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CURRENT AND ANTICIPATED DEFICITS, INTEREST RATES AND ECONOMIC ACTIVITY

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ABSTRACT

There is widespread feeling that current deficits, in Europe and the U.S., may hurt rather than help the recovery. This paper examines some of the issues involved, through a sequence of three models.

The first model focuses on sustainability and characterizes its determinants. It suggests that the issue of sustainability may indeed be relevant in some countries.

The second model focuses on the effects of fiscal policy on real interest rates, and in particular on the relative importance of the level of deficits and the level of debt in determining interest rates.

The third model focuses on the effects of fiscal policy on the speed of the recovery. It shows how a sharply increasing fiscal expansion might be initially contractionary rather than expansionary.

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The size of fiscal deficits is becoming a major source of concern. In Europe and Japan, the large current deficits are inhibiting the use of further, even temporary, fiscal expansion; indeed at the bottom of a recession, most governments are attempting to reduce spending and increase tax revenues. In the United States on the other hand, where current deficits are large and anticipated deficits much larger, there is widespread concern that they may slow or even prevent a complete recovery.

The perception that deficits may hurt rather than help the recovery is clearly at odds with the traditional view that deficits, although they will in general increase interest rates, will nevertheless increase demand and economic activity. Although no unified or well articulated "new view" has emerged, challengers of the traditional view insist on the abnormally large size of current deficits. Such deficits, they argue, may be simply unsustainable, a possibility never considered by the traditional view. They may be so large and so prolonged that the increase in real interest rates may more than offset their direct expansionary effect. The purpose of this paper is to see whether this new view has some validity, and more generally to reexamine the relation between debt, deficits, interest rates and economic activity.

The first issue taken up in the paper is that of sustainability. Is it the case that some countries are running unsustainable deficits and may be forced, at some time in the future, to repudiate the debt either explicitly or through inflation depreciation? If this was the case, the increased uncertainty generated by deficits might well offset their expansionary effect. The purpose of the first model is thus to clarify the notion of sustainability and to think about its determinants. A casual examination of the evidence suggests that sustainability may indeed have become a relevant issue in some European countries.

The second issue taken up is that of the relation between real rates, debt and deficits. Even if deficits are sustainable, they will affect interest rates. Do interest rates, however, depend on the level of debt, or on the level of deficits or on both? These are the questions addressed in the second model of the paper. Central to this set of issues is the question of the horizon of agents, as we know that if agents have infinite horizons, interest rates may depend neither on debt nor on deficits. The main element of the model is thus the derivation of an aggregate consumption function which does not satisfy Ricardo-Barro equivalence. The model shows that long real rates depend on the anticipated sequence of debt, or equivalently on the current level of debt and the anticipated sequence of deficits.

The third and last issue is that of potentially perverse effects of deficits on output. Can deficits increase real rates by so much as to decrease aggregate demand and output? The third model builds on the previous one but allows for an effect of aggregate demand on output. Its main conclusion is that, although current deficits are expansionary, the anticipation of growing deficits may well reduce economic activity. This suggests that the fiscal program of the current U.S. administration could be currently contractionary rather than expansionary.

The paper has four sections. Section I presents briefly the basic facts about debt, current and anticipated deficits and spending levels. Section II focuses on sustainability. Sections III and IV characterize the relation between debt, deficits, interest rates and output.

Section I. Basic Statistics

The relevant basic statistics are presented for the U.S. and eight EEC countries in Table 1.

Focusing first on debt, we find that the average ratio of debt to GDP is relatively low by historical standards. There are, however, wide variations of this ratio across countries, from 16% in Denmark to 98% in Ireland. (These inter-country variations are no wider than intra-country variations over time: the ratio fell in the U.S. from 100% in 1947 to 25% in the mid 70's).

Turning to deficits, we see that they are large by historical standards; this is true for both 1982 and projected 1983 deficits and still holds after inflation correction of nominal interest payments on government debt, as shown in Column 4. Column 5 shows, however, that with some exceptions, the current deficits are largely cyclical: if there was no change in fiscal policy, they would disappear as the world economy returned to full employment. As return to full employment is still far in the future, these full employment surpluses would still correspond to actual deficits until at least the mid 80's.

Most countries, therefore, do not currently have structural deficits. There is, however, evidence in the U.S. of looming structural deficits starting in 1983 and, in the absence of further changes in fiscal policy, averaging 6% of GNP for the rest of the decade.[1] Two of the proximate causes, the income tax cuts voted in 1981 and the increase in defense spending are clearly specific to the U.S. The third, the increase in real interest rates, is common to all countries, affecting them in proportion to their debt to GDP ratios. The stance of discretionary fiscal policy is quite different outside of the U.S.: cyclically adjusted budget deficits

Table 1. Debt, deficits and spending

%	1 1981 (end) Debt / GDP	2 1982 Surplus / GDP	3 1983 Surplus / GDP (forecast)	4 1982 Surplus / GDP Inflation Adjusted	5 1982 Surplus / GDP Full emp. Inflation Adjusted	6 1982 Receipts / GDP	7 1982 Disbursements / GDP
Belgium	88	-12.8	-12.1	-5.8	-2.0	47.2	59.9
Denmark	16	-9.5	-9.6	-9.0	-6.3	51.5	60.9
Germany	35	-3.9	-4.1	-3.1	-.1	45.6	49.5
France	17	-3.0	-3.0	-1.9	+1.6	48.1	51.2
Ireland	98	-14.7	-14.4	-3.2	-.1	44.1	58.8
Italy	64	-11.6	-11.0	-1.1	+1.5	40.7	52.3
Netherlands	47	-5.7	-5.5	-2.5	+3.5	54.8	60.5
United Kingdom	58	-.9	-.5	+2.4	+6.5	44.7	45.6
EEC total	42	-5.0	-4.9	-1.5	1.8	45.8	50.8
U.S.	29	-3.9	-6.5	-.3	3.7	32.1	36.0

Columns 1 to 3 — EEC : Source EEC, Annual Economic Report, Tables 6.1, 6.4.
U.S.: Source Budget of the U.S. Government, Fiscal year 1984.

Columns 4, 5 — EEC : Calculations by author.
U.S.: Source OECD, WP3, 1983.

Columns 6, 7 — EEC : Source EEC Annual Economic Report, Table 6.1.
U.S.: Source Economic Report of the President, 1983

have been and are expected to be reduced by .5% in 1981, .8% in 1982 and 1.2% in 1983 in Japan, by .9% in 1981, 1.4% in 1982 and 1.2% in 1982 for the EEC as a whole.[2]

Finally, although the focus of the paper is on deficits, that is on decreases in taxes given spending, it is important to remember what has happened to government spending. Except in the U.S., the level of spending has steadily gone up over time. The ratio of government outlays to GDP for the EEC as a whole has increased by 10% since 1970, by 15% since 1960. Columns 6 and 7 show how high the levels are. It is not unlikely that some of the problems attributed to deficits come in fact from the levels of government spending and that some arguments against deficits are really arguments against the level of spending.

Section II. Sustainability of Deficits

What does it mean to say that a given combination of debt and deficits is unsustainable? To answer that, we can start with the government budget constraint:

$$\dot{D} = rD + G - T$$

D is government debt and the deficit is assumed to be entirely debt financed. r is the real interest rate, G and T spending and taxes respectively. Let's further define $\overline{T}$ as the maximum amount of taxes which can be collected by the government and $\underline{G}$ the minimum socially acceptable amount of government outlays. Both, and expecially the second one, are admittedly fuzzy and would be difficult to determine empirically. Consider the level of debt $\overline{D} = r^{-1}(\overline{T} - \underline{G})$: if debt ever exceeds $\overline{D}$, the level of debt will be forever increasing. The government will be in effect running a Ponzi scheme and will ultimately have to repudiate its debt. The implication is that the government cannot sell debt beyond $\overline{D}$, which is therefore the maximum sustainable level of debt.[3] If for example $\overline{T} - \underline{G}$ is equal to 10% of the GNP and r to 5%, $\overline{D}$ is 2 times GNP. This shows why the issue of sustainability has arisen in parallel with increases in real interest rates. Sustainable levels of debt are very large at the historical level of real rates of 1 - 2%, much smaller at the current 3 - 6%.

This computation is too simple for many reasons. It is too pessimistic in that it does not take into account GNP growth which increases the sustainable ratio of debt to GNP, and does not allow for possible monetization and the use of the inflation tax.[4] It is also too optimistic for at least two reasons:

The first is that, unless Ricardo-Barro equivalence holds, r itself is likely to be an increasing function of the level of debt. The second is that increases in the tax burden or decreases in spending can only happen gradually. It is this element which is currently used to argue against a temporary fiscal expansion; many doubt that the new spending programs can indeed be only temporary. It is this last argument that we now formalize. Let:

$$(1) \qquad \dot{D} = rD - X \quad ; \quad X \equiv T - G$$

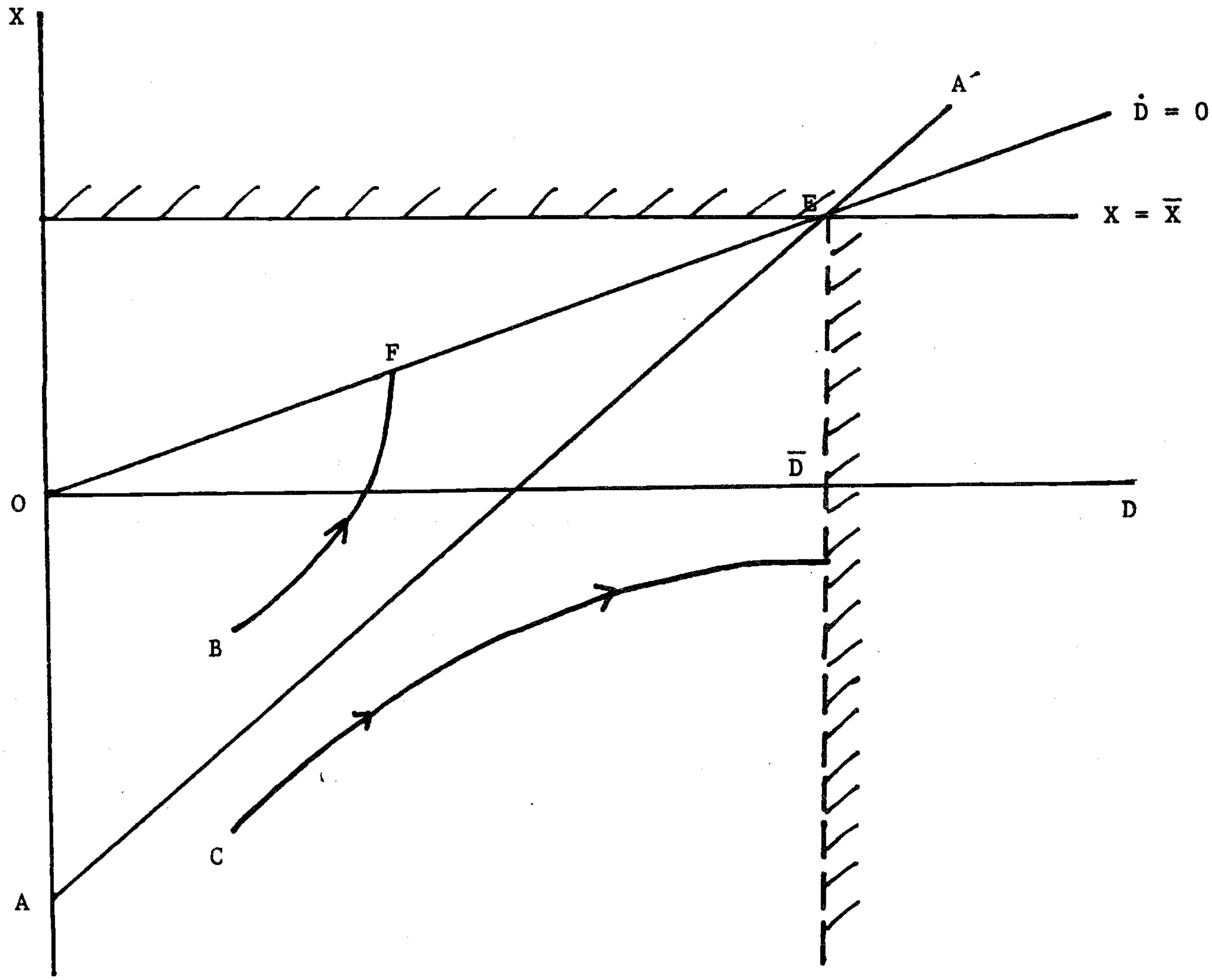
$$(2) \qquad \dot{X} \leq \alpha(\overline{X} - X) \quad , \quad \overline{X} \equiv \overline{T} - \underline{G} > 0$$

X is the budget surplus (deficit if negative) before interest payments. Equation (2) says that the gap between $\overline{X}$, the maximum surplus, and X can only be reduced at rate α.[5] We now want to know whether a given pair (X_0, D_0) (or equivalently $(D_0, \dot{D}_0)$) is sustainable or not. We can draw the phase diagram of the system, with the inequality in (2) replaced by an equality. This is done in Figure 1. The equilibrium is a saddle point, with stable arm AA′. Consider point C. Point C is not sustainable as, even if the deficit is reduced as fast as feasible, i.e. if (2) holds with equality, the maximum level of debt $\overline{D}$ is reached before deficits are eliminated. Point B on the other hand is sustainable as deficits can be eliminated before D reaches $\overline{D}$. BF represents the fastest feasible path of reduction of deficits. When F is reached, X needs not be increased further and (2) holds as an inequality.

The critical locus is therefore the locus AE. Pairs (X, D) below it are not sustainable and pairs above it are. It is given by:[6]

$$(r + \alpha)\ (D - \overline{D}) - (X - \overline{X}) = 0 \ , \ \overline{D} = r^{-1}\overline{X}$$

Figure 1. Sustainable deficit debt pairs



The sustainability condition for a given (X_0, D_0) is therefore:

$$(3) \qquad (r + \alpha)\ (D_0 - \bar{D}) - (X_0 - \bar{X}) \leq 0 \ .$$

If $\alpha = \infty$, so that there are no restrictions on changes in X, the condition is again that D_0 be less than $\bar{D}$. If $\alpha = 0$, the condition reduces to $\dot{D} \leq 0$: there cannot be a positive deficit.

Equation (3) shows the role of the speed of adjustment α, the interest rate, the level of debt, the actual deficit and the maximum potential surplus. Returning to Table 1, Belgium with its large debt, deficits and level of spending seems to be the country most likely to violate (3). We can attempt some crude computations. Using the implied values from Table 1 for D, X [7] together with r = 5% and α = 20% implies that $\bar{X}$ be at least equal to 7.5% for the inequality (3) to be satisfied. At the current level of spending, this would imply a ratio of receipts to GDP of close to 60%, which appears very high.[8] Thus sustainability might indeed be an issue in Belgium; it appears to be less so in other countries.

The model does not tell us what happens when a current fiscal program appears unsustainable. It is likely that a program does not suddenly become unsustainable but rather that agents start taking the possibility of repudiation into account. What happens depends on the type of repudiation that agents anticipate. If they anticipate attempts to depreciate the debt through inflation at some point in the future, they will require higher nominal interest rates on new issues of public and private bonds. Only if public debt is of sufficiently long maturity can the government successfully use inflation to repudiate part of the debt. If agents anticipate repudiation of government debt only — a less likely case — they will require a higher real rate on government debt than on private debt so as to be compensated for the risk of repudiation. In both cases, a shift in demand towards short maturity debt is likely.

Section III. Interest Rates, Debt and Deficits at Full Employment

This section focuses on the effects of debt and deficits on the equilibrium sequence of interest rates in a full employment economy. This is needed to understand their effects in an economy which may not be at full employment; it is also of more than academic interest as some of the larger anticipated U.S. deficits are expected to take place in an economy which should be by then at full employment.

The first step is to construct a consumption function consistent with non neutrality of debt; the second is to close the model to derive equilibrium interest rates.

Aggregate consumption

Aggregate consumption functions derived from individual life cycle behavior are usually intractable, for individuals differ in two respects, making exact aggregation difficult: they have different horizons and thus different propensities to consume out of wealth, as well as different levels of wealth. There is however one set of assumptions (and I believe only one) which preserves the assumption of finite horizons, essential to the analysis of debt and deficits but leads to a tractable aggregate consumption function; we now explore it.

Time is continuous. At any instant, a new cohort, composed of many agents, is born, its size normalized to be unity. Agents face, during their lifetime, a constant instantaneous probability of death p, so that their expected life is p^{-1}. Because of the large number of agents in each cohort, the probability p is also the percentage of agents in each cohort which die at any instant. The size of a cohort born at time zero as of time t is therefore e^{-pt} and the size of the population at any time t is $\int_{-\infty}^{t} e^{-p(t-s)}ds = p^{-1}$.

The main implication of this set of assumptions is that, although agents are of different ages, they all have at any time the same expected remaining life, p^{-1}, and thus the same marginal propensity to consume out of wealth.

Two additional assumptions, about income distribution and financial markets, considerably simplify the analysis. The first is that all agents alive work and thus share labor income equally.[9] The second is that agents can save or dissave by buying or selling actuarial bonds rather than regular bonds, i.e. bonds which are cancelled by death. Because of the large number of agents, intermediation between lenders and borrowers can be done risklessly. Lenders lend to intermediaries; these claims are cancelled by death of the lenders. Borrowers borrow from intermediaries; these claims are cancelled by death of the borrower. If the rate of interest on regular bonds is r then arbitrage and the zero profit condition in intermediation imply a rate of interest on actuarial bonds of (r + p). As by assumption agents have no bequest motive, they prefer to borrow and save only through these actuarial bonds. As a result, they leave no bequest (this clever device was introduced by Yaari [1965]).[10]

The aggregate consumption can now be derived intuitively as follows: (A derivation is given in the appendix.) Assume each agent is an expected utility maximizer, with instantaneous logarithmic utility and subjective discount rate θ. Then, denoting individual variables by lower case letters, his consumption is characterized by:

$$(4) \qquad c = (p + \theta)(w + h) \quad ; \quad h = \int_t^\infty y_s \, e^{-\int_t^s (r_v + p)dv} \, ds$$

$$(5) \qquad \dot{w} = (r + p)w + y - c$$

c is consumption, y is non interest income, w and h are non human and human wealth respectively. The presence of uncertainty about death modifies the standard formulation in two ways: The relevant interest rate is (r + p) rather than r; at the same time the marginal propensity to consume out of wealth is $(p + \theta)$ rather than θ.

Aggregate consumption is obtained by aggregating (4) and (5) over all agents alive at time t. Denoting aggregate variables by upper case letters, this gives:

$$(6) \qquad C = (p + \theta)(W + H) \; ; \; H = \int_t^\infty Y_s \, e^{-\int_t^s (r_v + p)dv} \, ds$$

$$(7) \qquad \dot{W} = rW + Y - C$$

Those two equations are similar to the individual equations with one - major - difference. Whereas the rate of interest used to discount non interest income is $(r + p)$, aggregate non human wealth accumulates at rate r, not $(r + p)$. This is because, although the interest on actuarial bonds is $(r + p)W$, a portion, pW, is extinguished with the death of wealth holders. Thus, the discount rate for aggregate human wealth $(r+p)$ is higher than the discount rate for aggregate non-human wealth (r). The simple form of the result is due to the existence of actuarial bonds. The qualitative nature of the result, namely the use of a higher discount rate for human than for non-human wealth does not depend on the existence of actuarial bonds but on the positive probability of death faced by agents. It is this difference in discount rates which implies non-neutrality of debt and deficits.

Debt and interest rates in steady state

Let us introduce now a government which collects lump sum taxes T on non interest income, spends G on goods and has debt outstanding in amount D. Debt is in the form of actuarial bonds, so that the budget constraint is:

$$(8) \qquad \dot{D} = (r + p)D + G - T - pD = rD + G - T$$

The term $-pD$ again represents the portion of the debt which is extinguished with the death of debt holders. To see why deficits matter, we can integrate equation (8) forward, subject to the condition that debt reaches some steady state level:

$$(9) \qquad D_t + \int_t^\infty G_s \, e^{-\int_t^s r_v dv} ds = \int_t^\infty T_s \, e^{-\int_t^s r_v dv} ds$$

From equation (6), now that non interest income net of taxes is given by $Y - T$, human wealth is given by

$$(10) \qquad H_t = \int_t^\infty Y_s \, e^{-\int_t^s (r_v + p)dv} ds - \int_t^\infty T_s \, e^{-\int_t^s (r_v + p)dv} ds \,.$$

In the absence of changes in government spending, changes in taxes must leave the right hand side of (9) unchanged. This will however change the value of the second term in (10). In effect the government "discounts" taxes at r, agents at $r + p$. Current deficits, that is lower taxes today and higher taxes later, will, unless $p = 0$, increase H_t and C_t at given interest rates.

To close the model, we simply assume that the economy is an exchange economy, with exogenous output Y. Thus in equilibrium, private non human wealth W is equal to government debt D. Equilibrium is therefore characterized by:

$$(11) \qquad Y = C + G = (p + \theta)(D + H) + G$$

$$(12) \qquad \dot{D} = rD + G - T$$

$$(13) \qquad \dot{H} = (r + p)H - Y + T$$

Equation (11) is the condition for equilibrium in the goods market. Equations (12) and (13) give the dynamic behavior of debt and of human wealth; (13) follows from time differentiation of (10).[11]

In steady state, $\dot{D} = \dot{H} = 0$ and this, with some manipulation, implies:

$$(14) \qquad rD = G - T$$

$$(15) \qquad r = \theta + (p + \theta)p\ (D/(Y - G)).$$

Equation (14) is the steady state government budget constraint. Equation (15) characterizes the steady state interest rate (on regular bonds).

If $p = 0$, then the interest rate equals the subjective discount rate and is independent of debt and spending. If p is positive however, the interest rate is an increasing function of both debt and spending; the larger p – the shorter the expected life – the stronger the effect. In order to induce agents to hold the debt, the government must make agents save more; it does so by increasing the interest rate over the subjective discount rate. The formula suggests relatively small effects of debt on interest rates. For example if we take reasonable upper bounds, say $D/Y = 1$, $G = .5Y$, $\Theta = 10\%$ and $p = 5\%$, $r - \Theta$ is equal to 1.5%. The strength of this model is, however, not in its quantitative answers and these numbers should be looked at with caution.[12]

Dynamic effects of deficits

Starting from steady state and keeping government spending constant, we now consider changes in the sequence of taxes which satisfy the intertemporal government budget constraint. From goods market equilibrium, given output and government spending, interest rates must be such as to leave consumption and thus the sum of debt and human wealth constant. If D + H = constant, $\dot{D} = -\dot{H}$ and from (12), (13):

$$rD + (r + p)H = Y - G .$$

Combining this with (11) gives:

$$(16) \qquad r = \theta + p(p + \theta)\ (D/(Y - G)).$$

Thus the relation between interest rates, debt and government spending holds at any point of time and not only in steady state. The short-term interest rate depends on the current level of debt and does not depend on the current level of deficits: a decrease in taxes, given spending has no effect on r. Deficits will, however, affect anticipated future real rates. To illustrate the effects of deficits on the whole term structure, consider now the sequence of deficits implied by:

$$(17) \qquad \dot{D} = rD + G - T(D, x)\ ;\ T_D > 0 \qquad T_x > 0$$

Taxes are now a function of a shift parameter x and an increasing function of debt. We want to consider only sustainable deficits and thus impose:

$$d\dot{D}/dD = D\,dr/dD + r - T_D = 2r - \theta - T_D < 0$$

This requires that taxes increase sufficiently fast as debt increases thus closing the deficit. Let's further define the long term interest rate as the yield on consols paying a constant coupon flow of unity. Let R be their yield and thus 1/R be their price. The instantaneous rate of return on consols is

$$(1 + d/dt(1/R))/(1/R) = R - \dot{R}/R$$

It is the sum of the yield and of the expected capital gain, which is negative if yields increase, or equivalently, if prices decrease. By arbitrage between short and long bonds:

$$(18) \qquad R - \dot{R}/R = r$$

We may now consider the system composed of (16), (17), (18) which determines the dynamic behavior of debt, short and long rates.[13] Eliminating r using (16) gives a system in debt and the long rate:

$$\dot{D} = (\theta + p(p + \theta)\frac{D}{Y - G})\, D + G - T(D, x)$$

$$\dot{R}/R = (R - \theta - p(p + \theta)\frac{D}{Y - G}).$$

This system has a saddle point equilibrium. Its local dynamics around equilibrium are characterized in Figure 2. The stable arm AA is upward sloping.

A decrease in x, i.e. a decrease in taxes at any level of debt, shifts the $\dot{D} = 0$ locus to the right. The dynamics of adjustment to an unanticipated permanent decrease in x are characterized in Figure 3. Starting from point E, R jumps to point C,and R and D move over time along CE´. The economic interpretation is straightforward: A decrease in x decreases taxes, creating a deficit. This deficit increases debt over time and thus short term rates. As debt increases, taxes increase reducing the size of the deficit. In the new steady state, debt and interest rates are higher. The initial deficits twist the term structure as short term rates do not move but long rates move in anticipation of higher short rates later. The term structure flattens over time, until R and r are again equal in the new steady state.

Figure 2. Debt, deficits and interest rates in full employment

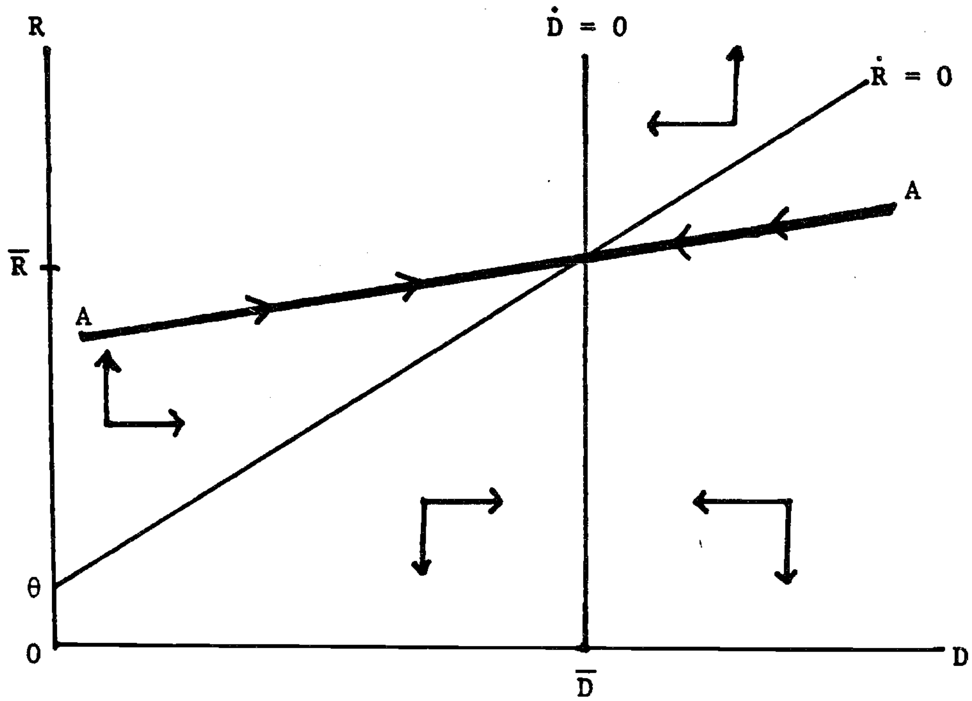
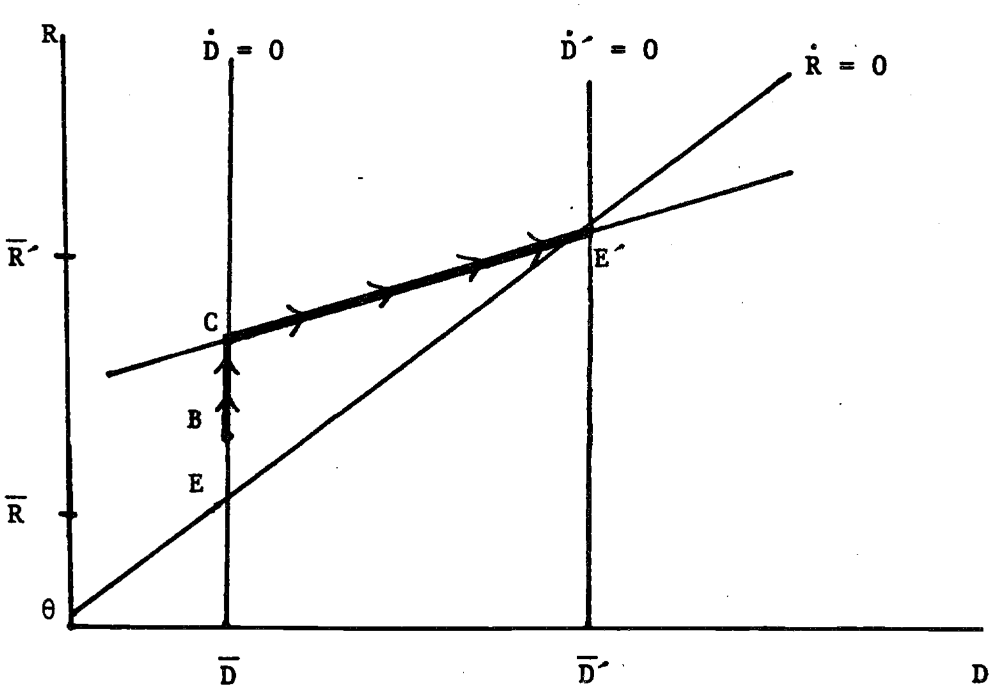


Figure 3. Anticipated deficits, short and long rates



The effects of anticipated deficits can also be characterized using Figure 3. A decrease in x, anticipated at t to take place at time t' leads to a jump from E to B at t, a movement from B to C from t to t' and a movement along CE' after t'. Although the short term rate does not move until t', the long rate increases at time t to cancel the effects of anticipated lower taxes on human wealth.

To summarize, short rates depend in this full employment exchange economy on the current level of debt. Thus long rates depend on the sequence of anticipated debt, or equivalently, on the initial level of debt and the anticipated sequence of deficits. A sequence of higher deficits will initially increase long rates over short rates, leading over time to higher short and long rates. This analysis suggests that the current focus on deficits rather than on debt is possibly misdirected. It is true that the anticipated sequence of U.S. deficits is exceptional in peacetime and implies a large increase in the level of debt. The current level of debt as well as the anticipated levels of debt for the medium run are still much lower than at many times in the past.

Section IV. Deficits, Interest Rates and Output

The focus is now on the potentially perverse effect of deficits on aggregate demand and on output. The strategy has been to remain close to the traditional Phillips curve augmented ISLM, extending it only to introduce the distinction between short and long rates.[14, 15] The model is the following:

$$\text{IS} \quad : \quad Y = Y(R, g) \qquad Y_R < 0 \quad ; \quad Y_g > 0$$

$$\text{LM} \quad : \quad i = L(Y, m/p) \qquad L_Y > 0 \quad ; \quad L_{m/p} < 0$$

$$(19) \quad : \quad r^* = i - \dot{p}^*/p$$

$$(20) \quad : \quad \dot{R}^*/R = R - r^*$$

$$\text{PC} \quad : \quad \dot{p}^*/p = \dot{p}/p = \theta(Y) \qquad \theta_Y > 0 \quad ; \quad \overline{Y} | \theta(\overline{Y}) = 0$$

Aggregate demand is assumed to depend on the long term rate, current income and an index of fiscal expansion g. Behind this specification is one important assumption and a technical short cut. The important assumption is that, although financial markets look forward, agents themselves do not; there is no direct effect of future income or future taxes on current aggregate demand (there will be an indirect effect through long real rates). We shall return to this assumption later. The short cut is that fiscal policy is summarized by a single index g. We know from the previous section that aggregate demand depends on each of the components of fiscal policy, taxes, spending and debt. Thus a permanent increase in g may correspond to a balanced budget increase in spending or, more interestingly, to initially higher deficits which resorb themselves as debt accumulates to reach a new higher steady state.[16]

The LM relation determines the short term nominal rate as a function of income and real money balances m/p. The next two equations provide the links between this short term nominal rate and the long real rate which appears in the IS. (19) defines the short real rate; stars denote expectations. (20), which was derived previously, relates short and long real rates. The last equation is a Phillips curve, relating inflation to the level of output.

The long run equilibrium of this model is similar to that of the previous section:

If $\dot{p} = \dot{p}^* = \dot{R} = 0,$

$$\overline{Y} | \theta(\overline{Y}) = 0 \; ; \; \overline{r}, \; \overline{R} | \overline{Y} = Y(\overline{R}, \; \overline{g}) \; , \; \overline{r} = \overline{R}$$

$$\overline{p} | \overline{r} = L(\overline{Y}, \; m/\overline{p})$$

Fiscal expansion has no long run effect on output but increases the steady state rate of interest. Prices adjust so that real money balances are consistent with the new rate of interest.

To characterize the dynamics of output and interest rates to a fiscal stimulus, we can reduce the system to a system in R and p. Replacing the IS, the LM and the Phillips curve in the interest rate equations (19) and (20):

(21) $\dot{R}^*/R = (R - r)$ where r is given by:

$$r = L(Y(R, g), m/p) - \theta(Y(R, g))$$

The effect of output on the short term rate is a priori ambiguous: an increase in output increases both the short term nominal rate and expected inflation. We shall assume that the nominal rate effect dominates, i.e. that $L_Y - \theta_Y > 0$

so that an increase in output increases the short real rate.[17] In this case, fiscal expansion increases short real rates; an increase in the long real rate decreases output and decreases short real rates. Finally an increase in prices decreases real money balances, increasing the short real rate.

The other relation follows from the IS and the Phillips curve:

$$(22) \qquad \dot{p}/p = \theta(Y(R, g))$$

Fiscal expansion increases output and inflation, while an increase in long real rates decreases output and inflation.

The analysis can again be carried out most easily with a phase diagram. The system has a saddle point equilibrium so that given p, there is a unique value of R consistent with convergence to steady state. The local dynamics around equilibrium are characterized in Figure 4. The stable arm AA is upward sloping.

The dynamic effects of a fiscal expansion, that is, of an increase in g are characterized in Figure 5. We first characterize the dynamics technically: The system jumps from E to C and converges to E' over time. From the Phillips Curve, as $\mathring{p}$ is positive, output initially increases. From the IS, as R increases along CE', output decreases along CE'. Finally, from the arbitrage equation, as $\mathring{R}$ is positive, R is larger than r along CE'. Thus a fiscal expansion leads initially to an increase in short real rates and output; over time, output goes back to normal and short real rates increase further. It is this increasing sequence of short rates which explains the initial jump in long rates. Fiscal expansion therefore twists the term structure, increasing long rates over short rates. This leads to more crowding out than would be predicted by models which do not distinguish between short and long rates. It does not, however, lead to perverse effects of a fiscal expansion on output.

Consider however a more realistic experiment, in which deficits instead of being suddenly larger, increase slowly through time. Instead of a jump of g from $\bar{g}$ to $\bar{g}'$ as before, consider instead the following fiscal expansion: until time t, g is equal to, and expected to remain equal to $\bar{g}$. At t, anticipations change and the new actual and anticipated path of g is:

$$\dot{g} = \Psi(\bar{g}' - g) \qquad \Psi' > 0$$

Such a path for g corresponds for example to deficits which initially grow over time before resorbing themselves as debt accumulates to a new, higher, steady state level. The path of adjustment is characterized in Figure 6. R jumps from E to C; R and p then adjust along CDE' over time. The behavior of R, r and Y is given below the phase diagram; whether r further decreases after its initial decrease is ambiguous.[18]

Thus this type of fiscal expansion has temporarily perverse effects on output. The reason is simple. The initial current fiscal stimulus is small. It is, however, anticipated to be large and thus to lead to high short real rates later. As a result, long real rates increase, leading to a decrease in aggregate demand which more than offsets the fiscal expansion, at least initially. Thus, the model tells us, the U.S. fiscal program and its growing projected deficits could well be initially contractionary. The model also suggests a way in which fiscal policy could be improved. As current deficits are expansionary and anticipated deficits contractionary, shifting of government spending towards the present would, by increasing current deficits and decreasing future deficits, increase aggregate demand and help the recovery.

Figure 4. Dynamics of interest rates and prices

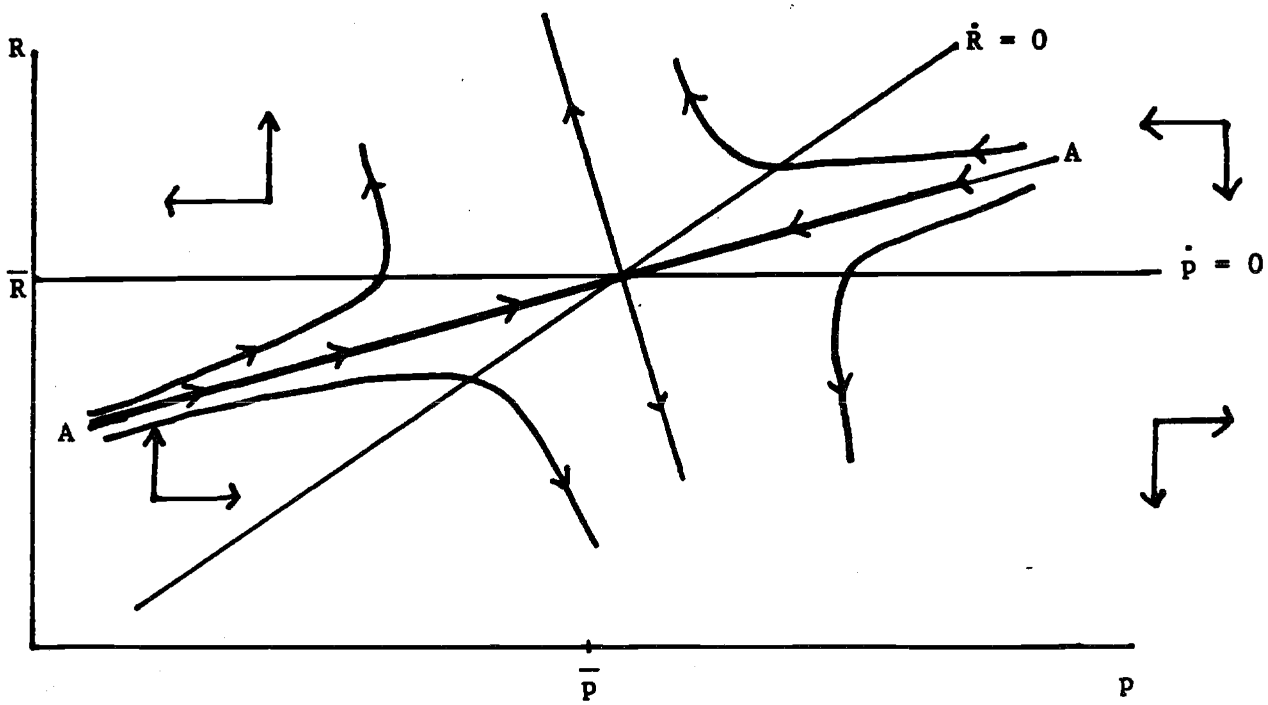


Figure 5. Effects of a fiscal expansion

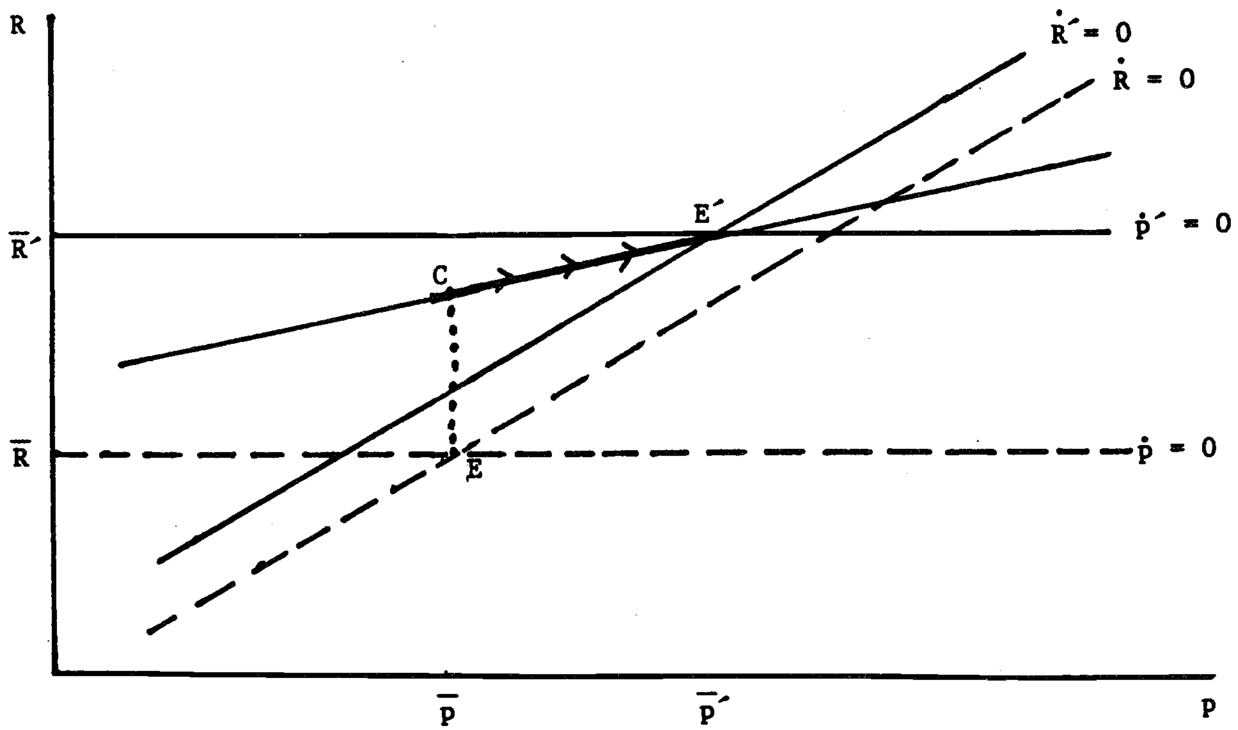
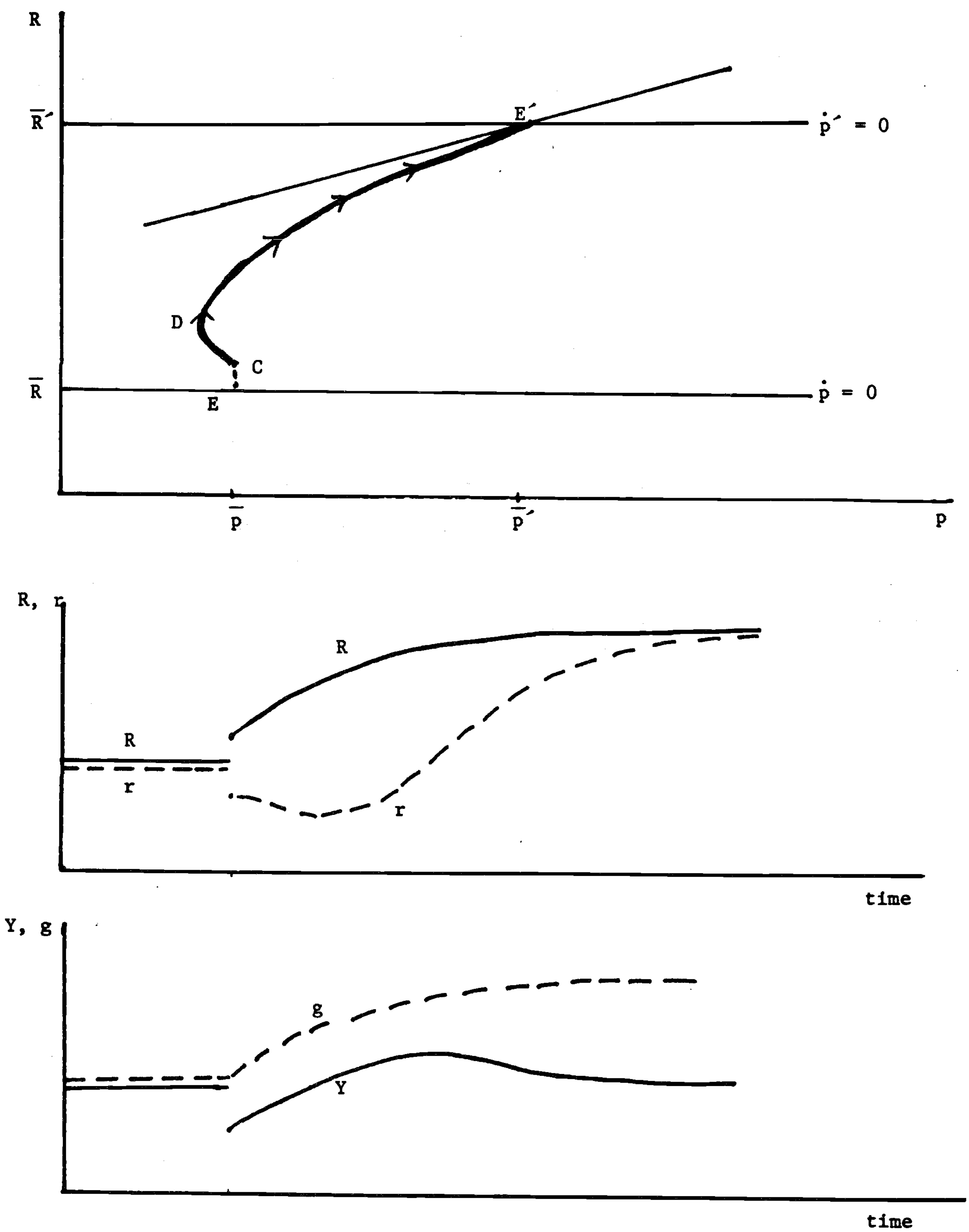


Figure 6. Effects of an anticipated fiscal expansion



It is, however, time to return to the specification of aggregate demand. What if agents are forward looking and take into account the anticipated sequence of taxes and income, as in the previous section? First, if they take into account the anticipated sequence of taxes, a slow increase in deficits is not equivalent to a slow effect of fiscal expansion on aggregate demand, to a slow increase in g: agents will realize that the present value of their tax burden has decreased and this will increase aggregate demand even if current deficits are still small. Second, if they take into account future income, the anticipation of temporarily higher output and income may also increase aggregate demand initially.[19] This effect will be stronger, the smaller the effect of liquidity constraints, the larger the effect of fiscal expansion on output--if for example the economy is expected to have substantial unemployed resources for many years to come. Whether these effects more than offset the interest rate effects is theoretically ambiguous. If these income effects dominate, the large U.S. anticipated deficits are expansionary in spite of their effect on current long term real rates.

Conclusion

What do we make then of the new view that fiscal deficits hurt rather than help the recovery? We have found that the issue of sustainability has indeed, because of the increase in real rates, become a relevant issue although probably not yet a pressing one. We have found that in turn, at full employment, short real rates increase with the level of debt; as a result, prolonged deficits lead to increasing real rates, thus to long rates being higher than short rates. We have finally found that, if output responds to aggregate demand, anticipations of growing deficits may be initially contractionary.

The three models presented in this paper are simple enough that they can withstand added complexity and realism without loosing analytical tactability. In particular integrating the first and the second, and the second and third, would probably be quite useful.

Finally, this paper has focused on the effects of deficits in closed economies. One major issue is, however, that deficits are anticipated to be much larger in the U.S. than in the other countries. This would lead in closed economies to large differences in real rates. It is likely to lead, in open economies with capital mobility, to large movements in exchange rates. I believe that a two-country extension of the second model will prove useful to analyze this issue.

Appendix. Derivation of the Aggregate Consumption Function

Individual consumption

Denote by $c(t, s)$, $y(t, s)$, $w(t, s)$, $h(t, s)$ consumption, non interest income, non human wealth and human wealth of an agent born at time t, as of time s.

At time s, the agent maximizes:

$$E_s\left(\int_s^\infty \log c(t, v)\, e^{(s - v)\theta} dv.\right.$$

Under the assumption of a constant instantaneous probability of death p, and of subjective certainty about $c(t, v)$, $v \geq t$, this is equivalent to

$$\text{(A1)} \qquad \max \int_s^\infty \log c(t, v)\, e^{(s - v)(\theta + p)} dv$$

The "budget constraint" faced by the agent at time s is, if the rate on actuarial notes is $r(\mu) + p$ at time μ: (the discussion and justification of the implicit transversality condition is given in Yaari [1965, p. 146]):

$$\text{(A2)} \qquad \int_s^\infty c(t, v)\, e^{-\int_s^v (r(\mu) + p) d\mu} dv = w(t, s) + \int_s^\infty y(t, v)\, e^{-\int_s^v (r(\mu) + P) d\mu} dv$$

The solution to this maximization problem is:

$$\text{(A3)} \qquad c(t, s) = (p + \theta)\left(w(t, s) + \int_s^\infty y(t, v) e^{-\int_s^v (r(\mu) + p) d\mu} dv\right)$$

$$\text{(A4)} \qquad dw(t, s)/ds = (r(s) + p)w(t, s) + y(t, s) - c(t, s)\ .$$

Aggregate consumption

Denote aggregate consumption, aggregate non interest income, aggregate non human wealth and aggregate human wealth at time s by C(s), Y(s), W(s) and H(s). Then

$$C(s) = \int_{-\infty}^{s} c(t, s)\, e^{(t - s)p} dt \quad \Rightarrow$$

(A5) $$C(s) = (\theta + p)[W(s) + \int_{-\infty}^{s} e^{(t - s)p} (\int_{s}^{\infty} y(t, v)\, e^{-\int_{s}^{v} (r(\mu) + p) d\mu} dv) dt]$$

where

$$W(s) = \int_{-\infty}^{s} w(t, s)\, e^{(t - s)p} dt.$$

Under the assumption that non interest income is the same for all agents alive, $y(t, v) = pY(v)\ \forall\ t$ and all agents alive have the same human wealth. Thus (A5) can be rewritten as:

(A6) $$C(s) = (\theta + p)[W(s) + H(s)]$$

$$H(S) = \int_{s}^{\infty} Y(v)\, e^{-\int_{s}^{v} (r(\mu) + p) d\mu} dv$$

Differentiating W(s) with respect to time gives:

$$dW(s)/ds = w(s, s) - pW(s) + \int_{-\infty}^{s} \frac{dw(t, s)}{ds} e^{(t - s)p} dt$$

Using (A4) and $w(s, s) = 0$ gives:

(A7) $$dW(s)/ds = r(s)W(s) + Y(s) - C(s) .$$

Equations (A3) and (A4) are equations (4) and (5) in the text, equations (A6) and (A7) are equations (6) and (7) in the text.

Footnotes

1. Budget of the U.S. Government, fiscal year 1984, section 3-31.

2. Sources: OECD Economic Outlook, December 1982, Table 9 and Annual Economic Report, EEC, November 1982.

3. For the argument to be complete, it should show why the government cannot issue more and more debt forever and therefore has to repudiate the debt. Dealing with these issues would lead us too far astray.

4. The maximum inflation tax is relatively small. Unanticipated inflation may, however, if debt is in the form of long term bonds with nominal coupons, substantially reduce the real value of the debt.

5. An interesting attempt to estimate OECD fiscal reaction functions in this light and to study implications for structural deficits is described in Hubbard [1983].

6. The roots of the system (1), (2) (with equality) are r and $-\alpha$. The characteristic vector associated with α, (x_1, x_2) is such that $x_1/x_2 = (r + \alpha)^{-1}$. Thus $D - \overline{D} = c_1(r + \alpha)^{-1} e^{-\alpha t}$ and $X - \overline{X} = c_1 e^{-\alpha t}$. Taking the ratio gives the equation in the text.

7. Interest payments were equal to 7.8% of GDP in 1982, and have to be deducted from disbursements to get G.

8. The medium term budgetary objectives, as of fiscal year 1982, for Belgium, are of a reduction of the general government deficit from 12.8% in 1982 to 7% in 1985. This is to be achieved partly through a reduction in spending. (Source: OECD. Public Sector Deficits: Problems and Policy Implications. Occasional Papers, June 1983). The June 1983 EEC projections of deficits in Belgium are, however, of 11.7% for 1983 and 12.1% for 1984 (Source: European Economy. Supplement A. No. 6. June 1983, Table 9).

9. Although the model captures the idea that agents do not have infinite horizons, agents in the model do not go through a life cycle. Thus the model cannot be used to examine issues for which the life cycle is essential, such as, for example, saving for retirement or social security.

10. In the absence of actuarial bonds, agents would not only leave unanticipated bequests but might also go bankrupt. Actuarial bonds allow agents to insure themselves against such contingencies. Their presence simplifies the analysis considerably but is in no way the source of the non-neutrality of deficits or debt.

11. In this section, no notational distinction is made between actual and expected values. $\dot{H}$ for example is the expected change in H.

12. Tobin [1967] developed a realistic model of life cycle to look at steady state savings. He did not look however at the effects of debt.

13. The system is in fact recursive. R depends on D, but D does not depend on R. Consols may actually not be traded at all in the economy. R is introduced to get a convenient characteristic of the term structure, and because it will play an important role in the next section.

14. An alternative strategy would have been to imbed the aggregate consumption function of the previous section in an otherwise Keynesian model. It would however be slightly more cumbersome analytically.

15. This is a simplified and modified version of Blanchard [1981]. It is very similar to a model developed by Cardoso [1983]. It is related to a recent model by Turnovsky and Miller [1982] which treats the government budget constraint explicitly but maintains the fixed price assumption.

16. In the case where consumption is given by the consumption function derived in the previous section, and where consumers have static expectations, we can derive g explicitly. In that case,

$$C + G = (\Theta + p)\ (D + \frac{Y-T}{r+p}) + G \quad . \qquad \text{Thus,}$$

$$g = (\Theta + p)\ (D - \frac{T}{r+p}) + G \quad .$$ Rearranging and using the government budget constraint gives:

$$g = (\Theta + p - r)D + \dot{D} + \frac{\Theta - r}{r+p}\, T \quad .$$

If r is close to Θ, this simplifies to:

$$g \doteq pD + \dot{D} \quad .$$

17. (Saddle point) stability of the system does not depend on this assumption.

18. The algebraic derivation of these paths is straightforward but extremely tedious. The method is identical to that used in appendix B in Blanchard [1981].

19. This possibility is partially explored in Blanchard [1981] by the introduction of a stock market which affects aggregate demand.

References

Barro, Robert J. "Are Government Bonds Net Wealth?", JPE (November 1974), 82-6, 1095 - 1117.

Blanchard, Olivier J. "Output, the Stock Market and Interest Rates", AER (March 1981), 71-1, 132 - 143.

Cardoso, Eliana "Fiscal Policy and Asset Prices,"mimeo, 1983.

Hubbard, G. "'Structural' Government Budget Deficits:Reappraisal and Implications", Mimeo, 1983.

Tobin, James "Life Cycle Saving and Balanced Growth", Ten Studies in the Tradition of Irving Fisher, Wiley, NY, 1967.

Turnovsky, Steven and M. Miller "Bond Market Efficiency and Macroeconomic Policy in a Simple Dynamic Model", mimeo, 1982.

Yaari, Menahem E. "Uncertain Lifetime, Life Insurance and the Theory of the Consumer", RE Studies (April 1965), 32, 137 - 150.