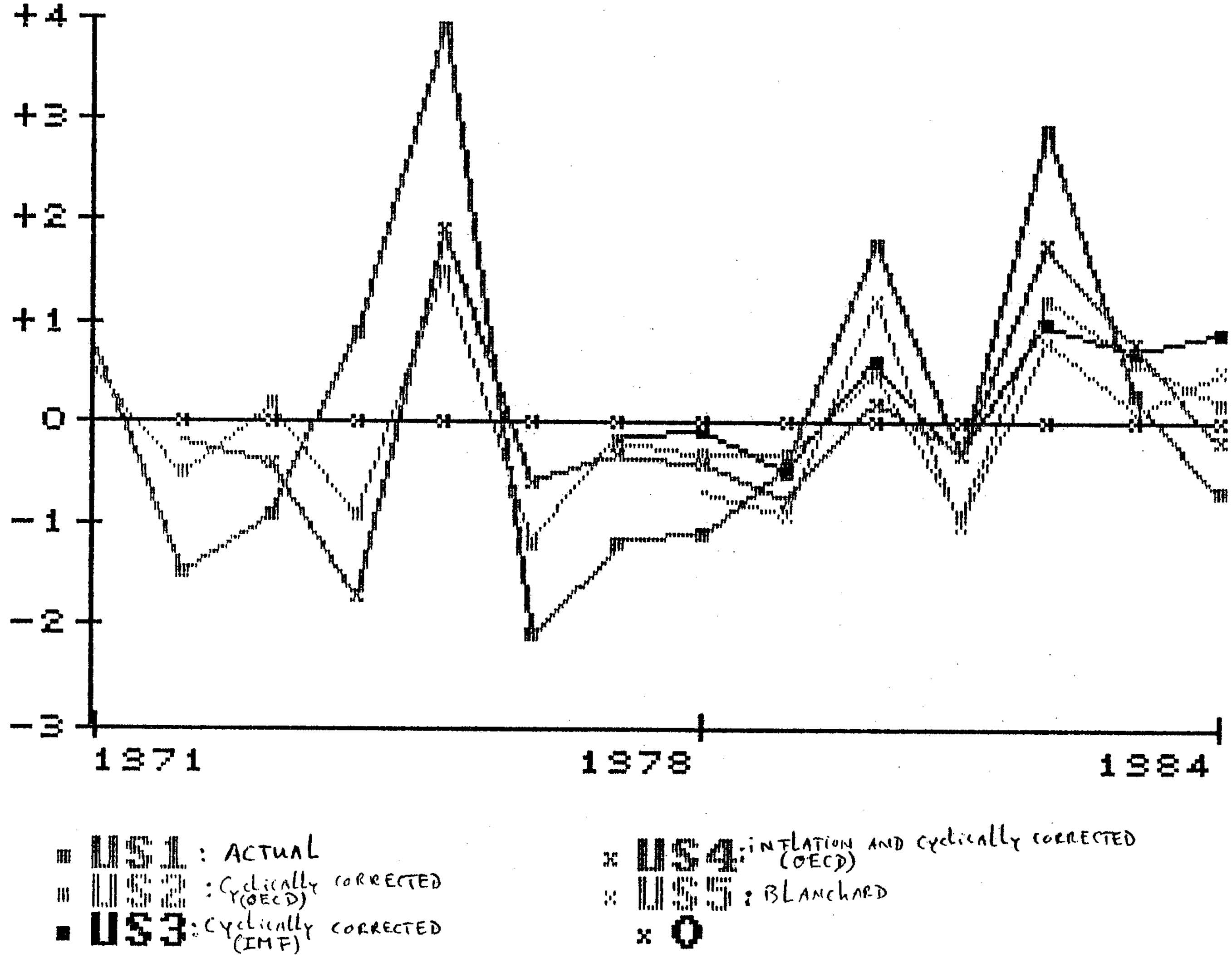


FIGURE 9a

Five general government fiscal impulse measures:USA.

(Change in (adjusted) deficit as a percentage of actual or potential GNP).



by the IMF and one by the OECD. Also for both countries we have the change in the inflation-corrected and cyclically-adjusted general government financial deficit as a percentage of GNP. Finally, for the United States, there is a short run of figures giving an estimate of the change in Blanchard's measure of fiscal stance in equation (44) and for the United Kingdom there is a set of NIESR estimates of the change in "demand-weighted," cyclically-corrected deficit measure. The latter represents an attempt to estimate the impact 55/ effect of discretionary fiscal changes on the demand for currently produced domestic coutput in a simple Keynesian world.

The summary statistics provided in Tables 6, 7, and 8 show that the different indices tell quite different stories. For the United States, over the brief period for which all five measures are available (1978-84), the divergence between the various indices is smallest. Even here, the mean change in the deficit as a percentage of GNP lies between 0.36 for the actual deficit and 0.00 for Blanchard's measure. The standard deviation of the actual deficit change is about twice that of the other measures. The measures are all positively correlated, but the correlation ranges from a high of 0.88 (between Blanchard's measure and the IMF's cyclically-corrected measure) to a low of 0.58 between the IMF's cyclically-corrected deficit measure and the actual deficit. Considering three of the measures for the United States over a longer period (1972-84) in Table 7, we see that while the actual deficit measure is both larger on average and more volatile than the two cyclically-corrected measures, the three are rather highly correlated.

Table 6. The Behavior of Five Indices of Fiscal Stance in the United States, 1978-84 1/

| Variables | Mean | Standard Deviation |
|---|---|---|
| Actual | 0.36 | 1.46 |
| Cyclically-corrected (OECD) | 0.14 | 0.70 |
| Cyclically-corrected (IMF) | 0.33 | 0.61 |
| Inflation and cyclically corrected (OECD) | 0.16 | 0.88 |
| Blanchard | 0.00 | 0.88 |

1/ Change in (corrected) deficit as a percentage of actual or potential GNP.

Correlation Matrix

| | | | | | |
|---|---|---|---|---|---|
| Actual | 1.00 | | | | |
| Cyclically corrected (OECD) | 0.78 | 1.00 | | | |
| Cyclically corrected (IMF) | 0.58 | 0.86 | 1.00 | | |
| Inflation and cyclically corrected (OECD) | 0.83 | 0.86 | 0.76 | 1.00 | |
| Blanchard | 0.72 | 0.84 | 0.88 | 0.64 | 1.00 |

Table 7. The Behavior of Three Indices of Fiscal Stance in the United States, 1972-84

| Variable | Mean | Standard Deviation |
|---|---|---|
| Actual | 0.12 | 1.79 |
| Cyclically-corrected (OECD) | -.008 | 0.81 |
| Inflation and cyclically-corrected (OECD) | -.02 | 1.00 |

Correlation Matrix

| | | | |
|---|---|---|---|
| Actual | 1.00 | | |
| Cyclically corrected (OECD) | 0.78 | 1.00 | |
| Inflation and cyclically correced (OECD) | 0.70 | 0.87 | 1.00 |

Table 8. The Behavior of Five Indices of Fiscal Stance in the United Kingdom, 1973-84 1/

| Variable | Mean | Standard Deviation |
|---|---|---|
| Actual | 0.18 | 1.03 |
| Cyclically corrected (OECD) | -0.23 | 1.74 |
| Cyclically corrected (IMF) | -0.01 | 1.61 |
| Inflation and cyclically corrected (OECD) | -0.05 | 2.93 |
| Demand-weighted, cyclically-corrected (NIESR) | -0.21 | 1.15 |

1/ Change in (corrected) deficit as a percentage of actual or potential GNP.

Correlation Matrix

| | | | | | |
|---|---|---|---|---|---|
| Actual | 1.00 | | | | |
| Cyclically corrected (OECD) | 0.75 | 1.00 | | | |
| Cyclically corrected (IMF) | 0.69 | 0.99 | 1.00 | | |
| Inflation and cyclically corrected (OECD) | 0.39 | 0.65 | 0.64 | 1.00 | |
| Demand-weighted, cyclically corrected (NIESR) | 0.64 | 0.65 | 0.69 | 0.09 | 1.00 |

For the United Kingdom (Table 8), the five measures behave very differently over the period 1973-84. The mean change in the deficit as a percentage of GDP ranges from 0.18 for the actual deficit to -0.23 for the OECD's cyclically-corrected measure. The change in the actual deficit is the least volatile of the five measures while for the United States it was the most volatile. The wildest swings are exhibited by the inflation and cyclically-corrected deficit measure of the OECD because of the great volatility of ex-post U.K. annual inflation rates over the period. The IMF's and the OECD's cyclically-corrected measures are almost perfectly positively correlated. Very low correlations are recorded for the actual deficit and the inflation and cyclically-corrected deficit (0.39) and for the demand-weighted cyclically-corrected deficit and the inflation and cyclically-corrected deficit (0.09).

Incorrect measures may sometimes give the right answer: the man who always insists it's twelve o'clock will be correct twice a day. Blanchard's measure and the NIESR's measure have the virtue of being model-based. Those who like the model must like the measure; those who disagree can be explicit and precise about the nature of the disagreement and so arrive at their own preferred model-based measure. All the other measures do not have interpretations as indices of the impact of fiscal policy on aggregate demand. Some (e.g., a superior version of the cyclically- and inflation-corrected deficit) may be crude approximations to one of the "permanent deficit" or solvency measures.

In general, the information required to obtain a measure of fiscal impact on demand consists of the following:

1) A model of the economy (one hopes for one that respects stock-flow identities and treats expectations seriously).

2) A specification of the length of the run over which one wishes to measure the impact of fiscal policy.

3) A full specification of the benchmark and the alternative policies. This includes the following:

   a) How fiscal policy is parameterized (the tax and spending functions)

   b) How monetary and financial policy are parameterized. (Is monetary policy fully accommodating, non-accommodating, or something in between? What is the exchange rate rule? etc.

4) A full specification of how information about the changes in fiscal and financial policy actions or rules is disseminated to and processed by the private sector. This includes at least a characterization of the unanticipated-anticipated, current-future, and permanent-transitory aspects of the policy change.

All this is hard work. It is also essential for informed policy debate. It is possible that there are reasonable shortcuts, but we won't know this until we have first obtained the results from following the correct procedures, which can then be compared with the answers suggested by seat-of-the-pants methods.

## 7. Conclusion

Probably more uninformed statements have been made on the issue of public sector debt and deficits than over any other topic in macroeconomics. Proof by repeated assertion has frequently appeared to be an acceptable substitute for the more conventional methods of proof by deduction or by induction. The public debt in the long run, and (except under some rather special parameterizations of fiscal and financial policy) the public sector deficit in the long run and in the short run are endogenously determined by the interaction of the economic system and the government's policy rules. As with all predetermined or endogenous variables, observations on public sector debt and deficits contain information about the current state and future evolution of the economy, i.e., they are signals from which the careful practioner can extract information. The practical problem is that (changes in) debt and deficits can signal almost anything, depending on the nature of the exogenous shocks perturbing the system and on the structure of the rest of the transmission mechanism. A larger deficit may signal a loosening of fiscal policy or a tightening of fiscal policy (without which the deficit would have been even larger) in response to a fall in export demand or a collapse in domestic animal spirits. A larger deficit could also reflect a tightening of monetary policy with an unchanged fiscal stance. It may signal increased eventual future monetization, higher expected future taxes, lower expected future spending, or a greater probability of debt-repudiation. It may also signal none of the above. To determine the significance of the behavior of public debt and deficits, we must get away from the dangerous shortcuts of "model-free" single-figure indices of fiscal stance. The way to deal with a complex issue is not by pretending that it's really quite simple. The fiscal and financial policy choices that co-determine the behavior of public debt and deficits are too serious a matter for them to be left either to fiscal quacks or to purveyors of conventional wisdom.

## Footnotes

* I would like to thank David Begg, Charles Wyplosz, and Charles Bean for helpful comments on an earlier draft. My two discussants at the Paris panel meeting of Economic Policy, Patrick Minford and Torsten Persson, made many useful suggestions. Some throwaway remarks by Alan Walters at a conference in September 1984 prompted the discussion of negative multipliers in Section 5.

1/ The theme of this paper, its structure and many of the ideas contained in it, were taken from Blanchard, Buiter, and Dornbusch [1985]. The manner in which the present paper follows and extends the ideas of the earlier paper would be even more apparent, if the original version of Blanchard, Buiter, and Dornbusch [1985] were in the public domain. The published version of that paper, however, does not contain the discussion of sovereign debt repudiation that motivated the discussion of that issue in this paper.

2/ See e.g., Webb [1980], Stiglitz and Weiss [1981], Grossman and Hart [1983], Williamson [1984], Greenwald and Stiglitz [1984], and Laffont [1985].

3/ See e.g., Eaton and Gersovitz [1981a, b], Sachs [1984], Sachs and Cooper [1984], and Ghosh [1985].

4/ This assumes that the tax cut is not specifically targeted to investment, e.g., accelerated depreciation or an investment subsidy. See Section 5 for a further discussion of this point.

5/ The debt figures measure public debt at nominal (roughly "par") values rather than at market values. If data on market values (security prices and quantities) were available, the change in the debt-output ratio could be decomposed into four terms as follows:

$$\Delta\left(\frac{P^B B}{PY}\right) \simeq P^B\frac{\Delta B}{PY} + \frac{\Delta P^B}{P^B}\frac{P^B_L G}{PY} - \frac{\Delta P}{P}\frac{P^B B}{PY} - \frac{\Delta Y}{Y}\frac{P^B B}{PY}$$

$P^B$ is the money price of government securities, B their quantity. Many different kinds of securities can be incorporated without any conceptual problems.

6/ See Buiter [1983], for a discussion of the relative merits of using short rather than long, and ex-ante rather than ex-post real interest rate measures for these calculations. The Bank of England's approach subtracts from the conventional PSBR the rate of inflation times the nominal value of the debt. A correction for foreign currency-denominated debt is also made.

7/ "Debt" here and in what follows means interest-bearing debt. The term "bonds" will be used interchangeably.

8/ A • over a variable denotes its instantaneous rate of change, e.g., $\dot{M} \equiv (d/dt)M$.

9/ Reserves are, for simplicity, treated as non-interest bearing.

10/ Models such as Sidrauski's [1967] with infinite-lived households characterized by a constant pure rate of time preference show no long-run effect of anticipated money growth or inflation on the real interest rate. Money-capital models in the spirit of Tobin [1965] have a negative long-run effect of higher inflation on the marginal product of capital and thus on the real interest rate, as portfolio holders switch from money to real capital in response to a higher rate of inflation. J. Carmichael and P.W. Stebbing [1983] found that the data supported a negative relationship between the real rate of interest and the rate of inflation. The proposition that the nominal interest rate was invariant under the rate of inflation could not be rejected. See also the papers collected in Tanzi [1984].

11/ Equation (5) assumed implicitly that $E_t d_t = d_t$ and that

$$E_t(\dot{M}(t)/P(t)) = \dot{M}(t)/P(t).$$

12/ Earlier estimates of the inflation semi-elasticity of base money demand yielded a value of around -2.0. The seigniorage-maximizing inflation rate would be 50 percent per year in that case.

13/ In general, $p^L(t) = cE_t \int_t^{\infty} e^{-\int_t^v i^s(u)du} dv$

14/ In general, $p^B(t) = cE_t \int_t^{T} e^{-\int_t^v i^s(u)du} dv + p^B(T)E_t e^{-\int_t^T i^s(u)du}$

15/ $$\frac{dp^B(t)}{di_s} = -\frac{c}{(i^s)^2}\{1 - [1 + i^s(T-t)]e^{-i^s(T-t)}\} - (T-t)p_T^B e^{-i^s(T-t)}$$

With a positive nominal interest rate and a positive time remaining to maturity, both terms on the right-hand-side of this equation are always negative.

16/ If a government could borrow abroad by issuing debt denominated in its own currency, the foreign exchange value of debt and debt service would vary proportionally and inversely with the exchange rate. Debtor governments that are foreign exchange-constrained might therefore be tempted to use devaluation as a means of improving their foreign exchange positions both in stock and in flow terms. This may be one reason why most major debtor countries have their debts denominated in foreign currency, mainly U.S. dollars. It will be interesting to see for how long the U.S. government will continue to be able to borrow abroad through dollar-denominated debt issues, if the United States continues along the road that took it from being a major net foreign investor to a zero net external asset position early in 1985, and to a future that could make it the largest external borrower within a couple of years.

17/ The correction for index-linked debt (introduced in 1981) would not yet be numerically significant as the following table shows:

The Importance of Index-Linked Debt in the United Kingdom

| Year | Total national debt (£ million)* (1) | Index-linked treasury stock (£ million) (2) | Share of index-linked treasury stock in total national debt (3) |
|---|---|---|---|
| 1981 | 113,037 | 1,000 | 0.9 |
| 1982 | 118,390 | 3,701 | 3.1 |
| 1983 | 127,730 | 5,984 | 4.7 |
| 1984 | 142,545 | 7,665 | 5.4 |

Source: Financial Statistics, various June issues.

Note: * Nominal amount outstanding at 31st March.

18/ I am indebted to Patrick Minford for this point.

19/ If velocity increases with inflation, the inflation cost of an increased debt-output ratio is higher since

$$\frac{\partial \mu}{\partial \tilde{b}} = \frac{v(r^s-n)}{1-\mu m\frac{\partial v}{\partial \mu}} > v(r^s-n) > 0$$

if

$$r^s > n; \quad \frac{\partial v}{\partial \mu} > 0; \text{ and } \quad 1 > \mu m\frac{\partial v}{\partial \mu}$$

20/ A cut in exhaustive public spending of one-fifth of one percent of GNP would of course also do the trick.

21/ I.e., $PV\,(c^G,\ t,\ r^s) \equiv E_t \int_t^{\infty} c^G(z) e^{-\int_t^z r^s(u)du} dz$

22/ Note that we could subtract the real value of the outstanding stock of high-powered money $M(t)/p(t)$ as another liability on the right-hand-side of (13). We preserve the identity by adding $M(t)/p(t)$ to $PV(\dot{M}/P,\ t,\ r^s)$. This gives us $\frac{M(t)}{P(t)} + PV(\frac{\dot{M}}{P},\ t,\ r^s) = PV(i^s\frac{M}{P},\ t,\ r^s)$, as the "gross" monetary asset of the authorities. It is the present value of the returns earned by the central bank through the investment of its entire expected portfolio at each future date in interest-bearing assets.

23/ $$\Omega(t) \equiv \lim_{z\to\infty} E_t[\frac{M(z) + B^s(z) + p^L(z)B^L(z)}{p(z)} p_K(z)K^G(z) - p_N(z)N^G(z)]e^{-\int_t^z r^s(u)du}$$

24/ $\Omega(t) = 0$ can be rewritten as:

$$\lim_{z\to\infty} E_t[\frac{M(z) + B^s(z) + p^L(z)B^L(z)}{p(z)Y(z)} - p_K(z)\frac{K^G(z)}{Y(z)} - p_N(z)\frac{N^G(z)}{Y(z)}]e^{-\int_t^z (r^s(u) - n)du} = 0$$

25/ I.e., (14) could be written as:

$$B^s(t) + p^L(t)B^L(t) - p(t)[p_K(t)K^G(t) + p_N(t)N^G(t)] \equiv$$

$$PV(P(T - c^G + (P_K - 1)\dot{K}),\ t,\ i^s) + PV(\dot{M},\ t,\ i^s)$$

26/ It is assumed for simplicity that $r^s$ and $n$ are constants.

27/ I am indebted to Stanley Fischer for this point.

28/ $\tilde{R}(t) \equiv [E_t \int_t^{\infty} e^{-\int_t^v [r^s(u) - n(u)]du} dv]^{-1}$

29/ "Residual" debause it omits certain taxes and transfers whose capitalized value was included in Hills' balance sheet.

30/ Annuitized at $\tilde{R} = 0.02$.

31/ General government interest payments. Source: IMF World Economic Outlook, April 1984, p. 106.

32/ I.e., $R(t) \equiv [E_t \int_t^{\infty} e^{-\int_t^z r^s(u)du} dz]^{-1}$

33/ See Eaton and Gersovitz [1981a, 1981b], Sachs [1984], Sachs and Cooper [1984], and Ghosh [1985].

34/ An interesting and as yet open question is under what conditions a policy of "honest" debt service is time-consistent, i.e., compatible with a sequence of rational moves when pre-commitment is impossible.

35/ See C.P. Kindleberger [1984].

36/ See Diamond [1965]; Barro [1974] and Buiter [1980].

37/ See Yaari [1965]; Blanchard [1985]; Frenkel and Razin [1984], and Buiter [1984].

38/ Since it is the after-tax interest rate that represents the opportunity cost of holding money, a cut in the tax rate applied to interest income would boost the demand for money and shift LM to the left, i.e., be contractionary as regards its effect on the financial markets.

39/ Feldstein [1984] reaches a similar conclusion via a quite different route involving general price level effects in a two-sector model.

40/ $\frac{dY}{dT} = [I'\ell_{Yd} - \ell_r C_{yd}][(C_{Yd}\frac{B}{P} + I')\ \ell_{Yd} + (1-C_{Yd})(\ell_r + \ell_{Yd}\frac{B}{P})]^{-1};$

The denominator is assumed to be negative.

41/ $\theta_2 > 1$ means that some taxes are raised (transfer payments are lowered) when debt service increases, by more than the increase in debt service, not that the marginal tax rate on interest income is more than 100 percent.

42/ With $\theta_2 = 0$,

$$\left.\frac{dY}{d\theta_0}\right|_{\overline{M}} = -\frac{1}{\theta_1} + \frac{H_{\theta_0}B}{P\theta_1} + \frac{1}{p}\left(\frac{r + H_B B}{\theta_1}\right)\frac{dB}{d\theta_0}$$

$$\left.\frac{dY}{d\theta_0}\right|_{\overline{B}} = -\frac{1}{\theta_1} + \frac{H_{\theta_0}B}{p\theta_1} + \frac{1}{p}\left(\frac{H_M B}{\theta_1}\right)\frac{dM}{d\theta_0}$$

If the model is stable, $dB/d\theta_0 < 0$, and $dM/d\theta_0 < 0$. Since $r + H_B > 0$ and $H_M < 0$, the long-run effect of bond-financed tax cuts on the IS-LM equilibrium level of output is greater than that of money-financed tax cuts.

43/ Consider the IS-LM model with a fixed level of output $Y = \overline{Y}$ and a perfectly flexible price level. The tax function is characterized by $0 < \theta_1 = \theta_2 < 1$. The IS-LM solution for r and p are:

$$r = H(M, B, \theta_0, \theta_1, G) \qquad H_M < 0; \qquad H_B > 0.$$

$$p = J(M, B, \theta_0, \theta_1, G) \qquad J_M > 0; \qquad J_B \lessgtr 0.$$

Under bond-financed deficits the stability condition is:

$$[r + H_B B] - \frac{rB}{P}J_B < 0$$

44/ The degree of confidence with which these expectations are held can only be built in if one is willing to model conditional second moments.

45/ Let $\overline{e}$ be the long-run equilibrium nominal exchange rate, then

$$e(t) = \overline{e}E_t \exp\left(-\int_t^{\infty} [r(u) - r^*(u)]\, du\right)$$

46/ If $\overline{c}$ is the long-run equilibrium real exchange rate then:

$$c(t) = \overline{c}E_t \exp\left(\int_t^{\infty} [r(u) - \frac{\dot{p}(u)}{p(u)}) - (r^*(u) - \frac{\dot{p}^*(u)}{p^*(u)}]du\right)$$

47/ The short-run efect ov an increase in $\delta$ or r is given by:

$$\left.\frac{dr}{d\delta}\right|_{IS-LM} = \frac{(1-C_y)(\alpha-1_w) - 1_y(C_w+C_y\mu)}{(1-C_y)1_r}$$

48/ In the long run:

$$\frac{d\delta}{dG} = \frac{(C_y-1)1_r}{\Omega}$$

$$\frac{dR}{dG} = \frac{(\alpha-1_w)(C_y-1)}{\Omega}$$

$$\frac{d\delta}{d\mu} = \frac{1_r(I'-C_y\delta)}{\Omega}$$

$$\frac{dR}{d\mu} = \frac{-(C_y\mu+C_w)1_r + (1_w-\alpha)C_y\delta}{\Omega}$$

where $\Omega = 1_r(C_y\mu+C_w) - I'(1_w-\alpha)$

49/ I assume $1-H_R + \Psi F_R > 0$; and $-\bar{R}(H_\delta - \Psi F_\delta) < 0$.

50/ We assume in terms of the notation of footnote 48, that $\Omega > 0$.

51/ This is the case analyzed by Blanchard [1985] and Buiter [1984]. No traded-nontraded goods distinction is made.

52/ $\lambda$ is the (constant) instantaneous probability of death in Blanchard's model.

53/ See Tanzi [1985] for a discussion of the international consequences of [US] fiscal deficits.

54/ The actual question addressed in these two papers concerned the stability of the debt process (or the debt-capital process) when the tax function takes the form $T = T(Y + rB)$; $0 < T' < 1$. The fiscal shock considered was an increase in G (or in G + rB), but this doesn't affect the argument.

55/ I.e., the first-round effects before the demand multiplier has had time to go to work. This would be measured by $dyK^{-1}$ in (42a) and $dyK'^{-1}$ in (43a).

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