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THE OPTIMAL GOVERNMENT DEBT

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1. INTRODUCTION

Deficits on current account are often justified as a suitable response to various real disturbances, such as oil price increases. Government budget deficits are an important element in this response. The present paper takes up this issue, by using a simple intertemporal framework.

The renewed interest in the intertemporal aspects of the current account brought about a new approach which is based on microeconomic foundations (see Bruno (1981), Dornbusch (1981), Obstfeld (1980), Razin (1980), Sachs (1981), Svensson (1981), and Svensson and Razin (1981)). These papers assume the existence of perfect capital markets and no distorting taxes. In this set-up it is clear that on efficiency grounds the government need not be concerned with current account fluctuations. Furthermore, shifts between debt and tax finance, for given public expenditures, have no effect on the current account. The reason is that this shift does not change the present value of taxes, and thus there is no change in private spending (as in Barro (1974)).

The current account need not, however, be socially optimal with respect to the intergenerational distribution of income and this perhaps is a reason for policies concerning the current account.

Recently Barro (1979) and Kydland and Prescott (1980) identified important factors that would influence the choice between taxes and debt finance of government spendings for a closed economy. When lumpsum taxes are infeasible the considerations of excess burden lead to a determinate intertemporal allocation of taxes, for given government spendings. The conclusion that emerges is that tax rates should remain constant, or nearly constant, over the business cycle with the budget being balanced on average.

In the present paper we study the optimum response of the current account and the government debt to real disturbances, permanent and temporary. The analysis is carried out in an explicit intertemporal framework, based on microeconomic foundations and the Ramsey rule for optimum taxation. Most of the analysis is expressed in simple diagrams.

The paper is organized in the following manner. Section 2 presents the general framework. In Section 3 the equilibrium is presented with the help of simple diagrams. In Section 4 we analyze the effects on the private and government current accounts of temporary and permanent disturbances. Section 5 contains concluding remarks.

2. THE FRAMEWORK

We consider a small country in a two-period framework with a single traded good. The private sector of the country is represented as a single consumer whose time endowment is one unit in each period. Its decision problem is to choose the two periods' labor supply, ℓ^1 and ℓ^2 , and private consumption, c^1 and c^2 , so as to maximize the intertemporal utility function

$$(2.1) \quad U(1 - \ell^1, 1 - \ell^2, c^1, c^2, g^1, g^2),$$

subject to the intertemporal private budget constraint,

$$(2.2) \quad c^1 + w^1(1 - \ell^1) + Dc^2 + Dw^2(1 - \ell^2) = w^1 + Dw^2,$$

where $1 - \ell^t$ is leisure, g^t is goods provided by the government, and w^t is the wage rate (net of taxes) in period t ($t = 1, 2$), and where D is the discount factor (equal to one over one plus the rate of interest). The consumer thus maximizes his(or her) intertemporal utility which depends on the amounts of leisure, private consumption, and public goods. The present value of consumption and leisure, at the prevailing wages and the rate of interest, is equal to the present value of full income, $w^1 + Dw^2$. We assume that there is no initial debt.

Output is produced by labor only. (There is no capital input and, thus, no capital accumulation.) The production function is

$$(2.3) \quad y^t = \alpha^t \ell^t,$$

where y^t is output in period t , and α^t is average (and marginal) productivity of labor in period t , ($t = 1, 2$).

Taxes are levied on labor income, and the competitive wage rate (net of taxes) is

$$(2.4) \quad w^t = (1 - \tau^t) \alpha^t,$$

where τ^t is the tax rate in period t .

The government spending is g^t and taxes are $\tau^t \alpha^t \ell^t$, in period t . The government must balance its budget intertemporally but not necessarily in each period. Its intertemporal budget constraint is

$$(2.5) \quad G \equiv g^1 + Dg^2 = \tau^1 \alpha^1 \ell^1 + D\tau^2 \alpha^2 \ell^2,$$

where G is the present value of government spendings.

Consider now government and private savings in period 1.

Government saving, s^g , is

$$(2.6) \quad s^g = \tau^1 \alpha^1 \ell^1 - g^1.$$

Private saving, s^p , is equal to full income minus consumption of goods and leisure. This implies that private saving is also equal to wages minus consumption of goods,

$$(2.7) \quad s^P = w^1 - (c^1 + w^1(1 - \ell^1)) = w^1 \ell^1 - c^1.$$

Our assumption that there is no investment implies that the current account surplus in period 1 is equal to the sum of private and government saving. Using (2.4)-(2.7), we can write the current account surplus as

$$(2.8) \quad s = s^P + s^G = \alpha^1 \ell^1 - c^1 - g^1 = x^1 - c^1 - g^1.$$

Observe that since there is no initial debt the current account is equal to the trade account.

We assume a small country which implies that the world rate of interest is fixed. The private sector, as well as the government, can borrow or lend freely at that rate.

No lump-sum taxes are allowed. The available tax instrument is commodity taxes with a zero tax on leisure. Because constant returns prevail and labor is a single factor of production this amounts to taxes on labor income. Optimal commodity taxation depends in general on the detailed structure of consumer preferences. The Ramsey rule says that the tax rate is relatively high (low) on goods which are complements (substitutes) to leisure. Thus changes in the optimal tax rates, due to an overall increase in taxes, would depend on differences in demand elasticities, and in particular how these demand elasticities themselves change. A priori it is not, however, possible to determine how demand elasticities vary with changes in prices and income. We shall therefore

find it convenient to use the assumption that goods are implicitly separable from leisure. Under this assumption the Ramsey Rule leads to uniform taxes on all goods (see, for example Deaton (1981) and Sadka (1977)). In our case this amounts to uniform income taxation across periods.

The equilibrium of the country can be solved in the following manner. The solution to the decision problem of the representative consumer, (2.1)-(2.2), generates labor supply and goods demand functions¹

$$(2.9) \quad \begin{aligned} \ell^t &= L^t(w^1, Dw^2) \quad \text{and} \\ c^t &= C^t(w^1, Dw^2) . \end{aligned}$$

We observe that the effects of w^1 , and w^2 on the supply and demand functions consist of both substitution and income effects. Substituting (2.4) into (2.9) and using (2.5), we obtain an implicit relation in τ (where $\tau = \tau^1 = \tau^2$ is the uniform tax rate),

$$(2.10) \quad G = \tau \alpha^1 L^1((1 - \tau)\alpha^1, (1 - \tau)D\alpha^2) + D\tau \alpha^2 L^2((1 - \tau)\alpha^1, (1 - \tau)D\alpha^2).$$

From (2.10) we can solve for the equilibrium tax rate τ . This can then be used to solve for w^t (from (2.4)), ℓ^t , c^t (from (2.9)) and s^g , s^p and s (from (2.6), (2.7) and (2.8)). Then the equilibrium allocation is fully determined.

3. A DIGRAMMATIC ANALYSIS

In order to be able to represent the equilibrium in simple diagrams and to obtain clearcut results, we now assume that the utility function is weakly homothetically separable in leisure, consumption, and public goods, i.e.,

$$(3.1) \quad U(m^1, m^2, c^1, c^2, g^1, g^2) = \bar{U}(m(m^1, m^2), c(c^1, c^2), g(g^1, g^2)),$$

where $m^t = 1 - \ell^t$ is leisure in period t , and the subutility functions $m(\cdot)$, $c(\cdot)$ and $g(\cdot)$ are linearly homogeneous. Observe that (3.1) implies that goods are implicitly separable from leisure. (See Deaton (1981)).

Maximizing (3.1) subject to the budget constraint (2.2) is analogous to choosing the leisure and consumption composites, m and c , so as to maximize $\bar{U}(m, c, g)$ subject to $wm + pc = w^1 + Dw^2$, where $w = w(w^1, Dw^2)$ is the price of the leisure composite and $p = p(1, D)$ is the price of the consumption composite.² This gives spending on consumption pc and "spending" on leisure wm . Then the composition of leisure and consumption between periods is obtained from choosing m^1 and m^2 so as to maximize $m(m^1, m^2)$ subject to $w^1 m^1 + Dw^2 m^2 = wm$, and from choosing c^1 and c^2 so as to maximize $c(c^1, c^2)$ subject to $c^1 + Dc^2 = pc$.

We assume that the composite of public goods, g^* , is constant. The government minimizes the costs of public consumption, $G = g^1 + Dg^2$, subject to $g(g^1, g^2) = g^*$. Then it chooses the tax rate τ in order to finance the costs, as in (2.5). The equilibrium wages are then given by (2.4).

The private sector equilibrium is represented in Figures 1-3. The allocation between the leisure composite and the consumption composite is shown in Figure 1 at point A, where the slope of the budget line (3.3) is equal to the slope of the indifference curve (which is derived from (3.2)). For the given spending on leisure, point B in Figure 2 shows the interperiod allocation of leisure. The interperiod allocation of the labor supply is also shown there from the origin $0'$. For the given spending on consumption, point C in Figure 3 shows the interperiod allocation of consumption. The labor supply, given by point B in Figure 2, gives rise to an income point F in Figure 3. The horizontal distance between C and F represents the private current account surplus in the first period.

Figure 4 illustrates the government equilibrium. The cost minimizing combination of g^1 and g^2 is given by point H, the government consumption point, in Figure 4. The labor supply combination in the presence of taxes, point B in Figure 2, gives rise to the tax revenue point I in Figure 4. The horizontal distance between points H and I represents the government budget surplus in period 1.

4. REAL DISTURBANCES: TEMPORARY AND PERMANENT

We now examine the effects of disturbances in the form of productivity declines, $\Delta\alpha^1 \leq 0$, and $\Delta\alpha^2 \leq 0$, on government, private, and total saving. We distinguish between a permanent disturbance where

$$(4.1) \quad \frac{\Delta\alpha^1}{\alpha^1} = \frac{\Delta\alpha^2}{\alpha^2} < 0,$$

and a temporary disturbance where

$$(4.2) \quad \Delta\alpha^1 < 0 \quad \text{and} \quad \Delta\alpha^2 = 0.$$

In order to isolate effects of disturbances from other dynamic effects of wealth accumulation we consider a stationary state as the initial situation, before the disturbances take place. A stationary state is defined by

$$(4.3) \quad \begin{aligned} \alpha^1 &= \alpha^2 = \alpha, \\ \ell^1 &= \ell^2 = \ell, \\ c^1 &= c^2 = c, \quad \text{and} \\ g^1 &= g^2 = g, \end{aligned}$$

which implies that

$$(4.4) \quad s^g = s^p = s = 0.$$

i.e. private saving as well as government saving is zero. Thus, initially there is no accumulation of wealth in the economy.

The stationary state is illustrated in Figure 5(a)-(d). Point A in Figure 5(a) is the stationary allocation of leisure and consumption composites. In Figure 5(b), the stationary allocation of leisure (and labor supply) is on the 45-degree ray through origin. In Fig. 5(c) the consumption and income points C and F coincide and are on the 45-degree ray. For the government, the public consumption and tax revenue points H and I also coincide and are on the 45-degree ray.

Consider now a permanent decline in productivity. Let us first trace out the effects at unchanged tax rate. The price index of leisure will fall. This corresponds to a counterclockwise tilt of the budget constraint through the point J. The consumption-leisure point A moves to A_1 . We assume the leisure composite increases. In Figure 5(b), the slope of the budget line does not change, but the budget line shifts outward. The leisure-labor point shifts to B_1 along the 45-degree ray. In Figure 5(c), both the consumption and the income points shift along the 45-degree ray to C_1, F_1 . This means that no private deficit arises.

For the government, the tax revenue point shifts along the 45-degree line to I_1 , whereas the public consumption point H stays put. Therefore

the government, at constant tax rate, runs a deficit in each period.

By assumption, there exists an optimal tax rate. Hence, at this rate the present value of the tax revenues must increase with the tax rate. For if it does not, the government could reduce the tax rate, thereby increasing private income and still finance its spending. But then the tax rate could not have been optimal.

It follows that in order to balance its budget, the government should increase the tax rate uniformly in both periods. The price index for leisure falls even more, the budget line in Figure 5(a) tilts further, and the consumption-leisure point shifts to A_2 . The leisure-labor point shifts to B_2 , and the private consumption and income points shift to C_2, F_2 . Again no private deficit arises. The tax revenue point shifts back to I . The tax increase eliminates the government deficit in each period.

The conclusion is that the current account remains balanced after a permanent disturbance.

Let us next consider a temporary decline in productivity. Again we first hold the tax rate constant. The price index w for leisure falls ($\Delta w/w \approx (w_m^1/w_m)(\Delta \alpha^1/\alpha^1)$), and the budget line tilts counter clock wise in Figure 6(a). The consumption-leisure point shifts to A_1 . By assumption the leisure composite increases. In Figure 6(b), the budget line shifts outward to a higher indifference curve, because of the increase in the leisure composite. Since the wage rate falls only in period 1

the budget line tilts /counter clock wise. The leisure-labor point moves to B_1 , which lies to the right of the 45-degree ray. There is intertemporal substitution towards relatively more leisure in period 1. This corresponds to a relative decline in the labor supply in period 1. In Figure 6(c), the consumption point shifts to C_1 , which corresponds to the fall in the consumption composite in Figure 6(a). Labor income falls relatively more in period 1 for two reasons: First, the wage rate falls in period 1. Second, the relative supply of labor in period 1 falls. Hence, the income point moves to F_1 , left of the 45-degree ray. A private deficit in period 1 is created.

For the government, the tax revenue declines relatively more in period 1, for the same two reasons. The tax revenue point shifts to I_1 . The government, at unchanged tax rate, runs a deficit in both periods.

To balance its budget, the government again increases the uniform tax rate. This decreases the price index for leisure even more. The consumption-leisure point in Figure 6(a) shifts to A_2 . The leisure composite increases even further. The budget line in Figure 6(b) shifts outward with an unchanged slope. The leisure-labor point moves along the ray OB_1 to B_2 . The relative labor supply in period 1 declines further. This implies that the relative labor income in period 1, and the income point in Figure 6(c) shifts to F_2 , left of the ray OF_1 . The consumption point shifts to C_2 . The private current account remains in deficit.

Tax revenues increase relatively more in period 2, since relative labor supply increases in period 2. The tax revenue point shifts to l_2 , to the left of the ray Ol_1 . Therefore, the government budget in period 1 remains in deficit (whereas it is in surplus in period 2).

We conclude that both the private sector and the government contribute to an overall current account deficit (in period 1) following a temporary real disturbance.

To the extent that the government cuts public consumption, the increase in the tax rate will be smaller (unless the cut in public consumption is larger than the initial decrease in tax revenue). If thus the increase in the tax rate is smaller than before, the deficits in both the private sector and the government are also smaller.

5. CONCLUSIONS

The paper analyzes the optimal current account of a small open economy in the presence of real disturbances. It considers the distorting effects of tax financed government spending and show that permanent disturbances have no effect on either the private or the government current account. This is shown to hold if the utility function is separable, as specified above, and initially there is a stationary equilibrium. For temporary disturbances, again starting off from an initial stationary equilibrium, both the private sector and the government develop a deficit on current account.

It would be interesting to extend the analysis in two ways: first, to introduce capital accumulation to study the effect of disturbances on investment in addition to saving; second, to introduce nontraded goods. It seems that in the latter extension the optimum response of the current account would depend on whether the disturbance hits the traded or the nontraded sectors.

F O O T N O T E S

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¹ In general D as well as g^1 and g^2 should also be included as separate arguments of the demand and supply functions, but they are fixed in the analysis and hence suppressed.

² The price indices $w(w^1, Dw^2)$ and $p(p^1, Dp^2)$ are the unit expenditure functions corresponding to the subutility functions $m(m^1, m^2)$ and $c(c^1, c^2)$, respectively. See Svensson and Razin (1981) for an example of the use of price indices in discussing the real trade balance.

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FIGURE 1

FIGURE 2

FIGURE 3

FIGURE 4

FIGURE 5

FIGURE 6