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6 International Spillovers of Taxation

Jacob A. Frenkel, Assaf Razin, and Steve Symansky

Tax policies have profound effects on the temporal composition and on the intertemporal evolution of the macro economy. They influence saving and investment decisions of households and firms as well as decisions governing labor supply and demand. With integrated world markets for goods and capital, the effects of tax policies undertaken by a single country spill over to the rest of the world. Recognition of such international economic interdependence stimulated interest in the international coordination of fiscal policies, in general, and of tax policies and tax reforms, in particular. The purpose of this paper is to highlight key issues pertinent for the understanding of some international effects of domestic tax policies and of international tax harmonization.

The analytical framework used in the paper adopts the saving-investment balance approach to the analysis of international economic interdependence. It thus emphasizes the effects of changes in the time profile of the various taxes on the intertemporal allocations of savings, investment, and labor. These dynamic effects are supplemented by the more conventional effects of the level of taxes on the margins governing labor-leisure choice (such as the negative effect of consumption and income taxes on labor supply). In order to gain some feel for the magnitudes involved, we present in section 6.1

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stylized facts on the time profile of average consumption and income tax rates for the seven major industrial countries. These stylized facts reveal large international diversity of tax rates and tax structures. They also reveal the significant changes that took place over time in some of the countries.

In section 6.2, we present the basic international-intertemporal model. The model, grounded on microeconomic foundations, is neoclassical in nature and is suitable therefore for the analysis of the incentive effects of tax policies. It allows for rich tax structures and contains a detailed specification of public- and private-sector behavior. The various economies are integrated through both goods and capital markets. Our formulation focuses on the roles played by taxes on income and consumption (value-added) as well as by a unified international market for capital.

In section 6.3, we apply the analytical framework to an examination of the international implications of tax harmonization. In this context, we analyze the consequences of revenue-neutral conversions between income and consumption (VAT) tax systems. Reflecting our emphasis on the saving-investment balance, we demonstrate that the effects of such changes in the composition of taxes depend critically on international differences in saving and investment propensities, which in turn govern the time profile of the current account of the balance of payments. The key results are derived analytically and are also illustrated by means of dynamic simulations. In section 6.4, we shift the focus of analysis from the composition of taxes to the timing of taxes. We thus examine the international effects of budget deficits and public-debt management. We demonstrate analytically as well as by means of dynamic simulations that these effects depend critically on whether the government manages its deficit through alterations in income or consumption taxes.

In section 6.5, we combine the analytical framework of section 6.2 with the key elements of the analysis in sections 6.3 and 6.4 to examine the effects of international tax harmonization. The impetus to such an examination is provided by the discussions surrounding the tax harmonization measures (notably the VAT) associated with the move toward the single market of Europe of 1992. The main results conform with those obtained from the analysis of revenue-neutral tax conversions. Accordingly, it is shown that the saving-investment balance approach is useful for the analysis of the effects of international tax harmonization. Specifically, the dynamic simulations demonstrate that these effects depend critically on the intercountry differences in saving and investment propensities. These differences underlie the current account position and its evolution over time. The paper ends with concluding remarks. The appendix that follows the main text presents the details of the simulation model.

6.1 Average Tax Rates in Major Industrial Countries

In this section, we present stylized facts concerning (average) tax rates in the seven major industrial countries: Canada, the United States, Japan,

France, Germany, Italy, and the United Kingdom. Since we focus our theoretical and simulation analysis on changes over time of income and consumption taxes, we attempt to present here some measures of the evolution of these tax rates.

It is important, however, to start with a word of caution: the marginal tax rates relevant for the analysis of investment, savings, and labor supply are relatively clear as a conceptual matter. In practice, however, owing to the complexity of the tax code involving progressivity of taxes, exemptions, tax credits, tax evasion, delays and advances in payments of taxes, and the like, the empirical counterparts to the conceptual marginal tax rates are less clear. Owing to intercountry differences in the tax code in the factors underlying tax collections and in the relative share of state and local governments in total tax revenue, the international comparison of tax rates is even more complex. Keeping these empirical difficulties in mind, we nevertheless attempt to highlight some key features of intercountry differences in consumption and income tax rates. In calculating the various tax rates, we divide the general government tax-revenue data from OECD (1987a) by a corresponding computed tax base from OECD (1987b). We thus generate series of average tax rates for the major industrial countries.[1]

Figure 6.1 exhibits the total tax rate for the period 1973–86.[2] It highlights the international diversity of this measure of the tax burden. While in Japan and the United States the total tax rate is less than 30 percent by 1986, the rest of the OECD are substantially higher, reaching close to 45 percent in

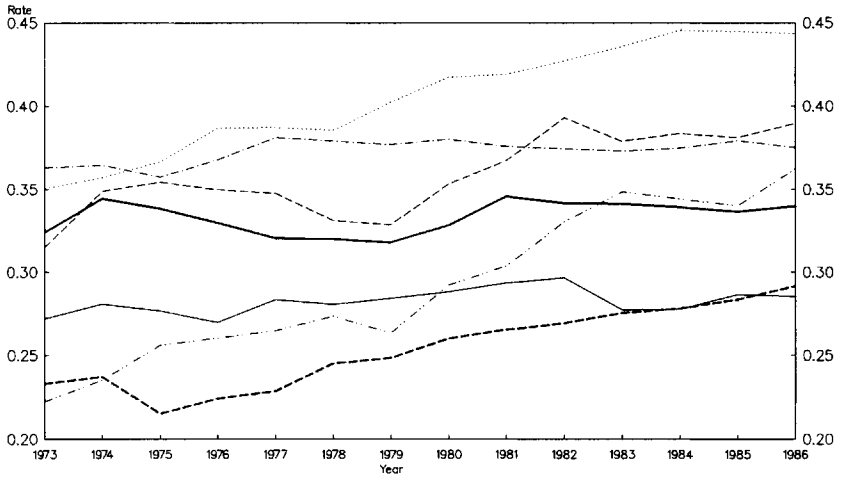

Fig. 6.1 Total tax

France. The other noteworthy feature apparent in figure 6.1 is the different degree of variability of this measure of tax rates over time. For example, while for some countries (e.g., Italy, France, and Japan) this measure of tax rates exhibits a positive trend, for other countries such a trend is less pronounced.

While the total tax rate provides some information regarding the overall tax burden, the key decisions concerning investment, saving, and labor supply depend on the detailed composition of taxes. Our main focus in this paper is on consumption and income taxes. We turn next, therefore, to examine more detailed information. Figure 6.2 exhibits the consumption tax rate. As is evident, the highest measure of the consumption tax rate prevails in France (about 15 percent), while the lowest prevails in Japan and the United States (about 3 percent). The figure also reveals the upward trend (during the 1980s) prevailing in Canada, Italy, and the United Kingdom, whose rate has risen to about 10 percent (the rate prevailing in Germany). In this context, the sharp increase in the U.K. tax rate associated with the decision in 1979 to nearly double the value-added tax rate is especially noteworthy. The intra-European differences in the consumption tax rates are of special relevance in view of the VAT harmonization proposals associated with the plans for Europe of 1992.

Figures 6.3–6.5 exhibit various measures of income tax rates. The personal income tax rates shown in figure 6.3 reveal the international diversity. The highest rate prevails in Canada (about 22 percent), while the lowest rate prevails in France (about 10 percent). Also noteworthy is the upward trend in the Italian personal income tax rate.

The income tax rates shown in figure 6.4 include both personal and corporate taxes. Based on this measure, the highest tax rates prevail in Canada and the United Kingdom. The height of the U.K. tax rate reflects its relatively high corporate income tax. The lowest tax rate (about 10 percent) prevails in France. The significant decline of this measure in 1982 in the United States reflects the sharp fall in the corporate income tax rates associated with the Tax Act of 1981.

The role of the social security and payroll tax rates and the internationally diversity thereof is presented in figure 6.5. We first note the upward trend prevailing in all major industrial countries. A second noteworthy feature is the roles played by these tax rates relative to the income tax rates in Canada and France. While France has the highest social security and payroll tax rate (exceeding one-third), Canada has the lowest rate (below 10 percent). This ranking of Canada and France is the opposite to the one obtained in figure 6.4 pertaining to the personal income tax rate.

In concluding this section, we present in table 6.1 selected summary data on the various tax rates in the major industrial countries and on their changes over time. The international diversity of these rates, notably within Europe, is of special interest in view of the tax harmonization plans for Europe of 1992.

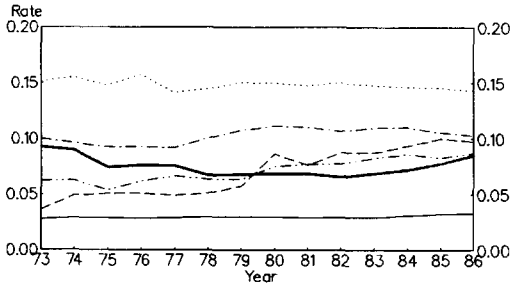

Fig. 6.2 Consumption tax

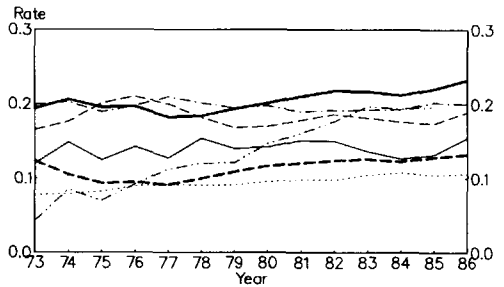

Fig. 6.3 Personal income tax

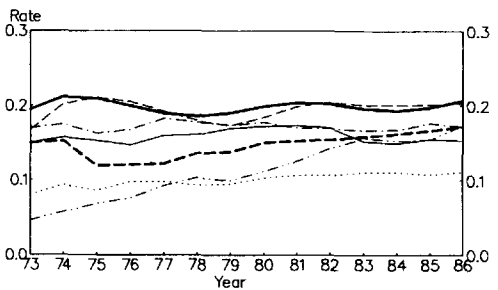

Fig. 6.4 Income tax

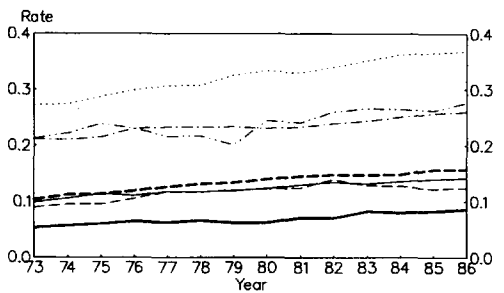

Fig. 6.5 Social security and payroll tax

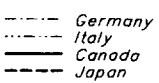

Table 6.1 **Average Tax Rates in the Major Industrial Countries (general government)**

	Total Tax Rate				Consumption Tax Rate				Personal Income Tax Rate				Income Tax Rate				Social Security and Payroll Tax Rate			
	1975	1980	1985	1986	1975	1980	1985	1986	1975	1980	1985	1986	1975	1980	1985	1986	1975	1980	1985	1986
Canada	33.8	32.8	33.6	34.0	7.4	6.8	7.7	8.5	19.6	20.1	22.0	23.2	20.9	19.9	19.7	20.6	6.0	6.2	8.3	8.6
United States	27.7	28.8	28.6	28.5	2.9	3.0	3.2	3.3	12.5	14.2	13.2	15.5	15.3	17.2	15.5	15.3	11.3	12.3	14.0	14.1
Japan	21.5	26.0	28.3	29.2	. . .	. . .	. . .	. . .	9.4	11.6	12.8	13.2	12.0	15.0	16.7	17.2	11.3	13.9	15.7	15.7
France	36.6	41.7	44.5	44.4	14.8	15.0	14.6	14.3	8.3	9.6	10.4	10.6	8.6	10.3	10.8	11.1	28.7	33.4	36.6	36.8
Germany	35.7	38.0	37.9	37.5	9.2	11.1	10.5	10.3	18.9	19.8	20.2	20.0	16.3	17.7	17.6	17.2	21.5	23.0	25.7	26.1
Italy	25.6	29.2	34.0	36.2	5.4	7.5	8.3	8.7	7.0	14.7	19.6	. . .	6.9	11.2	15.4	17.4	23.9	24.4	26.3	27.7
United Kingdom	35.4	35.3	38.1	39.0	5.1	8.6	10.0	9.7	20.1	17.0	17.4	18.9	21.1	18.4	20.2	20.3	9.5	12.3	12.3	12.4

Source: Computed from OECD (1987a) and OECD (1987b).

Note: Our measure of the *consumption-tax rate* is computed as the ratio of general taxes on goods and services (including value-added taxes, sales taxes, and other general taxes on goods and services) to private final consumption. For income taxes, we use various measures distinguishing between individuals and corporations as well as between social security and the more conventional definition of income taxes. Accordingly, the *personal income tax rate* is computed as taxes on incomes, profits, and capital gains of individuals divided by compensation of employees (a broader internationally comparable tax base is unavailable). The *income-tax rate* is computed as the taxes on income, profits, and capital gains (including individual and corporate taxes) divided by the compensation of employees plus property and entrepreneurial income. The *social security and payroll tax rate* is computed as social security contributions and payroll taxes of the work force divided by compensation of employees. Finally, the *total tax rate* is computed as taxes on income, profits, and capital gains plus social security contributions plus payroll taxes plus property taxes plus taxes on goods and services, all divided by GNP or GDP. To maintain a consistent use of the OECD data, we have used GNP for the United States, Japan, and Germany and GDP for Canada, France, Italy, and the United Kingdom.

In the subsequent sections, we provide a sketch of a theoretical analysis highlighting the key factors governing the macroeconomic effects of tax restructuring that is then developed further by means of dynamic simulations.

6.2 The Analytical Framework

In developing the analytical framework, we start with a formulation of the budget constraint that serves to focus attention on the key economic variables and tax-policy parameters that play a central role in the subsequent analysis.[3] The home country's private-sector (full-income) budget constraint applicable to period ($t = 0, 1, \ldots, T - 1$) is

$$(1)\quad (1 + \tau_{ct})C_t + (1 - \tau_{yt})w_t(1 - \ell_t) = (1 - \tau_{yt})[w_t + r_{kt}(K_{t-1} + I_{t-1}) - I_t\left(1 + \frac{b}{2}\frac{I_t}{K_t}\right)] + (1 - \tau_{bt})[B_t^P - (1 + r_{t-1})B_{t-1}^P],$$

where τ_{ct}, τ_{yt}, and τ_{bt} denote the cash flow tax rates on consumption (VAT), income, and international borrowing, respectively. The levels of consumption, labor supply, capital stock, investment, and the private-sector international borrowing are denoted, respectively, by C_t, ℓ_t, K_t, I_t, and B_t^P. The wage rate, the capital-rental rate, and the interest rate are denoted, respectively, by w_t, r_{kt}, and r_t. For convenience, we normalize the endowment of leisure to unity and assume costs of adjustment in capital formation of the form $(\frac{1}{2})bI_t^2/K_t$. We note that in the final period (period T) the private sector settles its debt commitments and no new investment or new borrowing occurs. Accordingly, $I_T = B_T^P = 0$.[4]

To simplify the exposition, we assume a linear production function with fixed coefficients. Thus, the competitive equilibrium conditions imply that the wage rate and the capital-rental rates, w and r_k, are constant. To simplify further, we also assume that the historical debt commitment of the private sector, B_{-1}^P, is zero.

The formulation of the periodic budget constraint illustrates the equivalence relation existing among the taxes on consumption, income, and international borrowing. Indeed, the real effects of any given combination of the three taxes can be duplicated by a policy consisting of any two of them.[5] For example, consider an initial situation with a positive consumption tax rate, $\bar{\tau}_c$ and zero income and international borrowing tax rates. If the consumption tax was eliminated and the income and international borrowing taxes were both set equal to $\bar{\tau}_c/(1 + \bar{\tau}_c)$, then the effective tax rates associated with this new combination of taxes are zero income and international borrowing taxes and a positive ($\bar{\tau}_c$) consumption tax. It follows that the real equilibrium associated with the new tax pattern ($\tau_c = 0$, $\tau_y = \tau_b = \bar{\tau}_c/[1 + \bar{\tau}_c]$) is identical to the one associated with the initial tax pattern ($\tau_c = \bar{\tau}_c$, $\tau_y = \tau_b = 0$).

The periodic (full-income) budget constraints specified in equation (1) can be consolidated to yield the lifetime present-value budget constraint. To facilitate the diagrammatic analysis of subsequent sections, we illustrate the lifetime present-value budget constraint for a two-period case ($t = 0,1$). Accordingly,

$$(2) \qquad C_0 + \alpha_c C_1 + \left(\frac{1 - \tau_{y0}}{1 + \tau_{c0}}\right)[w(1 - \ell_0) + \alpha_L w(1 - \ell_1)]$$

$$= \left(\frac{1 - \tau_{y0}}{1 + \tau_{c0}}\right) w + \left(\frac{1 - \tau_{y1}}{1 + \tau_{c1}}\right)\alpha_c w + \left(\frac{1 - \tau_{y0}}{1 + \tau_{c0}}\right)$$

$$\left[r_k K_0 + \alpha_I(a + r_k)K_1 - I_0\left(1 + \frac{b}{2}\frac{I_0}{K_0}\right)\right],$$

where

$$\alpha_c = \frac{(1 + \tau_{c1})}{(1 + \tau_{c0})}\frac{(1 - \tau_{b0})}{(1 - \tau_{b1})}\frac{1}{(1 + r_0)},$$

$$\alpha_L = \alpha_I$$

$$= \frac{(1 - \tau_{y1})}{(1 - \tau_{y0})}\frac{(1 - \tau_{b0})}{(1 - \tau_{b1})}\frac{1}{(1 + r_0)}.$$

As indicated, the discount factors α_c, α_L, and α_I are the effective (tax-adjusted) discount factors governing intertemporal consumption, leisure, and investment decisions, respectively.[6] The intratemporal choice between labor supply (leisure) and consumption of ordinary goods is governed by the prevailing effective intratemporal tax ratio $(1 - \tau_y)/(1 + \tau_c)$. We note that in this cash flow formulation the effective discount factor governing intertemporal consumption decisions, α_c, is independent of the income tax whereas the effective discount factors governing investment and leisure decisions, α_I and α_L, are independent of the consumption tax. In addition, the effective discount factors depend on the time path of the various taxes rather than on their levels. Specifically, if the various tax rates do not vary over time, then their time paths are "flat," and the effective discount factors α_c, α_L, and α_I are equal to the undistorted tax-free factor, $\alpha = 1/(1 + r_0)$. In that case, the intertemporal allocations are undistorted while the intratemporal allocations are distorted if the intratemporal tax ratio differs from unity.

Having discussed the formulation of the private-sector budget constraint, we turn next to the specification of the multiperiod utility function. To facilitate the discussion of the simulations reported in subsequent sections, we need to specify its form in some detail. We thus suppose that the

homothetic intraperiod utility function between consumption of ordinary goods and leisure is

$$u_t = [\beta C_t^{\frac{\sigma-1}{\sigma}} + (1-\beta)(1-\ell_t)^{\frac{\sigma-1}{\sigma}}]^{\frac{\sigma}{\sigma-1}} \tag{3}$$

while the interperiod utility function is

$$\cup_0 = \sum_{t=0}^{T} \delta^t \log(u_t), \tag{4}$$

where σ is the temporal elasticity of substitution between leisure and consumption of ordinary goods, β is the distributive parameter of consumption, and δ is the subjective discount factor.

Maximizing the utility functions in equations (3) and (4) subject to the lifetime present-value budget constraint (the multiperiod analogue to eq. [2]) yields the utility-based real spending, u, its associated price index, P, and the periodic demand functions for the consumption of ordinary goods, C, and leisure, $1-\ell$, as follows:

$$u_t = \left(\sum_{s=0}^{T} \delta^s\right)^{-1} \frac{W_0 \delta_t}{P_t \alpha_t}, \tag{5}$$

where α_t is period-t present-value factor (i.e.,

$$\alpha_t = [(1+r_0)(1+r_1)\ldots(1+r_{t-1})]^{-1}.$$

$$P_t = \left(\beta^\sigma \left(\frac{1+\tau_{ct}}{1-\tau_{bt}}\right)^{1-\sigma} + (1-\beta)^\sigma \left\{\left[\frac{(1-\tau_{yt})}{(1-\tau_{bt})}\right] w\right\}^{1-\sigma}\right)^{\frac{1}{1-\sigma}}, \tag{6}$$

$$C_t = \frac{\beta^\sigma \left[\frac{(1+\tau_{ct})}{(1-\tau_{bt})}\right]^{-\sigma} P_t u_t}{\beta^\sigma \left(\frac{1+\tau_{ct}}{1-\tau_{bt}}\right)^{1-\sigma} + (1-\beta)^\sigma \left[\frac{(1-\tau_{yt})}{(1-\tau_{bt})} w\right]^{1-\sigma}}, \tag{7}$$

$$1-\ell_t = \frac{(1-\beta)^\sigma \left[\frac{(1-\tau_{yt})}{(1-\tau_{bt})} w\right]^{-\sigma} P_t u_t}{\beta^\sigma \left[\frac{1+\tau_{ct}}{1-\tau_{bt}}\right]^{1-\sigma} + (1-\beta)^\sigma \left[\frac{(1-\tau_{yt})}{(1-\tau_{bt})} w\right]^{1-\sigma}}, \tag{8}$$

where $t = 1, 1, \ldots, T$, and where wealth is

$$W_0 = \sum_{t=0}^{T} \alpha_t \frac{(1-\tau_{yt})}{(1-\tau_{bt})}\left[w + r_k K_t - I_t\left(1 + \frac{b}{2}\frac{I_t}{K_t}\right)\right] + \alpha_T \frac{(1+\tau_{yT})}{(1-\tau_{bT})} a K_T.$$

To complete the description of the private-sector behavior, we maximize the representative individual wealth, W_0, with respect to investment, I_t.[7] This yields

$$(9) \quad -\frac{1-\tau_{yt}}{1-\tau_{bt}}\alpha_t\left(1+b\frac{I_{t-1}}{K_{t-1}}\right)+\sum_{s=t}^{T}\frac{(1-\tau_{ys})}{(1-\tau_{bs})}\alpha_s\left[r_k+\frac{b}{2}\left(\frac{I_s}{K_s}\right)^2\right] + (r_k+a)\alpha_T = 0.$$

Equation (9) represents the implicit investment rule. The negative term is equal to the marginal cost of investment in period t, while the positive terms are equal to the marginal benefits consisting of the rise in output resulting from the increased capital stock (the terms with r_k and a) and the fall in the future cost of investment (the terms associated with $[b/2] \cdot [I/K]^2$); all terms are expressed as present values adjusted for taxes. For the two-period case, the investment function implied by equation (9) is

$$(9a) \quad I_0 = \frac{1}{b}[\alpha_I(a+r_k)-1]K_0 .$$

Equation (9a) together with the assumption that $(a + r_k)$ exceeds unity (an assumption necessary for a positive level of investment in the two-period case) implies that the level of investment rises with the initial capital stock, K_0, with the effective (tax-adjusted) discount factor, α_I, with the rental rate, r_k, and with the consumption-coefficient, a, attached to the final-period capital. On the other hand, investment falls with an increase in the cost-of-adjustment parameter, b.

This completes the presentation of the key building blocks of the model. In the subsequent sections, we use the model for the analysis of three issues in tax restructuring: revenue-neutral tax conversions, budgetary imbalances arising from changes in the time profile of taxes, and international tax harmonization.

6.3 Revenue-Neutral Tax Conversions

In examining the effects of tax conversions between income and consumption tax systems, we focus on revenue-neutral reforms. By ensuring that the restructuring of the tax system does not result in budgetary imbalances (which are considered separately in sec. 6.4), we obtain the pure effects of tax conversions. The present section is divided into four subsections. The first lays the groundwork by considering tax conversions in a small open economy, the second extends the analytical framework to a two-country model of the world economy, the third examines tax conversions in this extended framework, and the fourth reports on some dynamic simulations.

6.3.1 Tax Conversions in a Small Open Economy

In considering revenue-neutral tax reforms, we note that such reforms are characterized by a change in the composition of a given tax revenue among different tax bases. It is obtained through alterations in the various tax rates designed to keep total tax revenue in each period intact. In what follows, we focus on a reform that substitutes a consumption tax (VAT) system for an income tax system.[8]

Even though the focus is on consumption and income tax systems, the equivalence relation that exists among the consumption, income, and international borrowing taxes permits us to simplify the exposition. Accordingly, we set the explicit consumption tax rate, τ_c, equal to zero while maintaining the rates of the other taxes, τ_b and τ_y, different from zero so as to assure a constant tax revenue. To simplify further, we consider the two-period case with inelastic labor supply[9] and an international borrowing tax equal to a fixed proportion, θ, of the income tax. Accordingly,

$$\tau_{ct} = 0, \quad \tau_{bt} = \theta\tau_{yt}, \quad 0 \leq \theta \leq 1, \quad t = 0, 1. \tag{10}$$

Substituting (10) into the expressions for the effective discount factors (in eq. [2]) yields

$$\alpha_c = \frac{(1 - \theta\tau_{y0})}{(1 - \theta\tau_{y1})}\alpha, \quad \alpha_I = \frac{(1 - \tau_{y1})(1 - \theta\tau_{y0})}{(1 - \tau_{y0})(1 - \theta\tau_{y1})}\alpha. \tag{11}$$

In the extreme case for which the proportionality factor, θ, is equal to zero, equation (11) implies that the effective-discount factor applicable to consumption decisions, α_c, equals the undistorted tax-free discount factor α. In that case, the tax system amounts to a pure income-tax system. In the other extreme case for which the proportionality factor, θ, is equal to unity, equation (11) implies that the effective discount factor applicable to investment decisions, α_I, is equal to the tax-free discount factor α. In that case, the tax system amounts to a pure consumption tax system.

In figure 6.6, we analyze the effects of revenue-neutral conversions involving consumption and income tax systems.[10] In the figure, we portray combinations of the intertemporal income tax rates, τ_{y1}/τ_{y0}, and the intratemporal (constant) proportionality factor, $\theta = \tau_b/\tau_y$, which generate constant tax revenue. The resulting iso-tax-revenue schedule is denoted by RR. The slope of the schedule depends on the initial-period trade-balance position. For the case drawn, the trade-balance position is in surplus, and the schedule is negatively sloped.

To verify that with a trade-balance surplus the iso-tax-revenue schedule is downward sloping, consider a change from a consumption tax system, in which $\theta = 1$ (e.g., point B), to an income-tax system, in which $\theta = 0$ (e.g., point A). This change can be thought of as consisting of two components. First, it involves a permanent reduction of the prevailing (consumption) tax and a permanent equiproportional rise of the other tax

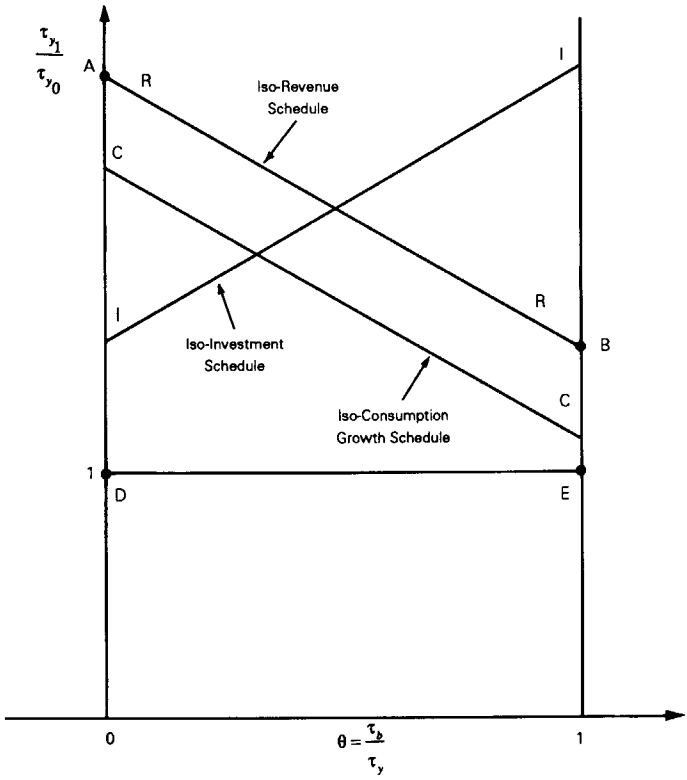

Fig. 6.6 Revenue-neutral tax conversions in a small, open economy

Data: $B^f_{-1} = 0, \tau_{c_t} = 0, \tau_{b_t} = \theta\tau_{x_t}, 0 \leq \theta \leq 1$,
The economy runs a current-period
trade balance surplus

(income tax). Second, it involves further adjustments in the newly introduced tax aimed at restoring the initial level of tax revenue. If the economy runs a current-period trade-balance surplus so that in the current period income minus investment (the income tax base) exceeds consumption (the consumption tax base) while in the future, owing to the intertemporal budget constraint, this pattern is reversed, the first component of the reform results in a budget surplus in the current period and in a budget deficit in the future. Evidently, the second component of the reform aimed at restoring the initial level of tax revenue lowers the income tax rate in the current period and raises the income tax rate in the future. As a result, the intertemporal income tax ratio, τ_{y1}/τ_{y0}, rises. It follows that the fall in the proportionality factor, θ, from one to zero, holding tax revenue intact, must be associated with a rise in the ratio τ_{y1}/τ_{y0}.

In figure 6.6, this is reflected by the negative slope of the iso-tax-revenue schedule connecting points A and B. If, on the other hand, the initial period trade-balance position is in deficit, the iso-tax-revenue schedule is positively sloped.

The II schedule in figure 6.6 portrays combinations of the intertemporal ratio, τ_{y1}/τ_{y0}, and the proportionality factor, θ, along which the level of investment remains intact. As is evident from the definition of the effective discount factor α_I in equation (11), a rise in the proportionality factor, θ, raises the effective discount factor, α_I, and encourages investment if the intertemporal income tax ratio, τ_{y1}/τ_{y0}, exceeds unity. In that case, in order to maintain the initial level of investment intact, the rise in θ (which raises α_I) must be accompanied by a rise in the intertemporal income tax ratio (which lowers α_I). This is the case shown by the positively sloped II schedule in figure 6.6.

The CC schedule in figure 6.6 portrays combinations of τ_{y1}/τ_{y0} and θ that maintain a given growth rate of consumption (indicated by the intertemporal consumption ratio C_1/C_0). Applying a similar reasoning to the analysis of the effects of changes in θ and τ_{y1}/τ_{y0} on the effective discount factor α_c in equation (11), it can be verified that the iso-consumption-growth schedule, CC, is negatively sloped if the intertemporal income tax ratio exceeds unity. The slopes of the II and the CC schedules are reversed if the intertemporal income tax ratio falls short of unity. In the borderline case in which the path of the income tax rates is flat (so that $\tau_{y1}/\tau_{y0} = 1$), the two schedules coincide with the horizontal line DE.[11]

These ingredients can now be used to analyze the consequences of a revenue-neutral tax conversion. As should be evident from the foregoing discussion, the key factor governing the effects of such tax policies is the initial trade-balance position. In terms of figure 6.6, if the economy runs a current-period trade-balance surplus and the intertemporal income tax ratio exceeds unity, then a revenue-neutral tax reform that replaces a consumption tax system (indicated by point B) by an income tax system (indicated by point A) moves the economy to new iso-investment and iso-consumption growth schedules passing through point A (not drawn). These new schedules correspond to lower investment and growth rate of consumption. A similar argument shows that, if the economy runs a current-period trade-balance deficit, the same tax conversion reduces the level of investment and lowers the growth rate of consumption.[12]

If the tax conversion is in the opposite direction so that an income tax system is replaced by a consumption tax system and the economy runs a trade-balance surplus, then such a conversion shifts the equilibrium from point A to point B in figure 6.6. The iso-investment and iso-consumption growth schedules passing through point B (not drawn) indicate that the new equilibrium is associated with a higher level of investment and growth rate of consumption. The opposite results obtain if the initial position is of trade-balance surplus.

6.3.2 The World Economy

We now extend the analysis to a two-country model of the world economy consisting of the domestic and the foreign countries. The economic structure of the foreign economy is similar to that of the domestic economy described in section 6.3.1. The endowments and the parameters of the production and utility functions, however, may differ across countries. Variables pertaining to the foreign country are denoted by asterisks. In contrast with the small-country case, the world rate of interest is endogenously determined in the two-country model. To facilitate the exposition, we assume that initially all taxes are zero. Thus, in terms of equation (2), the domestic discount factors governing consumption and investment decisions, α_c and α_I, respectively, are initially equal to the world discount factor $\alpha = 1/(1 + r_0)$.

In what follows, we carry out the analysis by means of a simple diagrammatic apparatus.[13] The initial equilibrium is portrayed in figure 6.7, in which the upward-sloping schedule, S^w, describes the ratio, z, of current to future world GDP net of investment (denoted by z) as an increasing function of the rate of interest. Accordingly, the world relative supply (evaluated at $r = r_0$) is

$$z^w = \frac{Y_0 - I_0\left[1 + \frac{1}{2}b(I_0/K_0)\right] + Y_0^* - I_0^*\left[1 + \frac{1}{2}b^*(I_0^*/K_0^*)\right]}{Y_1 + Y_1^*}, \tag{12}$$

where Y denotes output.

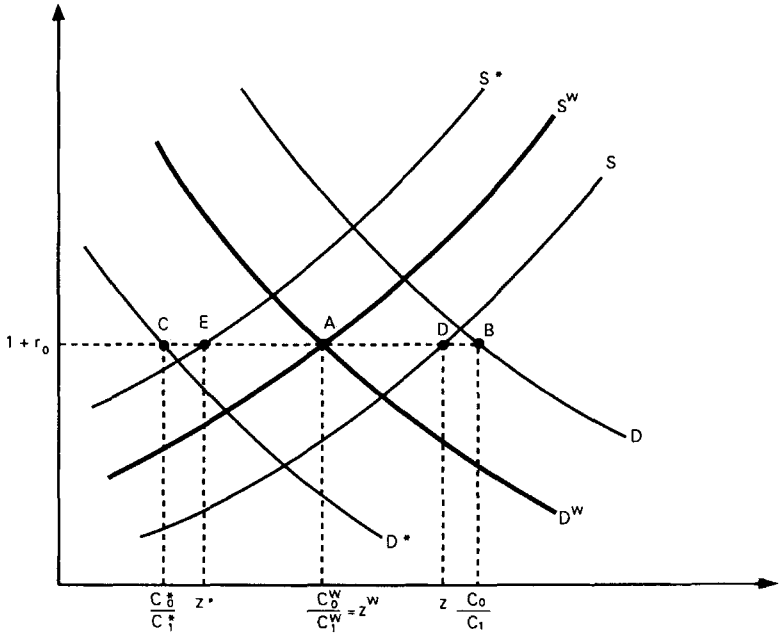

Fig. 6.7 Relative demands, relative supplies and world equilibrium

The positive dependence of z on the rate of interest reflects the fact that a rise in the rate of interest lowers investment. The world relative supply schedule, S^w, is a weighted average of the domestic country relative supply schedule, S, where

$$S = \left[Y_0 - I_0\left(1 + \frac{1}{2} b \frac{I_0}{K_0}\right)\right]/Y_1,$$

and the foreign country relative supply schedule, S^*, where

$$S^* = \left[Y_0^* - I_0^*\left(1 + \frac{1}{2} b^* \frac{I_0^*}{K_0^*}\right)\right]/Y_1^*.$$

Accordingly,

$$S^w = \mu_s S + (1 - \mu_s)S^*, \tag{13}$$

where the domestic-country weight is

$$\mu_s = \frac{Y_1}{Y_1 + Y_1^*}. \tag{14}$$

The downward-sloping schedules in figure 6.7 plot the desired ratio of current to future consumption as a decreasing function of the rate of interest. The domestic and foreign relative demands are denoted by D and D^*, respectively, and their values at the point in which $C_0/C_1 = C_0^*/C_1^* = 1$ are one plus the subjective rate of time preference, $1/\delta$ and $1/\delta^*$.

Analogously to the construction of the world relative supply, the world relative demand, $D^w = C_0^w/C_1^w = (C_0 + C_0^*) / (C_1 + C_1^*)$, is a weighted average of the two countries' relative demands, $D = C_0/C_1$ and $D^* = C_0^*/C_1^*$. Accordingly,

$$D^w = \mu_d D + (1 - \mu_d)D^*, \tag{15}$$

where the domestic-country weight is

$$\mu_d = \frac{C_1}{C_1 + C_1^*}. \tag{16}$$

The initial equilibrium is exhibited by point A in figure 6.7. As shown, the world rate of interest is r_0, and the world consumption ratio (indicating the reciprocal of the growth rate of world consumption) is C_0^w/C_1^w. The domestic and foreign consumption ratios corresponding to this equilibrium are C_0/C_1 and C_0^*/C_1^*, as indicated by points B and C, respectively. We also note that the domestic and foreign relative supplies associated with this equilibrium are z and z^*, as indicated by points D and E, respectively. As is evident, these levels of relative supplies are associated with the equilibrium levels of domestic and foreign investment. Finally, since point B lies to the right of point D while point C lies to the left of point E, the domestic economy runs an initial-period trade-balance deficit while the foreign economy runs a

corresponding trade-balance surplus. This pattern of trade imbalances is implied from the assumed zero level of the predetermined initial debt position. Obviously, solvency implies that this configuration of trade imbalances is reversed in the subsequent period. We also note that this pattern of trade imbalances implies that the equilibrium domestic relative demand weight, μ_d, falls short of the corresponding relative supply weight, μ_s.[14]

6.3.3 Tax Conversions in a Two-Country World Economy

Consider a revenue-neutral tax reform that introduces a consumption tax system in place of an income tax system. As before, the tax reform can be divided into two components. We first introduce permanent consumption taxes at the rate τ_c accompanied by the equiproportional reduction in income taxes.[15] As is evident from our previous discussions, this tax shift creates a current-period government budget surplus if the domestic economy runs a current-period trade-balance deficit, and vice versa. Obviously, this pattern of budgetary and trade imbalances is reversed in the subsequent period. The second component of the tax reform aims at restoring revenue neutrality in each period. Since the economy has adopted a consumption tax system, it is assumed that the restoration of revenue neutrality is achieved through appropriate further adjustments in the consumption tax rates.

Suppose that the domestic economy runs an initial-period trade-balance deficit. Under such circumstances, the first component of the tax reform results in an initial-period government budget surplus and in a corresponding future-period deficit. To restore revenue neutrality, the current-period consumption tax rate, τ_{c0}, must be lowered while the corresponding future-period rate, τ_{c1}, must be raised. This pattern of tax rates breaks the initial flatness of the time profile of the consumption tax so that $\tau_{c0} < \tau_{c1}$. The new configuration of the consumption tax rates raises α_c—the effective discount factor applicable to consumption decisions—so that $\alpha_c = [(1 + \tau_{c1})/(1 + \tau_{c0})]\alpha$ exceeds the world discount factor $\alpha = 1/(1 + r_0)$. Since income taxes remain flat, the effective discount factor applicable to investment decisions remains intact, so that $\alpha_I = \alpha$.

Armed with this information, we analyze in figure 6.8 the effects of this tax reform. The initial equilibrium is portrayed by point A at which the world rate of interest is r_0 (as in fig. 6.7). The rise in the effective discount factor applicable to consumption (i.e., the reduction in the corresponding effective rate of interest) induces an intertemporal substitution in domestic demand toward current-period 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 tax-induced rise in the effective discount factor. This proportion is $(1 + \tau_{c1})/(1 + \tau_{c0})$. Associated with the new levels of domestic demand, the new world relative demand $(C_0 + C_0^*)/(C_1 + C_1^*)$ also shifts to the right from D^w to $D^{w'}$ in figure 6.8. This shift

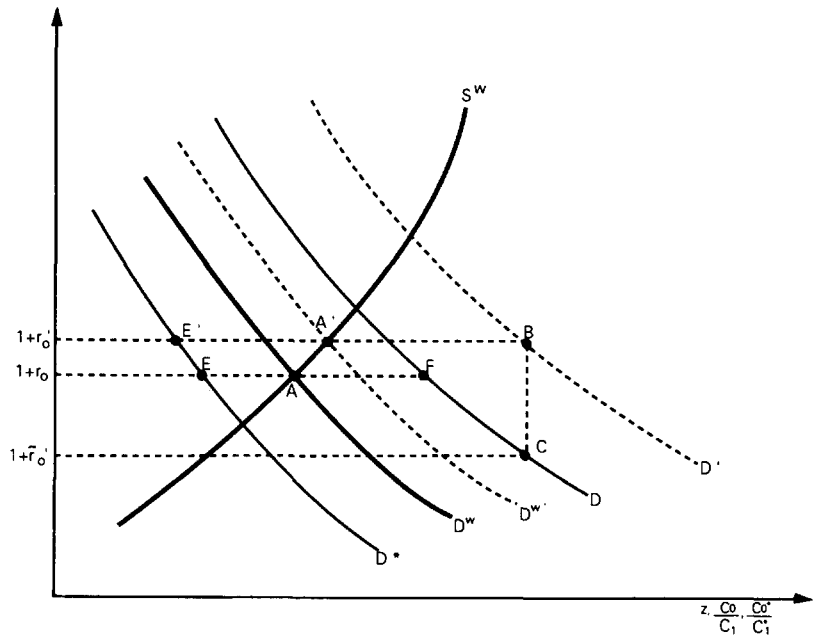

Fig. 6.8 The effects of a revenue-neutral tax shift from income taxes to consumption taxes with an initial-period domestic trade-balance deficit

reflects the substitution from future to current-period consumption in the domestic economy.[16] Furthermore, the proportional displacement of the world relative demand schedule is smaller than the corresponding displacement of the domestic relative demand schedule.[17]

In contrast with the effects of the tax reforms on the relative demand schedules, this reform does not affect the effective discount factor applicable to investment decisions, and it leaves the world relative supply schedule intact. The new equilibrium obtains at the intersection of the (unchanged) world relative supply schedule, S^w, and the new world relative demand schedule, $D^{w\prime}$. This equilibrium is indicated by point A′ in figure 6.8, at which the world rate of interest has risen from r_0 to r_0'.

To determine the incidence of this change on the domestic effective rate of interest, we subtract from $1 + r_0$ the distance BC, representing the tax-induced percentage change in the effective discount factor. This yields $1 + \tilde{r}_0'$ in figure 6.8. As is evident, $\tilde{r}_0'$ is lower than the initial world rate r_0 since the vertical displacement of the D^w schedule is smaller than the magnitude represented by the distance BC.

In view of the rise in the world rate of interest, both domestic and foreign investment fall, and the rate of growth of foreign consumption, as indicated by the move from point E to point E′ in figure 6.8, rises. On the other hand, the fall in the domestic effective rate of interest applicable to consumption

lowers the rate of growth of domestic consumption, as indicated by the move from point F to point C. Thus, this tax reform crowds out both domestic and foreign investment and results in a negative correlation between the rates of growth of domestic and foreign consumption. Using similar reasoning, we can show that, in the presence of an initial surplus in the balance of trade, the tax reform crowds in both domestic and foreign investment, lowers the rate of growth of foreign consumption, and raises the growth rate of domestic consumption. As in the small-country case (discussed in sec. 6.3.1), this analysis also underscores the critical importance of the trade-balance position in determining the domestic and international effects of such a tax reform.

The same reasoning can be used to analyze the opposite tax conversion, from a consumption tax to an income tax system. In that case, the first component of the tax restructuring yields a budgetary deficit if the initial-period current-account position was in deficit (so that income net of investment falls short of consumption). The restoration of revenue neutrality therefore involves a rise in the initial-period income tax rate, τ_{y0}, and a corresponding reduction in the future-period income tax rate, τ_{y1}. These changes in the time profile of income taxes raise the effective discount factor governing investment decisions, α_I, while keeping intact the effective discount factor governing consumption decisions, α_c. In terms of figures 6.7–6.8, the rise in investment induces a leftward shift of the relative supply schedule, resulting in a higher world rate of interest. The rise in the world rate of interest crowds out foreign investment, while the fall in the domestic effective rate of interest applicable to domestic investment decisions crowds in domestic investment. This tax conversion also raises the rates of growth of domestic and foreign consumption. As is evident, in contrast with the case shown in figure 6.8 in which the tax conversion from income to consumption tax system alters the relative demand schedules, in the present case, where the conversion is from a consumption to an income tax system, the reform alters the world equilibrium through its effect on the relative supply schedules. Obviously, these results reflect the assumed initial-period trade-balance deficit. They are reversed if the initial-period trade-balance position is in surplus.

6.3.4 Dynamic Simulations of Tax Conversions

The foregoing analysis identified the key factors determining the domestic and international consequences of revenue-neutral tax reforms. We turn next to highlight these features by means of dynamic simulations. For that purpose, we return to the multiperiod model and allow for a variable labor supply. The detailed specification of the two-country dynamic-simulation model is provided in the appendix.

In performing the simulations, we first computed a baseline equilibrium. This equilibrium was then perturbed by the assumed tax conversion. The various figures presented below show the effects of the tax restructuring measured as percentage deviations from the baseline levels.

As indicated by the theoretical analysis, a key factor governing the effects of such revenue-neutral tax conversions is the time pattern of the trade-balance position. Since the trade-balance position can be expressed in terms of the saving-investment gap, trade imbalances reflect intercountry differences in either saving propensities (induced, e.g., by differences between the subjective discount factors, δ and δ^*) or investment patterns (induced, e.g., by differences between the productivities of capital, r_k and r_k^*). In figures 6.9–6.12, we plot the simulation results for cases distinguished according to the time pattern of trade imbalances. We focus in these simulations on tax conversions from an income to a consumption tax system. Throughout, we assume that the home country reduces permanently its income tax rates by 5 percent and restores its tax revenue by raising consumption tax rates.

Consider first figures 6.9 and 6.10. These figures characterize the situation in which in the early periods the home country runs trade-balance deficits. Obviously, the intertemporal budget constraints imply that in later periods the country runs trade-balance surpluses. The initial domestic trade deficits may arise from either a relatively low saving propensity ($\delta < \delta^*$), shown in figure 6.9, or from a relatively high productivity of capital ($r_k > r_k^*$), shown in figure 6.10. These figures demonstrate the results obtained in the simplified theoretical analysis as well as new results reflecting the multiperiod-variable labor supply model. As seen, the revenue-neutral tax conversion policy from income to consumption taxes raises the world rates of interest, lowers domestic and foreign investment, and worsens the home country's (early-periods) current account of the balance payments. Reflecting the solvency requirement, the simulations show that, in the medium term, the home country's current account improves. Throughout the adjustment process, the home country external-debt position worsens. The changes in the domestic tax structure induce corresponding changes in labor supply and output. As seen, both domestic employment and output decline in the early periods following the tax conversion. In the medium term, the level of domestic employment rises. The medium-term effects of the tax conversion on the level of domestic output reflect the rise in employment and the decline in the capital stock. Figure 6.9 shows a case in which output rises in the medium term, while figure 6.10 shows the opposite case. These results, which correspond to the case in which the home country runs trade-balance deficits in the early period, are reversed in the opposite case, in which the country runs early-periods trade surpluses. Such an opposite pattern is exhibited in figures 6.11 and 6.12, corresponding, respectively, to the cases in which the home country has a high saving propensity ($\delta > \delta^*$) and low investment ($r_k < r_k^*$).

6.4 Budget Deficits under Consumption and Income Tax Systems

The analysis in section 6.3 focused on the effects of changes in the composition of taxes while maintaining in each period a given value of total

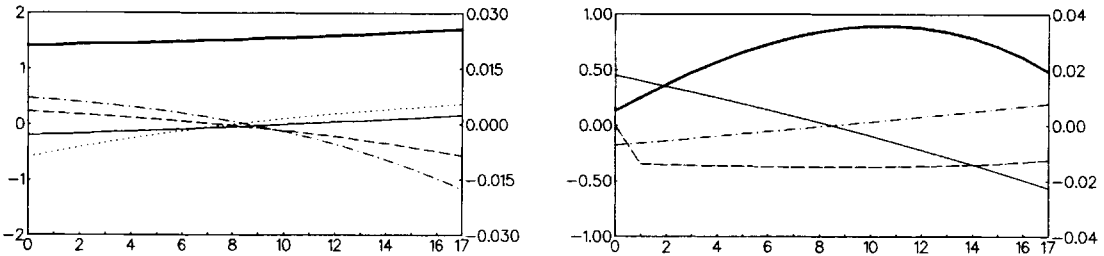

Fig. 6.9 Tax conversion: consumption tax replacing 5% income tax

$\delta < \delta^*$

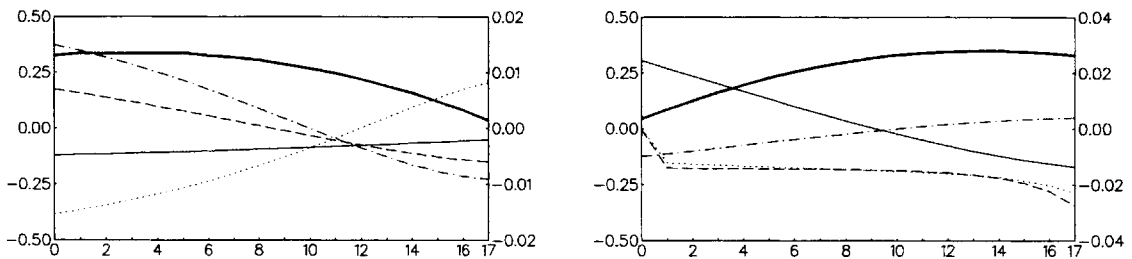

Fig. 6.10 Tax conversion: consumption tax replacing 5% income tax

$r_k > r_k^*$

(Percentage deviations)

- *Home output*
- *Foreign output*
- *Home labor*
- *Foreign labor*
- *Interest rate (right scale, basis points)*
- *Home investment*
- *Foreign investment*
- *Home consumption*
- *Foreign consumption*
- *Home external debt (right scale, level)*

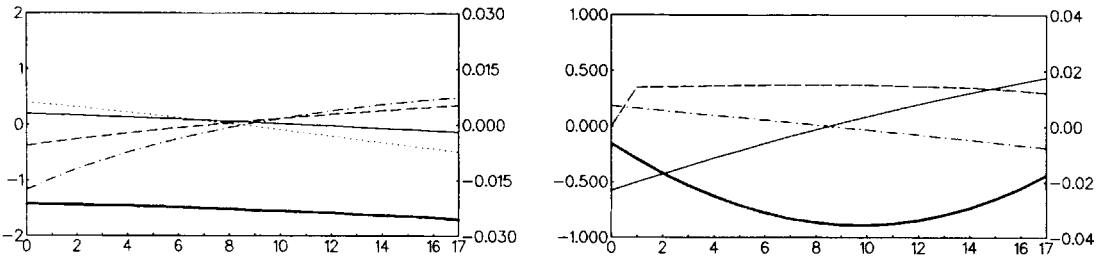

Fig. 6.11 Tax conversion: consumption tax replacing 5% income tax

$\delta > \delta^*$

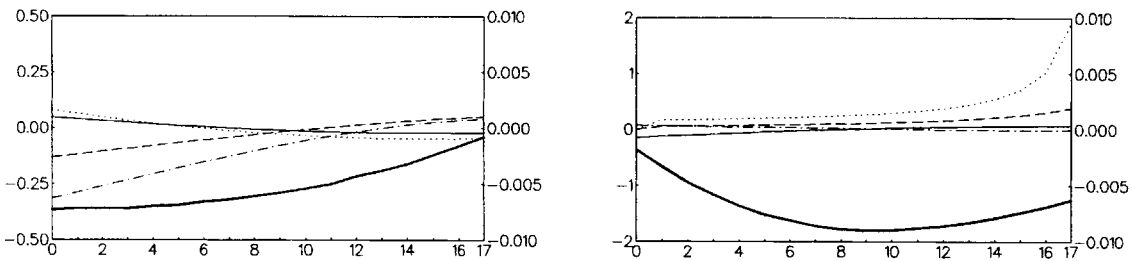

Fig. 6.12 Tax conversion: consumption tax replacing 5% income tax

$r_k < r_k^*$

(Percentage deviations)

- *Home output*
- *Foreign output*
- *Home labor*
- *Foreign labor*
- *Interest rate (right scale, basis points)*
- *Home investment*
- *Foreign investment*
- *Home consumption*
- *Foreign consumption*
- *Home external debt (right scale, level)*

tax revenue. Such revenue-neutral tax restructuring ensures that the tax conversion policies do not affect the budgetary imbalances. In this section, we use the same analytical framework to shed light on the domestic and international macroeconomic consequences of changes in the timing of taxes and provide dynamic simulations.[18]

6.4.1 Budget Deficits in a Two-Country World Economy

Consider the effects of budget deficits arising from a current tax cut. Of course, the intertemporal government budget constraint implies that, as long as government spending remains intact, the current tax cut must be followed by a future rise in taxes. The main conclusion of the analysis is that the effect of budget deficits depends critically on whether it arises from changes in the timing of consumption or income taxes.

Consider first a budget deficit arising from a current-period consumption tax cut (followed by a corresponding rise in future consumption taxes). As is evident from the definitions of the effective discount factors in equation (2), such a tax shift raises the effective discount factor governing consumption decisions, α_c, while leaving the discount factor governing investment decisions intact. These changes induce a substitution of demand from future to current consumption and induce rightward shifts of the domestic (and the world) relative demand schedules in figure 6.7 while leaving the relative supply schedules intact.[19]

Figure 6.8, which was used for the analysis of tax conversion from income to consumption tax systems, is also fully applicable for the analysis of the budget deficit under the consumption tax system. Accordingly, the budget deficit raises the world rate of interest and crowds out domestic and foreign investment. It also lowers the growth rate of domestic consumption while raising the growth rate of foreign consumption.

By the same reasoning, a budget deficit arising from a cut in current income tax rates (and followed by a corresponding rise in future income tax rates) yields results similar to those obtained under a revenue-neutral tax conversion from consumption to income tax systems. Again, as is evident from the definitions of the effective discount factors in equation (2), this change in the timing of income tax rates lowers the effective discount factor governing investment decisions, α_I, and discourages domestic investment while leaving α_c intact. In terms of figure 6.7, these tax changes induce a rightward shift of the domestic (and the world) relative supply schedule while leaving the relative demand schedules intact. As a result, the world rate of interest falls, foreign investment rises, and the domestic investment is crowded out. At the same time, the lower world rate of interest lowers the growth rate of both domestic and foreign consumption.

6.4.2 Dynamic Simulations of Budget Deficits

The simulations that allow for a variable labor supply in a multiperiod model illustrate the key relations implied by the theoretical model: they underscore

the critical importance of the underlying tax system in determining the macroeconomic effects of budget deficits. They also provide further insights into the dynamic consequences of budget deficits.

Figures 6.13 and 6.14 contain selected simulations of the dynamic effects of current-period budget deficits under a consumption tax system and under an income tax system, respectively. We assume that the current-period deficit arises from a 10 percent reduction in tax rates, which is made up for by a permanent rise in tax rates in all future periods. By and large, the directions of changes in the various variables in the two figures are opposite to each other. This underscores the key proposition of the theoretical analysis. In addition, the simulations show that the effects of the budget deficit on the qualitative characteristics of the time path of employment and output also depend critically on the underlying tax system. Specifically, under a consumption tax system, a domestic budget deficit exerts recessionary effects on the contemporaneous levels of domestic employment and output and expansionary effects on the corresponding levels abroad. These employment and output effects are reversed in all future periods.[20] In contrast, under an income tax system, the same budget deficit induces a contemporaneous expansion at home and a recession abroad. These changes are reversed in subsequent periods. In general, the international transmission of the effects of budget deficits is shown to be negative in both the short and the medium run.

We also note that the current-period budget deficit exerts opposite effects on the levels of domestic and foreign consumption. Under a consumption tax system, the deficit raises current-period domestic consumption and lowers the corresponding level of foreign consumption. These changes are reversed in subsequent periods. In contrast, under an income tax system, domestic consumption falls in the current period while foreign consumption rises, and, as before, these changes are reversed in subsequent periods. Again, in terms of the correlations between domestic and foreign consumption, the simulations demonstrate the negative transmission of the effects of domestic budget deficits.

The effects of the budget deficits on the time paths of consumption and leisure influence the levels of domestic and foreign welfare. Using the utility function specified in equation (4), our simulations show that the current period budget deficit, arising from a 10 percent reduction in the consumption tax rate, raises the level of domestic welfare (by about 2 percent) and lowers the level of foreign welfare (by about 1.5 percent). In contrast, if the current-period budget deficit arises from a 10 percent reduction in the income tax rate, then the level of domestic welfare falls (by about 3 percent) while the corresponding foreign welfare rises (by about 3.5 percent). These opposite changes in the levels of domestic and foreign welfare reflect the negative transmission of the effects of budget deficits.

The effects of an expected future-period budget deficit are shown in figures 6.15–6.16. These simulations show the consequences of an expected 10 percent tax cut in periods 4 and 5 that is then made up for by a permanent

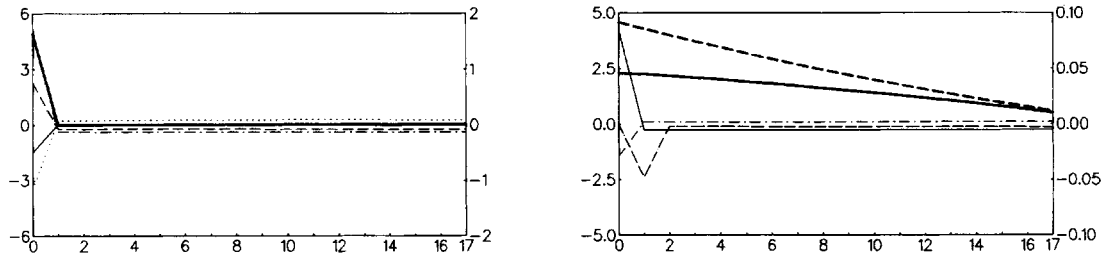

Fig. 6.13 Budget deficit under a consumption tax system: 10% decrease in consumption tax in year 0

$\delta = \delta^*$, $r_h = r_h^*$

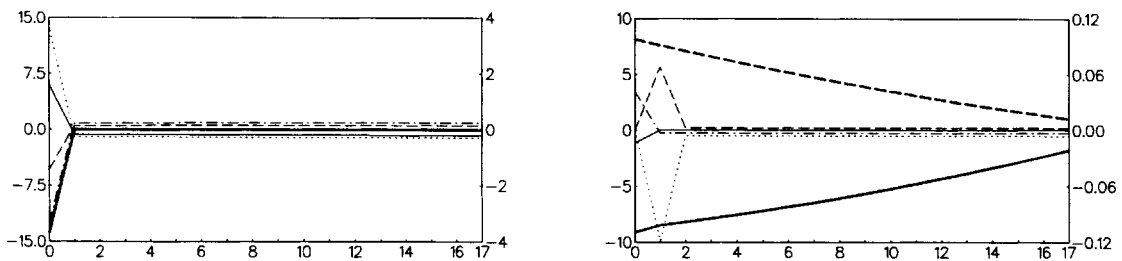

Fig. 6.14 Budget deficit under an income tax system: 10% decrease in income tax in year 0

$\delta = \delta^*$, $r_h = r_h^*$

(Percentage deviations)

- *Home output*
- *Foreign output*
- *Home labor*
- *Foreign labor*
- *Interest rate (right scale, basis points)*
- *Home investment*
- *Foreign investment*
- *Home consumption*
- *Foreign consumption*
- *Home external debt (right scale, level)*
- *Home government debt (right scale, level)*

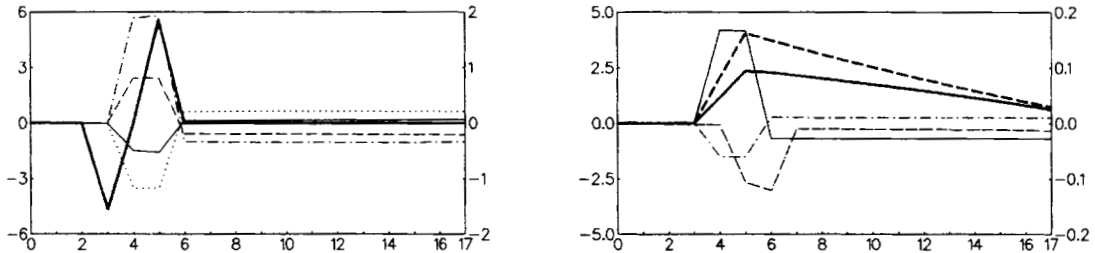

Fig. 6.15 Budget deficit under a consumption tax system: 10% decrease in consumption tax in years 4 & 5

$\delta = \delta^*$, $r_k = r_k^*$

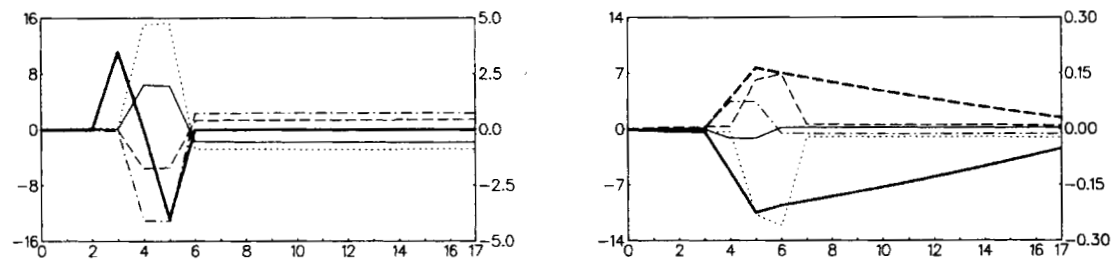

Fig. 6.16 Budget deficit under an income tax system: 10% decrease in income tax in years 4 & 5

$\delta = \delta^*$, $r_k = r_k^*$

(Percentage deviations)

- Home output
- Foreign output
- Home labor
- Foreign labor
- Interest rate (right scale, basis points)
- Home investment
- Foreign investment
- Home consumption
- Foreign consumption
- Home external debt (right scale, level)
- Home government debt (right scale, level)

rise in tax rates in all subsequent periods. As before, they reveal the central role played by the tax system. They also reveal the general feature of a negative transmission. However, since the various changes in tax rates occur only in the more distant future, our simulations show that their effects on the levels of domestic and foreign utility (viewed from the standpoint of the current period) are very small.

6.5 VAT Harmonization

In this section, we examine the dynamic effects of international VAT harmonization. Such policies form an important ingredient of the wide-ranging measures associated with the move toward the single market of Europe of 1992. In the fiscal area, the European Commission has drawn up various proposals on the approximation of the rates and the harmonization of the structures of VAT.

The process of harmonization of the VAT systems has started with the First Council Directive of April 1967 and has proceeded thereafter through consecutive directives. The process involved the adoption of VAT in various member countries and the continuous convergence of rates and structures among members of the community. Much of the discussion surrounding the practical implementation of the approximation of the VAT rates concerned the width of bands within which various VAT rates should be placed, the products to which a reduced rate would be applicable, and the problem of zero-rated products.[21] For 1992, the commission envisaged a standard VAT rate ranging between 14 and 20 percent and a reduced rate (applied to selected categories, such as foodstuffs) ranging between 4 and 9 percent. The commission proposes to abolish the higher rate that presently exists in some member countries on certain categories of goods. In subsequent discussions, an alternative proposal was considered, according to which the standard rate band would be replaced by a minimum rate applicable from 1 January 1993. Each member state would choose a rate at least equal to the minimum rate, with due regard to the budgetary implications and to the "competitive pressures" arising from the rates chosen by other neighboring states and main trading partners. Table 6.2 provides summary information on VAT in the European Community. It illustrates the disparities among the various member-country VAT rates.

One of the central issues that needs to be addressed is the budgetary consequences of the harmonization in the VAT systems. A few member states (notably Denmark and Ireland) would suffer considerable tax revenue losses, while others (notably Spain, Luxembourg, and Portugal) would see their tax revenue go up considerably.

In what follows, we present dynamic simulations of the consequences of international harmonization of VAT. We use our two-country model and presume that, prior to the VAT harmonization, the two countries use very different tax systems. The home country tax revenue stems from high

Table 6.2 VAT Rates in the European Community (1989)

Country (year of VAT introduction)	Statutory Rates (%) Reduced Rate	Standard Rate	Higher Rate	Revenue Contribution as % of Total Tax Revenue (1986)	Revenue Contribution as % of GDP (1986)
Belgium (1971)	1, 6, 7	19	25, 33	15.5	7.0
Denmark (1967)	0	22	. . .	19.5	9.9
France (1968)	5.5, 7	18.6	28	19.2	8.5
Germany (1968)	7	14	. . .	15.3	5.7
Greece	3, 6	18	36	. . .	. . .
Ireland (1972)	0, 2.2, 10	25	. . .	20.8	8.4
Italy (1973)	2, 9	18	38	14.5	5.0
Luxembourg (1970)	3, 6	12	. . .	13.3	5.7
Netherlands (1969)	6	19	. . .	16.5	7.5
Portugal (1986)	8	17	30	17.6	5.7
Spain (1986)	6	12	33	. . .	. . .
United Kingdom (1973)	0	15	. . .	15.5	6.9
Commission proposal:					
	A:	4 to 9		14 to 20	abolished
	B:	4 to 9		minimum rate	abolished

Sources: Table 2.1 in Cnossen and Shoup (1987) and table 3.5.1 in *European Economy* (March 1988); *EC: The Evolution of VAT Rates Applicable in the Member States of the Community* (Inter-tax, 1987/3, pp. 85–88); and OECD, *Revenue Statistics of OECD Member Countries* (Paris, 1988).

income tax, while the foreign country revenue stems from high VAT. The harmonization of VAT entails a rise in the home country VAT rate and an equivalent reduction in the foreign VAT rate.

To avoid the budgetary imbalances consequent on the changes in the VAT rates, we ensure revenue neutrality by adopting the same procedure used in the analysis of tax conversions in section 6.3. Accordingly, the induced budgetary imbalances are corrected through changes in income tax rates. In the home country, the rise in the VAT is accompanied by a reduction in income tax rates, whereas in the foreign country the fall in the VAT rate is accompanied by a corresponding rise in income tax rates. The narrowing of the international disparities between VAT captures the commission's proposal of reducing the disparities of VAT rates among member countries and categories of goods. The maintenance of budgetary balance through appropriate changes in income tax rates makes the analysis of revenue-neutral tax conversion of section 6.2 applicable to the problem at hand.

In performing the simulations, we first computed a baseline equilibrium. This equilibrium was then perturbed by the assumed VAT harmonization.

The various figures presented below show the effects of the tax restructuring measured as percentage deviations from the baseline levels.

As indicated by the theoretical analysis, one of the key factors governing the effects of revenue-neutral tax conversions is the time pattern of the current-account position. Since the current-account positions can be expressed in terms of the saving-investment gap, they reflect intercountry differences either in saving propensities, induced, for example, by differences between the subjective discount factors, δ and δ^*, or in investment patterns, induced, for example, by differences between the productivities of capital, r_k and r_k^*. In figures 6.17–6.22, we plot the simulation results for cases distinguished according to the time pattern of current-account imbalances. In these figures, we assume that the income tax used in both countries is of the case-flow variety. Throughout, we assume that the home country raises permanently its VAT by 6 percent and restores its tax revenue by lowering its cash-flow income tax rates; the foreign country (whose initial VAT rate is assumed to be high) lowers permanently its VAT by 6 percent and restores its tax revenue by raising its cash-flow income tax rates. The figures show the paths of domestic and foreign output, labor supply, savings, investment, and consumption as well as the paths of the world rate of interest and the home country's external debt consequent on the VAT harmonization. All paths are expressed as percentage deviations from baseline (except for the rate of interest, whose deviation is expressed in basis points). The simulations reveal that the international VAT harmonization triggers a dynamic response in all the key macroeconomic variables. The specific nature of the dynamic response reflects international differences in the parameters governing saving and investment patterns.

The key features of the simulation analysis of tax harmonization underlying figures 6.17–6.22 are summarized in table 6.3, which also reports the implied welfare implications of the VAT harmonization. In order to capture the essence of the dynamic evolution of the various variables, we report in table 6.3 the direction of changes for both the short run (SR) and the medium run (MR). In figures 6.17–6.18, we show the time path of the endogenously determined home and foreign income tax rates. These rates are adjusted in each period so as to offset the budgetary implications of the VAT harmonization. The changes in the time profile of income taxes influence the present-value factors governing intertemporal investment and labor-supply decisions. In addition, the level changes in the VAT rates affect intratemporal consumption-leisure choice. In figures 6.19–6.22, we show the corresponding effects on employment, investment, consumption, the current account, and welfare.

In conformity with the tax conversion analysis of section 6.3, the results in table 6.3 demonstrate the key role played by the current-account position. Specifically, if in the early stage the home country runs a current-account deficit owing to low saving or high investment (e.g., if $\delta < \delta^*$ or $r_k > r_k^*$), then the paths of domestic and foreign income tax rates rise over time while

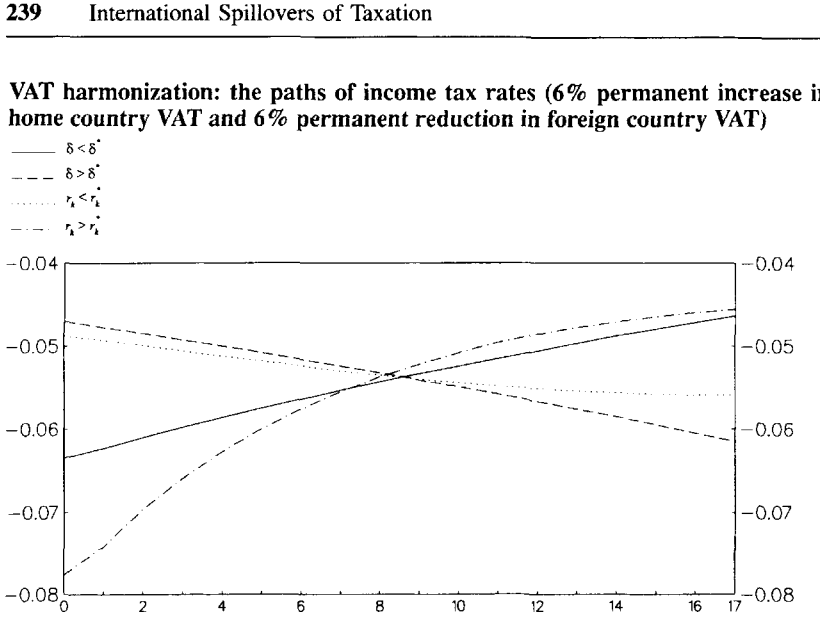

Fig. 6.17 Home country income tax rates (deviations from baseline)

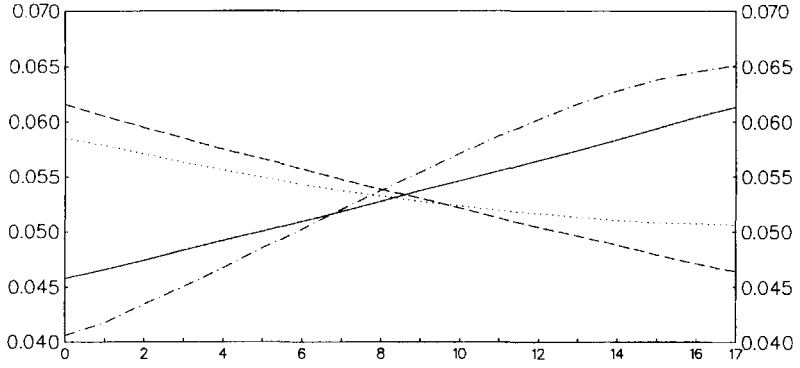

Fig. 6.18 Foreign country income tax rates (deviations from baseline)

the world rate of interest falls. In that case, the rates of growth of domestic and foreign consumption (g_c and g_c^* respectively) fall, both in the short and in the medium runs.

If, on the other hand, the configuration of saving and investment propensities is such that the home country runs a current-account surplus in the early stage, then the dynamic effects of the VAT harmonization on these

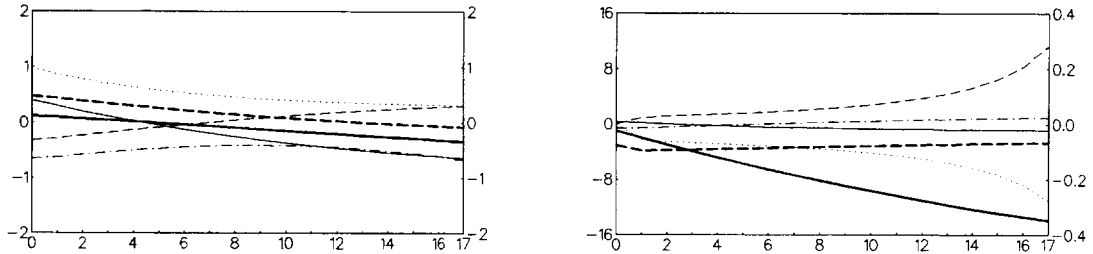

Fig. 6.19 VAT harmonization: 6% permanent increase in home country VAT and 6% permanent reduction in foreign country VAT

$\delta < \delta^*$

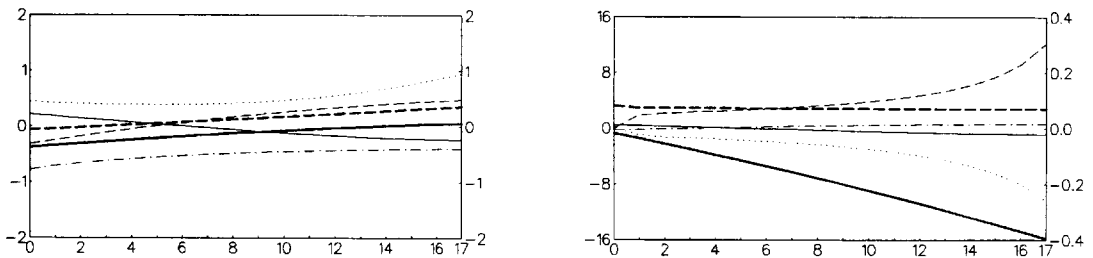

Fig. 6.20 VAT harmonization: 6% permanent increase in home country VAT and 6% permanent reduction in foreign country VAT

$\delta > \delta^*$

(Percentage deviations)

- *Home output*
- *Foreign output*
- *Home labor*
- *Foreign labor*
- *Home consumption*
- *Foreign consumption*
- *Home investment*
- *Foreign investment*
- *Home saving ratio*
- *Foreign saving ratio*
- *Home external debt ratio*
- *Interest rate (right scale, basis points)*

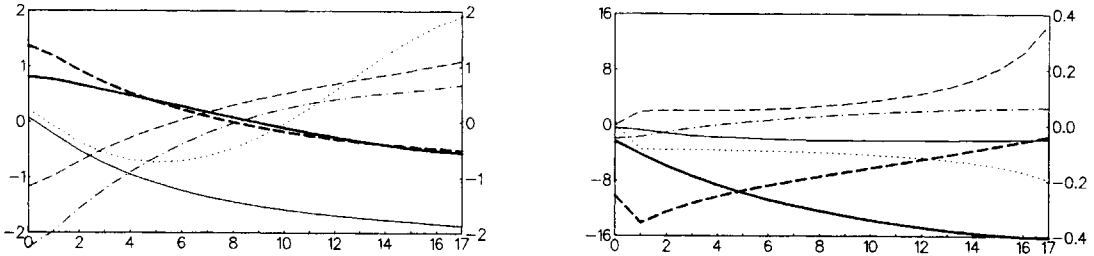

Fig. 6.21 VAT harmonization: 6% permanent increase in home country VAT and 6% permanent reduction in foreign country VAT

$r_k > r_k^*$

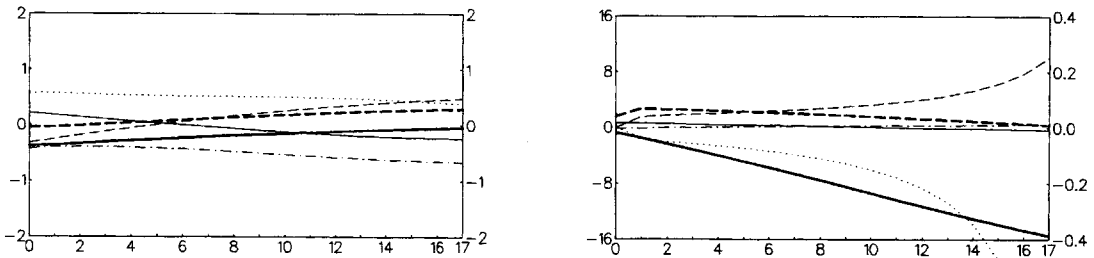

Fig. 6.22 VAT harmonization: 6% permanent increase in home country VAT and 6% permanent reduction in foreign country VAT

$r_k < r_k^*$

(Percentage deviations)

- Home output
- Foreign output
- Home labor
- Foreign labor
- Home consumption
- Foreign consumption
- Home investment
- Foreign investment
- Home saving ratio
- Foreign saving ratio
- Home external debt ratio
- Interest rate (right scale, basis points)

Table 6.3 **Effects of VAT Harmonization under Alternative Current-Account Positions (deviations from baseline)**

Variable	Home Country Current-Account Deficit				Home Country Current-Account Surplus			
	$\delta < \delta^*, r_k = r_k^*$		$\delta = \delta^*, r_k > r_k^*$		$\delta > \delta^*, r_k = r_k^*$		$\delta = \delta^*, r_k < r_k^*$	
	SR	MR	SR	MR	SR	MR	SR	MR
Path of τ_y	rising		rising		falling		falling	
Path of τ_y^*	rising		rising		falling		falling	
r	−	−	−	−	+	+	+	+
g_c	−	−	−	−	+	+	+	+
g_c^*	−	−	−	−	+	+	+	+
I	−	−	−	−	−	−	−	−
I^*	+	+	+	+	+	+	+	+
L	+	+	−	+	+	+	+	+
L^*	−	−	−	−	−	−	−	−
Y	+	−	−	−	+	−	+	+
Y^*	−	+	−	+	−	+	−	+
C	+	−	+	−	−	+	−	−
C^*	+	−	+	−	−	+	+	+
S	+	−	−	−	+	−	+	−
S^*	−	+	−	+	−	+	−	+
B	−	−	−	−	−	−	−	−
$\cup$	−	+	+	+	−	+	−	+
$\cup^*$	+	−	+	−	+	−	+	−

Note: The VAT harmonization obtains through a permanent reduction in τ_c and a rise in τ_c^*. Budgetary balance obtains through appropriate adjustments in the periodic income tax rates, τ_y and τ_y^*. SR and MR denote, respectively, the short run and the medium run. The tax system is a cash-flow system. In general, the short run pertains to the first few periods, while the medium run pertains to the remaining periods in the simulation. For the utility index, SR pertains to the discounted sum of utilities over the entire periods except for the final one, while MR pertains to the final-period utility (reflecting the entire function beyond the simulation period).

variables are reversed. Specifically, if in the home country saving is high or investment is low (e.g., if $\delta > \delta^*$ or $r_k < r_k^*$), then the paths of domestic and foreign income tax rates fall while the world rate of interest rises. In that case, the rates of growth of domestic and foreign consumption rise. Thus, under the present cash-flow income tax system, the direction of changes in the world rate of interest and in the growth rates of consumption consequent on international VAT harmonization depend exclusively on the paths of the saving-investment gap.

The lower panel of table 6.3 summarizes the corresponding short- and medium-run changes in other key economic variables. As can be seen, in the cases considered, the international VAT harmonization crowds out domestic investment and crowds in foreign investment independent of the current-account positions. These investment responses reflect the induced changes in the domestic and foreign effective discount factors governing investment.

These changes in the effective discount factors reflect two conflicting effects: the effect of the change in the world rate of interest and the opposite effect of the change in the tax wedges induced by the alteration of the time paths of income tax rates. The changes in the tax structure also alter the intraperiod tax ratios governing labor supply and consumption demand. These tax ratios are subject to conflicting forces since the changes in the consumption tax rates and the associated changes in the income tax rates induce opposite effects on both labor supply and consumption demand. In addition to these conventional substitution mechanisms, the simulation results also reflect wealth effects on labor supply and consumption demand induced by changes in the intertemporal terms of trade (the world rate of interest) and by changes in the excess burden associated with the distorted tax system. Finally, the time paths of labor supply and consumption demand are altered by the intertemporal substitution induced by changes in the effective discount factors governing labor supply and consumption demand. The changes in these discount factors arise from the change in the world rate of interest and, in the case of labor supplies, from the changes in the time paths of income taxes. The welfare effects of term-of-trade changes depend on the magnitudeof the change in the terms of trade and on the gap between purchases and sales of the good whose relative price has changed. In our intertemporal context, the terms of trade correspond to the world rate of interest, and the gap between purchases and sales corresponds to the current-account position. As illustrated by table 6.3, in all cases the change in the terms of trade operates in favor of the country that raises its VAT. When the country runs a current-account deficit (i.e., when it borrows in the world economy), its intertemporal terms of trade improve since the rate of interest falls. Likewise, if the country's current-account position is in surplus, its intertemporal terms of trade also improve since the rate of interest rises. As illustrated by the table, this improvement in the home country welfare induced by the changes in the world rate of interest can be mitigated (or even offset) by the excess-burden effects of the VAT harmonization. Similar considerations apply to the welfare consequences of the reduction in VAT in the foreign economy.

A comparison between the effects of the international VAT harmonization on the domestic and the foreign economies reveals that in the two countries the level of foreign employment, investment, output, and some other key macroeconomic indicators change in opposite directions. In fact, in most cases, the utility index indicates that domestic and foreign welfare move in opposite directions. These phenomena suggest the possibility that international VAT harmonization may induce international conflicts of interest. A resolution of such conflicts may necessitate international fiscal transfers from countries benefiting from the VAT harmonization to countries that lose. The potential difficulties arising from international conflicts of interest may be augmented by internal conflicts of interest associated with

redistributions of income between labor and capital in the short and medium runs.

The foregoing analysis was confined to the case in which the income taxes used to restore budgetary balance following the international VAT harmonization were of the cash-flow variety. Under such circumstances, in conformity with the analytical results of section 6.2, the current-account positions played the key role in determining the direction of changes in the world rate of interest and the growth rates of domestic and foreign consumption. As indicated by the simulations in figures 6.17–6.22 and in the summary results in the lower panel of table 6.3, the dynamic effects of the international VAT harmonization on the paths of the other key macroeconomic variables do not depend only on the current-account positions. In fact, for the cases shown in these simulations, domestic investment, foreign employment, foreign savings (in the short run), and the level of the domestic country's external debt are reduced independent of the current-account positions, while foreign investment and foreign savings (in the medium run) always rise.

6.6 Concluding Remarks

The increased integration of world goods and capital markets has stimulated interest in the policy implications of international economic interdependence. In this paper, we have analyzed several aspects of such interdependence, focusing on the international transmission of tax policies. For this purpose, we have presented an analytical framework suitable for the examination of the dynamic effects of tax restructuring. In our analysis, we considered the international effects of changes in the composition and the timing of taxes. Accordingly, we have analyzed the consequences of revenue-neutral tax conversions between income and consumption taxes as well as budget deficits that arise under alternative tax systems. Motivated by the various proposals for tax harmonizations associated with the creation of a single market in Europe of 1992, we have also analyzed the effects of international VAT harmonization. Throughout, we have complemented our analytical results with illustrative dynamic simulations. We have identified key factors governing the international effects and transmission of tax policies. These include the intercountry differences in saving and investment propensities. Accordingly, we have shown that the effects of tax policies depend critically on whether the country adopting these policies runs a deficit or a surplus in the current account of its balance of payments. We have also shown that the qualitative and quantitative effects of budget deficits depend critically on whether the deficit arises from changes in income taxes or in VAT. These factors were shown to play a central role in determining the effects of international tax harmonization.

Our analysis focused on a two-country model of the world economy. A useful extension would consider a three-country world and examine the

consequences of tax harmonization between two of the three countries. Such an extension would facilitate an analysis of "trade creation" and "trade diversion" in both goods and capital markets in Europe of 1992.

Appendix
The Simulation Model

The model described in this appendix was used in the simulations discussed in the main text. We present below the exact computer printout of the model that is based on the theoretical model described in the text. However, this model was developed to be more general in order to evaluate a wider range of policy questions than are discussed in this paper.

An attempt has been made to use the same notation in the computer model as in the theoretical model. Whenever possible, reference is made to the relevant equations in the main text. There are several additional definitions and specifications in the simulation model, but none of these should alter the theoretical propositions of the paper. First, a number of definitions have been added to the model in order to enhance our understanding of the model's properties or to simplify the presentation of an equation (e.g., the definition of income). In addition, equations have been added in order to examine many possible government policy scenarios (e.g., tax reaction functions). Finally, some equations have been added to account for endpoint and starting point conditions (e.g., consumption of endpoint capital).

A few general notational rules were followed in order to make the reading of the model a little easier. Also $\Sigma_{i=1}^{T} X_i$ is written out as SUM [I = 1 to T: $X(i)$]. In general, all home country variables end with an H and foreign variables with an F. The model is simulated for years 20–40.

Endogenous Variables

BH	= home international borrowing (-BH for the foreign country).
BPH(F)	= home (foreign) private-sector international borrowing.
CH(F)	= home (foreign) private consumption.
EH(F)	= home (foreign) private total expenditures (inclusive of leisure consumption).
INVADJH(F)	= home (foreign) net investment.
INVH(F)	= home (foreign) gross investment.
KH(F)	= home (foreign) capital stock.

LH(F) = home (foreign) labor supply.
PCH(F) = home (foreign) tax-adjusted price of consumption.
PH(F) = home (foreign) price index of utility-based real spending.
PLH(F) = home (foreign) tax-adjusted price of labor.
R = rate of interest plus one.
RR = the inverse of the present-value factor.
RRH(F) = the inverse of the present-value factor (tax adjusted).
R20(R20F) = home (foreign) tax-adjusted present-value factor in period T.
SURPH(F) = home (foreign) cumulative government surplus.
TBH(F) = home (foreign) tax rate on bonds (τ_b in the text).
TCH(F) = home (foreign) consumption tax rate (τ_c in the text).
TERKH(F) = home (foreign) capital stock consumed in period T.
TYH(F) = home (foreign) income tax rate (τ_y in the text).
UH(F) = home (foreign) utility-based total expenditure.
WH(F) = home (foreign) wealth.
YH(F) = home (foreign) income.
VH(F) = home (foreign) lifetime utility from $t = 0$ to T.

Exogenous Variables and Parameters

GH(F) = home (foreign) government spending.
INV0H(F) = home (foreign) investment in period 0.
TCH(F)BAR = home (foreign) consumption tax rate when income tax rate is endogenous.
TYH(F)BAR = home (foreign) income tax rate when consumption tax rate is endogenous.
WAGEH(F) = home (foreign) wage rate (w in the text).
ALPHAH(F) = home (foreign) fraction of consumption of end period capital stock (a in the text).
KADJH(F) = home (foreign) adjustment parameter of the capital stock (b in the text).
BETAH(F) = home (foreign) distributive parameter of consumption (β in the text).
DELTAH(F) = home (foreign) subjective discount rate (δ in text).
MPKH(F) = home (foreign) marginal product of capital (r_k in the text).
SIGMAH(F) = home (foreign) consumption-leisure elasticity of substitution (σ).
THETAH(F) = home (foreign) rate of depreciation of capital stock.

TAXDUMH(F) = home (foreign) tax dummy (1[0] income [consumption] tax is endogenous).
TBTYH(F) = home (foreign) determines relation between bond and income taxes (θ in the text).
TERSURPH(F) = home (foreign) value of terminal budget deficit.

Equations

(1) YH = WAGEH*LH + (MPKH − THETAH)*KH.

(2) YF = WAGEF*LF + (MPKF − THETAF)*KF.

(3) CH = (1 − BETAH)**SIGMAH*PCH**(− SIGMAH)*EH/
((1 − BETAH)**SIGMAH*PCH**(1 − SIGMAH)
+ BETAH** SIGMAH*PLH**(1 − SIGMAH)).

(4) CF = (1 − BETAF)**SIGMAF*PCF**(− SIGMAF)*
EF/((1 − BETAF)**SIGMAF*PCF**(1 − SIGMAF)
+ BETAF**SIGMAF*PLF**(1 − SIGMAF)).

(5) 1 − LH = BETAH**SIGMAH*PLH**(− SIGMAH)*EH/
((1 − BETAH)**SIGMAH*PCH**(1 − SIGMAH)
+ BETAH**SIGMAH*PLH**(1 − SIGMAH)).

(6) 1 − LF = BETAF**SIGMAF*PLF**(− SIGMAF)*EF/
((1 − BETAF)**SIGMAF*PCF**(1 − SIGMAF)
+ BETAF **SIGMAF*PLF**(1 − SIGMAF)).

(7) PH = ((1 − BETAH)**SIGMAH*PCH**
(1 − SIGMAH) + BETAH**SIGMAH*PLH**
(1 − SIGMAH))**(1/(1 − SIGMAH)).

(8) PF = ((1 − BETAF)**SIGMAF*PCF**(1 − SIGMAF)
+ BETAF**SIGMAF*PLF**(1 − SIGMAF))**
(1/(1 − SIGMAF)).

(9) 0 = IF YEAR() EQ 20 THEN INVADJH − INVOH ELSE
(− (1 − TYH(− 1)))/(RRH(− 1))*
(1 + KADJH*INVADJH/KH(− 1)) + (1 − THETAH)**
(20 − TIME) *(MPKH − THETAH + ALPHAH)/R20
+ SUM(I = 1 TO 19 : (1 − THETAH)**(I − 1)*
(1 − TYH(I − 1))/RRH(I − 1)* IDUM(I)*
(MPKH − THETAH) + (1 − TYH(I − 1))*KADJH/2*
(INVADJH(I)/KH(I − 1))**2).

(10) 0 = IF YEAR() EQ 20 THEN INVADJF − INVOF ELSE
(− (1 − TYF(− 1)))/(RRF(− 1))*(1 + KADJF*INVADJF/

```
                KF(-1))+(1-THETAF)**(20-TIME)*(MPKF-THETA
                +ALPHAF)/R20F+SUM(I = 1 TO 19 :
                (1-THETAF)**(I-1)*(1-TYF(I-1))/RRF(I-1)*
                IDUM(I)*(MPKF-THETAF)+(1-TYF(I-1))*KADJF/2*
                (INVADJF(I)/KF(I-1))**2).

(11) KH     = (1-THETAH)*KH(-1)+INVADJH.

(12) KF     = (1-THETAF)*KF(-1)+INVADJF.

(13) INVH   = INVADJH*(1+KADJH/2*INVADJH/KH(-1)).

(14) INVF   = INVADJF*(1+KADJF/2* INVADJF/KF(-1)).

(15) PLH    = WAGEH*(1-TYH).

(16) PLF    = WAGEF*(1-TYF).

(17) PCH    = (1+TCH).

(18) PCF    = (1+TCF).

(19) UH     = (1-DELTAH)*WH/PH/(1-DELTAH**21)*DELTAH
                **TIME*RRH.

(20) UF     = (1-DELTAF)*WF/PF/
                (1-DELTAF**21)*DELTAF**TIME*RRF.

(21) EH     = PH*UH.

(22) EF     = PF*UF.

(23) WH     = IF YEAR() EQ 20 THEN SUM(J=0 TO 19 :
                ((1-TYH(J))*(WAGEH(J)+(MPKH-THETAH)*KH(J)
                -INVH(J+1))/RRH(J))+((1-TYH(20))*
                (WAGEH(20)+(MPKH-THETAH)*KH(20)+
                TERKH(20))/ RRH(20) ELSE WH(-1).

(24) WF     = IF YEAR() EQ 20 THEN WF-R+1 ELSE WF(-1).

(25) SURPH  = SURPH(-1)*R(-1)+(TBH*(BPH-R*
                BPH(-1))+TCH*CH+TYH*(LH*WAGEH
                +(MPKH-THETAH) *KH-INVH(1)+TERKH)-GH).

(26) SURPF  = SURPF(-1)*R(-1)+(TBF*(BPF-R*BPF
                (-1))+TCF*CF+TYF*(LF*WAGEF+
                (MPKF-THETAF)*KF-INVF(1)+TERKF)-GF).

(27) TYH    = TAXDUMH*(IF YEAR() LT 21 THEN TYHBAR ELSE
                (IF YEAR() EQ 21 THEN
                (TERSURPH-SURPH(-1)-SUM(J = 0 TO 19 :
                1/RR(J)*(TBH(J)*(BPH(J)-R(J)*BPH(J-1))+TCH(J)
```

```
                *CH(J) - GH(J))))/SUM(I = 0 TO 19 :
                (LH(I)*WAGEH(I) + (MPKH - THETAH)*KH(I)
                - INVH(I + 1) + TERKH(I))/RR(I)) ELSE
                TYH( - 1))) + (1 - TAXDUMH)*TYHBAR.

(28) TYF    = TAXDUMF*(IF YEAR() LT 21 THEN TYFBAR ELSE
              (IF YEAR() EQ 21 THEN
              (TERSURPF - SURPF( - 1) - SUM(J = 0 to 19 :
              1/RR(J)*(TBF(J)*(BPF(J) - R(J)*BPF(J - 1))
              + TCF(J)*CF(J) - GF(J))))/SUM(I = 0 TO 19 :
              (LF(I)*WAGEF(I) + (MPKF - THETAF)*KF(I)
              - INVF(I + 1) + TERKF(I))/RR(I)) ELSE TYF( - 1)))
              + (1 - TAXDUMF)*TYFBAR.

(29) TCH    = (1 - TAXDUMH)*(IF YEAR() LT 21 THEN TCHBAR
              ELSE (IF YEAR() EQ 21 THEN
              (TERSURPH - SURPH( - 1) - SUM(J = 0 TO 19 :
              1/RR(J)*(TBH(J)*(BPH(J) - R(J)*BPH(J - 1))
              + TYH(J)*(LH(J)*WAGEH(J) + (MPKH - THETAH)*
              KH(J) - INVH(J + 1) + TERKH(J) - GH(J))))/SUM(I = 0
              TO 19 : 1/RR(I)*CH(I)) ELSE
              TCH( - 1))) + TAXDUMH*TCHBAR.

(30) TCF    = (1 - TAXDUMF)*(IF YEAR() LT 21 THEN TCFBAR
              ELSE (IF YEAR() EQ 21
              THEN(TERSURPF - SURPF( - 1) - SUM(J = 0 TO 19 :
              1/RR(J)*(TBF(J)*(BPF(J) - R(J)*BPF(J - 1)) + TYF(J)
              *(LF(J)*WAGEF(J) + (MPKF - THETAF)*KF(J) - INVF(J +
              1) + TERKF(J) - GF(J))))/SUM(I = 0 TO 19 :
              1/RR(I)*CF(I)) ELSE TCF( - 1))) + TAXDUMF*TCFBAR.

(31) TBH    = TBTYH*TYH.

(32) TBF    = TBTYF*TYF.

(33) TERKH  = IF YEAR() LT 40 THEN 0 ELSE ALPHAH*KH.

(34) TERKF  = IF YEAR() LT 40 THEN 0 ELSE ALPHAF*KF.

(35) BPH    = ((1 + TCH)*CH - (1 - TYH)*(YH + TERKH -
              INVH(1))(R( - 1) - 1)*BPH( - 1))/(1 - TBH) + BPH( - 1).

(36) BPF    = ((1 + TCF)*CF - (1 - TYF)*(YF + TERKF -
              INVF(1)) + (R( - 1) - 1)*BPF( - 1))/(1 - TBF) +
              BPF( - 1).

(37) VH     = SUM(I = 0 TO 19 : DELTAH**I*LOG(UH(I))).

(38) VF     = SUM(I = 0 TO 19 : DELTAF**I*LOG(UF(I))).
```

(39) R20H = IF YEAR() EQ 20 THEN RR(20)/(1 − TYH(20)) ELSE R20H(−1).

(40) R20F = IF YEAR() EQ 20 THEN RR(20)/(1 − TYF(20)) ELSE R20F(−1).

(41) RRH = EXP(SUM(J = −19 TO 0 : LOG(1 − TBH(J) + R(J) − 1))).

(42) RRF = EXP(SUM(J = −19 TO 0 : LOG(1 − TBF(J) + R(J) − 1))).

(43) GH + GF + CH + CF + INVH(1) + INVF(1) = YH + YF + TERKH + TERKF.

(44) RR = EXP(SUM(J = −19 TO 0 : LOG(R(J)))).

(45) BH = CH − YH + R(−1)*BH(−1) + INVH(1) + GH − TERKH.

Equations (1) and (2) define home and foreign country income as labor income plus the return on capital. Equations (3)–(8) are the behavioral equations derived by maximizing utility subject to the lifetime present-value budget constraint. Equation (3) is the home consumption equation and identical to equation (7) of the main text. Equation (5) is the leisure equation and (7) the price equation; they represent equations (8) and (6) of the main text. The foreign country equations for these three variables are (4), (6), and (8).

The home and foreign investment equations, (9) and (10), derived by maximizing wealth, differ slightly from equation (9) in the main text in so far as the rate of depreciation (THETA) is included here but omitted from the text. Equations (11) and (12) define the home and foreign capital stocks, and equations (13) and (14) describe investment demands allowing for adjustment costs.

Equations (15)–(19) are definitions of tax-adjusted prices that are then substituted in other equations. For example, a comparison of equation (6) of the text to equation (7) of the simulation model shows that PCH is used in place of $(1 + \tau_{ct})$.

Real utility-based expenditures (eq. [5] of the text) are given in equations (19) and (20), while the values in terms of the consumption good of these expenditures are defined in (21) and (22). Home country wealth is defined by equation (23) and is identical to the wealth equation in the main text. A similar equation could be written for foreign wealth, but, by Walras law, we have dropped this equation from the model and use the relation to solve for the interest rate. Note that these equations solve for W_0 and R_0 in period $t = 0$ (year 20 in the computer model). However, for $t = 1$ to T, these equations set wealth at their previous values (i.e., WH_0 and WF_0) thereafter.

The next eight equations are used to describe government behavior and vary depending on the type of scenario that we are simulating. Equations (25) and (26) define the home and foreign country's cumulated surplus as tax receipts less spending. Various combinations of the next six equations and values for dummy variables are used in the simulations to capture alternative tax and spending policies. For example, in the simulation of a revenue neutral conversion of consumption for income tax, equations (27) and (29) are dropped from the model, and the income tax rate, TYH, and the government surplus, SURPH, are assumed exogenous while the consumption tax rate, TCH, can be thought of as balancing the government's net revenue position. For the budget deficit simulations, the model is altered in a very different way. For example, in order to analyze a current income tax shift, the consumption tax equation, (29), is dropped from the model, and the consumption tax rate is assumed exogenous. Then an exogenous income tax rate is imposed in the relevant years, and equation (27) is used to alter future income tax rates so that the budget is balanced by year T. Analogous assumptions can be made for consumption tax shifts. Equations (31) and (32) define the international borrowing tax rates as described in equation (10) in the main text, and the coefficient, TBTYR (θ in the text), can be set in order to consider a wide variety of tax conversion policies as a result of the tax equivalence relation between the consumption, income, and international borrowing taxes.

Equations (35) and (36) define the privately held home (foreign) stock of international borrowings. The definitions of lifetime utility are given in equations (37) and (38). Note that, since the model is simulated for only twenty years, the only relevant calculation for VH and VF is in the first year. Also, the utility calculation excludes the final year (T) because the arbitrary choice of a time horizon may cause somewhat perverse results at time T. Equations (39) and (40) define period T's tax-adjusted value of the discount factor used in the investment equations, and (41) and (42) define the tax-adjusted discount factor for all other years.

The final three equations do not have home and foreign counterparts. Equation (43) is the equilibrium condition for world output; demand for world output must equal the supply of world output. Equation (44) defines the present-value factor. Finally, the balance of payments for the home country is defined in equation (45). Obviously, the negative of BH defines the foreign country's balance of payment position.

The parameter values used in the baseline simulations are $\beta = \beta^* = .4$, $\delta = \delta^* = .97$, $\sigma = \sigma^* = 0.3$, $r_k = r_k^* = 0.3$, and $\alpha = \alpha^* = 0.2$. For intercountry differences in the parameter values of the discount factor, we use ($\delta = .95$, $\delta^* = .97$) or ($\delta = .97$, $\delta^* = .95$), while, for intercountry differences in the parameter values of the marginal product of capital, we use ($r_k = 0.2$, $r_k^* = 0.3$) or ($r_k = 0.3$,$r_k^* = 0.2$).

Notes

1. We are grateful to Mario Blejer and Jonathan Levin, who assisted us in obtaining the data and the interpretation of the various accounting measures.

2. The definitions of the various statistics are provided in the note to table 6.1.

3. The analytical framework underlying the international-intertemporal approach to open-economy macroeconomics is based on Frenkel and Razin (1987, 1988b). For an analogous approach developed in a closed economy context, see Auerbach and Kotlikoff (1987). The tax systems in many countries include incentives to saving and investment and thereby contain important features of the cash flow income tax system. Suppose that the underlying income tax system is represented by the following modification of the right-hand side of eq. (1):

$$(1 - \tau_{wt})w + (1 - \tau_{kt})((r_k - \theta)K_t) - (1 - \tau_{It})I_t(1 + bI_t/2K_t) + (1 - \tau_{bt})(B_t^p - B_{t-1}^p) - (1 - \tau_{kt})(1 + \tau_{st})r_{t-1}B_{t-1}^p,$$

where τ_{wt} and τ_{Kt} denote the tax rates on labor income and capital income, respectively, and τ_{It} and τ_{st} denote investment-tax credit and saving-tax credit, respectively. Then the tax configuration $\tau_k = \tau_I = \tau_s/(1 + \tau_s)$ yields a cash flow income tax system.

4. Our formulation reflects the assumption that, except for the final period, bolted capital cannot be consumed. However, in the final period, the capital stock, K_T, can be transformed into consumption at the rate equals to aK_T, where $0 \leq a \leq 1$. This assumption serves to mitigate abrupt changes in the behavior of the economy arising in the final period of the finite horizon model. Accordingly, the budget constraint applicable to the final period (period T) is analogous to the one shown in eq. (1) with an added term on the right-hand side equal to $a(K_{T-1} + I_{T-1}) = aK_T$. For a formulation of a model highlighting the interaction between investment, government spending policies, and international interdependence within an infinite horizon model, see Buiter (1987).

5. A detailed analysis of the various equivalence relations in international macroeconomics and their policy implications is contained in Auerbach, Frenkel, and Razin (1989).

6. Obviously, with more than two periods, these discount factors are replaced by the appropriate present-value factors.

7. The investment behavior could have been generalized to include the depreciation of the capital stock. The simulation model used in this paper and described in the appendix includes capital depreciation.

8. This analysis is based on Frenkel and Razin (1989).

9. In terms of the utility function, this assumption amounts to setting $\beta = 1$ in eq. (3). The simulation analysis relaxes these assumptions by considering multiperiod simulations with a variable labor supply.

10. We are indebted to Alan Auerbach for suggesting this diagram.

11. These considerations imply that, in the neighborhood of a flat path of income tax, if the intertemporal income tax ratio exceeds unity, then the CC schedule is flatter than the RR schedule (assuming an initial-period trade-balance deficit). This is the case shown in fig. 6.6.

12. It can be verified that the quantitative results of the tax conversion remain the same if the intertemporal income tax ratio falls short of unity, though in the latter case the slopes of the CC and the II schedules are reversed (but the II schedule is flatter than the RR schedule in the neighborhood of $\tau_{y1}/\tau_{y0} = 1$).

13. To facilitate the diagrammatic exposition, we continue to assume that labor supply is fixed (so that $\beta = 1$ in eq. [3]). The diagrammatic analysis could also

allow for variable labor supply if leisure and ordinary consumption are separable in the utility function as in Frenkel and Razin (1987).

14. This follows from the fact that in equilibrium the denominators of μ_s and μ_d are equal to each other. Thus, if the domestic economy runs a trade surplus in the second period, then $C_1 + Y_1$, and, since $C + C_1^* = Y_1 + Y_1^*$, it follows that $\mu_d < \mu_s$.

15. In the subsequent analysis, we find it convenient to set the international borrowing tax, τ_b, equal to zero and to use explicitly the consumption and income tax rates rather than using the equivalence relations as in section 6.2.1.

16. Our assumptions that the initial undistorted equilibrium was with a current-account balance imply that the real-income effects induced by the departure from the flat tax pattern and by changes in the world rate of interest are dominated by the substitution effect.

17. To verify this point, we note that

$$\hat{D}^w = [C_0/(C_0 + C_0^*)]\hat{D} + [C_0/(C_0 + C_0^*) - C_1/(C_1 + C_1^*)]\hat{C}_1,$$

where a "hat" denotes a proportional change in the variable. Accordingly, the proportional change in the world relative demand is composed of two components. The first consists of the product of the proportional change of the domestic relative demand and a fraction (the relative share of current-period home consumption in the world consumption), and the second consists of the product of the proportional change in future-period consumption and a term measuring the difference between the relative shares of current and future-period home consumption in world consumption. This latter bracketed term reflects the difference between the domestic and foreign saving propensities. If the current-period trade-balance deficit arises from a relatively low domestic saving propensity, then this bracketed term is positive. We also note that $\hat{C}_1$ is negative since the change in the time profile of consumption taxes induces a substitution away from future-period consumption. It follows that, under such circumstances, $\hat{D}^w < \hat{D}$ and, therefore, the displacement of the D^w schedule is smaller than that of the D schedule.

18. This analysis is based on Frenkel and Razin (1988a).

19. Recall that, in developing fig. 6.7, we have used for simplicity a two-period model with fixed labor supply (so that $\beta = 1$ in eq. [3]). As before, these assumptions are relaxed in the dynamic-simulation model.

20. In performing the simulations, we allow for a variable labor supply. Thus, we assume that $\beta < 1$ in eq. (8). Our simulations are based on the assumption that the elasticity of substitution between consumption and leisure, σ, is smaller than unity. The time path of employment following a current-period cut in consumption tax rates may be reversed if this elasticity was assumed to exceed unity.

21. Zero-rated products involve the reimbursement of taxes levied on inputs with the result that the final good is completely untaxed.

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Comment Willem H. Buiter

Working through this interesting paper by Frenkel, Razin, and Symansky was a very useful investment of time and effort. Like Oliver Twist, a typical discussant will always ask for "some more." My comments are no exception.

The paper consists of three parts. Part 1 considers some empirical material on the tax structures of the major seven OECD countries. Part 2 contains a small analytical model that is used to evaluate various changes in the tax structure in a small open economy and in a two-country world. Part 3 goes through the same kinds of exercises using a numerical simulation model that is a generalization of the analytical model of section 6.1. My comments will deal mainly with part 2, the analytical model. Some brief remarks on the data section are, however, in order.

The Data

Figures 6.1 and 6.2 and table 6.1 of the Frenkel-Razin-Symansky paper (henceforth FRS) provide some stylized facts concerning average tax rates (both total and disaggregated) for the seven major industrial countries since the early 1970s. This suggests that there is considerable cross-sectional and time-series variation in the importance of different taxes and in the total tax burden. As regards the latter, the secular increase since World War II came to an end around 1981–82, as can be seen from table C6.1. While there has been no significant reduction in the total tax burden (the sum of direct and indirect taxes and social security contributions paid by employers and employees collected by general government as a percentage

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Table C6.1 **Total Outlays and Current Receipts of General Government as Percentage of GDP**

	1967	1982	1986
United States:			
Outlays	30.5	36.5	36.9
Receipts	27.1	31.1	31.3
Japan:			
Outlays	18.2	33.7	33.1
Receipts	19.3	29.5	31.3
Germany:			
Outlays	38.6	49.4	46.6
Receipts	36.7	45.4	44.7
France:			
Outlays	39.0	50.4	51.8
Receipts	38.2	45.9	47.1
United Kingdom:			
Outlays	38.2	47.4	46.2
Receipts	36.2	43.3	41.9
Italy:			
Outlays	33.7	47.6	50.5
Receipts	31.0	36.0	38.9
Canada:			
Outlays	31.5	46.6	46.2
Receipts	30.3	39.1	39.2

Source: OECD Economic Outlook 44 (December 1988), tables R14, R15.

of GDP), the roughly stationary shares of general government revenue and expenditure in GDP since the early 1980s represent a major economic and political change.

It is recognized by the authors that the average tax rates bear no obvious relation to the marginal rates that provide the incentives that govern labor demand and supply, saving, capital formation, and portfolio allocation.

These marginal tax rates too are characterized by considerable cross-sectional and time-series variation. For example, in 1986 the top marginal rate of the personal income tax was 38 percent in the United States, 76.5 percent in Japan, 60 percent in the United Kingdom, 56 percent in West Germany, and 65 percent in Italy. The top marginal income tax rate in the United Kingdom had come down from 83 percent (99 percent for unearned income) and was lowered in 1988 to 40 percent.

When there are many different taxes, some of which apply to the same base (e.g., wage income taxes and social security contributions) while others apply to distinct bases, their combined effect on behavior is what matters.

Indeed, for a proper appreciation of the incentive effects and distributional consequences of the budget, we must look jointly at the tax and benefit systems. Some of the most spectacular instances of high effective marginal

tax rates (occasionally in excess of 100 percent) come from the interaction of the tax and benefit systems. In many industrial countries, a "poverty trap" exists when at low levels of income a small increase in earned income is effectively nullified by a significant loss of benefits and a high "starting" marginal tax rate. The "Why work?" phenomenon refers to the possibility that the choice between low-paid employment and unemployment is decided in favor of the latter through the combined effect of unemployment benefit, income tax, and social security.

Table C6.2 shows how the "total" marginal tax rate on average wages differed in the seven main industrial countries in 1986.

The marginal tax rates (or tax-net-of-benefit rates) that we can read off the tax and benefit laws and regulations may not represent the relevant economic signals if there is significant scope for tax avoidance.

Finally, even the exhaustive public-spending part of the budget will have potentially important distributional and incentive effects. For instance, public expenditure on health and education, provided free of charge, represents income in kind to private agents and may be a direct substitute for or complement to private spending. Some of this public expenditure may have the characteristics of a national public good, an international public good, a local public good, or a conventional private good. Different income groups benefit differentially from public expenditure on defense and on law and order.

Note that, while the exhaustive expenditure side of the budget will obviously affect private behavior through income (or wealth) effects, it is quite possible that it also affects relevant private static or intertemporal terms of trade.

The empirical material of part 1 is not sufficiently rich to give us a sense of the cross-sectional or time-series variation in the "net" effects of general government budgets on the incentives to work, save, invest, and bear risk or on the distribution of income. In the theoretical parts of the paper, all taxes are assumed to be levied at given proportional or "flat" rates. There is no progressivity or regressivity, no exemptions, tax credits, leads and lags, etc. Even so, the analysis can get rather involved. Modeling descriptively realistic tax-benefit-expenditure structures appears to be a daunting task indeed.

Table C6.2 **Marginal Tax Rates on Average Wages under 1986 Tax Systems[a]**

United States	40.9
Japan	31.5
Germany	62.7
France	51.2
United Kingdom	43.9
Italy	57.8
Canada	33.7

Source: OECD Economic Outlook 41 (June 1987), table 16.

[a]Overall marginal tax rate for an average (unmarried) production worker, allowing for direct taxes at all levels of government, social security contributions by both employees and employers, and relevant tax concessions.

The Analytical Model

In the small open economy case, there is a single (finite-lived) representative household-worker-producer. There is one traded good that can be used for private consumption, private investment, or export. Public consumption or investment is not considered explicitly. There is a fixed endowment each period of a single nontraded good. This can be either consumed (leisure) or combined with capital to produce the traded good. The production function of the traded good is linear, and the marginal products of labor and capital are fixed at w and r_K, respectively.

A competitive equilibrium with the domestic interest rate, r, fixed by the assumption of perfect international capital mobility and a parametric world rate of interest, would result in corner solutions for the capital stock (unless $r = r_K$). The assumption of quadratic internal adjustment costs to investment guarantees an interior solution for the capital stock, while the competitive wage rate remains independent of the capital-labor ratio.

The multiperiod utility function is time additive and logarithmic, while the single-period utility function is a C.E.S. function of traded goods consumption and leisure.

Without loss of generality, the private sector is assumed to hold no domestic government debt, and (with some loss of generality) the initial external debt is assumed to equal zero.

There are three taxes, each levied at a constant proportional rate in any given period but potentially differing between periods. The taxes are labeled consumption tax (or VAT), (cash flow) income tax, and tax on external private borrowing. These labels are rather misleading.

The "consumption tax" is a tax on the private consumption of the traded good only. Leisure, the nontraded good, is not taxed. A comprehensive flat-rate consumption tax would fall equally on the private consumption of traded and nontraded goods and on public consumption. Henceforth, *consumption* denotes private consumption of traded goods only.

The "cash flow income tax" is a tax on domestic factor income (GDP) minus investment expenditure. This is of course identically equal to consumption plus exhaustive public spending plus the trade balance surplus. With zero public spending, it is a tax on consumption plus the trade balance surplus.

The tax on private external borrowing is in fact a tax on the private external primary (noninterest) deficit (i.e., private external borrowing minus interest paid on the external private debt). With a balanced government budget, the external primary deficit of the private sector equals the trade deficit. We therefore have (in each period) proportional taxes on consumption, on consumption plus the trade balance surplus, and on the trade balance deficit. The fact that any linear combination of these three taxes can be reproduced by some linear combination of any two of the three is therefore not surprising. I will restrict attention in what follows to the consumption tax and the cash-flow tax.

In the special case of the two-period model with inelastic labor supply, most of the single-country analysis can be obtained directly from the two intertemporal first-order conditions or "Euler equations" governing private consumption and investment.

If the instantaneous utility function is $u(c)$, the optimal intertemporal consumption choice is characterized by

$$\frac{1}{1+\tau_{c_0}}u'(c_0) = \frac{(1+r_0)}{1+\tau_{c_1}}\delta u'(c_1). \tag{1}$$

In the logarithmic utility case ($u[c] = lnc$), this implies

$$\frac{c_1}{c_0} = (1+r_0)\left[\frac{1+\tau_{c_0}}{1+\tau_{c_1}}\right]\delta. \tag{2}$$

One plus the growth rate of consumption is increasing in the "consumption interest factor" $(1 + r_0)[(1 + \tau_{c_0})/(1 + \tau_{c_1})]$. In the small open economy, r_0 is exogenous, and the growth rate of consumption increases with $(1 + \tau_{c_0})/(1 + \tau_{c_1})$. A higher value of $(1 + \tau_{c_0})/(1 + \tau_{c_1})$ increases the opportunity cost of consuming today.

For the investment decision, the first-order condition is

$$(1-\tau_{y_0})\left[1+\frac{bI_0}{K_0}\right] = \left[\frac{a+r_k}{1+r_0}\right](1-\tau_{y_1}), \tag{3}$$

which implies

$$I_0 = \frac{1}{b}\left[\left(\frac{a+r_k}{1+r_0}\right)\left(\frac{1-\tau_{y_1}}{1-\tau_{y_0}}\right) - 1\right]K_0. \tag{4}$$

With both r_k and r_0 exogenous and K_0 predetermined, a higher value of τ_{y_1} relative to τ_{y_0} raises the effective (after-tax) investment rate of interest and reduces investment.

If we want c_1 and c_0 separately rather than just c_1/c_0, it is easily checked that

$$(1+\tau_{c_0})c_0 = \frac{1}{1+\delta}W_0,$$

$$(1+\tau_{c_1})c_1 = \frac{\delta}{1+\delta}W_0(1+r_0),$$

where

$$W_0 = (1-\tau_{y_0})\left[w + r_kK_0 - I_0\left(1+\frac{b}{2}\frac{I_0}{K_0}\right)\right] + \frac{1}{1+r_0}(1-\tau_{y_1})$$
$$[w + (r_k + a)K_1],$$

and

$$K_1 = K_0 + I_0.$$

Since for consumption growth all that matters is τ_{c_0}/τ_{c_1} and for investment all that matters is τ_{y_1}/τ_{y_0}, the analysis of the consequences of a balanced-budget switch from a consumption tax to a cash-flow tax is straightforward.

If the first-period equilibrium is characterized by a trade deficit, first-period consumption exceeds first-period cash flow, and second-period consumption is less than second-period cash flow. If τ_{c_0} and τ_{c_1} were reduced by a common percentage and τ_{y_0} and τ_{y_1} increased by a common percentage (so as to maintain public-sector solvency over the two-period horizon), there would be a first-period budget deficit and a second-period budget surplus. To maintain period-by-period budget balance, we must reduce τ_{c_0} proportionally by less than τ_{c_1} and increase τ_{y_0} proportionally by more than τ_{y_1}. If follows immediately that c_1/c_0 and I_0 rise. With a little work, it can also be shown that c_0 falls.

In a two-country setting (with a single traded good), the world interest rate becomes endogenous. Assume that the home country, which undergoes the balanced-budget move from a consumption tax to a cash-flow tax, has a first-period trade deficit (say, because it has a higher subjective rate of time preference, a higher marginal product of capital, or a lower adjustment cost coefficient). The single-country analysis showed that, at a given interest rate, the home country wishes to switch resources to the future by increasing saving and investment. In the world economy, this reduces the interest rate, boosting foreign investment and reducing foreign consumption growth. The decline in r_0 further stimulates home country investment and reduces the increase in consumption growth but does not reverse it; that is, $(1 + r_0)$ $[(1 + \tau_{c_0})/(1 + \tau_{c_1})]$ increases. In an overlapping generations model, the decline in r_0 could be strong enough to reduce $(1 + r_0)$ $[(1 + \tau_{c_0})/(1 + \tau_{c_1})]$ despite the increase in $(1 + \tau_{c_0})/(1 + \tau_{c_1})$ (this is an open economy version of the result shown in Diamond [1970]).

An "unbalanced budget" (but solvency consistent) cut in τ_{c_0} followed by an increase in τ_{c_1} can again be analyzed directly from equations (2) and (4). At a given value of r_0, the growth rate of consumption falls, while I_0 is unaffected. In a two-country world, the world interest rate rises, depressing capital formation at home and abroad, raising foreign consumption growth and mitigating the decline in home country consumption growth.

"Tax harmonization" in the two-country model is the sum of two balanced budget tax conversions, in the home country a move toward a lower consumption tax rate and a higher cash-flow tax rate and in the foreign country a move in the opposite direction. No new analytics are involved.

Other Assorted Comments

1. A minor technical problem with the current presentation of the model is that government revenue "disappears." The government's intertemporal budget constraint or solvency constraint is not explicitly substituted into the private sector's intertemporal choice set to obtain the general equilibrium

responses. There is no government spending on goods and services, and the proceeds from the distortionary taxes are not returned (in lump-sum fashion or otherwise) to the private sector. The analysis is therefore strictly valid only for (small) tax rate changes evaluated "at zero."

2. The analysis proceeds as if a cut in tax rates always reduces revenue from the tax in question. This is correct in the FRS model for consumption tax cuts and for equal proportional cuts in cash-flow tax rates in both periods. It is not obviously true if τ_{y_1} alone is cut since this boosts I_0, which might raise cash flow in period 1 by enough to raise cash-flow tax receipts in period 1 despite the cut in τ_{y_1}. With endogenous labor supply (the general case considered in the simulation exercises), the scope for Laffer-style phenomena is enhanced.

3. It would be interesting (and in my view essential for a policy relevant analysis) to extend the analysis beyond the representative agent case with its maintained hypothesis of first-order debt neutrality. Samuelson-Diamond OLG models or the Blanchard-Yaari version of the OLG model are the natural vehicles for carrying out a rich analysis of changes in tax structure with and without balanced budgets. Frenkel and Razin have pioneered the application of these models to international tax questions (see, e.g., Frenkel and Razin 1987), and I hope that in further work on the topics covered in the FRS paper they will take the key step of moving beyond the representative agent paradigm. My own analysis of a proportional tax on the income from labor and capital in open, interdependent economies (Buiter 1989) shows that qualitatively different results can be obtained (even in a balanced budget setting) if we move from a representative agent to an OLG setting.

4. For a policy-oriented analysis, the introduction of endogenous terms of trade (i.e., at least two traded goods) is important. Part of the real-world debate about the switch from conventional income taxes to a VAT concerns the effects of such a change on international competitiveness (see, e.g., Feldstein and Krugman, in this volume). While the model of the FRS paper can be used to analyze the consequences of tax conversions of this kind on the relative sizes of the traded and nontraded goods sectors (in the case where the supply of labor is not exogenous), it cannot be used to address questions concerning effects on the production of exportables and import-competing goods and on the terms of trade. Engel and Kletzer (1987) have demonstrated the importance of the specification of savings behavior for the determination of the effects of a tariff (a tax on the consumption of and an equal proportional subsidy on the production of importables) on the external accounts. A similar sensitivity of the behavior of the external accounts (and of the sectoral allocation of resources) to alternative assumptions about savings behavior can be expected for other changes in the structure of taxation, transfers, and subsidies.

5. The consumption tax of the FRS paper is a reasonable ideal type of a simple VAT with a single rate on traded goods and a zero-rated nontraded

goods sector. The other two taxes, however, cannot be described as reasonable approximations to real-world taxes, nor do they correspond to traditional public finance ideal types such as an ideal consumption tax (equal proportional taxes on the consumption of traded and nontraded goods in all periods) or a Hicks-Simons comprehensive income tax.

Instead of a tax conversion from the FRS cash-flow tax to a consumption tax, it might be more informative to consider switches between conventional taxes on the income from labor and capital (or employers' social security taxes) and a consumption tax. The tax on the external primary deficit of the private sector also has (as far as I know) no close real-world counterpart. It would be useful to analyze changes in the taxation of foreign asset income, perhaps as part of a general review of source- versus residence-based tax systems.

6. Finally, when considering tax harmonization (or the convergence of VAT rates and income tax rates among nations), it is important to realize that the argument in the European Community about this issue is part of a wider debate about the merits of competition between fiscal jurisdictions versus harmonization or uniformity. A proper understanding requires the joint consideration of exhaustive public-spending and tax-transfer-subsidy programs. The right perspective involves extensions of the theories of fiscal federalism, the theory of clubs, and the theory of local public goods. One of the authors of the FRS paper also contributed to this subject at this very conference (Razin and Sadka, in this volume). Issues such as the mobility of factors of production, of owners of factors of production, and of taxpayers and benefit recipients relative to the span of control of national fiscal authorities must be considered when this wider approach to fiscal harmonization is pursued.

The FRS paper is a useful first step toward a dynamic general equilibrium analysis of changes in tax structures in open interdependent economies.

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