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ANTICIPATED BUDGET DEFICITS AND THE TERM STRUCTURE OF INTEREST RATES

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ABSTRACT

This paper investigates the implications of government deficits in an overlapping generations consumption loan model with longterm assets. The only asset in the economy is a real consol issued by the government and serviced by lumpsum taxes on the young. We explore here the time path of short and longterm interest rates following the announcement of a future, transitory budget deficit under two alternative assumptions. In one case the deficit arises from transitory government spending, in the other case from a transfer.

We show that a deficit policy ultimately raises longterm interest rates and lowers consol prices. The exact shape of the path of short-term rates depends on the source of the deficit and on the saving response to interest rates. In general, though, the term structure will be v-shaped.

The interest of the model resides in the fact that the prices of longterm assets link the current generations to future disturbances. Because future disturbances affect future interest rates they affect the current value of debt outstanding and hence equilibrium short-term rates. The exact manner in which the disturbances are transmitted to prior periods depends on the extent to which consumers substitute easily across time or, on the contrary, have a strong preference for consumption smoothing.

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This paper investigates the implications of government deficits in an overlapping generations consumption loan model with longterm assets. The macroeconomic implications of deficit finance have been studied in a number of approaches. The results depend sharply on the extent to which generations are linked or people view their lives as finite or infinite. But they are also affected by the longevity of assets that links present and future generations even if there were no other source of overlap. The standard question is the following: suppose the government reduces taxes today and finances the resulting budget deficit by debt issue. Future taxes, starting some periods hence, will be raised to assure the balanced-budget service of the increased debt. In such a setting are there any effects on private spending or on asset prices?

Barro (1974) has shown that when generations are linked by bequest motives the present value of the prospective taxes offsets the current tax cut leaving spending unchanged and raising saving to build up increased income with which to service the debt. Thompson (1967) by contrast has argued that those who enjoy the tax cuts are not those who pay the taxes and that accordingly a net expansion of demand should be expected at the time of deficit finance. This same line has been formalized by Blanchard where finitely lived individuals value current income in excess of corresponding

* We are indebted to Stanley Fisher for helpful suggestions.

future taxes because they do not expect to bear the full burden of the taxes. In such a framework Blanchard (1984a, 1984b) has shown that anticipated future deficits would lead to an increase in net wealth and hence an increase in aggregate demand.

In this paper we address the effects of anticipated future deficits in a closed-economy exchange model with overlapping generations and longterm assets. Following Dornbusch (1984) the only asset in the economy is a real consol issued by the government and serviced by lumpsum taxes on the young. We explore here the time path of short and longterm interest rates following the announcement of a future, transitory budget deficit under two alternative assumptions. In one case the deficit arises from transitory government spending, in the other case from a transfer.

We show that a deficit policy ultimately raises longterm interest rates and lowers consol prices. The exact shape of the path of shortterm rates depends on the source of the deficit and on the saving response to interest rates. In general, though, the term structure will be v-shaped. In the longrun the increased stock of debt, although serviced by increased taxes, leads to an increase in the short and longterm interest rate to achieve full crowding out. The shortterm rate also rises in the period of deficit finance, independently of the saving response to interest rates and the kind of deficit,--spending or transfers. But in prior periods the rise in longterm interest rates reduces the value of debt outstanding and therefore tends to reduce the shortterm rate required for saving to equal the supply of debt outstanding. These nearterm results, though, depend on the saving response to interest rates.

The interest of the model resides in the fact that the prices of longterm assets link the current generations to future disturbances. Because future disturbances affect future interest rates they affect the current value of debt outstanding and hence equilibrium shortterm rates. The exact manner in which the disturbances are transmitted to prior periods depends on the extent to which consumers substitute easily across time or, on the contrary, have a strong preference for consumption smoothing.

1. The Model

We assume that households live for two periods and allocate consumption so as to maximize the intertemporal utility function:

$$(1)\quad U = V(c_1) + V(c_2) \quad ; \quad V = \frac{1}{1-\theta} c^{1-\theta} \quad , \quad \theta > 0$$

subject to the budget constraint

$$(2)\quad c_1 + q_t c_2 = w - b_t + q_t v_{t+1} \equiv a_t$$

where

w	the given endowment of output
$q_t = 1/(1+r_t)$	the one period discount factor
b_t	the amount of taxes equal to the number of consols each of which yields a coupon of one unit of output
$q_t v_{t+1}$	the present value of transfers received when old
a_t	lifetime disposable income

Maximization of the utility function gives a consumption and a saving function that depends on disposable income and the shortterm interest rate:

$$(3)\quad c_1 = \frac{\lambda}{1+\lambda} a_t, \qquad s_t = \frac{1}{1+\lambda} a_t - q_t v_{t+1} \quad ; \quad \lambda \equiv q_t^{(1-\theta)/\theta}$$

The elasticity of saving with respect to the shortterm rate is positive or negative depending on the magnitude of elasticity of the marginal utility of consumption. The elasticity of saving is:

$$(4)\quad \frac{\partial s}{\partial q} \frac{q}{s} = \alpha(1-1/\theta) \equiv \beta$$

where α is the marginal propensity to consume in the first period.

Saving responds positively or negatively to the shortterm interest rate depending whether the elasticity of marginal utility, θ, is smaller or larger than unity. A case of θ close to zero corresponds to extremely easy intertemporal substitution while a value of θ tending to infinity corresponds to a strong preference for consumption smoothing and hence income effects that dominate substitution.

Goods market equilibrium, given a constant population requires, that consumption of the government, g, and the young, c_1, plus consumption of the old equal the available output. Consumption of the old is equal to the coupon payments plus resale value of their bonds plus transfer receipts or $(1+p_t)b_t+ v$. Thus a goods market equilibrium requires:

(5) $w = g + c_1 + (1+p_t)b_t + v_t$

where $p_t = 1/R_t$ is the price of a consol or the reciprocal of the longterm interest rates. An alternative way of stating the equilibrium condition, using (5), is the following:

(5a) $s(a_t,q_t) = g + p_t b + v_t$

where saving, s, is defined as current income, $w-b_t$, less current consumption.

The model is completed by an arbitrage equation that links current and next period's consol prices via the shortterm interest rate:

(6) $p_t = q_t(1 + p_{t+1})$

Using (5), the first order conditions $q_t V'(c_1) = V'(c_2)$ and (6) we can state the equilibrium condition as follows:

(7) $p_t V'(w-g-v_t - (1+p_t)b_t) = (1+p_{t+1})V'(p_{t+1}(1+b) + v_{t+1})$

Figure 1 shows the steady state of the model for the case of zero transfers or government spending. In the steady state short and longterm interest rates are equal and hence $p_t \equiv 1/R_t = 1/r_t$. Therefore we can plot the value of the stock of consols outstanding as a function of the shortterm rate. The downward sloping schedule thus represents the value of consols given a fixed number b. The saving schedule which depends on the shortterm rate is shown upward sloping, representing the case where saving responds positively to the interest rate. As noted above, this case arises when $\theta < 1$ so that substitution effects dominate the income effect. In the borderline logarithmic case the saving schedule is vertical and when $\theta > 1$ it is negatively sloped, though steeper than the schedule showing the value of consols.[1]

Comparative Steady States: The model can be applied now to determine the steady state effects of an increase in government debt. At this stage we do not ask how the debt was introduced but rather look at the longrun effects of higher debt, matched by increased taxation of the young to service the debt.

In terms of Figure 1 an increase in debt shifts the value-of-debt schedule out and to the right. The saving schedule shifts left since the imposition of taxes reduces life-time income and hence lowers both consumption and saving. The steady state interest rate unambiguously rises, whatever the response of saving to the interest rate. The increase in the interest rate and the fall in bond prices is larger the lower the elasticity of the marginal utility of consumption.

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[1]From (4) above the maximum value of the saving response is α as θ tends to infinity. Thus the saving schedule must be steeper than the schedule showing the value of consols.

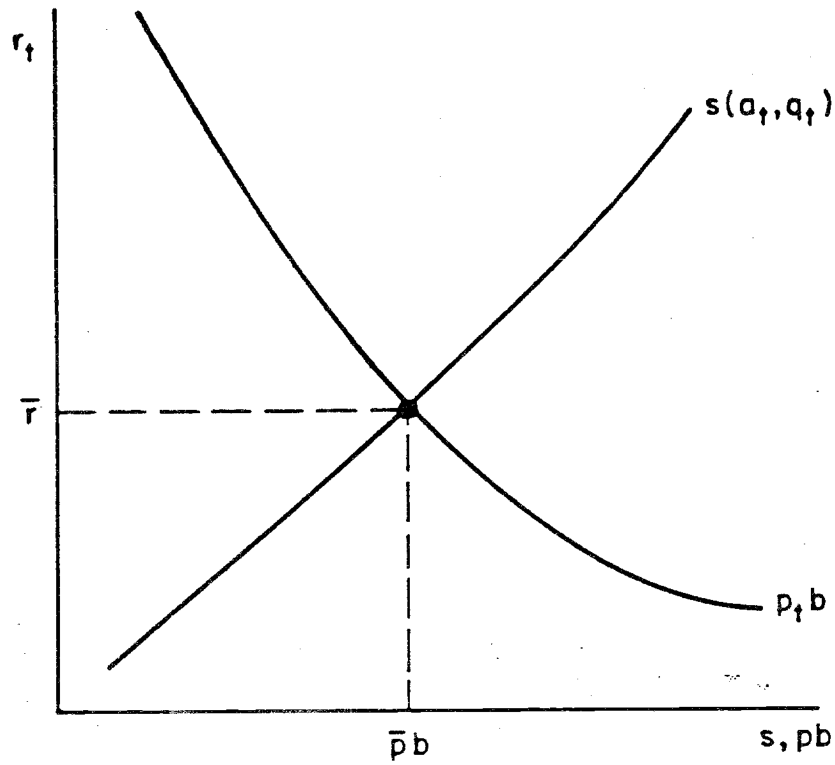

Figure 1

From (6a), using the definition of the saving eleasticity in (4) we derive the steady state effect of increased debt, serviced by lumpsum taxes on the young, as:

$$(8) \quad \hat{p} = -\frac{1+\gamma}{1-\beta(1-q)}\hat{b} \qquad ; \qquad \gamma \equiv b_t/a_t$$

where a denotes a percentage change and a bar denotes a steady state value. Note that the denominator of (8) is always positive. Therefore an increase in debt must reduce the <u>value</u> of debt outstanding, pb, unless the saving elesticity, β, is sufficiently negative. Only when consumers show little preference for consumption smoothing, so that intertemporal substitution is high, can an increase in debt lead to an increased value of debt outstanding. Otherwise the rise in longterm interest rates depresses asset prices out of proportion with the increase in the number of consols outstanding.

These longrun effects of an increase in debt, with debt service financed by increased taxation, are part of the adjustment to transitory deficits. These are the longrun effects, beyond the deficit. We now turn to the effects during the period of deficit finance and the period of anticipation. We split that discussion, starting with the case of a current deficit, financed by debt issue.

2. <u>Current Deficits</u>: Consider now a situation where the government during the current period effects an unanticipated transfer, or an unanticipated goernment expenditure. Debt finance covers the deficit. At the same time it is announced that taxes, starting next period lumpsum taxes will be permanently increased by an amount sufficient to match the higher coupon payments associated with the once and for all increase in debt.

A current transfer accruing to the old raises their consumption by the full amount of the transfer. The current young are not directly affected by the measure because they neither receive transfers now nor pay taxes next period. The goods and capital market equilibrium is also affected by the prospect of lower bond prices in period t+1. We already saw above that the steady state price of bonds will decline in response to higher debt. That decline will spill-over to some extent to the current period. This must be the case because consol prices today and next period are linked by an arbitrage equation using the shortterm rate. Equation (6) above implies that an increase in future consol prices, given the current shortterm rate, must lower also the current consol price. This longrun implication of debt finance thus tends to depress present consol prices thereby partly offsetting the increased purchasing power of the old due to the transfer.

The solution is given by the equilibrium conditions in todays capital market and in the market next period which is also the new steady state.[2] Using (6) and denoting a steady state value by a bar, they are respectively:

$$(9) \quad s(w - b,\ p_t/(1 + \bar{p})) = p_t b + v_t \quad ; \quad v_t = p_t b' \quad \bar{b} \equiv b + b'$$

$$(10) \quad s(w - \bar{b},\ \bar{p}/(1 + \bar{p})) = \bar{p}\bar{b} \quad ; \quad p_m = \bar{p}$$

where b' is the number of bonds the government sells, the proceeds being distributed as a transfer to the old, i.e. $v_t = p_t b'$. We already saw in (8) the effect on the steady state price $\bar{p}$. Using that result we obtain from (9) the impact on the current consol price:

[2]In Dornbusch (1984) it is shown that given debt and income the only perfect foresight path consistent with the budget constraint is an immediate move to the steady state.

$$(11)\quad \hat{p}_t = \frac{-1 + \beta(1 + q_t\gamma)}{(1 - \beta)[1 - \beta(1 - q)]}\hat{b}$$

Equation (11) shows the effect on consol prices: Specifically if saving responds positively to the interest rate the consol price will fall already today or, equivalently, the longterm rate rises immediately. But if β is positive this is also the case. Note that in the extreme case of no substitution $\beta = \alpha$ so that the consol price will fall if $\alpha(1 + qb/a) < 1$. This condition is satisfied and hence, whatever the saving response, current debt financed deficits must cause the present consol price to fall or longterm rates to rise.[3]

In the same way we can show that the shortterm interest rate must already rise during the period of deficit finance, whatever the saving response. Only in the extreme case of no intertemporal substitution does the shortterm rate remain unchanged. Equation (12) shows the these results.[4]

$$(12)\quad r_t = b(\alpha - \beta)/(1 - \beta)[1 - \beta(1-q)]$$

We now have shown that present transfer payments financed by debt, with increased debt service financed by higher taxes starting next period must raise interest rates both in the longrun and during the period of deficit finance. This holds for short and longterm rates independent of the saving response. Furthermore, the same result holds if instead of transfer payment we had considered a transitory, current government spending. This is apparent from equation (9) where in place of v_t we would have $g_t = p_t b'$.

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[3]We can write the inequality as $\alpha(1+qb/a) < 1$ or $\alpha\, qb/a < 1-\alpha = pb/a$. Since α is a fraction and qb/a is less than pb/a the condition must be satisfied.

[4]β is at most equal to α in the case of no intertemporal substitution. The equation is derived by noting that in equilibrium pb/a is equal to the savings ratio and hence $pb/a = 1-\alpha$.

Therefore we can generalize to state that unanticipated, transitory transfers to the old, or government spending, must raise interest rates as they occur. Before proceeding to the case of anticipations we offer a brief diagrammatic explanation of these results.

In Figure 2 we show the effect of the current transfer on on the supply of securities outstanding by the rightward shift of the schedule showing the value of consols. The steady state saving schedule shifts left due to increased taxes. The steady state interest rate therefore rises from r to $\bar{r}'$. Now consider the effect in the preceding period where deficit finance occurs. Here saving is still given by the initial schedule. But the supply of debt is now equal to the value $q_t(1+\bar{p}')b$, with $\bar{p}' = 1/\bar{r}'$. The dashed schedule shows the value of the increased stock of consols, given $\bar{p}'$, as a function of the current shortterm rate. Since the next period price is given, changes in the shortterm rate have only a minor effect on the value of debt. Thus the schedule JJ is relatively steep compared to the schedule showing the value of debt. Of course it must pass through point A' since at a current short rate equal to the new steady state rate the value of debt today is equal to what it will be next period.

The current equilibrium is at point A" where saving equals the value of securities outstanding. The equilibrium corresponds to equation (9) above with $\bar{p}'$ determined by (10). In this case the shortterm rate rises less than the longterm rate and the total value of consols rises. The interpretation is simply the following: At the initial interest rate $\bar{r}$, the value of consols exceeds saving. To restore capital market equilibrium the shortterm must rise to increase saving and to depress the value of securities. Thus the

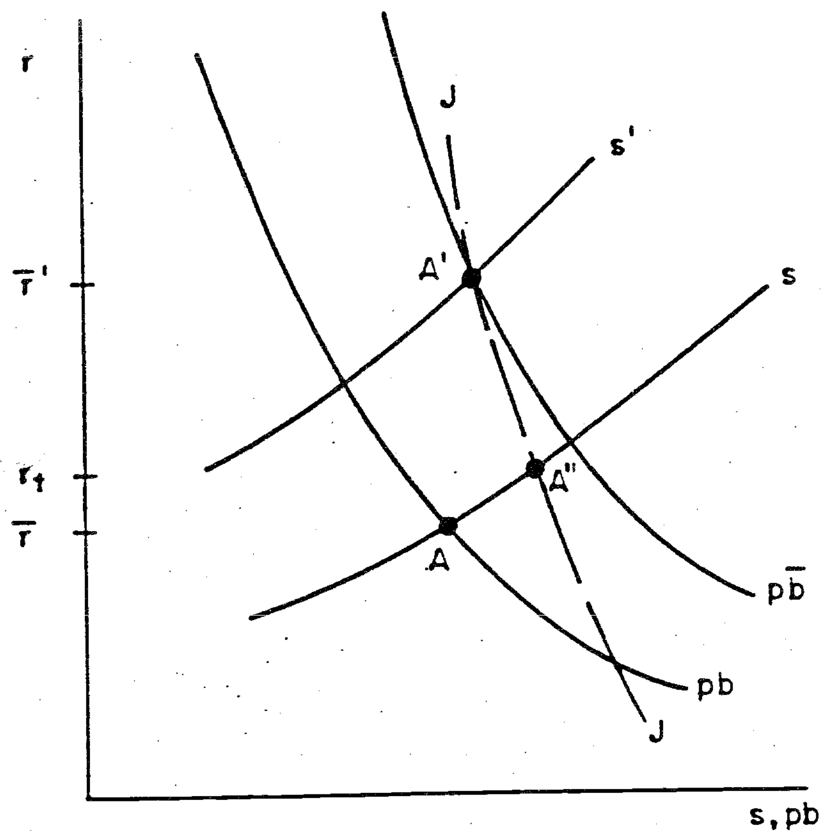

Figure 2

shortterm rate must increase from A to A".[5]

Welfare Implications: Consider next the welfare implications. Welfare of the old depends only on their current purchasing power $b + p_t\bar{b}$. This welfare of the old must rise if the value of total debt increases as it does in the case shown in Figure 2. Now note that if saving is unresponsive to the interest rate we have a borderline case where the value of total assets remains unchanged so that the old generation derives no benefit from the transfers because there are offsetting capital losses on their existing holdings of bonds. If saving responds negatively to the interest rate the old actually lose since capital losses outweigh the transfers.[6]

Consider next the impact of deficits on the the generation that is young. They are net savers and lenders. Accordingly an increase in the shortterm rate improves their terms of trade and hence increases their welfare. But whereas the currently young generation must gain there is a steady state loss in welfare. The increased taxes more than outweigh their benefits of higher interest rates and thus welfare of future generations deteriorates.[7] A debt-financed transfer thus redistributes welfare from future generations toward the current young and, perhaps, toward the current old. The interesting possibility, of course, is that the transfer receipients lose and the current young who neither receive transfers nor pay

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[5]The diagram makes it easy to study the case where the current young generation receives the transfers and future generations pay the taxes to servive the increased debt.

[6]To show these results we note that the change in the value of securities $p_t b\ (\hat{b} + \hat{p}_t)$. Using (11) we derive the results in the text.

[7]See Dornbusch (1984) where this result is demonstrated.

taxes are the net beneficiaries. This case always obtains when there is little intertemporal substitutability.

Anticipated Government Spending: We now consider the effects on asset prices and shortterm interest rates of transitory, future government spending. Specifically, starting in a steady state it becomes known at time T_0 that in period T_4 the government will spend an amount g, financing the spending by debt issue. The government is assumed to sell an amount b' of consols so that spending equals $g = p_4 b'$. In period 5 and beyond taxes are increased by b' so that henceforth the budget is again balanced at a higher level of debt service.

The solution for short and longterm interest rates and asset prices is determined by equations (12). The equations are ordered in the sequence of solution, starting from the new steady state in period 5 to the initial period:

(12a) $$s(w-\bar{b},\bar{p}/(1+\bar{p})) = \bar{p}\bar{b} \quad ; \quad \bar{b} = b+b'$$

(12b) $$s(w-b,p_4/(1+p)) = p_4 b + g \quad ; \quad g = p_4 b'$$

(12c) $$s(w-b,p_3/(1+p_4)) = p_3 b$$

(12d) $$s(w-b,p_2/(1+p_3)) = p_2 b$$

(12e) $$s(w-b,p_1/(1+p_2)) = p_1 b$$

(12f) $$s(w-b,p_0/(1+p_1)) = p_0 b$$

where s( ) is given in (3) above. Note from the equations that deficit financed spending change equilibrium asset prices prior to the actual spending. Spending first appears in period 4 and carries over via increased debt and debt service to the new steady state in (12a). It affects earlier periods via the impact on asset prices already seen in equations (11) and

(7). We now consider how anticipations of the debt financed spending change equilibrium asset prices prior to the actual spending. We start with a benchmark case where the utility function is logarithmic in which case saving is unresponsive to the interest rate.

The Logarithmic Case: We saw in equation (11) that an increase in government spending (or transfers) lead to a fall in asset prices in the period of deficit finance. In terms equations (12b) that implies a decline in p_4 in proportion to the increase in debt since $\beta = 0$. Thus we have $\hat{p}_4 = -\hat{b}$. With saving unresponsive to interest rates and no change in debt or the lifetime income of the young in period 3 the equilibrium consol price in that period remains unchanged. By equation (6) the unchanged consol price of period 3 and the fall in p_4 imply that the shortterm rate in period 3 must fall sufficiently to offset the lower future consol price. The same unchanged asset price applies to periods 2, 1, and zero.

We thus obtain a term structure of interest rates defined by the condition that asset prices in periods 0 to 3 remain unchanged at a common level $P_0=P_1=P_2=P_3$. Applying equation (6) we find that that the new shortterm rate in period 3, r'3, must be negative:

(13) $$r'3 = (p_4' - p_3)/p_3 = (R_3 - R_4')/R_4'$$

The shortterm rate must turn negative since, as we saw in Figure 2 the longterm rate in period 4 (the average of r_t and $\bar{r}'$) exceeds the initial rate $\bar{r}$ so that the righthand side of (13) is negative. The manner in which the spill over is split between short and longterm interest rates depends on the saving response to the interest rate. In the present extreme case of no saving response the adjustment falls entirely on the short rate so as to keep the consol price constant.

Note next that applying (6) to the equality of consol prices in periods 0 to 3 implies that the shortterm rate in periods 0, 1 and 2 must be equal to the initial long rate $\bar{R}$.[8] Figure 3 shows the path of shortterm rates and of the long rate from the announcement in period 1 to the new steady state.

The logarithmic case serves as an interesting benchmark in showing that future disturbances, via their effect on asset prices must spill over to earlier periods. This spill-over determines the welfare effects of the policy. In the case of logarithmic utility welfare of the generations living in periods 0 to 2 is unaffected. The young in period 3 lose as the shortterm rate declines and welfare is transferred from them to the young of period 4 who benefit from the increased shortterm rates since they are lenders. Crowding out thus takes place at the expense of bond holders at the time of the government spending, sheltering all previous generations. This is a very special case resulting from the assumption of a zero saving response as we shall now see.

Alternative Savings Behavior: Figures 4 and 5 show the time path of interest rates for an example of positive and negative saving response. The diagrams show the solutions to equations (12) for particular parameter values with elasticities of the marginal utility of consumption of 0.5 and 1.5 respectively.

In both Figures 4 and 5 the effects in periods 3 to 5 are qualitatively the same. The steady state rate increases and that increase spreads to the period in which government spending rises. In period 3, at a short rate $r_3 = \bar{R}$ the value of debt outstanding thus has fallen relative to saving. To

[8]We have $p_2 = (1+p_3)/(1+r_2') = p_3$ where $p_3 = 1/\bar{R}$. Thus $r_2' = \bar{R}$. The same argument applies to p_1.

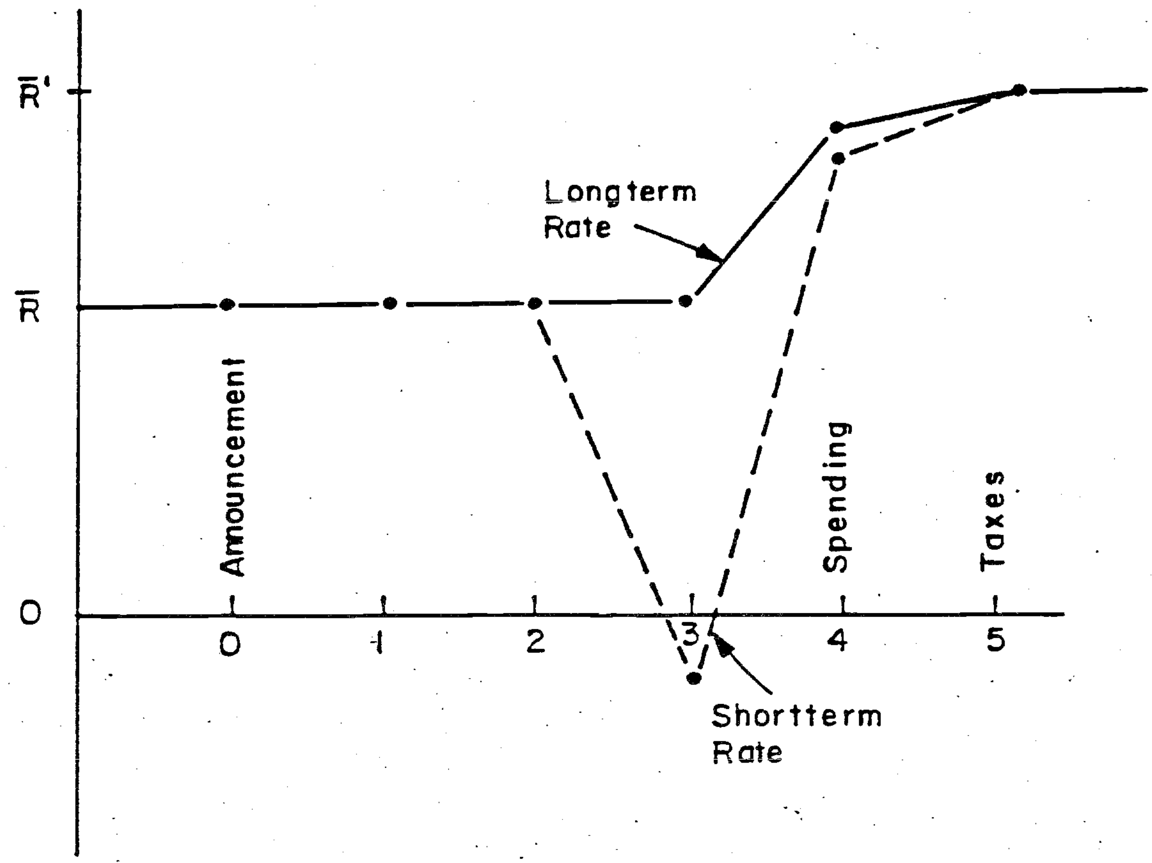
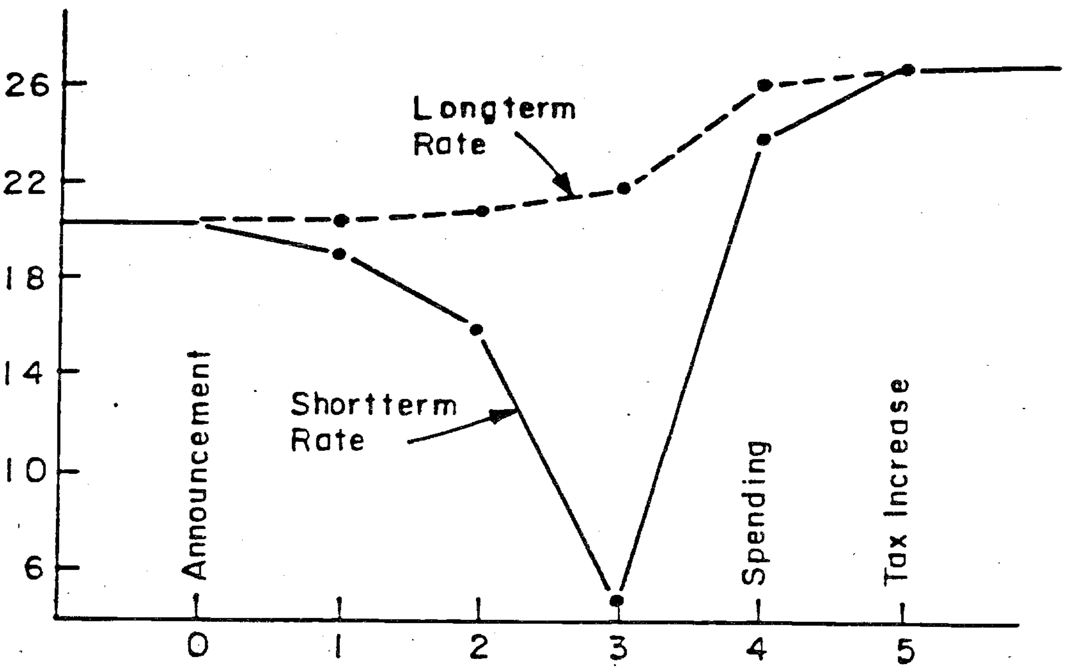

R̄'
R̄
0
Longterm Rate
Announcement
Spending
Taxes
0
1
2
3
4
5
Shortterm Rate

Figure 3



Note: w = 100, b = 10, b' = 3, θ = 0.5

Figure 4

restore capital market equilibrium saving must rise and/or the price of bonds must rise. Independent of the saving response the shortterm rate in both cases must fall. But in periods 0, 1 and 2 the interest rate behavior, however, differs markedly. We first consider the case of a positive saving response.

In period 3 the decline in the value of bonds at a shortterm rate $r_3 = \bar{R}$ implies an excsss of saving over the value of debt. Hence the shortterm rate must fall below the initial long rate, raising the value of debt and discouraging saving. Thus in period 3, with saving lower, the value of debt also is lower than in the initial stady state. Since the stock of consols has not changed this implies that the longterm rate has risen.

Going to period 2 we apply the same argument: At the initial rate $r_2 = \bar{R}$ the value of debt is reduced and hence the shortterm rate must fall below $\bar{R}$, though less than r_3. Once more the argument applies to period 1 and 0. Thus we generate a V-shaped path for the shortterm rate and an upward trending path of the long rate. For welfare purposes that implies an immediate loss for the old and a loss for the young up to period 3. They bear the costs of increased government spending while the young of period 4 are net beneficiaries. In the steady state, as noted above there is a deterioration of welfare as increased taxes outweigh the benefits of higher interest rates.

In Figure 5 we look at the case where saving responds negatively to the interest rate. The period 3 interest rate must fall because the impact of the short rate on the value of debt exceeds the saving elasticity.[9] In the

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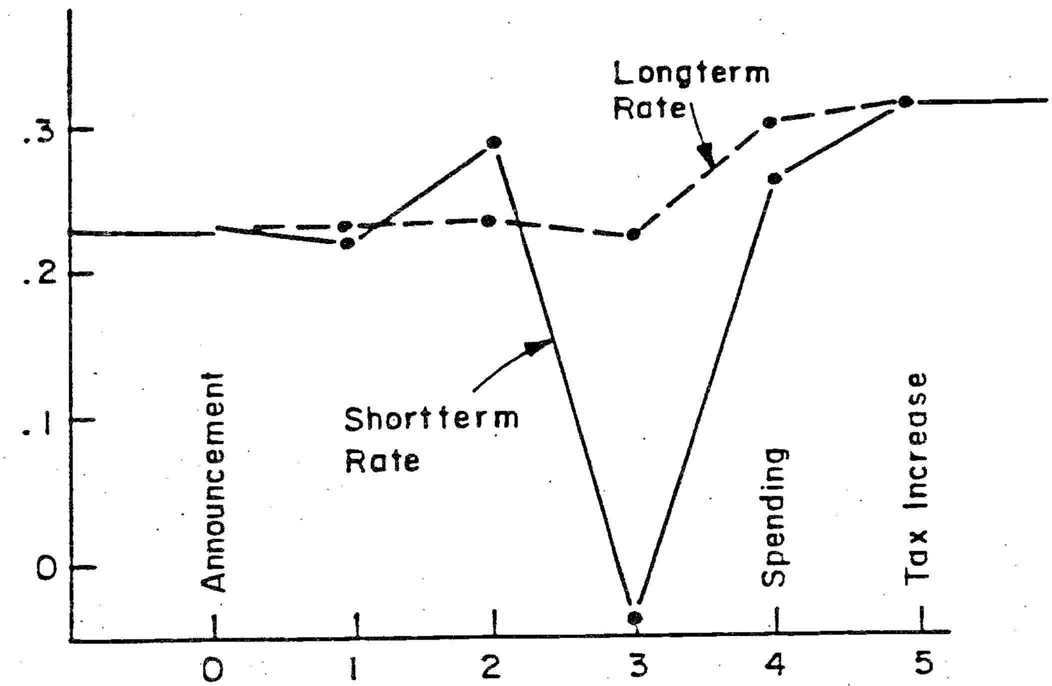
[9]From the equilibrium condition $s = q(1+p_4)b$ we have:
$\hat{q} = -[(qbp_4/q(1+p_4)b)/(1-\beta)]\hat{p}_4$.



Note: w = 100, b = 10, b' = 3, θ = 0.5

Figure 5

case of a positive saving response the fall in the interest rate tends to reduce saving and thus helps restore equilibrium both on the demand and supply side of the capital market. Here, by contrast, the fall in the interest rate raises saving and hence a larger fall in interest rates is required to achieve balance between saving and the value of debt outstanding. But note that equilibrium saving in period 3 is higher and so must accordingly be the value of debt. That means the short rate has fallen so much as to lower the period 3 longterm rate and raise consol prices above the initial sterady state. This is the explanation for the oscillating longterm rate in Figure 5.

Going back to period 2 we now have an increased value of debt at a short rate $r_2 = \bar{R}$. Thus there is an excesss supply of debt and the short rate must rise to reduce saving and the value of debt. With the short rate now above $\bar{R}$, savings is reduced below the initial steady state and thus we have shown that ther longterm rate must have risen above $\dot{R}$. This implies that in period 1 the shortterm rate must fall to equilibrate the capital market.

The welfare consequences in this case are the same as above in periods 3, 4 and in the new steady state. But in prior periods gaining and losing generations alternate. Figure 5 shows that the highest shortterm rate prevails in period 2 thus making the young in that period best off.

3. Transfers.

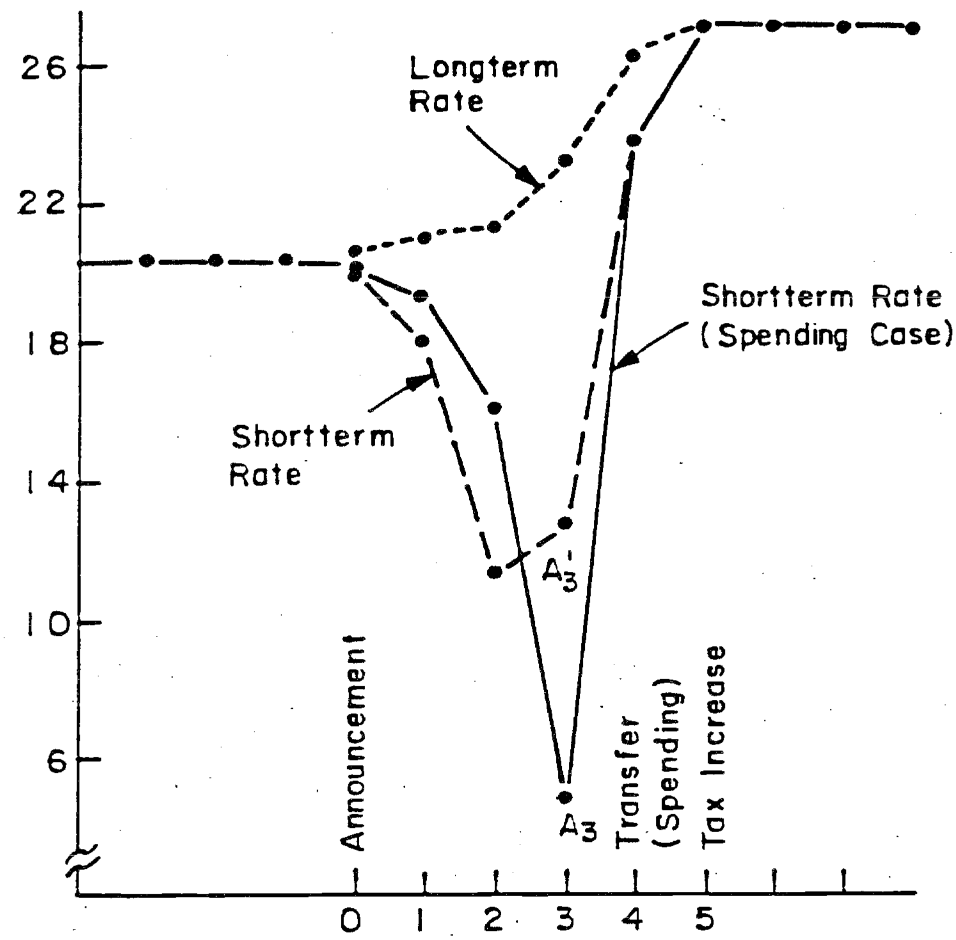
We now turn to the case where in period 4 the government makes a transfer to the old in the amount $v = p_4 b'$ and finances the transfer by issuing debt. In period 5 and beyond the increased debt will be financed by an increase in lumpsum taxes. Figure 6 shows the short and longterm interest rates for the case where saving responds positively to interest rates and parameters are the same as in Figure 4. While the general shape of the term structure is the same there is an important difference in that the minimum shortterm rate, in this case, prevails in period 2.

The longrun results are identical to those in Figure 4. This must be the case because in the longrun the two applications are identical: increased debt and increased taxes to service the debt. Also in period 4 the applications are identical. In one case there is increased government spending in the other case increased spending by the old, but the amount of increased spending $v = g = p_4b'$ is the same. Accordingly interest rates in that period, too, are the same as in Figure 4. The difference arises in period 3. Government spending had been treated as if it did not affect private welfare. But the transfers discussed now do enter the private lifetime budget constraint of the young in period 3. They look ahead to a transfer receipt and hence reduce the saving they would otherwise do.

Accordingly equation (12c) now is modified to include in lifetime income of the young the present value of the transfers they will receive in period 4. Noting the saving equation in (3) the condition for capital market equilibrium in period 3 becomes:

$$(12c)' \quad s(w - b + q_3v_{t+1}, q_3v_{t+1}, q_3) = p_3b \quad ; \quad v_{t+1} = p_4b', \; q_3 = p_3/(1 + p_4)$$

In particular we note from (3) that a future transfer reduces saving by the young by a fraction $\lambda/(1 + \lambda)$ of the prospective transfer. This decline in saving modifies the response of asset prices to the deficit by comparison with the government spending case. The analysis is made easy by keeping in



26
22
18
14
10
6
Longterm Rate
Shortterm Rate (Spending Case)
Shortterm Rate
A'3
A3
Announcement
Transfer (Spending)
Tax Increase
0
1
2
3
4
5

Figure 6

mind the spending case, which leaves the analysis unchanged from period 4 on, and superimposing now the reduction in period 3 saving due to the transfer.

The comparison in Figure 6 reveals that in the transfer case shortterm rates decline less than in the spending case. Moreover the lowest rate is reached in period 2, not 3. The explanation is the following. At the rate r_3 of the spending case at point A_3 in Figure 6 there is now an excess of debt outstanding over savings because the young who look ahead to transfer receipts reduce their saving. Accordingly interest rates must rise to clear the asset market. The interest rate rises to point A_3' to compensate for the extra effect of anticipated transfers that depress saving.

The higher interest rate in period 3, with the same rates in periods 4 and beyond, imply that the value of existing debt p_3b is less than in the transfer case. Accordingly going back toward period zero shortterm rates of interest will be lower in period 2, 1 and zero since it only takes smaller rates of saving to clear the asset market.

The saving response to interest rates affects the relative shortterm interest rates of the spending and transfer case in periods 0 to 3. We saw above that with a positive saving response to interest rates the trough of interest rates occurs in period 2. When saving responds negatively to interest rates the analysis of Figure 7 applies. Again we show for comparison the shortterm rate of the spending case. The negative response of saving to the interest rate reverses the relative magnitude of interest rate changes by comparison with Figure 6 as well as the period in which the trough occurs.

The anticipation of transfers reduces saving in period 3 compared to the spending case. The resulting excess supply of debt at the shortterm rate of the spending case, at point A_3, requires a rise in interest rates to

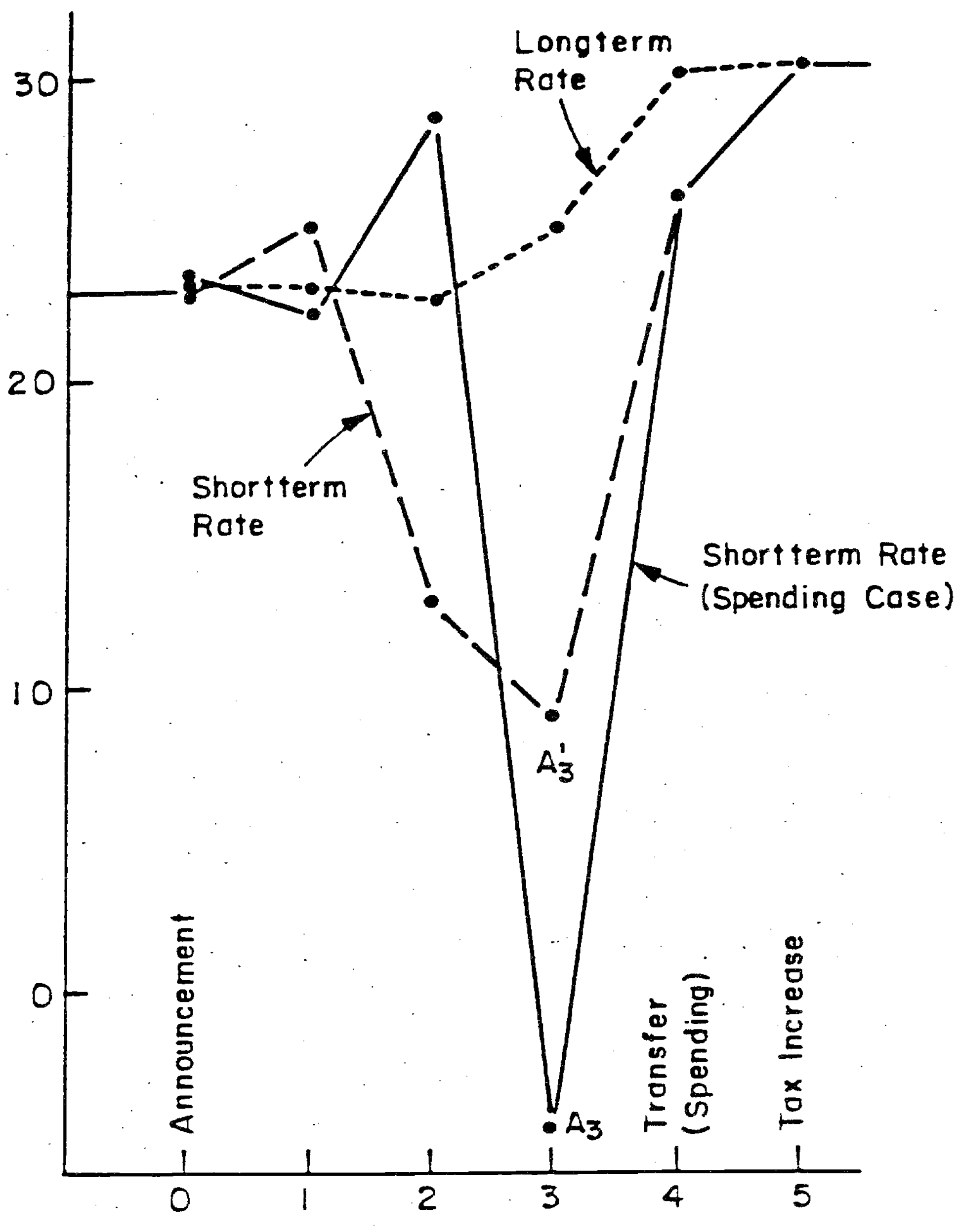

Longterm Rate
Shortterm Rate
Shortterm Rate (Spending Case)
30
20
10
0
A_3'
A_3
Announcement
Transfer (Spending)
Tax Increase
0
1
2
3
4
5

Figure 7

eliminate the excess supply of securities.[10] The shortterm rate in the transfer case thus is shown by point A_3'. We also note that in period 3 the longterm rate exceeds the initial steady state so that the value of debt is below the initial value. This fact implies that in period 2, at the intitial interest rate, the value of debt falls short of saving. Accordingly the shortterm interest rate in period 2 must be below the initial steady state as shown in Figure 7.

The case of a negative saving response to interest rates arises when there is a dominant preference for consumption smoothing. Given the exogeneous income and disturbances this preference implies large accommodating fluctuations in shortterm interest rates. Moreover these fluctuations in shortterm rates are sufficently large to even make the longterm rate oscillate and thus the value of debt. The fluctuations in the value of debt, in turn, feed back into preceding periods, forcing further, though dampened, adjustments in shortterm rates to balance the capital market.

Concluding Remarks: A Limiting Case

An interesting limiting case considers only shortterm assets. Suppose that the government instead of issuing consols issues one period bonds. Every period the maturing debt with a face value b_t is retired by selling new debt. The difference between the face value and the market value of new issues is covered by lump-sum taxes on the young amounting to $(1-q_t)b_t$. The equilibrium condition in the asset market now is:

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[10] From the capital market equilibrium condition $s(q,w)=q(1+\bar{p})b$ we have $\hat{q} = z/(1-a)(1-1/\theta)$ where z denotes the effect on saving of the second period transfer. The term z is negative and the saving elasticity with respect to q, $\alpha(1-1/\theta)$ is positive. Therefore we have shown that the shortterm rate must rise.

(8) $q_t b_t = s(q_t, w_t)$

In this case where anticipated future deficit finance has no immediate effect on the economy. In the case of government spending there is no effect on interest rates until period 4, in the case of transfers effects occur first in period 3 when anticipated transfers reduce saving.

The two limiting cases--the logarithmic case studied above and the shortterm bond case--show that in the case of finitely lived individuals it takes both longterm assets and a saving response to interest rates in order for future disturbances to affect current asset prices. The longer the maturity of assets and the lower the intertemporal elasticity of substitution the more future events affect current prices of assets.

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