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DEFICITS WITH DISTORTIONARY TAXES: INTERNATIONAL DIMENSIONS

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ABSTRACT

This paper deals with the international effects of budget deficits arising from distortionary tax and transfer policies. The analysis demonstrates that the consequences of tax policies and the characteristics of the international transmission mechanism depend critically on the precise composition of taxes. Specifically, the international effects of budget deficits of a given size differ sharply according to the types of taxes used to generate the deficit. We show that in determining the effects of taxes it is useful to divide the various distortionary taxes into two groups: those that stimulate current external borrowing (national dissaving) and those that stimulate current external lending (national saving). A pro-borrowing tax policy raises the world rate of interest while a pro-lending tax policy lowers it. The resulting change in the rate of interest is the channel through which the effects of budget deficits are transmitted to the rest of the world. The key propositions are illustrated by a series of examples involving consumption taxes (VAT), taxes on income of labor and capital and taxes on international borrowing.

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This paper deals with the international effects of budget deficits arising from tax and transfer policies. In order to focus on issues of public finance we assume that the path of government spending is given and we examine the implications of alternative time profiles of taxes and of public-debt issue. To conduct a meaningful analysis of budget deficits we depart from the pure Ricardian model (in which the timing taxes does not matter) by allowing for distortionary taxes, and examine the effects of budget deficits arising from tax policies under alternative tax systems. We consider deficit policies involving taxes of different types: consumption taxes, taxes on income from domestic investment, taxes on income from foreign lending, and taxes on labor income.

Throughout we assume that capital markets in the world economy are fully integrated and, therefore, that individuals and governments of different countries face the same world rate of interest. This feature provides the key channel through which the effects of policies undertaken in one country are transmitted to the rest of the world.

Much of the recent research in macroeconomics and public finance has been conducted in a closed-economy framework and has emphasized the intertemporal dimensions of tax policies and their effects on saving, investment labor supply and growth. In this context special attention has been given to the implications of budget deficits.[1] Our analysis extends the closed-economy framework to a two-country model of the world economy. This extension enables the treatment of questions and issues that could not have been dealt with in a closed-economy framework. Furthermore, we show that open-economy considerations lead to modifications of propositions derived previously in a closed-economy model.[2]

The key result of this paper is that the consequences of tax policies and the characteristics of the international transmission mechanism depend critically on the precise composition of taxes. Specifically, the international

effects of a budget deficit of a given size differ sharply according to the types of taxes used to generate the deficit.

In section I we develop a simple analytical framework suitable for the analysis of distortionary taxes. This framework is applied in the subsequent three sections to an examination of the international effects of budget deficits arising from cuts in consumption taxes, capital-income taxes, and taxes on international borrowing. The analytical framework is extended in section V to incorporate a variable labor supply and to allow for taxes on labor income. This framework is used in section VI where we examine the effects of budget deficits arising from a cut in taxes on labor income. The paper concludes in section VII which contains an integrated summary of the main results.

I. Analytical Framework

Consider a two-period model of a non-monetary open economy producing and consuming one aggregate tradable good. The aggregation of goods into a single aggregate commodity and the abstraction from money are done in order to focus attention on intertemporal trade, that is, on international borrowing and lending. The economy is assumed to be endowed with an initial sequence of endowments, $\bar{Y}_0$ and $\bar{Y}_1$ where the subscripts zero and one designate the corresponding periods. The initial endowment may be consumed or, alternatively, it may be invested in intertemporal production process. Such an investment process modifies the intertemporal pattern of available outputs (GDP). Formally, output in period one, Y_1, is linked to the initial endowments through $Y_1 = \bar{Y}_1 + F(I_0)$ where I_0 denotes investment in period zero. The function $F(I_0)$, which transforms current investment into future output, exhibits positive and diminishing returns.

The private sector's periodic budget constraints are

$$(1) \qquad (1+\tau_{c0})C_0 = (1-\tau_{k0})(\bar{Y}_0 - I_0) + (1-\tau_{b0})B^p_0 - (1+r_{-1}-\tau_{b0})B^p_{-1}$$

$$(2) \qquad (1+\tau_{c1})C_1 = (1-\tau_{k1})(\bar{Y}_1 + F(I_0)) - (1+r_0-\tau_{b1})B^p_0 \quad .$$

In equations (1)-(2) C_0 and C_1 denote first and second-period consumption, B^p_t (t=-1,0) denotes period-t borrowing (which could be positive or negative), I_0 measures the losses of firms (negative dividends) corresponding to initial investment, $F(I_0)$ measures second period dividends, r_t (t=-1,0) denotes the world rate of interest in period t, and τ_{ct}, τ_{kt} and τ_{bt} (t=0,1) denote, respectively, the ad-valorem tax rates in period t on comsumption, capital income and new borrowing. In this 2-period model, the solvency requirement ensures that in the second period the private sector settles all debt commitments and does not incur new debt. In equation (1) the coefficient of C_0 indicates that the unit cost of consumption is one plus the corresponding ad-valorem tax. The coefficient of the level of capital income $(\bar{Y}_0-I_0)$ is one minus the corresponding ad-valorem tax, reflecting taxes on income from existing capital $(\bar{Y}_0)$ and a tax rebate on negative income from current investment. Our formulation of the tax on international borrowing assumes that the tax applies to new net private-sector borrowing -- $(B^p_0 - B^p_{-1})$. This could be verified by noting that the last two terms on the right-hand-side of equation (1) could also be written as $(1-\tau_{b0})(B^p_0-B^p_{-1})-r_{-1}B^p_{-1}$. In this formulation debt service is exempt from the tax. An analogous interpretation applies to the second-period budget constraint in equation (2). We note that in the second period there is negative new net borrowing (since past debt is repaid and no new debt is issued); therefore, the term $\tau_{b1}B^p_0$ corresponds to a tax rebate. As is evident from the formulation of equations (1)-(2), the three taxes are linked through an

equivalence relation: the effects of each tax can be replicated by a specific combination of the other two taxes.

With these taxes, the periodic budget constraints of the government are

$$G_0 = B_0^g + \tau_{c0}C_0 + \tau_{k0}(\tilde{Y}_0 - I_0) + \tau_{b0}(B_0^p - B_{-1}^p) - (1+r_{-1})B_{-1}^g \tag{3}$$

$$G_1 = \tau_{c1}C_1 + \tau_{k1}(\tilde{Y}_1 + F(I_0)) - \tau_{b1}B_0^p - (1+r_0)B_0^g \tag{4}$$

where G_t (t=0,1) denotes government purchases in period t and where B_t^g (t=-1,0) denotes government borrowing in period t. Analogously to the private sector, solvency requires that, in the second period, the government settles all debt commitments and does not incur new debt. In this formulation we have implicitely assumed that aside for domestically imposed taxes, the private-sector and the government can borrow at the same rate of interest in the world capital market. We also note that,in conformity with the national income identities, in each period the difference between aggregate absorption and GNP equals the net accummulation of external debt (the sum of private and public-sector debts); this can be verified by adding, for each period, the private-sector's and the government budget constraints.

The private-sector seeks to maximize life-time utility subject to the consolidated life-time constraint, obtained from the periodic budget constraints. Accordingly, adding equation (2), multiplied by $(1-\tau_{bo})/(1+r_0-\tau_{b1})$, to equation (1) and dividing the resultant equation by $(1+\tau_{c0})$ yields

$$(5) \qquad C_0 + \alpha_{\tau 1} C_1 = \frac{(1-\tau_{k0})}{(1+\tau_{c0})} \bar{Y}_0 + \frac{(1-\tau_{k1})(1-\tau_{b0})}{(1+\tau_{c0})(1+r_0-\tau_{b1})} \bar{Y}_1$$

$$+ \frac{(1-\tau_{k0})}{(1+\tau_{c0})} \left[\alpha_{I1} F(I_0) - I_0\right] - \frac{(1+r_{-1}-\tau_{b0})}{(1+\tau_{c0})} B^P_{-1}$$

where $\alpha_{\tau 1} = \frac{(1-\tau_{b0})(1+\tau_{c1})}{(1+r_0-\tau_{b1})(1+\tau_{c0})}$, $\alpha_{I1} = \frac{(1-\tau_{b0})}{(1+r_0-\tau_{b1})} \frac{(1-\tau_{k1})}{(1-\tau_{k0})}$. For subsequent use we denote the world discount factor by $\alpha_1 = \frac{1}{1+r_o}$.

Equation (5) is the private-sector consolidated budget constraint which incorporates the role of taxes. The key point to emphasize is that the discount factors applicable to the quantities pertaining to the future period (period one) are the tax-inclusive discount factors. These are the <u>effective discount factors</u> relevant for private-sector decisions. Accordingly, $\alpha_{\tau 1}$ measures the effective intertemporal price of C_1 in terms of C_0. This price reflects the prevailing tax structure. It is governed by the time profiles of the consumption tax (reflected by the ratio $(1+\tau_{c1})/(1+\tau_{c0})$) and of the international borrowing tax (reflected by the ratio $(1-\tau_{b0})/(1+r_0-\tau_{b1})$).

Analogously, the effective discount factor applicable for investment decisions is α_{I1}. This, effective discount factor is governed by the time profiles of the taxes on international borrowing and on capital income. It does not depend on the time profile of the tax on consumption.

This dependence of the effective discount factors on the time profiles of the various taxes reflects the non-Ricardian feature of the model. A budget deficit arising from a current tax cut (for a given path of government spending) must be followed by a future tax hike (in order to assure government solvency). The change in the time profile of taxes alters the effective discount factors. This provides for the principal channel through which budget deficits affect the

intertemporal allocation of consumption and investment. We note that if the time profile of any given tax is flat (so that $\tau_{c0}=\tau_{c1}$ or $\tau_{k0}=\tau_{k1}$ or $\tau_{b0}=\tau_{b1}/(1+r_0)-\alpha_1\tau_{b1}$), then this tax is non-distortionary and its impact is similar to that of a lump-sum tax. Finally, in our two-country model of the world economy, the foreign country is assumed to be characterized by a similar structure and, in what follows, we use an asterisk to denote variables pertaining to the foreign country.

II. The Effects of Cuts in Taxes on Consumption

Consider the effects of a budget deficit induced by a cut in the tax on consumption. We note in passing that this consumption tax is equivalent to a value-added tax system (VAT) under which investment and exports are exempt. In order to isolate the effect of this tax cut, we assume that all other taxes are zero. We also assume that the path of foreign taxes is flat (so that the foreign tax system does not introduce a distortion) and that the foreign government runs a balanced budget (so that changes in the world rate of interest do not impact on the foreign government's solvency).

The analysis is conducted with the aid of Figure 1 in which the upwards sloping schedule, S^w, describes the ratio, z, of current to future world GDP net of investment and of government spending, as an increasing function of the rate of interest. Formally, this world relative-supply, z, is

$$z = \frac{\bar{Y}_0 - I_0(\alpha_{I1}) + \bar{Y}_0^* - I_0^*(\alpha_{I1}^*) - G_0 - G_0^*}{\bar{Y}_1 + F[I_0(\alpha_{I1})] + \bar{Y}_1^* + F^*[I_0^*(\alpha_{I1}^*)] - G_1 - G_1^*} \quad .$$

The world relative-supply schedule is a weighted average of the domestic and the foreign relative-supply schedules, S and S^*, respectively. Accordingly,

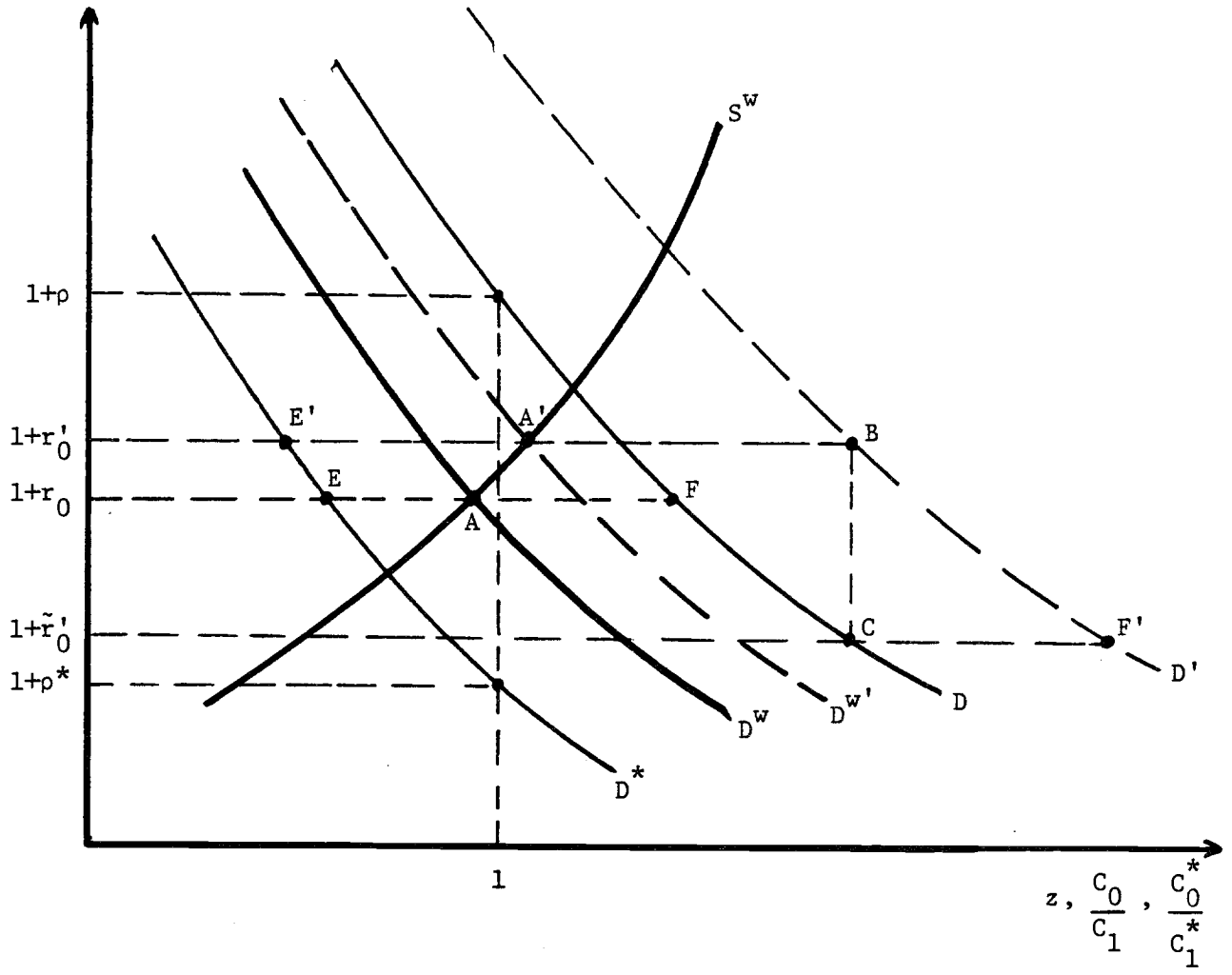

Figure 1: The Effects of a Budget Deficit Arising from a Cut in Consumption Taxes.

$S^W = \mu_s S + (1-\mu_s)S^*$ where

$$\mu_s = \frac{\bar{Y}_1+F(I_0)-G_1}{\bar{Y}_1+F(I_0)-G_1+\bar{Y}_1^*+F^*(I_0^*)-G_1^*} = \frac{\bar{Y}_1+F(I_0)-G_1}{C_1+C_1^*}$$

The positive dependence of z on the rate of interest reflects the fact that a higher effective rate of interest (a lower effective discount factor) induces profit-maximizing firms to lower investment.

On the demand side of the model, private and public goods are assumed to be separable in the utility functions and the latter are assumed to be homothetic. This implies that the desired ratio of consumption in the two consecutive periods depends only on the intertemporal price (that is, the rate of interest). Accordingly, the downwards sloping schedules in Figure 1 plot the desired ratios of current to future consumption as decreasing functions of the rate of interest. The domestic and foreign private-sector relative demands are denoted by D and D^* (where $D=C_0/C_1$ and $D^*=C_0^*/C_1^*$), respectively, and their values at the point $C_0/C_1=C_0^*/C_1^*=1$ measure the corresponding subjective rates of time preference, ρ and ρ^*. Evidently, the domestic and foreign relative-demand functions depend on the corresponding (tax inclusive) effective discount factors $\alpha_{\tau 1}$ and $\alpha_{\tau 1}^*$, respectively. The world relative demand schedule, D^W, indicates the desired ratio of current to future world consumption $(C_0+C_0^*)/(C_1+C_1^*)$. Thus, D^W is a weighted average of the two private sectors' relative demands. That is, $D^W=\mu D+(1-\mu)D^*$ where $\mu=C_1/(C_1+C_1^*)$

The initial equilibrium is described in Figure 1 by point A. In this Figure the vertical axis measures one plus the (tax-free) world rate of interest. At the initial equilibrium this quantity is indicated by $1+r_0$. The

schedules pertaining to the initial equilibrium (D, D^*, D^W and S^W) are drawn for the given initial configuration of taxes. A reduction in the current tax on consumption from τ_{c0} to τ'_{c0} and a corresponding rise in the future tax from τ_{c1} to τ'_{c1} (necessary to restore government solvency) raises the effective discount factor applicable to domestic consumption, $\alpha_{\tau 1}$ (that is, lowers the effective rate of interest) and induces a substitution towards current consumption. Thus, for each and every value of the world rate of interest, the domestic (relative) demand schedule shifts to the right from D to D'. The proportional vertical displacement of the schedule equals the proportional rise in the effective discount factor. This proportion is $\left[(1+\tau'_{c1})/(1+\tau_{c1})\right]\left[(1+\tau_{c0})/(1+\tau'_{c0})\right]$. Associated with the new domestic relative demand, the new world relative demand also shifts to the right from D^W to $D^{W'}$. Being a weighted average of the domestic and foreign relative demands, the vertical displacement of D^W is smaller than that of D.

The rise in the effective discount factor applicable to consumption decisions, from $\alpha_{\tau 1}$ to $\alpha'_{\tau 1}$, does not affect the effective discount factor applicable to investment decisions. Therefore, the relative supply schedule in Figure 1 remains intact. Hence the equilibrium world rate of interest rises from r_0 to r'_0. This higher world rate of interest discourages domestic investment as well as investment in the foreign country and results in a positive cross-country correlation of investment.

In order to determine the incidence of this change in the time-profile of taxes on the domestic effective rate of interest we recall that the percentage vertical displacements of the D schedule equals the tax-induced percentage change in the effective discount factor. This change is represented by the distance BC in Figure 1. Accordingly, in order to determine the new equilibrium value of the domestic effective rate of interest, we subtract from

$1+r_0'$ the distance BC. This yields $1+\tilde{r}_0'$ in Figure 1. Evidently, the new equilibrium effective rate of interest $\tilde{r}_0'$ is lower than the initial rate r_0 since the vertical displacement of D^W is smaller than BC, and since the percentage fall in the world discount factor is even smaller than the vertical displacement of D^W.

Since in the new equilibrium the world rate of interest rises, it induces intertemporal substitution in foreign consumption towards future consumption and, thereby, results in a higher growth rate of foreign consumption (represented by the move from point E to point E' in Figure 1). By similar reasoning, the fall in the domestic effective rate of interest induces intertemporal substitution in domestic consumption towards current consumption which lowers the growth rate of domestic consumption (represented by the move from point F to point F' in Figure 1). Finally, we note that even though the growth rate of foreign consumption rises, the growth rate of world consumption falls (as represented by the move from point A to point A' in Figure 1). This decline reflects the fall in world investment.

The unambiguous inference concerning the effects of this cut in taxes on domestic and foreign investment and on the growth rates of consumption (indicated by the ratios C_1/C_0 and C_1^*/C_0^*), does not carry over to the level of domestic consumption. In order to determine the effect of the tax cut on the level of consumption, we need to take account of both the induced changes in the value of the budget constraint relevant for the economy as a whole, and of changes in the rate of interest relevant for private-sector decisions. The budget constraint relevant for the economy as a whole is obtained by combining the private sector life-time budget constraint (5) with the corresponding government present-value budget constraint (obtained by dividing equation (4) by $(1+r_0)$ and adding to equation (3)). This consolidated budget constraint is .

$$(6) \qquad C_0(\alpha_{\tau 1}, W_0) + \alpha_1 C_1(\alpha_{\tau 1}, W_0)$$

$$= (\bar{Y}_0 - G_0) + \alpha_1(\bar{Y}_1 - G_1) + \alpha_1 F(I_0(\alpha_1)) - I_0(\alpha_1) - (1+r_{-1})B_{-1} = V_0$$

where B_{-1} denotes the historically given initial external debt $(B_{-1}=B^p_{-1}+B^g_{-1})$. The left-hand-side of equation (6) is the discounted sum of life-time consumption, and the right-hand-side (defined as V_0) is the discounted sum of GDP net of government spending, investment and initial debt commitment. Both discounted sums are evaluated by using the discount factor, α_1, applicable to the economy in the world capital markets. Thus V_0 is the value of the constraint relevant for the economy as a whole. However, as reflected in the arguments of the consumption functions $C_t(\alpha_{\tau 1}, W_0)$, the decisions concerning the intertemporal allocation of consumption are governed by the effective (tax inclusive) discount factor, $\alpha_{\tau 1}$.

At the initial world rate of interest, a cut in the current tax on consumption, τ_{c0}, accompanied by a future rise in the tax, τ_{c1}, raises the effective discount factor, $\alpha_{\tau 1}$. As seen from equation (6), for a given value of α_1, this rise in $\alpha_{\tau 1}$ does not alter the value of the constraint, V_0. The change in the world rate of interest, however, does alter the constraint according to

$$(7) \qquad \frac{\partial V_0}{\partial \alpha_1} = F(I_0(\alpha_1)) + (\bar{Y}_1 - G_1) \quad .$$

Hence, it follows that the budget deficit which raises the world rate of interest, must lower the value of V_0, by the amount equal to (period-one) GDP net of government spending.

In what follows we use these considerations concerning the induced changes in α_1, $\alpha_{\tau 1}$ and V_0 in order to analyse the effects of the budget

deficit on the level of domestic consumption. Points A and B in Figure 2 describe the patterns of consumption and investment prevailing in the initial equilibrium in which the world rate of interest is r_0. The assumption that the tax on capital income is zero implies that the initial level of investment is undistorted (hence the tangency at point B between the investment opportunity schedule and the world "price line" with the slope of $1+r_0$) and that the consumption expansion locus, OA, corresponds to the situation in which the initial effective rate of interest, $\tilde{r}_0$, equals the world rate, r_0. The rise in the world rate of interest from r_0 to r_0' shifts the domestic investment point to B′ (lowering investment), alters the economy-wide budget constraint from BV_0 (with the slope $1+r_0$) to $B'V_0'$ (with the steeper slope $1+r_0'$) and rotates the consumption expansion locus from OA (corresponding to $\tilde{r}_0'$) to OA′ (corresponding to the lower effective rate, $\tilde{r}_0'$).

The new pattern of consumption is described by point A′ in Figure 2. In the case drawn current consumption rises but this result is not general. For example if the intertemporal elasticity of substitution is low, then the rotation of the consumption-expansion locus is relatively small and the new equilibrium can be obtained at a point such as A" at which current consumption falls. A key factor determining the effects of the budget deficit on the level of domestic consumption is whether, in the current period, the country as a whole lends or borrows internationally. The case shown in Figure 2 corresponds to a situation in which the domestic economy borrows abroad (the amount B_0). Alternatively if the economy is a net lender (if the consumption point lies to the left of the investment point) then both the rise in the world rate of interest and the fall in the effective rate of interest operate to raise the level of domestic current consumption.

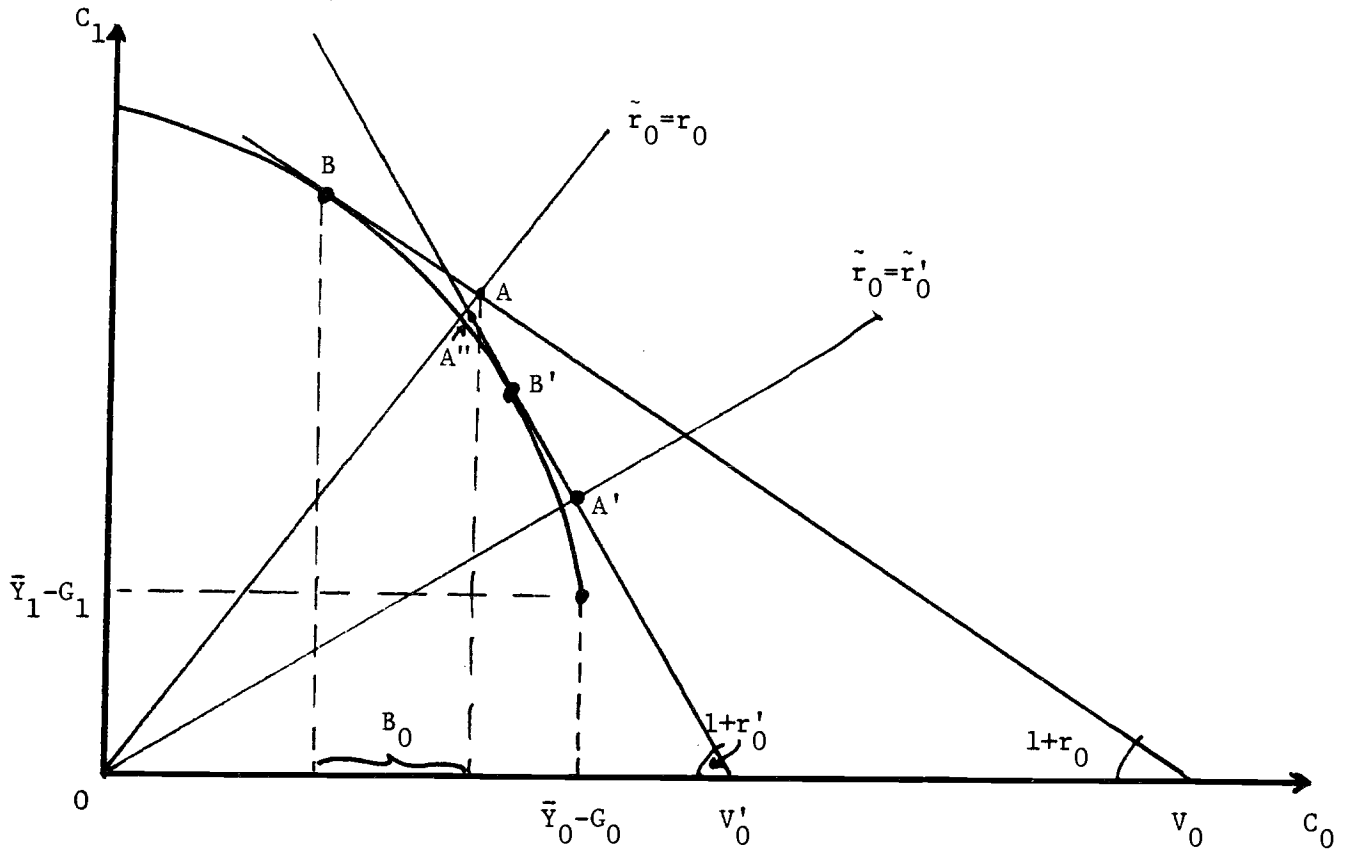

Figure 2: The Effects of a Budget Deficit Arising from a Cut in Consumption Taxes on the Level of Domestic Consumption.

Data: $B_{-1}=0$, $r_0 < r'_0$, $r_0 > \tilde{r}'_0$, $B_0 > 0$

This ambiguity of the effects of the budget deficit on the level of consumption is enhanced in the more general situation in which the initial time profile of taxes is not flat. In that case the initial equilibrium is distorted, and the change in the level of consumption also reflects the influence of the change in the magnitude of the initial distortion.

By influencing the world rate of interest the domestic budget deficit is transmitted internationally. If the foreign economy has a flat tax profile then, ruling out a backwards bending saving function, the rise in the world rate of interest operates to reduce current foreign consumption. We conclude that if the intertemporal elasticities of substitution between current and future consumption are relatively low, then the correlation between changes in domestic and foreign consumption consequent on the budget deficit may be positive or negative. On the other hand if the elasticities of substitution are relatively high, then the budget deficit results in a negative correlation between domestic and foreign levels of consumption.

Finally, in the case for which the foreign saving function does not bend backwards, foreign absorption (consumption plus investment) falls and, therefore, the foreign economy's trade account improves. This improvement is mirrored by a corresponding deterioration in the domestic balance of trade.

III. The Effects of Cuts in Taxes on Capital Income

We now consider the effects of a deficit arising from a current cut in taxes on income from capital. Assuming that all other taxes are zero, this tax cut must be accompanied by a corresponding rise in future taxes. Accordingly, suppose that the time profile of taxes be changed from (τ_{k0}, τ_{k1}) to a steeper profile (τ'_{k0}, τ'_{k1}). The initial equilibrium is described by point A in Figure 3. Since the taxes τ_{k0} and τ_{k1} do not influence the effective discount

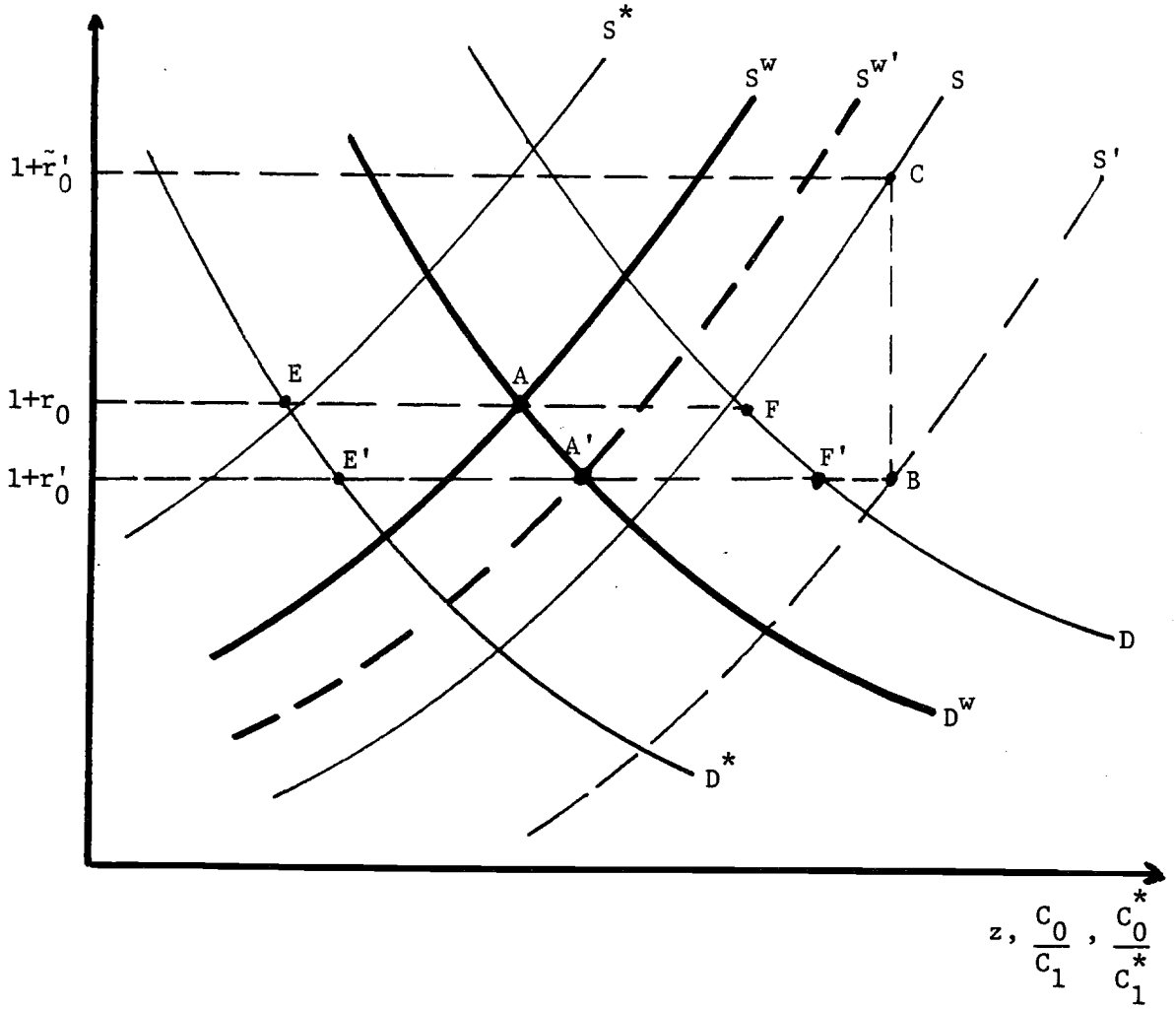

Figure 3: The Effects of a Budget Deficit Arising from a Cut in Capital Income Tax.

factor applicable to consumption decisions, $\alpha_{\tau 1}$, changes in the time profile of this tax do not alter the desired ratio of intertemporal consumption. Therefore, the relative demand schedules in Figure 3 remain intact.

Turning to the supply side, we note that by lowering the effective discount factor relevant to investment decisions, α_{I1}, the budget deficit displaces the domestic relative supply schedule downwards from S to S'. The proportional displacement is equal to $(1-\tau'_{k1})(1-\tau_{k0})/(1-\tau_{k1})(1-\tau'_{k0})$ which measures the percentage change in α_{I1}. Recalling that the world relative-supply schedule S^w is a weighted average of S and S^*, if follows that the proportional downwards displacement of the <u>world</u> relative supply schedule is smaller than this quantity since the domestic-weight weight, μ_s, is smaller than unity.

The new equilibrium obtains at the intersection between the (unchanged) world relative-demand schedule, D^w, and the new world relative-supply schedule, $S^{w'}$. This equilibrium is indicated by point A' at which the world rate of interest falls, from r_0 to r'_0, and (one plus) the effective interest rate applicable to domestic investment rises by the proportion $(1+\tilde{r}'_0)/(1+r'_0)$. This rise is indicated by the distance BC corresponding to the vertical displacement of the domestic relative-supply schedule. In the new equilibrium the rates of growth of domestic and foreign consumption fall. This is indicated by the respective moves from points F to F' and E to E'. As a result, the rate of growth of world consumption must also fall. In view of the fall in the world rate of interest from r_0 to r'_0, foreign investment rises and, in view of the rise in the effective domestic rate of interest from r_0 to $\tilde{r}'_0$, domestic investment falls. Thus, a deficit arising from a cut in taxes on income from capital crowds-out domestic investment and crowds-in foreign investment.These changes result in a negative correlation between domestic and foreign investment, and in

a positive correlation between domestic and foreign rates of growth of consumption.

In contrast with the ambiguity concerning the effects of a cut in consumption taxes on the level of domestic consumption, the consumption effects of a cut in taxes on income from capital are unambiguous if the initial tax profile is flat. For, the fall in the world rate of interest raises current consumption by increasing wealth (through the increased value of the discounted sum of GDPs) and by inducing intertemporal substitution. Similarly, if the time profile of foreign taxes is also flat, the fall in the world rate of interest raises foreign consumption for the same reasons. It follows that under these circumstances the domestic budget deficits crowds-in both domestic and foreign private-sector consumption and results in a positive cross-country correlation between the levels of consumption.

It is also noteworthy that, in contrast with the effects of a cut in consumption taxes, the reduction in taxes on income from capital improves the domestic-country trade balance. This improvement of the domestic balance of trade is the counterpart to the deterioration in the foreign trade account consequent on the rise in foreign absorption (consumption plus investment).

Finally, we note that if the initial tax profile is not flat, then the effects of the cut in capital-income tax on the level of domestic consumption are not clear cut. For, in this case the budget constraint relevant for the economy as a whole is the same as in equation (6) except for one modification: in the present case the discount factor relevant for investment decisions is the effective discount factor, α_{I1}, rather than the world discount factor, α_1. With this modification, for a given value of α_1, the rise in the effective domestic discount factor induced by the change in the time profile of taxes on income from capital alters the value of the constraint, V_0, by

$$(8) \qquad \frac{\partial V_0}{\partial \alpha_{I1}} = \left[\alpha_1 F'(I_0(\alpha_{I1}))-1\right] I_0'(\alpha_{I1}) \quad , \qquad \text{for given } \alpha_1 \ .$$

Since investment depends positively on the effective discount factor and since the marginal product of investment diminishes with the rate of investment, it follows that whether V_0 rises, remains unchanged, or falls, depends on whether α_{I1} is smaller than, equal to, or larger than α_1. If initially taxes are zero then $\alpha_1 = \alpha_{I1}$ and, therefore, for given α_1 the value of V_0 stays intact. Hence, the change in taxes does not exert a first-order effect on V_0 and, as implied by equation (7), the rise in the world rate of interest lowers the value of V_0 by the amount $F(I_0) + \bar{Y}_1 - G_1$.

IV. The Effects of Cuts in Taxes on International Borrowing

The foregoing analysis demonstrated that consumption-tax policies influence the equilibrium in the world economy by altering the relative-demand schedules whereas capital-income tax policies influence the equilibrium by altering the relative-supply schedules. With fixed labor supply, as evident from the budget constraints (1)-(2), a tax on international borrowing is equivalent to a combination of consumption and capital-income taxes. It follows that such a tax policy influences the equilibrium by altering both the relative-demand and the relative-supply schedules. In this section we analyse such a tax policy by examining the effects of a budget deficit arising from a current cut in taxes on international borrowing. In order to focus on this tax we assume that all other taxes are zero and, for convenience, we assume that the initial taxes on international borrowing are also zero. As seen from the government budget constraints, taxes on international borrowing induce both government revenue from tax collections and government expenditures from tax rebates. Therefore, we need to determine first whether the deficit arises from a current

cut in tax rates or from a current rise in tax rebates. Further, we need to determine what changes in future tax rates are necessary to maintain the discounted sum of tax revenue unchanged.

The first-period government budget constraint (3) implies that if, during the first period, the private sector is a net borrower (that is, $B^p_0 - B^p_{-1}$ is positive) then, obviously, a cut in the current tax rate τ_{b0} induces a budget deficit. The second-period government budget constraint (4) indicates that the tax rebate is $\tau_{b1}B^p_0$. Hence, with positive borrowing, the maintenance of a given government revenue (in present value terms) implies that the tax rate τ_{b1} must also fall according to

$$\frac{d\tau_{b1}}{d\tau_{b0}} = \frac{B^p_0 - B^p_{-1}}{\alpha_1 B^p_0} \qquad (9)$$

These changes in the time-profile of taxes on international borrowing, influence the effective discount factors that are applicable to both consumption and investment decisions. As is evident from equation (5), in the absence of other taxes, the two effective discount factors, $\alpha_{\tau 1}$ and α_{I1}, are both equal to $(1-\tau_{b0})/(1+r_0-\tau_{b1})$. Using equation (9) and the definition of $\alpha_{\tau 1}$, it can be shown that for a given world rate of interest and for zero initial taxes the change in the effective domestic discount factor is

$$\frac{d \log \alpha_{\tau 1}}{d\tau_{b0}} = -\frac{B^p_{-1}}{B^p_0} \qquad \text{for a given } \alpha_1 . \qquad (10)$$

Thus, with positive borrowing, the current cut in taxes on international borrowing raises the effective domestic discount factor and, correspondingly, lowers the effective domestic rate of interest.

The analysis of the effects of the budget deficit on the equilibrium values of the world rate of interest and on the growth rates of domestic and foreign consumption is carried out with the aid of Figure 4 in which the initial equilibrium is shown by point A. The reduction in the domestic tax on international borrowing, τ_{b0}, raises the effective discount factor applicable to consumption, $\alpha_{\tau 1}$ (that is, lowers the effective rate of interest) and induces a substitution towards current consumption. Thus, for each and every value of the world rate of interest, the domestic (relative) demand schedule shifts to the right from D to D'. As argued earlier the vertical displacement of the schedule equals the proportional change in $\alpha_{\tau 1}$ (represented by the distance BC in Figure 4). Associated with the new domestic relative demand, the new world relative demand (the weighted average of domestic and foreign relative demands) also shifts to the right from D^W to $D^{W'}$, and its proportional rightwards displacement is equal to the fraction μ, (representing the domestic-country weight, $(C_1/(C_1+C_1^*))$, times the percentage rightwards displacement of the D schedule. Since the weight, μ, is smaller than unity, the D^W schedule shifts upwards by a proportion smaller than the change in $\alpha_{\tau 1}$.

The rise in the effective discount factor, $\alpha_{\tau 1}$, is associated with an equi-proportional rise in the effective discount factor applicable to domestic investment decisions or, equivalently, lowers the corresponding effective rate of interest. At the prevailing world interest rate this stimulates current investment and results in an upwards displacement of the domestic relative-supply schedule from S to S'. This proportional displacement equal the vertical displacement of the D schedule which equals the percentage rise in the effective discount factor (represented by the distance BC in Figure 4). As a

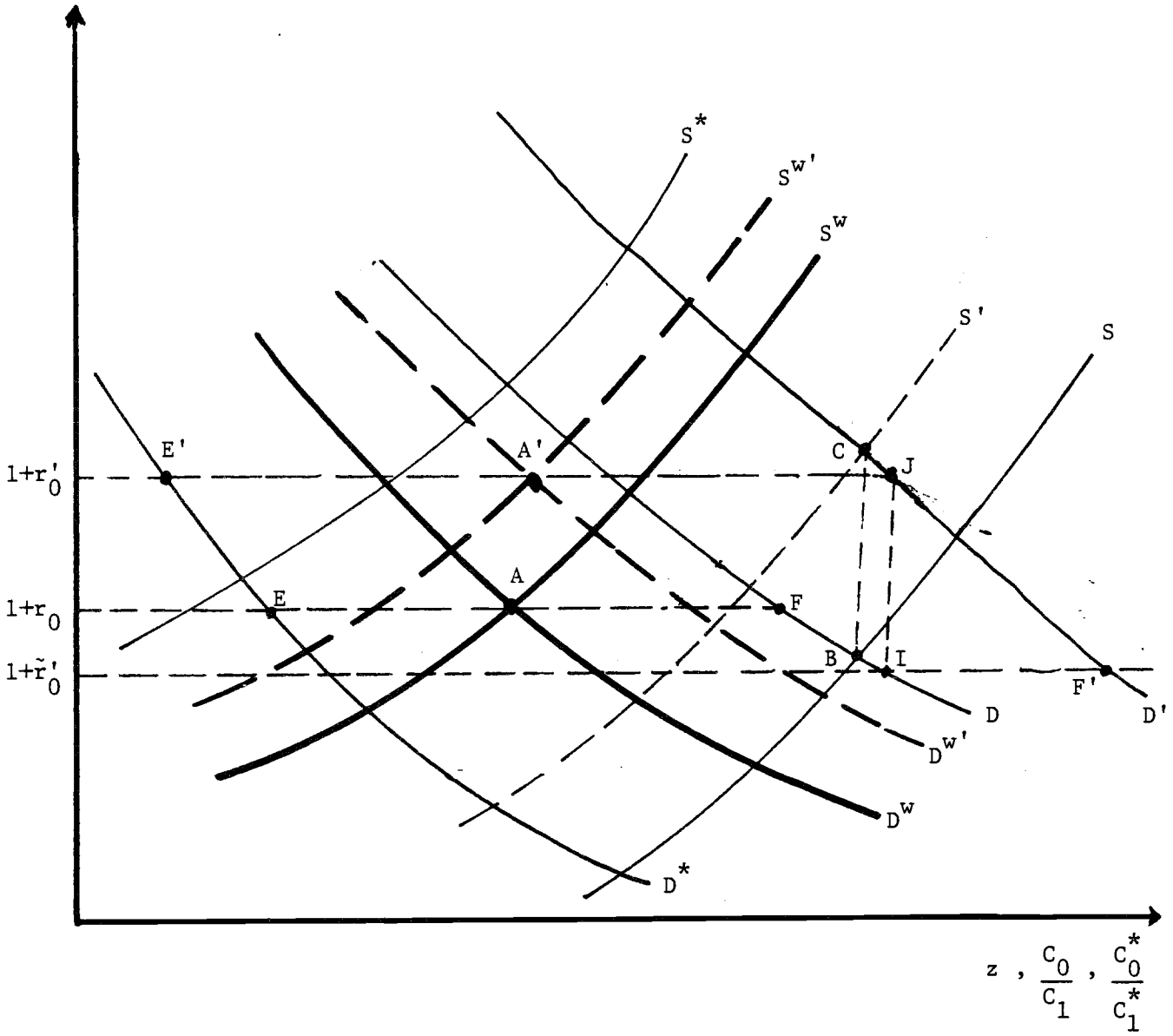

Figure 4: The Effects of a Budget Deficit Arising from a Cut in Taxes on International Borrowing.

Data: $B_0^p > 0$, $B_0^p > B_{-1}^p$

result, the world relative-supply schedule shifts to the left from S^w to $S^{w'}$ by a proportion that is equal to the fraction μ_s times the percentage leftwards displacement of the S schedule. Since μ_s is smaller than unity, the S^w schedule shifts upwards by a proportion smaller than the percentage rise in α_{I1}. Hence, the new equilibrium obtains at point A' at which the world rate of interest rises from r_0 to r_0'. This higher world rate of interest discourages investment in the foreign country.

To determine the incidence of the change in the tax on the equilibrium value of the domestic effective rate of interest we subtract from the new equilibrium value $1+r_0'$, the tax-induced rise in the effective discount factor. Diagramatically, this subtraction is indicated by the distance IJ in Figure 4 measuring the vertical displacement of the domestic relative-demand schedule. As seen, in the new equilibrium the domestic effective rate of interest falls to $\tilde{r}_0'$, and, thereby, domestic investment rises. We thus conclude that the budget deficit arising from a cut in taxes on international borrowing results in a negative correlation between domestic and foreign investment.

The rise in the world rate of interest raises the equilibrium growth rate of foreign consumption (indicated by the move from point E to point E'). At the same time, the fall in the effective domestic rate of interest lowers the equilibrium growth rate of domestic consumption (indicated by the move from point F to F'). Thus, as in the case of budget deficits arising from a cut in consumption taxes, the cut in taxes on international borrowing also results in a negative correlation between the growth rates of domestic and foreign consumption.

The effect of the tax cut on the grwoth rate of world consumption depends on the ralative vertical displacements of the world relative-demand and relative-supply schedules. These two displacements are equal to each other if μ,

the domestic-country weight in the world relative-demand schedule, D^W, equals its weight, μ_s, in the world relative-supply schedule, S^W. Recalling that $\mu = C_1/(C_1+C_1^*)$ and that $\mu_s = \left(\bar{Y}_1 + F(I_0) - G_1\right)/(C_1+C_1^*)$, it follows that if $\mu = \mu_s$, then the (second-period) trade account is balanced. In that case the new equilibrium point, A', lies vertically above the previous equilibrium point, A, and the growth rate of world consumption remains unchanged. If, on the other hand, μ_s exceeds μ, then the (second-period) trade account is in a surplus and point A' lies to the left of point A. In this case the growth rate of world consumption rises. The opposite holds if μ_s falls short of μ (the case illustrated in Figure 4).

As with consumption taxes, the unambiguous inference concerning the changes in domestic and foreign investment and in the growth rates of consumption that are induced by the tax change does not carry over to the level of domestic consumption. The effect of the tax cut on the level of consumption reflects both the induced changes in the value of the budget constraint relevant for the economy as a whole and the induced changes in the rate of interest relevant for private-sector decisions.

From this point onwards the analysis of the effects of the change in taxes on international borrowing on the levels of domestic and foreign consumption and on the trade balance follows similar lines to the previous analysis of the effects of changes in consumption taxes. Accordingly, the budget deficit which raises the world rate of interest lowers foreign consumption (ruling out a backwards-bending saving function) and, since foreign investment also falls it follows that foreign absorption (consumption plus investment) falls and the foreign trade balance improves. The counterpart to this improvement is a deterioration in the domestic balance of trade. Finally, the direction of the change in the level of domestic consumption is not clear cut. It depends on the

initial level of international borrowing as well as on the extent of the rise in domestic investment induced by the fall in the effective domestic rate of interest.

V. Taxes on Labor Income: The Analytical Framework

In this section we extend the model to allow for a variable labor supply and for taxes on labor income. We consider the effects of a budget deficit arising from a cut in current taxes on labor income. In order to focus on this effect, we abstract from other taxes. Further, in order to allow for endogenous labor supply and variable output we modify the utility function and the production function.

Normalizing total endowment of time in each period t to unity, let the fraction of time spend on labor be ℓ_t. Correspondingly, the fraction of time left for leisure is $1-\ell_t$. We assume that life-time utility is a function of four "goods": ordinary consumption, (C_0,C_1), and leisure consumption $(1-\ell_0,1-\ell_1)$. In order to facilitate the exposition suppose that the utility function is separable between ordinary consumption and leisure, and let each sub-utility be homothetic. These assumptions imply that the utility-maximizing ratio of consumption in the two consecutive periods depends only on the rate of interest; likewise, the utility-maximizing ratio of leisure in the two consecutive periods depends only on the ratio of wages (net of tax).

As in the previous sections, the individual who has access to the world capital market, maximizes life-time utility subject to the consolidated life-time budget constraint. With variable labor supply it is convenient to include in the definition of life-time spending the imputed spending on leisure. Correspondingly, the definition of wealth includes the imputed value of labor endowment. Thus, the life-time budget constraint is

$$(11) \qquad C_0 + (1-\tau_{\ell 0})(1-\ell_0)w_{\ell 0} + \alpha_1\left[C_1+(1-\tau_{\ell 1})(1-\ell_1)w_{\ell 1}\right]$$

$$= (1-\tau_{\ell 0})w_{\ell 0} + r_{k0}K_0 - I_0 + \alpha_1\left[(1-\tau_{\ell 1})w_{\ell 1} + r_{k1}(K_0+K(I_0))\right]$$

$$- (1+r_{-1})B^p_{-1} = W_0$$

where $\tau_{\ell t}, w_{\ell t}$, and r_{kt} denote, respectively, the tax on labor income, the wage rate and the rental rate on capital in period t ($t=0,1$), and where K_0 denotes the initial endowment of capital. As indicated in (11) the individual life-time (full) income, that is the individual wealth (W_0), is the discounted sum of the value of time endowment (net of taxes) and of capital income (net of initial debt committment). Capital income in the current period is the rental on existing capital, $r_{k0}K_0$, minus investment, I_0; correspondingly, the stock of capital in the subsequent period is $K_0 + K(I_0)$.

Maximization of the utility function subject to the life-time budget constraint yields the demand functions for ordinary consumption and for leisure in each period. These demand functions depend on the three relative prices (net wages in each of the two periods and the discount factor), and on wealth. Accordingly, the labor supply functions (which are inversely related to the leisure demand functions) can be written as

$$(12) \qquad \ell_0 = \ell_0\left[(1-\tau_{\ell 0})w_{\ell 0}\ ,\ \alpha_1\ ,\ \alpha_1(1-\tau_{\ell 1})w_{\ell 1}\ ;\ W_0\right]$$

$$(13) \qquad \ell_1 = \ell_1\left[(1-\tau_{\ell 0})w_{\ell 0}\ ,\ \alpha_1\ ,\ \alpha_1(1-\tau_{\ell 1})w_{\ell 1}\ ;\ W_0\right]$$

The assumption that leisure is not a Giffen good implies that a rise in the current period net wage raises ℓ_0 and a rise in the (discounted value of)

future net wage raises ℓ_1. Assuming that the amounts of leisure consumed in two consecutive periods are gross-substitutes implies that for a given level of wealth a current tax cut lowers future labor supply while a future tax cut lowers current labor supply. This specification will be useful in the subsequent analysis of the effects of changes in the time-profile of taxes on labor income.

In each period the level of outputs Y_0 and Y_1, depends on labor and capital inputs. In order to simplify the exposition we assume linear production functions. Thus, let

$$Y_0 = a_0\ell_0 + b_0K_0 \tag{14}$$

$$Y_1 = a_1\ell_1 + b_1\left[K_0+K(I_0)\right] \quad . \tag{15}$$

The assumption that factor markets are competitive, implies that in equilibrium the wage rates and the rental rates equal the corresponding marginal productivities of labor and capital, respectively. Thus,

$$w_{\ell 0} = a_0 \ , \ w_{\ell 1} = a_1 \ , \ r_{k0} = b_0 \ , \ r_{k1} = b_1 \quad . \tag{16}$$

As usual, profit-maximizing investment implies equality between the marginal cost of capital, $(1+r_0)$ and the marginal return on the investment, which is the product of the marginal product of investment in capital formation and the discounted sum of the rental rates on capital. Hence, in the present two-period model, profit maximization requires that

$$r_{k1}K'(I_0) = 1 + r_0 \quad . \tag{17}$$

In order to close the model we note that the present-value budget constraint of the government is

$$G_0 + \alpha_1 G_1 = \tau_{\ell 0} w_{\ell 0} \ell_0 + \alpha_1 \tau_{\ell 1} w_{\ell 1} \ell_1 - (1+r_{-1}) B^g_{-1} \quad . \tag{18}$$

Combining the private sector life-time constraint (11), with the government present-value constraint (18), and making use of the supply-side equations (13)-(15) yields the economy's consolidated budget constraint in which the discounted sum of consumption equals V_0, where

$$C_0 + \alpha_1 C_1 = \left[a_0 \ell_0 + b_0 K_0 - G_0 - I_0\right] + \alpha_1 \left[a_1 \ell_1 + b_1 (K_0 + K(I_0)) - G_1\right] - (1+r_{-1}) B_{-1} = V_0 \quad . \tag{19}$$

The right-hand-side of equation (19) measures the value of the constraint, V_0, relevant for the economy as a whole. As with the previous case a key property of the specification of this constraint is that it is evaluated by using undistorted prices. Thus, in comparison with the private-sector constraint (11) the wages used in (19) for evaluating leisure and income are the tax-free wages. Obviously, the wages which appear as arguments in the consumption and leisure demand (labor supply) functions, C_0 , C_1 , ℓ_0 , and ℓ_1 are the after-tax wages.

In order to analyse the equilibrium of the system we assume that the foreign economy has a similar structure of production, consumption and taxes. The initial equilibrium of the system is described by point A in Figure 5. As before, the downwards sloping schedules D and D^* denote the domestic and foreign relative demands for (ordinary goods) consumption in the two periods,

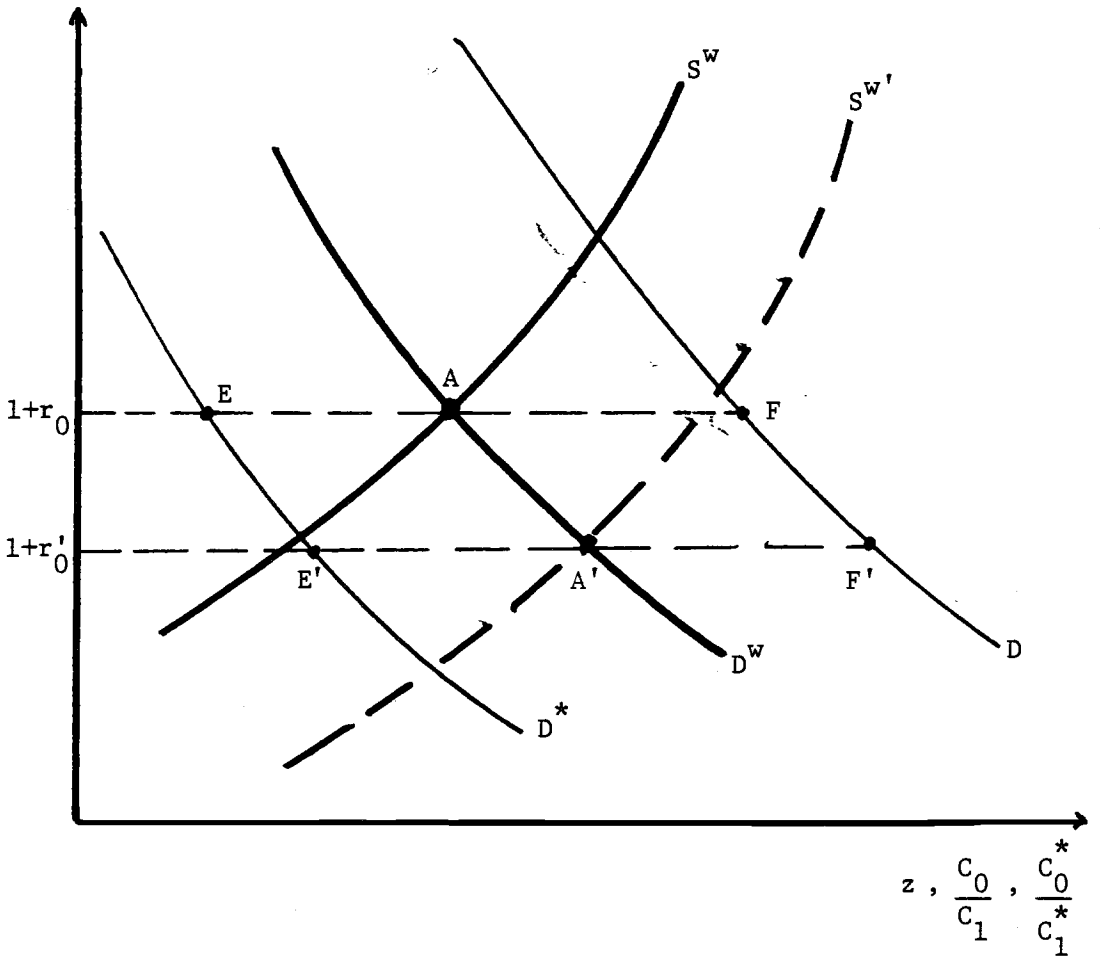

Figure 5: The Effects of a Budget Deficit Arising from a Cut in Taxes on Labor Income.

and the schedule D^W is the weighted average of the domestic and foreign relative demands. The negative slopes of the schedules reflect the intertemporal substitution arising from changes in the rate of interest. The positively sloped schedule, S^W, reflects the response of z to the rate of interest, where, as before, z measures the ratio of world GDP net of investment and government spending in the two consecutive periods. That is,

$$(20) \qquad z = \frac{(a_0\ell_0+b_0K_0-I_0-G_0) + (a_0^*\ell_0^*+b_0^*K_0^*-I_0^*-G_0^*)}{[a_1\ell_1+b_1(K_0+K(I_0))-G_1] + [a_1^*\ell_1^*+b_1^*(K_0^*+K^*(I_0^*))-G_1^*]}$$

The S^W schedule is drawn with a positive slope for convenience. In fact changes in the rate of interest affect the intertemporal prices of leisure and of ordinary goods as well as wealth. These changes may alter the supply of labor in a way that more than offsets the effect of the induced changes in investment on z. In that case the S^W schedule is negatively sloped but, as long as it is steeper than the world relative demand schedule, our subsequent analysis remains intact.

VI. The Effects of Cuts in Taxes on Labor Income

Consider the effect of a budget deficit arising from a current reduction in the tax ($\tau_{\ell 0}$) on labor income (accompanied by a future rise in the tax, $\tau_{\ell 1}$). Implicit in this formulation is the assumption that there is a negative relation between the tax rate and the budget deficit so that the tax system operates on the "efficient" portion of the Laffer curve. The assumption that the homothetic utility functions are separable between leisure and ordinary consumption implies that for a given rate of interest the change in the time-profile of wages (net of taxes) does not alter the desired ratios of ordinary

consumption in the two consecutive periods. Thus, the budget deficit does not alter the position of the relative demand schedules in Figure 5.

On the other hand, the assumption that the amounts of leisure consumed in the two periods are gross substitutes, ensures that the rise in the current net wage and the fall in the future net wage raises the current labor supply, ℓ_0, and lowers the future labor supply, ℓ_1. Therefore, as seen from equation (20), this change in the time-profile of taxes raises the value of z for any given rate of interest. This is shown by the righwards shift of the world relative supply schedule from S^w to $S^{w'}$ in Figure 5.

The new equilibrium shifts from point A to point A' , the world rate of interest falls from r_0 to r_0' and, the rates of growth of domestic, foreign and world consumption falls. The lower rate of interest induces a positive correlation between growth rates of consumption. It also stimulates investment in both countries and, therefore, induces a positive correlation between domestic and foreign rates of investment.

The budget deficit arising from the change in the time-profile of taxes on labor income also alters the levels of consumption in both countries. In the domestic economy the changes in the level of consumption reflect the combination of the induced changes in labor supply, the wealth and substitution effects induced by changes in the world rate of interest, and the response of investment. In order to illustrate the first two we abstract for the moment from domestic investment. Consider Figure 6. Points A and B describe the initial pattern of domestic consumption and production. The change in the time-profile of taxes and the lower rate of interest alter the pattern of GDP from point B to point B', it shifts the economy's budget line from BV_0 to $B'V_0'$, and rotates the consumption-expansion locus from OA to OA'. The assumption implicit in the construction and rotation of the consumption-expansion loci is that consumption

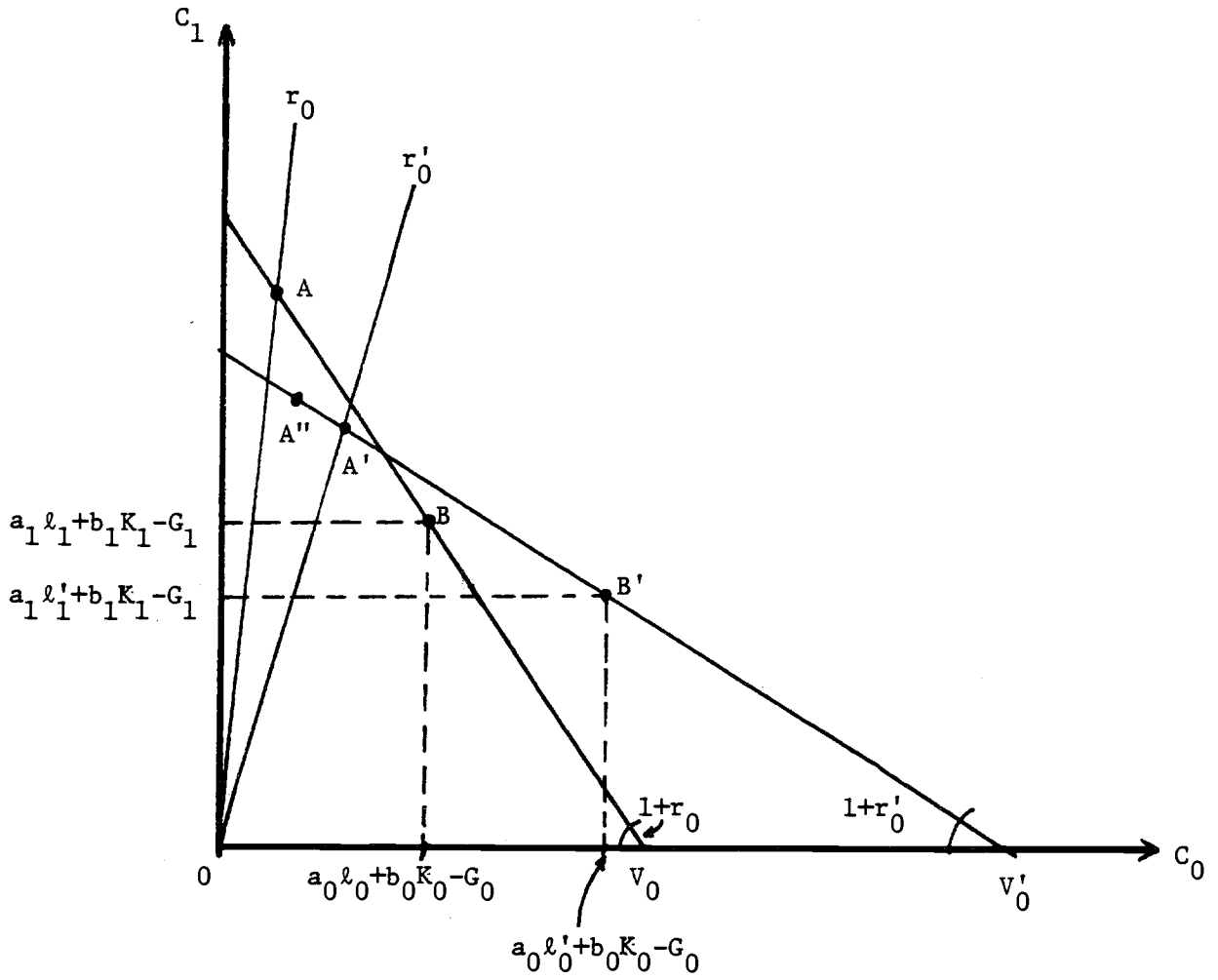

Figure 6: The Effects of a Budget Deficit Arising from a Cut in Taxes on Labor Income on the Level of Domestic Consumption.

Data: $B_{-1}=0$, $r_0' < r_0$

and leisure are separable in the utility function and therefore the indifference map between C_0 and C_1 (under- lying these loci) is independent of labor supply.

The new equilibrium pattern of consumption is described by point A' which, in the case shown in Figure 6, corresponds to a higher level of current consumption. This result, however, is not general. For example, if the intertemporal elasticity of substitution is relatively low, then the extent of the rotation of the consumption-expansion locus is small and the new equilibrium obtains at a point such as A". In that case current consumption falls. As with taxes on international borrowing, a key factor governing the direction of the change in the level of consumption is whether the economy as a whole is a lender or borrower in the world capital market. In the case shown in Figure 6 the economy is a lender; in that case a fall in the rate of interest exerts conflicting effects on current consumption. If on the other hand the economy is a borrower (so that the consumption point lies to the right of the production point), then both the wealth and the substitution effects induced by the fall in the rate of interest operate to raise the level of current consumption.

The exposition up to this point abstracted from the role of investment. With investment, the fall in the rate of interest contributes positively to wealth by raising the profits on investment $\left[\alpha_1 K(I_0) - I_0\right]$. Furthermore, the increased profitability of investment encourages borrowing (or discourages lending). This diminishes the weight of the factor contributing to a negative wealth effect associated with a fall in the rate of interest.

In order to determine the effects of the domestic budget deficit on the level of foreign consumption, we note that the fall in the world rate of interest raises the discounted sum of foreign GDP (provided that the foreign labor supply is not greatly reduced by the fall in the rate of interest). In addition (ruling out a backwards bending saving function) the fall in the rate

of interest induces substitution of current consumption for future consumption. Hence, if the intertemporal elasticities of substitution are relatively large, the budget deficit results in a positive correlation between domestic and foreign consumption.

Finally, in the present framework the budget deficit may cause an improvement in the balance of trade. For example, if the foreign labor supply does not respond appreciably (positively) to the fall in the rate of interest, and, correspondingly if the foreign GDP (net of government spending) does not rise much, then the rise in foreign absorption (consumption plus investment) worsens the foreign trade balance and, correspondingly, improves the domestic balance of trade. Thus, in contrast with the previous examples, the budget deficit causes an improvement in the trade account. This improvement reflects the rise in current period output induced by the stimulating policy of the lower taxes on labor income.

VII. Summary

The foregoing analysis examined the effects of budget deficits on the world rates of interest, investment, consumption and on the trade balance. Throughout we assumed that the path of government spending is given so that budget deficits arise only from tax cuts.[3] We have analysed the implications of four kinds of tax cuts: a cut in consumption taxes (valued-added taxes), a cut in taxes on income from capital, a cut in taxes on international borrowing, and a cut in taxes on labor income. In this context we assumed that the initial paths of domestic and foreign taxes are flat (or zero) and that the foreign government runs a balanced budget. The cut in current taxes results in a budget deficit and necessitates a tax hike in future periods in order to restore

solvency. We showed that the effects of such a deficit depend critically on the precise tax that is altered.

The formulation of the various taxes also suggests that they are interrelated through equivalence relationships. For example, as indicated by equations (1), (2) and the periodic budget constraints underlying (11), a consumption (VAT) tax is equivalent to a cash-flow income tax (capital income tax with expensing, plus a labor income tax) plus a tax on foreign borrowing. The inclusion of the tax on foreign borrowing in this tax-equivalence proposition is the special feature arising from the openness of the economy. Obviously, this feature is absent from the various tax-equivalence propositions developed in the context of closed-economy analyses.[4]

The mechanism through which the budget deficit impacts on the world economy operates through wealth effects and through temporal and intertemporal substitution effects. The latter are of central importance under circumstances in which taxes are distortionary. In such cases the substitution effects induced by tax cuts may operate in opposite directions than the wealth effects and, as a result, may yield outcomes opposite to those predicted by models (such as the Keynesian or the overlapping generations models) in which the wealth effects serve as the principal mechanism through which budget deficits influence the economy.[5]

The important role attached to the intertemporal substitution effects suggests that the various distortionary taxes can be usefully divided according to whether they induce excess demand for current goods or for future goods or, equivalently, whether they stimulate current external borrowing (national dissaving) or lending (national saving). Tax policy that induces an excess demand for current goods by raising current consumption or investment or by lowering current GDP relative to future GDP is classified as a <u>pro-borrowing</u>

policy, and tax policy that creates an excess supply of current goods by discouraging current consumption or investment, or by raising current GDP relative to future GDP is classified as a pro-lending policy. Alternatively, the various tax policies associated with the budget deficit can be classified into expansionary supply-shift policies and expansionary demand-shift policies. Accordingly, a deficit arising from a cut in taxes on income from capital or labor (that is a cut in income tax) reflects supply-shift policies, whereas a deficit arising from a cut in consumption tax (valued-added tax) reflects demand-shift policy and the latter is a pro-borrowing policy. With this classification we note that a budget deficit arising from a cut in taxes on international borrowing contain elements of both supply and demand-shift policies. Since, however, the demand-shift component dominates, this tax cut is a pro-borrowing policy.

The results of the analysis are summarized in Table 1. It is seen that the effects of the budget deficit on the world rate of interest, r_0 , depend on whether the deficit arises from a pro-borrowing or a pro-lending tax cut. A cut in current taxes on consumption and on international borrowing, is a pro-borrowing tax policy that raises the world rate of interest. On the other hand a cut in current taxes on capital income and on labor income is a pro-lending tax policy that lowers the world rate of interest.

The Table also shows that in the case of consumption and capital-income taxes domestic investment falls while in the case of taxes on international borrowing and labor income investment rises.

The results reported in the Table show that independent of whether the tax cut is pro-borrowing or pro-lending, the budget deficit always lowers the growth rate of domestic consumption, $g_c = (C_1/C_0)-1$. On the other hand, the international transmission of the effects of the deficit depends on whether the

TABLE 1

THE EFFECTS OF DOMESTIC BUDGET DEFICITS ARISING FROM A CUT IN TAXES ON INTERNATIONAL BORROWING, CAPITAL INCOME, AND LABOR INCOME

Tax Cut On	g_c^w	r_0	$\tilde{r}_0$	g_c	g_c^*	I_0	I_0^*	C_0	C_0^*	$(TA)_0$
Consumption	-	+	-	-	+	-	-	+	-	-
International Borrowing	$^{+}_{-}$ if $\mu_s \gtrless \mu$	+	-	-	+	+	-	?	-	-
Capital Income	-	-	+	-	-	-	+	+	+	+
Labor Income	-	-	-	-	-	+	+	?	+	+

Note: g_c^w, g_c and g_c^* denote, respectively, the world, the domestic and the foreign growth rates of consumption. $\tilde{r}_0$ denotes the effective domestic rate of interest applicable to consumption decisions (except for the case of a capital income tax for which consumption depends on the world rate r_0). This effective rate also governs domestic investment decisions (except for the case of consumption taxes for which domestic investment depends on the world rate of interest r_o). If $\mu_s > \mu$, then the (second-period) domestic trade account is in a surplus and vice versa. The ambiguities in the effects of taxes on domestic consumption reflect conflicting substitution and wealth effects. Domestic consumption rises if the substitution effect dominates the wealth effect. The latter depends on the initial borrowing needs position. The assumption underlying the direction of the changes in the levels of consumption and the trade account is the absence of backwards bending saving functions.

deficit arises from a pro-borrowing or pro-lending tax policy. If the tax policy is a pro-borrowing policy, then the growth rate of foreign consumption rises and foreign investment falls, and conversely if the tax policy is a pro-lending policy.

Table 1 also reports the changes in the growth rates of world consumption $g_c^w = (1/z)-1$ (that is equal to the growth rate of world GDP net of investment and government spending). As seen the direction of the change in the growth rate of world consumption depends on the characteristics of the taxes that are changed. Since the various taxes influence the levels of current and future consumption, investment and GDP, the net effects reflect the interactions among these changes. Accordingly, the growth rate of world consumption rises if the (second-period) domestic trade account is in a surplus and the budget deficit arises from a cut in taxes on international borrowing. On the other hand the growth rate of world consumption falls if the tax cut on international borrowing occurs in the presence of a (second-period) domestic trade-account deficit, or if the budget deficit stems from a cut in the other taxes.

Expressed in terms of correlations, Table 1 reveals that a budget deficit arising from a pro-borrowing tax policy results in <u>negative</u> cross-country correlations between growth rates of consumption. On the other hand a budget deficit arising from a pro-lending tax policy results in <u>positive</u> cross-country correlations between the growth rates of consumption. As for the cross-country correlations between levels of investment, Table 1 shows that this correlation is positive if the deficit arises from a cut in taxes on consumption or labor income, and the correlation is negative if the budget deficit stems from a cut in taxes on international borrowing and capital income.

The effects of the budget deficit on the <u>levels</u> of domestic and foreign consumption and on the balance of trade depend in general on the shape of the

initial time-profile of taxes, on the initial borrowing needs of the country (being positive or negative) and on the size of the intertemporal elasticity of substitution. The signs of the effects indicated in the last three columns in Table 1 are based on the assumption that the initial tax profile is flat and that the saving functions are not backwards bending. With these assumptions a budget deficit arising from a pro-borrowing tax policy worsens the balance of trade, while a budget deficit arising from a pro-lending tax policy improves the balance of trade.

We conclude by reiterating the principal message of the paper: a proper analysis of the effects of budget deficits on the world economy must specify the details of the tax structure, including the timing of taxes as well as the types of taxes used to finance the budget.

FOOTNOTES

[1]Representative research emphasizing intertemporal considerations in a closed-economy framework is found in Barro (1974, 1979), Feldstein (1974, 1977) and King (1983). For recent surveys and integrations of the various issues see Aschauer and Greewnwood (1985) and Auerbach and Kotlikoff (1987).

[2]Examples of previous analyses of various aspects of the effects of distortionary taxes in the context of a small open economy are found in Aschauer and Greenwood (1985), Greenwood and Kimbrough (1985) and Razin and Svensson (1983). By adopting a two-country model we deal with the interdependencies within the world economy, an issue that could not be addressed in the small-country framework. Some aspects of the interdependencies are examined in van Wijnbergen (forthcoming).

[3]Elsewhere we analysed in detail the effects of government spending on the equilibrium in the world economy and on the international transmission mechanism; see Frenkel and Razin (1985, 1986b).

[4]In a recent tax-reform proposal Hall and Rabushka (1983) advocate the adoption of a consumption-tax system a la Fisher (1939). In specifying the implementation of the consumption tax and its virtues over the conventional income tax they use the closed-economy equivalence relation between a consumption tax and a cash-flow income tax (capital-income tax with expensing plus a labor-income tax). Being confined to a closed-economy framework, they abstract from the role that taxes on international borrowing play in this tax-equivalence relation. For a comprehensive discussion of the closed-economy tax-equivalence propositions see Auerbach and Kotlikoff (1987).

[5]For open-economy analyses emphasizing the pure wealth effects of lump-sum non-distortionary tax policies see Blanchard (1985), Buiter (1986), Frenkel and Razin (1986a) and Persson (1985). In these models the pure wealth effects of budget deficits arise from differences between the time horizon of individuals and of the economy at large.

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