

IMF WORKING PAPER

© 1991 International Monetary Fund

This is a working paper and the author would welcome any comments on the present text. Citations should refer to an unpublished manuscript, mentioning the author and the date of issuance by the International Monetary Fund. The views expressed are those of the author and do not necessarily represent those of the Fund.

WP/91/22

INTERNATIONAL MONETARY FUND

Research Department

International VAT Harmonization: Economic Effects

Prepared by Jacob A. Frenkel, Assaf Razin, and Steven Symansky*

February 1991

Abstract

This paper highlights key macroeconomic issues related to VAT harmonization. A model is developed which emphasizes the effects of changes in the time profile of various taxes on international behavior. Dynamic simulations reveal that the macroeconomic and welfare implications of VAT harmonization, including conflicts of interest, depend critically on the tax system and the degree of substitution governing temporal and intertemporal allocations. We also demonstrate that the effects of revenue-neutral tax conversions between income and consumption tax systems undertaken by a single country depend critically on international differences in behavior.

JEL Classification Numbers:

320, 430

*We wish to thank Lans Bovenberg, David Bradford, Martin Feldstein, Peter Isard and Bennett McCallum, for useful discussions and Ravina Malkani for efficient research assistance. This paper was written while Assaf Razin was a visiting scholar in the Research Department of the IMF.

<u>Contents</u>	<u>Page</u>
Summary	iii
I. Introduction	1
II. VAT Harmonization: Europe 1992	2
III. The Tax Model	5
IV. Simulations of VAT Harmonization: Alternative Tax Systems	10
V. Tax Conversions: Revenue Neutrality and Current-Account Imbalances	14
VI. Simulations of VAT Harmonization: Current Account Imbalances	17
VII. Concluding Remarks	22
 <u>Tables</u>	
1. VAT Rates in European Community (1989)	4
2. Effects of VAT Harmonization under Alternative Tax Systems	11
3. Effects of VAT Harmonization under Alternative Current-Account Positions	19
4. Effects of a 10 Percentage Point Rise in the International Borrowing Tax Rate between Europe and the Rest of the World	29
 <u>Figures</u>	
1. VAT Harmonization: 6% Permanent Increase in Home Country VAT and 6% Permanent Reduction in Foreign Country VAT under Cash Flow Tax System	12a
2. VAT Harmonization: 6% Permanent Increase in Home Country VAT and 6% Permanent Reduction in Foreign Country VAT under Wage Tax System	12a
3. VAT Harmonization: 6% Permanent Increase in Home Country VAT and 6% Permanent Reduction in Foreign Country VAT under Capital Tax System	12b
4. VAT Harmonization: 6% Permanent Increase in Home Country VAT and 6% Permanent Reduction in Foreign Country VAT under Capital Tax and Saving Incentive System	12b
5. VAT Harmonization: 6% Permanent Increase in Home Country VAT and 6% Permanent Reduction in Foreign Country VAT under Capital Tax and Investment Incentive System	12c
6. Dynamic Effects of a Revenue-Neutral Tax Conversion from Income Taxes to VAT with an Initial-Period Domestic Current-Account Deficit	16a
7. VAT Harmonization: 6% Permanent Increase in Home Country VAT and 6% Permanent Reduction in Foreign Country VAT	18a
8. VAT Harmonization: 6% Permanent Increase in Home Country VAT and 6% Permanent Reduction in Foreign Country VAT	18a
9. VAT Harmonization: 6% Permanent Increase in Home Country VAT and 6% Permanent Reduction in Foreign Country VAT	18b
10. VAT Harmonization: 6% Permanent Increase in Home Country VAT and 6% Permanent Reduction in Foreign Country VAT	18b
Appendix I The Solution of the Model	24
Appendix II Tax on International Borrowing	26
References	30-31

Summary

The discussion of fiscal policy convergence within Europe in 1992 necessarily includes the issue of harmonization of value-added taxes (VAT). This paper highlights macroeconomic issues pertinent to the understanding of the international and domestic effects of VAT harmonization. It outlines the elements of the policies of VAT harmonization envisaged for Europe of 1992 and develops a basic tax model. As the model, grounded on microeconomic foundations, is neoclassical, it is suitable for the analysis of the incentive effects of various tax policies and their welfare implications. Allowing for a rich tax structure, it also contains a detailed specification of public and private sector behavior. By adopting the saving-investment balance approach to the investigation of international economic interdependence, this analysis 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), the consumption-saving choice (such as the negative double-taxation effect of income tax on saving), and the choice of investment plans (such as the negative effect of the corporate income tax on investment). This formulation focuses on the roles played by the levels and the time profile of taxes on income (wage tax and capital income tax), investment and saving incentives (investment tax credit and saving tax credit), taxes on consumption (value-added tax), and on international borrowing.

The effects of VAT harmonization are illustrated by means of dynamic simulations. The simulations reveal that the effects of such tax changes on the domestic and foreign levels of output, employment, investment, consumption, and other key macroeconomic variables depend critically on the degree of substitution governing temporal and intertemporal allocations as well as on the tax system. Furthermore, it is shown that these characteristics of the economic system also govern the precise welfare implications of VAT harmonization. We show that the policy of VAT harmonization may generate conflicts of interest within each country as well as between countries.

The paper analyzes the dynamic mechanism associated with changes in the time profile of taxes. Reflecting an emphasis on the saving-investment balance, the study demonstrates analytically and by means of simulation 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.

I. Introduction

A major challenge facing the move toward the single market in Europe of 1992 lies in the fiscal front. The increased degree of international economic interdependence stimulated interest in the international coordination of fiscal policies, in general, and of tax policies in particular. A central issue in the discussion of fiscal policy convergence within Europe in 1992 involved the harmonization of value added taxes (VAT). The increased integration of markets for goods and services within the European Community has contributed to the urgency of VAT harmonization among member countries. Such harmonization is designed to reduce tax revenue losses induced by cross-border arbitrage. In addition, in countries with high tax rates, industry puts pressures for lower tax rates aimed at restoring competitiveness and maintaining market shares. Furthermore, the increased integration of capital markets makes the tax base associated with internationally mobile capital highly elastic. All these factors imply that the process of European integration may need to bring about significant restructuring of tax systems. The purpose of this paper is to highlight key macroeconomic issues pertinent for the understanding of the international and the domestic effects of VAT harmonization.

In Section II, we outline the elements of the policies of VAT harmonization envisaged for Europe of 1992. In Section III, we present the basic tax model. The model, grounded on microeconomic foundations, is neoclassical in nature and is suitable therefore for the analysis of the incentive effects of various tax policies and their welfare implications. It allows for a rich tax structure and contains a detailed specification of public and private sector behavior. 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), the consumption-saving choice (such as the negative double taxation effect of income tax on saving) and the choice of investment plans (such as the negative effect of the corporate income tax on investment). Our formulation focuses on the roles played by the levels and the time profile of taxes on income (wage tax and capital income tax), investment and saving incentives (investment tax credit and saving tax credit), taxes on consumption (value-added tax), and on international borrowing.

In Section IV, we apply the tax model of Section III to examine the effects of international VAT harmonization. Throughout the analysis we ensure that the tax restructuring is constrained by the requirement that government solvency is maintained. Accordingly, changes in the value-added tax rates are accompanied by compensatory changes in other taxes. The effects of VAT harmonization are illustrated by means of dynamic simulations. The simulations reveal that the effects of such tax changes on the domestic and foreign levels of output, employment,

investment, consumption and other key macroeconomic variables depend critically on the degree of substitution governing temporal and inter-temporal allocations as well as on the tax system. Furthermore, it is shown that these characteristics of the economic system also govern the precise welfare implications of VAT harmonization. We show that the policy of VAT harmonization may generate conflicts of interest within each country as well as between countries.

In Section V, we analyze the dynamic mechanism associated with changes in the time profile of taxes. Since VAT harmonization involves changes in the composition of taxes, we examine in this section the dynamic consequences of revenue-neutral tax conversions between income and consumption (VAT) tax systems undertaken by a single country. The revenue-neutrality requirement is motivated by inflationary fears or debt aversion. Reflecting our emphasis on the saving-investment balance we demonstrate analytically 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. These issues, are examined by means of dynamic simulations in Section VI, in which the role of current imbalances in global tax restructuring is analyzed. Concluding remarks are contained in Section VII.

II. VAT Harmonization: Europe 1992

In this section, we outline elements of the policies of VAT harmonization envisaged for Europe of 1992. Such policies form an important ingredient of the wide ranging measures associated with the move toward the single European market in 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 discussions 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. ^{1/} 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

^{1/} Zero-rated products involve the reimbursement of taxes levied on inputs with the result that the final good is completely untaxed.

and 9 percent. ^{1/} 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 January 1, 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 1 provides a summary information on VAT in the European Community. It illustrates the disparities among the various member country VAT rates. ^{2/}

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.

The increased integration of markets for goods and services within the European Community has contributed to increased pressures for VAT harmonization among member states. In the absence of such harmonization, cross-border arbitrage results in tax revenue losses in countries with high tax rates and tax revenue gains in countries with low rates. In addition, faced with reduced competitiveness, industry in countries with tax rates puts pressures for lower rates. These forces have provided some of the impetus for the movement toward narrowing the intra-European gaps among VAT rates.

One of the key issues addressed in the deliberations concerns the specification of the value-added tax: whether it would be a destination-based VAT (as is traditionally the case in Europe) or whether it would be a source-based VAT. The problem arises since the removal of fiscal frontiers through the abolishment of border controls may complicate the administration of destination-based VAT which requires the levying VAT on imports and rebating the VAT on exports. These administrative difficulties, however, can be overcome through a variety of methods such as those used for cross-border transactions among the Benelux countries since 1969 as well as between Ireland and the United Kingdom until 1984. The key feature of the various methods involves computing border tax adjustment from books of accounts verified through written records (in the absence of border controls). An alternative method to protect the tax

^{1/} Until the end of 1992 the only permissible changes in the standard rates must be within the 14-20 percent range or, if the rates lies outside the range then only changes towards the range are allowed. The final agreement on the rate structure is planned to be reached by the end of 1991.

^{2/} For a recent broad survey of the international practice and problems in the area of VAT, see Tait (1988).

Table 1. VAT Rates in the European Community

Country (Year of VAT Introduction)	Statutory Rates (1990, percent)			Revenue Contribution as Percentage of Total Tax Revenue (1987)	Revenue Contribution as Percentage of GDP (1987)
	Reduced Rate	Standard Rate	Higher Rate		
Belgium (1971)	1,6 and 7	19	25 and 33	16.3	7.2
Denmark (1967)	0	22	-	26.9	9.8
France (1968)	5.5, and 7	18.6	25	20.9	8.7
Germany (1968)	7	14	-	13.1	3.8
Greece	3 and 6	16	36	20.9	7.8
Ireland (1972)	0, 2.2, and 10	23	-	18.9	8.0
Italy (1973)	2 and 9	18	38	13.1	4.7
Luxembourg (1970)	3 and 6	12	-	13.3	6.0
Netherlands (1969)	6	18.5	-	15.2	7.9
Portugal (1986)	8	17	30	18.8	7.7
Spain (1986)	6	12	33	16.0	5.3
United Kingdom (1973)	0	15	-	16.3	6.0

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, International Bureau of Fiscal Documentation, Tax News Service, various issues; IMF, Government Finance Statistics Yearbook (1989), and OECD, Revenue Statistics of OECD Member Countries, 1966-1988, Paris, 1989.

revenue of the country of destination is the establishment of a clearance mechanism among the various tax authorities. 1/

In the subsequent section we develop a tax model that will be used to assess the global implications of the move toward VAT harmonization. Throughout, we specify the tax system as being destination based. This formulation conforms with the prevailing system even though the future system is envisaged to be source-based. However, the European Commission has proposed in May 1990 (following the guidelines set by the Council of its Economics and Finance Ministers in 1989) to maintain the present destination principle until January 1997. Our analysis, however, can also be used to shed light on the implications of harmonization with a source-based VAT system.

III. The Tax Model

We start with a formulation of the budget constraint. 2/ As usual, this serves to focus attention on key economic variables and tax policy parameters that play a central role in the analysis. The home country's private sector (full-income) budget constraint applicable to period t ($t=0,1,\dots,T-1$) is

$$(1+r_{ct}) C_t + (1-r_{wt}) w (1-l_t) = (1-r_{wt})w + (1-r_{kt})((r_k-\theta)K_t) \quad (1)$$

$$- (1-r_{It})I_t(1+\frac{b}{2}\frac{I_t}{K_t}) + (B_t^p - B_{t-1}^p) - (1-r_{kt})(1+r_{st})r_{t-1}B_{t-1}^p$$

Where r_{ct} , r_{wt} , and r_{kt} denote the tax rates on consumption (VAT), labor income and capital income, respectively; all taxes are residence based. The terms r_{It} and r_{st} denote investment tax credit and saving tax credit,

1/ Such a proposal is still under review by the commission. For a further examination of the various proposals and considerations, see Cnossen and Shoup (1987).

2/ The analytical framework underlying the international intertemporal approach to open economy macroeconomics is based on Frenkel and Razin (1987, 1988b). A fuller analysis of international taxation is contained in Frenkel, Razin and Sadka (1991). For an analogous approach developed in a closed economy context see Auerbach and Kotlikoff (1987), for an analogous approach developed in the context of a two-country world economy see Bovenberg and Goulder (1989) and for an extension to a model with borrowing constraints see Perraudin and Pujol (1990). For a discussion of supply-side policies see Tanzi and Bovenberg (1989). In the present formulation capital markets are assumed to be integrated through the free access to credit markets; in Appendix II we consider taxes on international borrowing. To simplify we exclude direct foreign investment which is analyzed in Frenkel and Razin (1989).

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 , r_k , and r_t ; and θ denotes the rate of depreciation. 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 so that $I_T = B_T^P = 0$. ^{1/} To sum up, the left hand side of equation (1) represents the value of consumption of ordinary goods and leisure; the right hand side of this equation represents the value of labor endowment, capital income (net of investment) and new borrowing (net of debt service). All of these quantities are evaluated at the after-tax prices. 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.

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

$$C_0 + \alpha_c C_1 = \left\{ \frac{1-\tau_{w0}}{1+\tau_{c0}} \right\} \left\{ w\ell_0 + \alpha_L w\ell_1 \right\} + \left\{ \frac{1-\tau_{I0}}{1+\tau_{c0}} \right\} \left\{ \alpha_I (r_k - \theta) - \left(1 + \frac{b}{2} \frac{I_0}{K_0}\right) \right\} I_0 \quad (2)$$

$$+ \left\{ \left(\frac{1-\tau_{b0}}{1+\tau_{c0}} \right) (r_k - \theta_k) [1-\tau_{k0} + \frac{1-\tau_{k1}}{1-\tau_{b1} + (1-\tau_{k1})(1+\tau_{s1})r_0}] \right\} K_0$$

$$- \left\{ \frac{1 + (1-\tau_{k0})(1+\tau_{s0})r - 1}{1 + \tau_{c0}} \right\} B_{-1}^P$$

^{1/} 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 equation 1 with an added term on the right hand side equal to 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) and Frenkel and Razin (1987).

where

$$\alpha_c = \frac{(1+\tau_{c1})}{(1+\tau_{c0})} \frac{1}{1 + (1-\tau_{k1})(1+\tau_{s1})r_0}, \quad \alpha_I = \frac{(1-\tau_{k1})}{(1-\tau_{I0})} \frac{1}{1 + (1-\tau_{k1})(1+\tau_{s0})r_0}$$

$$\alpha_L = \frac{(1-\tau_{w1})}{(1-\tau_{w0})} \frac{1}{1 + (1-\tau_{k1})(1+\tau_{s1})r_0} \quad \text{and} \quad \gamma_0 = \frac{1-\tau_{w0}}{1+\tau_{c0}}$$

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. 1/ The intratemporal choice between labor supply (leisure) and consumption of ordinary goods is governed by the prevailing effective intratemporal tax ratio $\gamma = (1-\tau_w)/(1+\tau_c)$.

The expressions in equation (2) show the key factors operating on the various margins of substitution. The intratemporal tax ratio, γ , shows the conventional negative effect of labor income tax and consumption tax on labor supply. The effective discount factor governing consumption, α_c , shows the conventional negative effect of capital income tax, τ_k (through double taxation) on saving. Likewise, the effective discount factor governing investment, α_I , shows the negative effects of capital income tax, τ_k , on investment. In addition to these conventional channels, the expressions in equation (3) highlight the dynamic channels of tax policies. Specifically, as can be seen, the effective discount factors depend on the time path of the various taxes. 2/

To understand the dynamic mechanisms underlying the effective discount factors it is useful to define a benchmark case in which the double-taxation of savings is eliminated. In that case, the tax incentive rates on savings and investment are equalized and the common rate is equal to the capital income tax. Accordingly, these equalities imply that $\tau_k = \tau_I = \tau_S/(1+\tau_S)$. Such a configuration of taxes yields the cash flow income tax system. 3/

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

2/ The expression for α_L reveals an added dynamic effect whereby a rise in the capital income tax, τ_k , induces intertemporal substitution towards future labor supply.

3/ The tax system in many countries include incentives to saving and investment and, thereby, contain important features of the cash flow income tax system. Such a system was advocated recently for the United States by Feldstein (1989). For a recent comparative analysis of capital income tax systems in various industrialized countries, see Peckman (1988).

It is noteworthy that such a cash flow income tax system is equivalent to a value-added tax system that is source based. 1/ We note that in this benchmark case the effective discount factor governing intertemporal consumption decisions, α_C , is independent of the income tax whereas the effective discount factor governing investment and leisure decisions, α_I and α_L , are independent of the consumption tax. 2/ Since with such a cash flow tax system, the effective discount factors depend only on the time path of the various taxes rather than on their levels, it follows that if the various tax rates do not vary over time, then 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 in which the time paths of the various tax rates are "flat", the intertemporal allocations are undistorted. Of course as indicated earlier, the intratemporal are distorted if the intratemporal tax ratio γ differs from unity.

Having discussed the budget constraint we turn next to the specification of the utility function. To facilitate the simulation analysis in subsequent sections we need to adopt a specific form of the multi-period utility function. Accordingly, we assume that the intraperiod utility function between consumption of ordinary goods and leisure is

$$u_t = \left\{ \beta C_t^{\frac{\sigma-1}{\sigma}} + (1-\beta) (1-l_t)^{\frac{\sigma-1}{\sigma}} \right\}^{\frac{\sigma}{\sigma-1}} \quad (3)$$

while the interperiod utility function is

$$U_0 = \sum_{t=0}^T \delta^t \log(u_t) \quad (4)$$

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. This formulation implies a unitary intertemporal elasticity of substitution.

1/ To verify this point we note from equation (1) that, under a destination-based value-added tax system, the tax rate $1-(1/(1+t_C))$ applies to the value of GNP (net of investment) minus exports, plus imports; thus in effect, imports are taxed while export taxes are rebated. In contrast, the cash flow income tax applies only to GNP (net of investment); thus in effect imports are not taxed, while export taxes are not rebated. Hence this tax system is equivalent to a value-added tax system which is source based. We are indebted to Sijbren Cnossen for providing us with this interpretation of the relation among the various VAT systems.

2/ This latter property is more general and not confined only to the benchmark case.

Maximizing the utility functions in equations (3) and (4) subject to the lifetime present value budget constraint (the multi-period analogue to equation (2)) yields the consumption function and the labor supply function. The formal solutions are presented in Appendix I where it is shown that consumption demand and labor supply depend on wealth (which is defined, as usual, as the discounted sum of tax-adjusted income, net of investment, minus the initial debt commitment), on the path of the tax-adjusted rates of interest and on the intratemporal and intertemporal tax structure. The maximization of wealth yields the investment function. It is shown in Appendix I that, in addition to the conventional technological characteristics, investment depends on the path of the tax-adjusted rates of interest. As is evident, in this model economic welfare as well as the key behavioral relations (consumption, labor supply, investment, and output) are determined within a dynamic context. Accordingly, the paths of saving and investment and thereby the current account of the balance of payments are also governed by dynamic considerations. In the present context the model highlights the central role played by the dynamics of the tax structure. The dynamics are reflected by the temporal and intertemporal substitutions captured by the various tax-adjusted discount factors. It follows, of course, that a proper evaluation of positive and normative implications of trends in savings, investment, and the current account cannot be complete without an assessment of the expected paths of taxes and the other economic variables influencing income and spending. ^{1/}

The foregoing discussion focused on the various channels and margins of substitution through which taxes impact on economic behavior. Such changes in economic behavior also influence economic welfare. The welfare implications depend, as always, on the distorted margins of substitution arising from the tax wedges, and on the elasticities of response to the implied changes in incentives. The behavioral response to changes in the tax wedges are shown in the consumption demand, labor supply and investment in Appendix I. Our formulation in equation (2) shows that in addition to their effects on the margins of substitution, the various taxes also contain elements that resemble lump sum taxes. These elements are found in the taxes that fall on inelastic tax bases. For example, the capital income and consumption tax rates, τ_k and τ_c are also applied (directly, and indirectly) to the value of initial assets (K_0 and (B_{-1}^D)) which are obviously inelastic tax bases. These elements of the tax structure are non-distortive. Our simulation analysis of the welfare implications of alternative tax instruments incorporates these attributes of the tax system.

^{1/} In the present model, the tax structure affects the economic system through altering the inter-and intra-period margins of substitution as well as by altering wealth. An additional mechanism would recognize that in the context of overlapping generations model intertemporal-offsetting shifts of tax revenue of equal present value may alter private sector behavior through changes in the intergenerational wealth distribution. This mechanism is analyzed in Blanchard (1985) and Frenkel and Razin (1986, 1987).

The tax model developed in this section and its formal solution presented in Appendix I are used in subsequent sections for the dynamic simulations of the effects of international tax harmonization.

IV. Simulations of VAT Harmonization: Alternative Tax Systems

In this section we present dynamic simulations of the effects 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 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 rate. The narrowing of international disparities between VAT rates, captures the commission's proposal of reducing the disparities of VAT rates among member countries and categories of goods. Furthermore, in order to maintain fiscal solvency, we assume that (in the absence of changes in government spending) changes in the VAT rates are accompanied in each country by opposite changes in income tax rates.

In performing the simulations we consider first a benchmark case in which the saving and investment propensities do not differ internationally, so that $\delta = \delta^*$ and $r_k = r_k^*$. These assumptions ensure that the current account positions (that is, the saving-investment gaps) are zero and, thereby, the tax restructuring in and of itself does not affect the world rate of interest. In subsequent sections, we depart from this benchmark case.

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. Throughout, the home country was assumed to raise its VAT by 6 percent and restores fiscal solvency by a corresponding reduction of its income tax. We considered various tax systems: cash flow income tax, labor income tax, capital income tax, capital income tax combined with saving incentives, and capital income tax combined with investment incentives. The results of these simulations are shown in Figures 1-5 and are summarized in Table 2, which also reports the implied welfare implications of the VAT harmonization. To capture the essence of the dynamic evolution of the various variables, we report in Table 2 the direction of changes for both the short run (SR) and the medium run (MR).

The multiplicity of mechanisms and channels operating on the various tax incentives result in a variety of configurations of the response of the other key economic variables as illustrated for the cases shown in Table 2. Of special interest are the welfare effects indicated by the utility index in the simulations. As always, the welfare consequences of tax policies can be decomposed into two components.

Table 2. Effects of VAT Harmonization Under
Alternative Tax Systems

(Deviations from baseline)

	Cash Flow Income Tax		Labor Income Tax		Capital Income Tax		Capital Income Tax and Saving Incentives		Capital Income Tax and Investment Incentives	
Variable	SR	MR	SR	MR	SR	MR	SR	MR	SR	MR
r	0	0	0	0	0	0	0	0	0	0
I	-	-	0	0	+	+	+	+	-	-
I*	+	+	0	0	-	-	-	-	+	+
L	+	+	+	+	+	-	-	-	+	-
L*	-	-	-	-	-	+	+	+	-	+
Y	+	-	+	+	+	-	-	+	+	-
Y*	-	+	-	-	-	+	+	-	-	+
C	-	-	+	+	-	+	-	-	-	+
C*	+	+	-	-	+	-	+	+	+	-
S	+	-	-	+	+	-	+	+	+	-
S*	-	+	+	-	-	+	-	-	-	+
B	-	-	+	-	-	-	+	+	-	-
U	-	+	-	+	-	+	-	+	-	+
U*	+	-	+	-	+	-	+	-	+	-

Note: The VAT harmonization obtains through a permanent rise in r_c and a fall in r_c^* . Budgetary balance obtains through appropriate adjustments in the periodic rates of cash flow, labor income, capital income taxes (with and without saving incentives). The technology and preference parameters of the two countries are assumed to be equal (so that the current account position is balanced). SR and MR are defined as short run and medium run, respectively.

First, those arising from changes in excess burden, and second, those arising from terms of trade effects. The changes in the degree of excess burden induced by VAT harmonization depend on the elasticity of the tax base as well as on the magnitude of the existing distortion. In the cases illustrated by the simulations, we have chosen parameters that result in relatively low investment and labor supply elasticities, and a relatively high consumption elasticity. ^{1/} This choice suggests that in the case considered, the excess burden associated with a consumption tax is relatively high in comparison with the corresponding excess burden associated with an income tax.

The assumption that the saving and investment propensities do not differ internationally implies that the initial current account positions are balanced. As a result, the international VAT harmonization does not alter the world rate of interest. The dynamics of adjustment in this case arise only from the effects of the tax wedges on the various incentives.

In summarizing the results presented in Figures 1-5 and Table 2, we first note that with a labor income tax system, the VAT harmonization does not induce any change in the time path of domestic and foreign investment.

Second, whenever the income tax system contains an investment incentive component, it dominates in its effect on the paths of investment. Indeed, under the cash flow income tax system (which obviously contains an investment incentives component), and under a system of capital income tax combined with investment incentives, the path of domestic investment consequent on the reduced income tax is lowered for both the short and the medium runs. The opposite occurs in the foreign country. This pattern is reversed under the income tax systems that do not contain incentives to investment.

Third, and analogously to the foregoing reasoning, whenever the income tax system contains a saving incentive component (which eliminates the double taxation of savings) its effect dominates the changes in consumption. Thus, under the cash flow income tax system and under a system of capital-income tax combined with saving incentives, the path of domestic consumption consequent on the VAT harmonization is lowered for both the short and the medium runs. The opposite occurs in the foreign country. This pattern is reversed under the labor tax system.

^{1/} The intertemporal labor supply elasticity, indicated by σ , is 0.3, the coefficient of cost of adjustment for investment, indicated by b , is 40, and the intertemporal elasticity of substitution for consumption is unitary. To examine the sensitivity of the results with respect to the values of the elasticities we also simulated the model with a lower cost-of-adjustment coefficient and a higher labor supply elasticity. Under these circumstances the welfare cost of VAT diminished relatively while the welfare cost of income taxes increased relatively.

FIGURE 1

VAT HARMONIZATION: 6% PERMANENT INCREASE IN HOME COUNTRY VAT AND
6% PERMANENT REDUCTION IN FOREIGN COUNTRY VAT UNDER CASH FLOW TAX SYSTEM

(Percentage deviations)

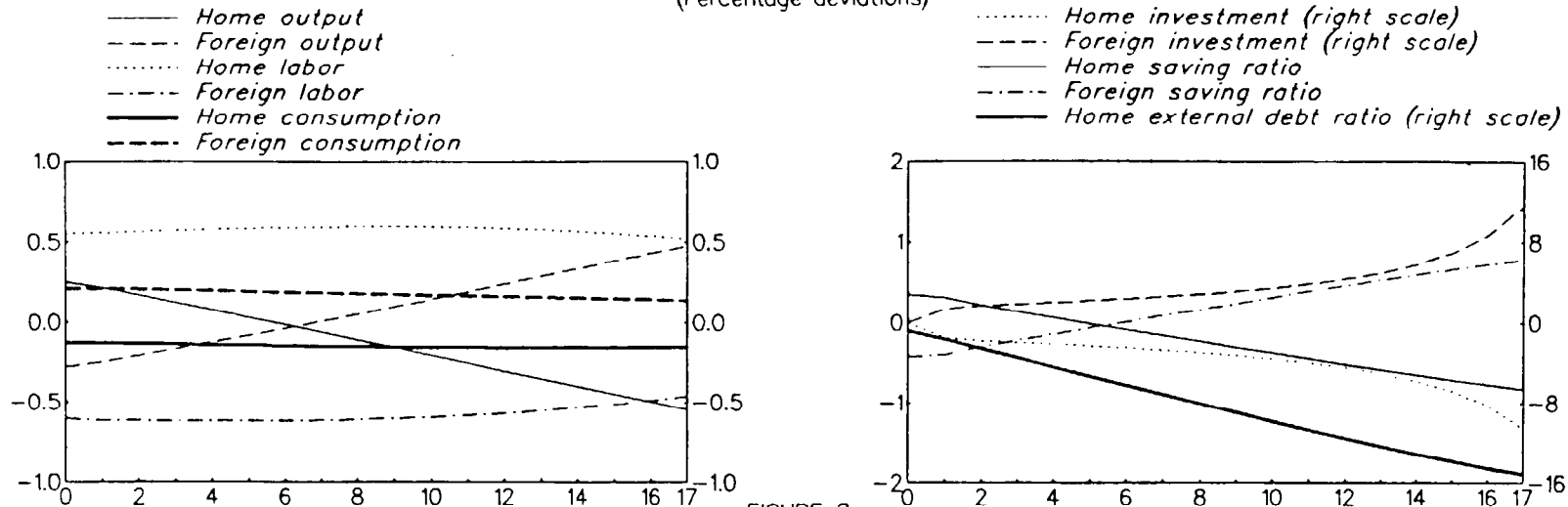


FIGURE 2

VAT HARMONIZATION: 6% PERMANENT INCREASE IN HOME COUNTRY VAT AND
6% PERMANENT REDUCTION IN FOREIGN COUNTRY VAT UNDER WAGE TAX SYSTEM

(Percentage deviations)

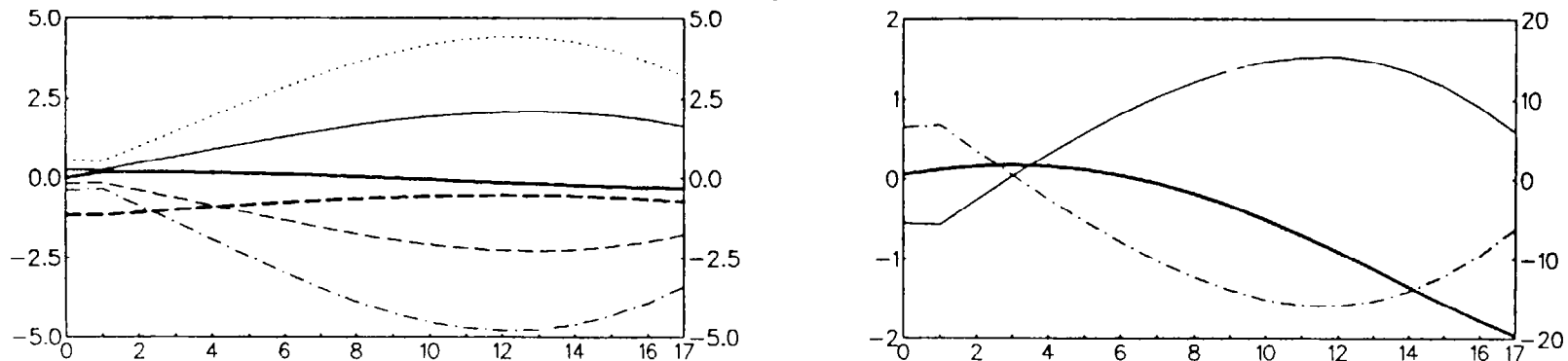


FIGURE 3

VAT HARMONIZATION: 6% PERMANENT INCREASE IN HOME COUNTRY VAT AND
6% PERMANENT REDUCTION IN FOREIGN COUNTRY VAT UNDER CAPITAL TAX SYSTEM

(Percentage deviations)

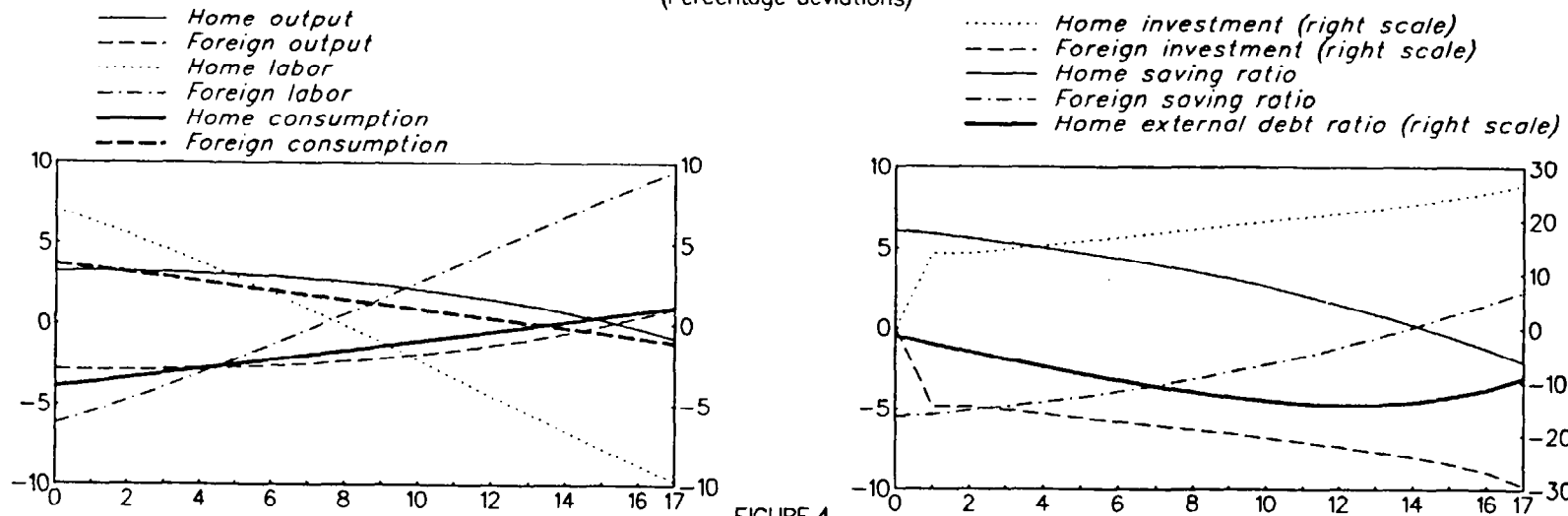


FIGURE 4

VAT HARMONIZATION: 6% PERMANENT INCREASE IN HOME COUNTRY VAT AND 6% PERMANENT REDUCTION
IN FOREIGN COUNTRY VAT UNDER CAPITAL TAX AND SAVING INCENTIVE SYSTEM

(Percentage deviations)

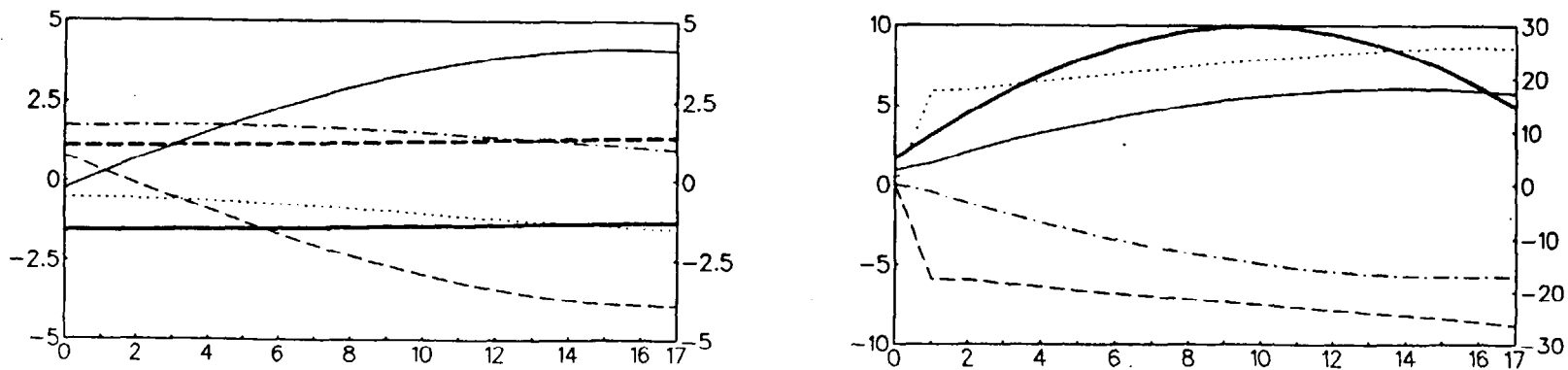
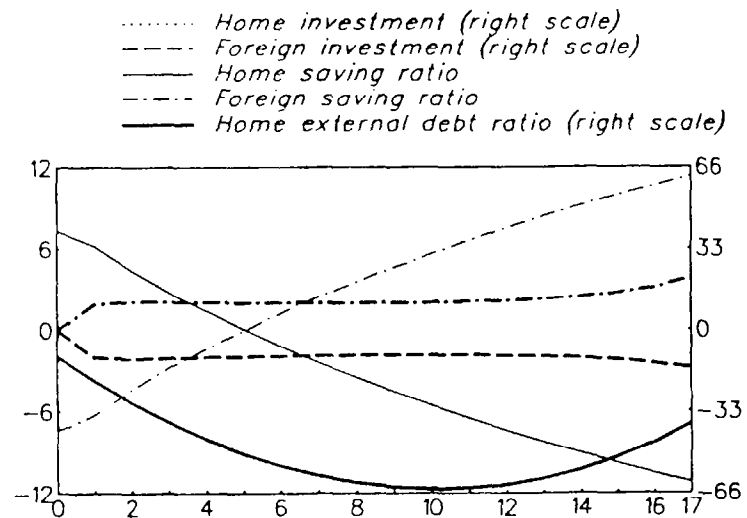
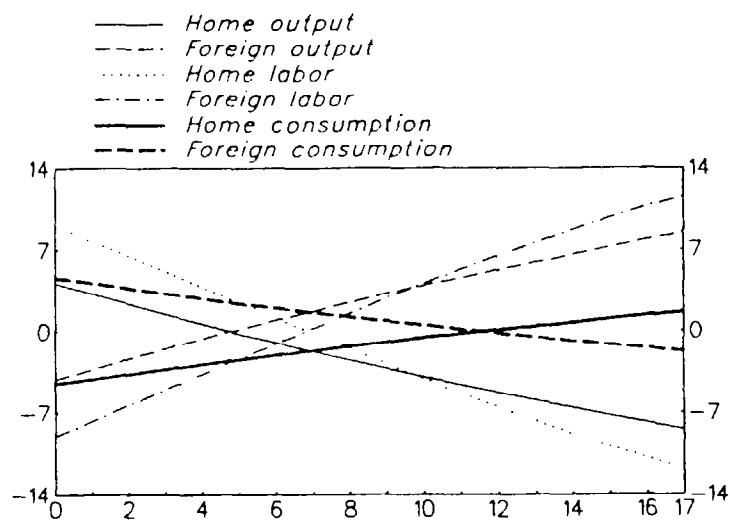


FIGURE 5
 VAT HARMONIZATION: 6% PERMANENT INCREASE IN HOME COUNTRY VAT AND 6% PERMANENT REDUCTION
 IN FOREIGN COUNTRY VAT UNDER CAPITAL TAX AND INVESTMENT INCENTIVE SYSTEM
 (Percentage deviations)



Fourth, whenever, the income tax system contains a tax on labor income, changes in that tax dominate the effect of the VAT harmonization on employment. Thus, under the cash flow income tax system and under the system of labor income tax, the path of domestic employment consequent on the reduced income tax is raised for both the short and the medium runs. The opposite occurs in the foreign country in which income taxes rise. Finally, by inspecting the Figures, one could infer the effects of the VAT harmonization under alternative tax systems on the growth rates of domestic and foreign output and on the path of external debt. 1/

An examination of Figures 1-5 and Table 2, indicates a potential for international conflicts of interest with respect to the implementation of VAT harmonization. In fact, as is evident, under all tax systems considered, the direction of changes in domestic and foreign employment, output, consumption, savings and investment, consequent on the international VAT harmonization are opposite to each other in both the short and the medium runs. The same phenomenon emerges from an examination of the utility indices of economic welfare. In all cases the domestic and foreign SR utility indices (given by the discounted sums of utilities over the entire period except for the final one) move in opposite directions. In general, the same holds for the MR utility indices, reflecting the entire future beyond the simulation period. Furthermore, the cases considered the VAT harmonization results in a redistribution of welfare between generations. This is evident by the opposite direction of changes in the SR and MR utility indices within each country. The various simulations show that the changes in the utility indices reflect, by and large, a redistribution of world welfare since the sum of the domestic and foreign utility indices does not change appreciably. This result underscores the notion that the resolution of international conflicts of interest in implementing the VAT harmonization may necessitate a compensation mechanism from gainers to losers.

The foregoing analysis of international VAT harmonization was confined to the case in which the propensities to save and invest were equal internationally. As a result, the current accounts were balanced and the various tax bases (consumption and income tax bases) did not vary over time. The constancy of the tax bases implied that the various tax rates could also be constant over time, without violating fiscal solvency and, at the same time, ensuring that the VAT harmonization was revenue-neutral period by period. In the subsequent sections we allow for current account imbalances by allowing for international differences in saving and investment propensities. Such current account imbalances introduce rich dynamics to the tax structure. To clarify the main

1/ The results of the consequences of VAT harmonization accompanied by compensatory adjustments of the cash flow income tax, can shed light on the likely effects of transforming a VAT system which is destination-based to a system that is source-based (since the cash flow income tax is equivalent to the source-based VAT).

analytical mechanisms set in motion, we devote the next section to an analytical examination of the global effects of tax conversions. This examination provides the necessary ingredients for the subsequent simulations of the effects of VAT harmonization in the presence of current account imbalances.

V. Tax Conversions: Revenue Neutrality and Current Account Imbalances

In analyzing the domestic and global effects of revenue-neutral tax conversions, we note that such tax reforms are characterized by a change in the composition of a given amount of 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 introduces a consumption tax (VAT) system instead of the prevailing income-tax system. 1/

To simplify, we consider a two-period case with a cash flow tax system. With such a tax system the effective discount factors governing consumption, investment, and labor supply decisions (indicated in equation (2)) become:

$$\alpha_c = \frac{1+\tau_{c1}}{1+\tau_{c0}} \alpha, \quad \alpha_I = \frac{1-\tau_{k1}}{1-\tau_{k0}} \alpha, \quad \alpha_L = \frac{1-\tau_{w1}}{1-\tau_{w0}} \alpha \quad (5)$$

where $\alpha = 1/(1+r_0)$ denotes the undistorted discount factor. 2/

The tax conversion can be thought of as consisting of two components. First, it involves a permanent reduction of the income tax and a permanent equiproportional rise in VAT. Second, it involves further adjustments in the income tax aimed at restoring the initial level of the revenue in each period. As is evident from equation (5) with a cash flow income tax system, the first component of the tax conversion does not alter the effective discount factors governing decisions concerning the rate of growth of consumption and the level of investment. As a result, the dynamic characteristics of the real equilibrium (involving the levels of investment and the rates of growth of output and consumption) remain

1/ This analysis is based on Frenkel and Razin (1989). In order to highlight the pure effects of tax conversions we only consider cases of revenue neutrality. In the absence of revenue neutrality the tax conversion results in periodic budgetary deficits and surpluses. The effects of such budgetary imbalances are analyzed in Frenkel and Razin (1988a) and dynamic simulations are presented in Frenkel, Razin, and Symansky (1990).

2/ The simulation analysis relaxes these assumptions by considering multi-period simulations with a richer tax structure that allows for the various taxes and incentives specified in the previous section.

intact. 1/ However, to the extent that the equiproportional changes in the tax rates alter government revenue, further adjustments in income taxes are necessary. The key factor determining whether the tax conversion results in a shortfall or an excess of tax revenue is the economy's initial current account position. The conversion from an income tax system to a VAT system broadens the tax base if the level of consumption exceeds the level of output plus net investment, that is, if the country runs a deficit in the current account of its balance of payments. 2/ In that case the first component of the tax conversion raises government revenue. To ensure revenue neutrality the second component involves a downward adjustment in the present-period income tax rate. Since intertemporal solvency implies that the economy runs a current account surplus in the future period, restoration of future revenue neutrality necessitates an upward adjustment of the future-period income tax rate. Opposite adjustments in the current and future income tax rates would be necessary if the economy's present-period current account position was in surplus so that the first-component of the conversion toward a VAT system narrows the tax base.

We now apply the analysis to a two-country model of the world economy consisting of the domestic and the foreign countries. We carry out the analysis by means of a simple diagrammatic apparatus which portrays the rates of growth of consumption and output (net of investment) as functions of the corresponding tax-adjusted discount factors. In Figure 6 the upward sloping schedule, S^W , describes the ratio of future to present world output net of investment as an increasing function of the discount factor. The positive slope reflects the fact that a rise in the discount factor (a fall in the rate of interest) raises current investment and induces a substitution away from present-period labor supply toward a future-period labor supply. These changes raise the ratio of future-to-present-period output net of investment. This world relative supply schedule is a weighted average of the corresponding domestic (S) and foreign (S^*) relative supply schedules. The downward sloping schedule, D^W , shows that world desired ratio of future to current consumption as a decreasing function of the discount factor. This world relative demand is a weighted average of the two countries relative demand schedules (not drawn). As shown in Figure 6 the initial equilibrium obtains at point A at which the world rate of interest is r_0 .

1/ We note that even though the effective tax-adjusted discount factors do not change following the first component of the tax conversion, the intratemporal tax ratio $(1-\tau_w)/(1-\tau_c)$ rises. As a result the supply of labor in each period rises.

2/ More precisely since under the cash flow formulation the income tax base is the level of output net of investment and the VAT base in the level of consumption, the difference between the two tax bases is the primary current account, that is the current account net of debt service.

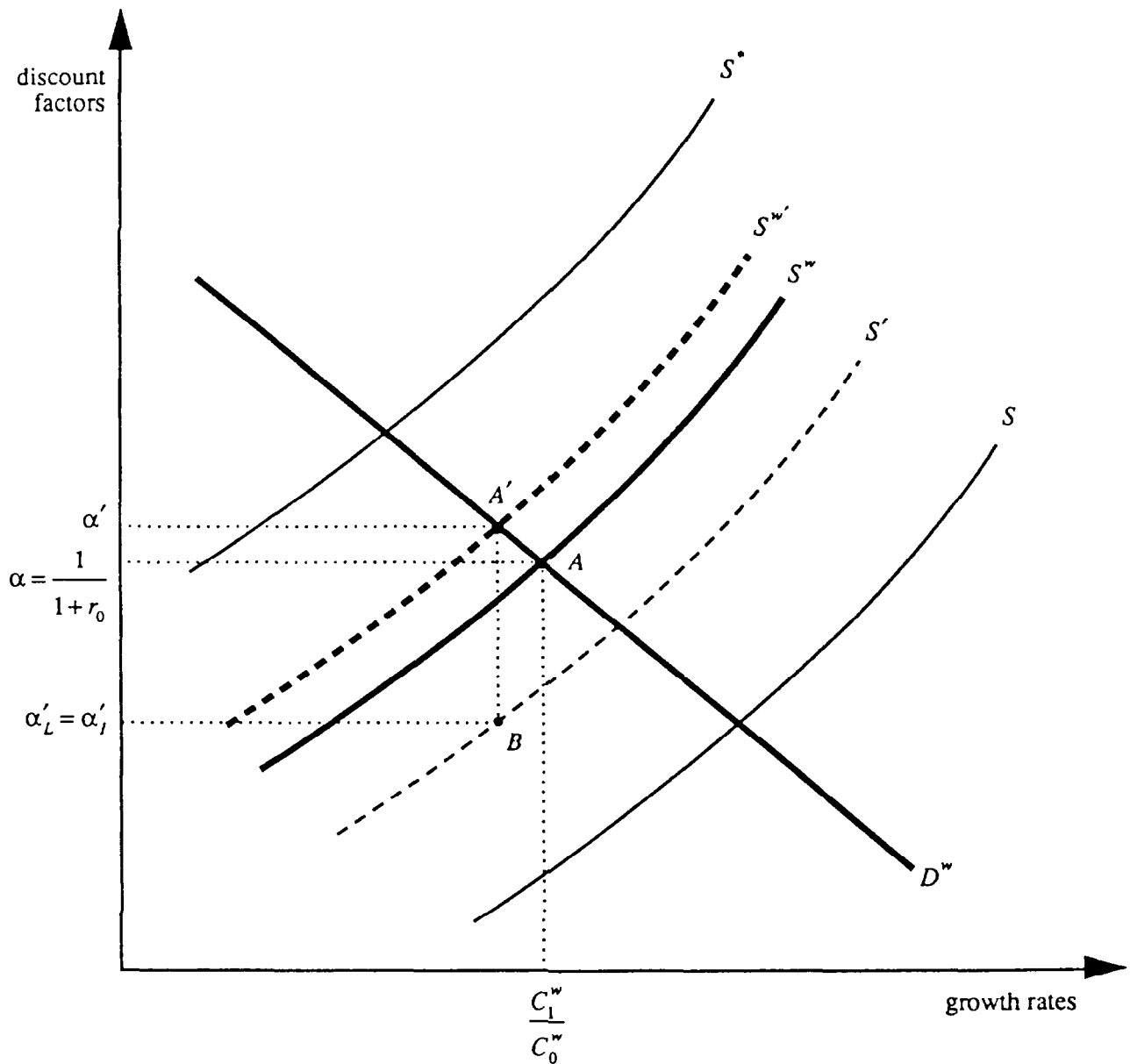
Suppose that the domestic economy runs a present-period current account deficit. Under such circumstances the shift toward a VAT broadens the tax base. To maintain revenue neutrality the current income taxes, r_{k0} and r_{w0} , fall while future income taxes, r_{k1} and r_{w1} , rise. As seen from equation (5), the new configuration of income tax rates lowers the effective discount factors applicable to investment and labor decisions, α_I and α_L . On the other hand since the intertemporal ratio of consumption taxes remains unchanged, the effective discount factor applicable to consumption decisions, α_C , remains intact.

The fall in the effective discount factors applicable to investment and labor supply induces an intertemporal substitution in the domestic economy toward current period output (net of investment). Thus, for each and every value of the world discount factor the domestic relative supply schedule shifts to the left from S to S' . The proportional vertical displacement of the schedule equals the proportional tax-induced fall in the effective discount factor. Associated with the new level of domestic relative supply, the new world relative supply schedule also shifts to the left from S^W to $S^{W'}$. We note that the proportional displacement of the world relative supply schedule is smaller than the corresponding displacement of the domestic relative supply schedule. The new equilibrium obtains at the intersection of the (unchanged) world relative demand schedule, D^W , and the new world relative supply schedule $S^{W'}$. This equilibrium is indicated by point A' , at which the world discount factor has risen from α to α' . To determine the incidence of this change on the domestic discount factors, we subtract from α' the tax wedge and obtain the new lower domestic effective discount factors α'_I and α'_L . Thus, by raising the world discount factor this tax conversion reduces the rates of growth of domestic and foreign consumption and crowds in foreign investment. On the other hand, the induced fall in the domestic tax-adjusted discount factor, governing investment and labor supply, crowd out domestic investment and the rate of growth of domestic employment falls.

Using similar reasoning it is evident that if the country adopting the tax reform has a present-period current account surplus, then the tax conversion toward a VAT system narrows the present-period tax base and lowers tax revenue. Restoration of revenue neutrality necessitates intertemporal adjustments of income tax rates in directions opposite to those underlying Figure 6. In that case the world discount factor falls and the domestic tax adjusted discount factors α_I and α_L rise. In that case the tax reform increases the rates of growth of domestic and foreign consumption, crowds out foreign investment and crowds in domestic investment. ^{1/}

^{1/} The foregoing analysis assumed that revenue neutrality obtains through appropriate changes in income taxes. If, on the other hand, budgetary corrections obtain through changes in consumption tax rates, then the effective discount factor governing investment and labor supply decisions would not change while the effective discount factor governing consumption decisions would change the supply of labor (the direction of

FIGURE 6
DYNAMIC EFFECTS OF A REVENUE-NEUTRAL
TAX CONVERSION FROM INCOME TAXES TO
VAT WITH AN INITIAL-PERIOD DOMESTIC
CURRENT ACCOUNT DEFICIT



The analysis in this section provides key analytical ingredients necessary for an examination of the link between the current account position and the dynamic effects of international VAT harmonization. ^{1/} Such harmonization entails changes in the composition of the tax structures in the various economies so as to yield greater convergence of VAT rates. Our analysis reveals that the neutralization of the budgetary implications of such VAT harmonization may have profound effects on the domestic and the international economic systems. We identified the saving-investment gap as being a key factor governing the dynamic consequences of such tax changes. Armed with this information we consider in the next section the effects of international VAT harmonization in the presence of current account imbalances.

VI. Simulations of VAT Harmonization: Current Account Imbalances

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

Our analysis can be illuminated by the analytical results obtained in the previous section on tax conversions. In fact, our specification of VAT harmonization entails various tax conversions which take place simultaneously in all countries. 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 V. 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 requirement of revenue neutrality made here

the change would depend in an obvious way on the initial current account position). In that case the domestic (and thereby the world) relative demand schedules in Figure 1 would shift while the relative supply schedules would remain intact. For an analysis of such changes see Frenkel and Razin (1989).

^{1/} In addition to the dynamic effects associated with the saving-investment gaps, the tax conversion towards a VAT system may also exert conventional employment effects if the rise in r_c and the fall in r_w result in a change in the intratemporal tax ratio (governing the intraperiod consumption-leisure choice). Since the dynamic path of the change in labor income tax rates reflects the current account position, the latter influences indirectly the rate of change of employment.

is due to considerations such as inflationary fears from budget deficits or debt aversion. 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 V applicable to the problem at hand.

In performing the simulations as in Section IV 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 in either 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 7-10 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 cash 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 trigger 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 7-10 are summarized in Table 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 3 the direction of changes for both the short run (SR) and the medium run (MR).

In conformity with the tax conversion analysis of Section V the results in Table 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 due to low saving or high investment (e.g.,

FIGURE 7

VAT HARMONIZATION: 6% PERMANENT INCREASE IN HOME COUNTRY VAT AND
6% PERMANENT REDUCTION IN FOREIGN COUNTRY VAT

(Percentage deviations)

$\delta < \delta^*$

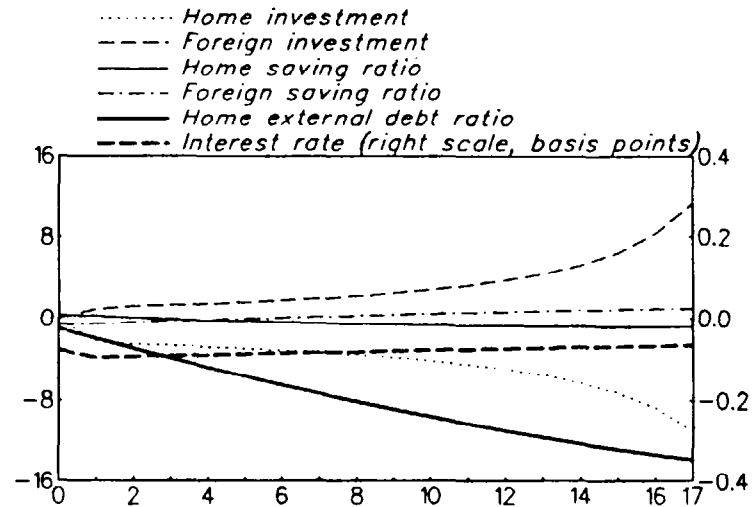
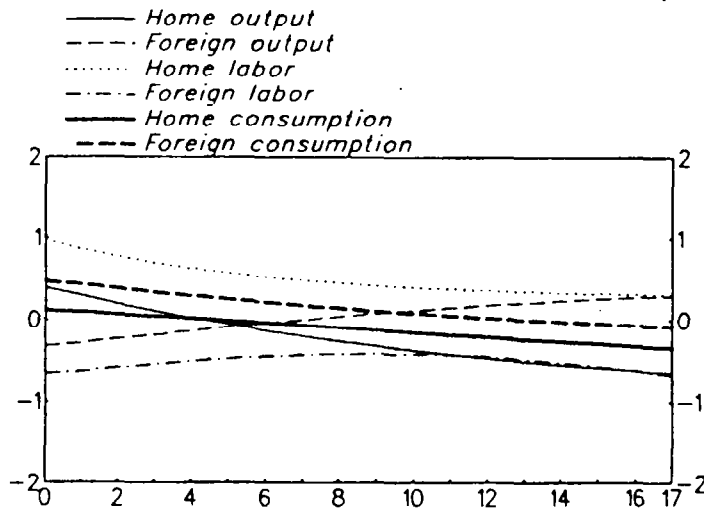


FIGURE 8

VAT HARMONIZATION: 6% PERMANENT INCREASE IN HOME COUNTRY VAT AND
6% PERMANENT REDUCTION IN FOREIGN COUNTRY VAT

(Percentage deviations)

$\delta > \delta^*$

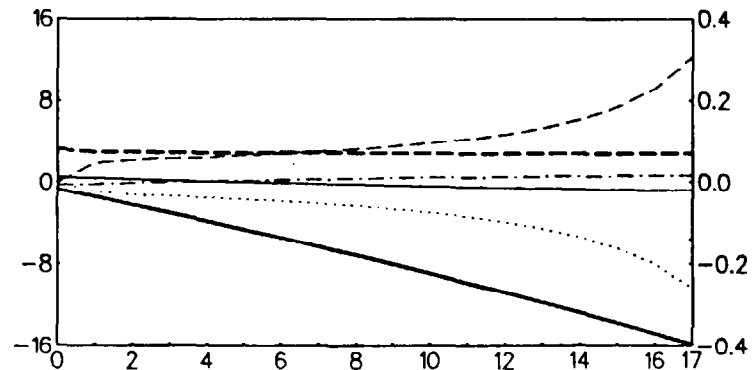
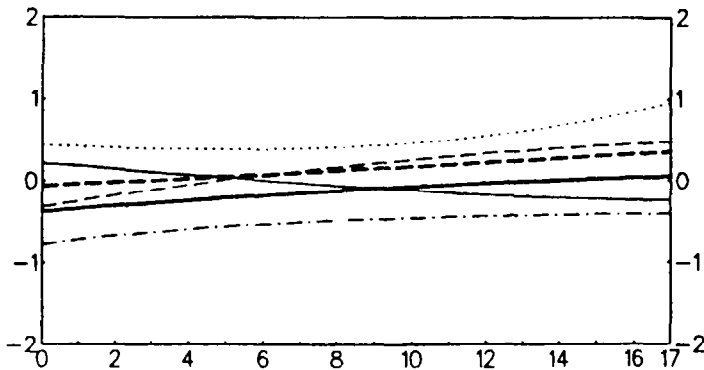


FIGURE 9

VAT HARMONIZATION: 6% PERMANENT INCREASE IN HOME COUNTRY VAT AND
6% PERMANENT REDUCTION IN FOREIGN COUNTRY VAT

(Percentage deviations)

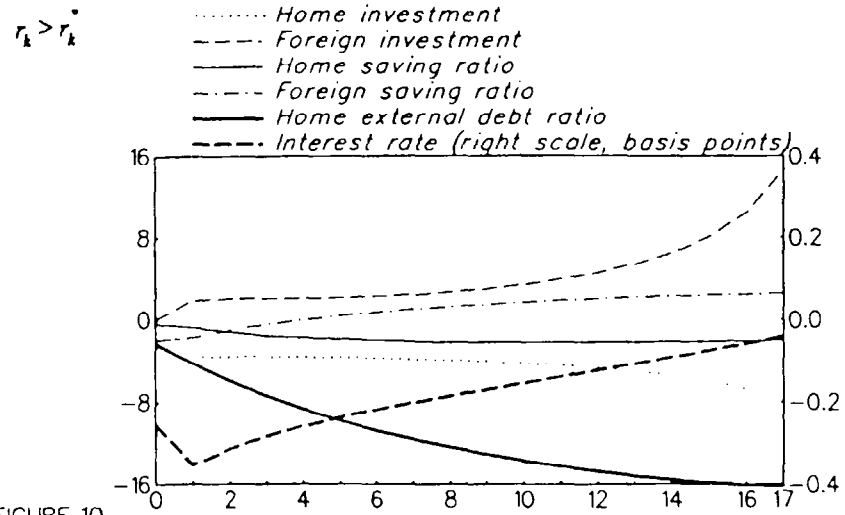
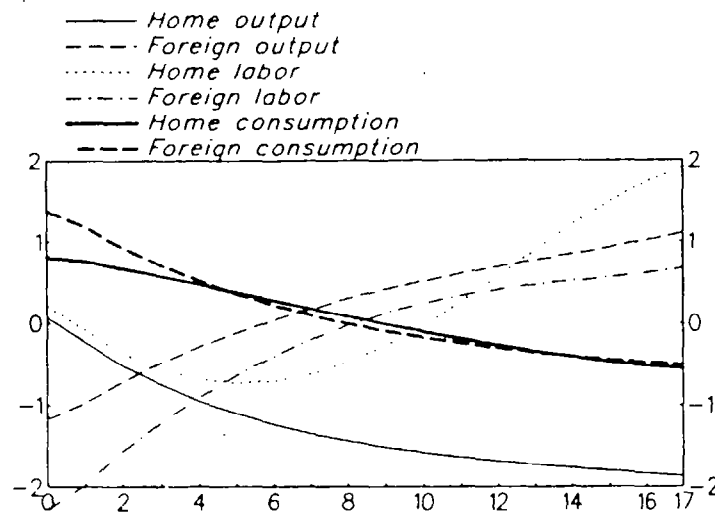


FIGURE 10

VAT HARMONIZATION: 6% PERMANENT INCREASE IN HOME COUNTRY VAT AND
6% PERMANENT REDUCTION IN FOREIGN COUNTRY VAT

(Percentage deviations)

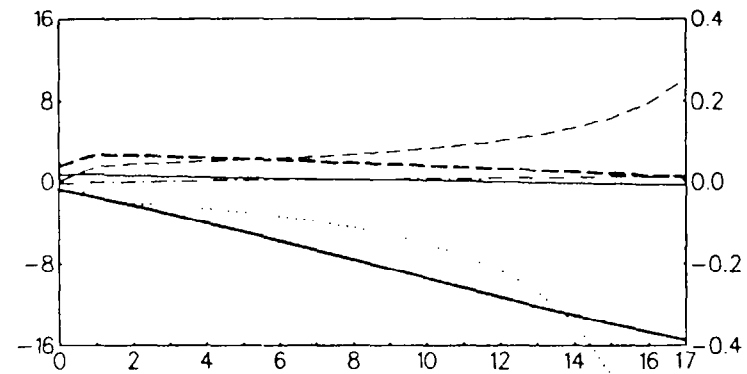
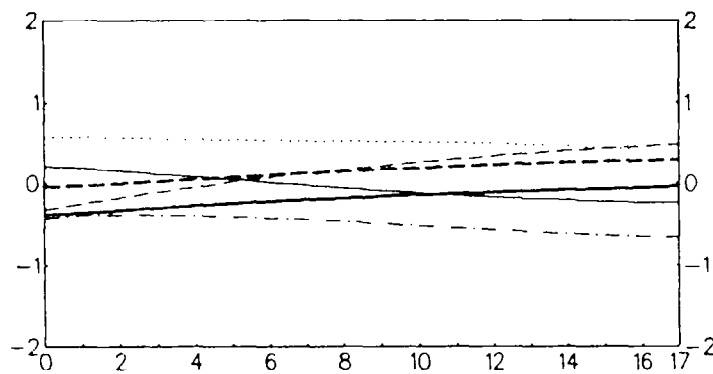


Table 3. Effects of VAT Harmonization under
Alternative Current Account Positions

(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 r_y	rising		rising		falling		falling	
Path of r_y^*	rising		rising		falling		falling	
r	-	-	-	-	+	+	+	+
E_c	-	-	-	-	+	+	+	+
E_c^*	-	-	-	-	+	+	+	+
I	-	-	-	-	-	-	-	-
I^*	+	+	+	+	+	+	+	+
L	+	+	-	+	+	+	+	+
L^*	-	-	-	-	-	-	-	-
Y	+	-	-	-	+	-	+	+
Y^*	-	+	-	+	-	+	-	+
C	+	-	+	-	-	+	-	-
C^*	+	-	+	-	-	+	+	+
S	+	-	-	-	+	-	+	-
S^*	-	+	-	+	-	+	-	+
B	-	-	-	-	-	-	-	-
U	-	+	+	+	-	+	-	+
U^*	+	-	+	-	+	-	+	-

Note: The VAT harmonization obtains through a permanent reduction in r_c and a rise in r_c^* . Budgetary balance obtains through appropriate adjustments in the periodic income tax rates, r_y and r_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 future beyond the simulation period).

if $\delta < \delta^*$ or $r_k > r_k^*$), then the paths of domestic and foreign income tax rates rise over time so as to maintain tax revenue. As a result, the world rate of interest falls. ^{1/} 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 variables are reversed. Specifically, if in the home country's 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 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 tax incentives and the world rate of interest. These changes yield 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 incentives governing labor supply and consumption demand. These tax incentives 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

^{1/} Intuitively, the rise in the home country VAT accompanied by an equiproportional fall in the income tax broadens the tax base and raises tax revenue in the current period if the home country runs a current account deficit. To restore tax revenue the income tax rate must be lowered. The opposite changes occur in the future period in which the current account position is in surplus, reflecting the intertemporal budget constraint. Similar considerations imply that the path of income tax abroad also steepens. As a result, the tax incentives to investment decline yielding a fall in the world rate of interest. See Frenkel and Razin (1987, ch. 8).

consumption demand are altered by the intertemporal substitution induced by changes in incentives governing labor supply and consumption demand. The changes in these incentives 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 terms of trade changes depend on the magnitude of 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 of interest, and the gap between purchases and sales correspond to the current account position. As illustrated by Table 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 reveal 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. 1/

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 V, 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 7-10 and in the

1/ As an example for induced changes in the functional distribution of income consider the left hand column of Table 3. There, the VAT harmonization raises the share of labor and lowers the share of capital income in the domestic economy for both the short and medium runs while inducing opposite redistribution in the economy.

summary results in the lower panel of Table 3, the dynamic effects of the international VAT harmonization on the path 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.

VII. Concluding Remarks

One of the major developments in the world economy during the 1990 is likely to be the move toward the single market of Europe of 1992. The removal of barriers to trade and factor movements, the unification of markets, the developments of new monetary arrangements, the increased harmonization of fiscal policies and tax structures are all key factors in a process that is likely to shape the global economic system for years to come.

One of the elements of the move toward tax harmonization in the European Community involves a convergence of the various VAT systems. In this paper we have analyzed the global effects of such an international VAT harmonization. For this purpose we have developed a model that encompasses a rich menu of tax systems. The model contains two countries and therefore is capable of highlighting the spillover effects of taxes across countries. The analytical framework is grounded on microeconomic foundations and therefore is suitable for an examination of the incentive effects as well as the welfare consequences of tax policies.

To examine the quantitative implications of international VAT harmonization, we have performed dynamic simulations. The analysis as well as simulations demonstrate that the effects of VAT harmonization on the key macroeconomic variables (such as output, employment, investment, consumption, interest rates the current account, and the value of external debt) are very significant. Furthermore, these effects (quantitatively and qualitatively) are not spread evenly across income groups, generations and countries. As a result such a VAT harmonization may give rise to internal conflicts of interest within each country (arising from changes in the distribution of income among members of each generation as well as among generations) and between countries. The international differences in the incidence of the VAT harmonization arise from differences in the current account positions (reflected underlying differences in saving and investment propensities) as well as from differences in the tax structures. The resolution of the various conflicts of interest regarding the adoption of VAT harmonization may give rise to the developments of a fiscal mechanism by which gainers compensate losers within countries as well as between countries.

Throughout, we have emphasized the dynamic features of the interactions among economies as they operate through the integrated world capital market. Accordingly, we have focused on the intertemporal terms of trade--the rate of interest. Obviously, an additional channel through which the effects of tax policies spillover to the rest of the world is the temporal commodity terms of trade--the relative price of tradable to nontradable goods and the relative price of exportables to importables. 1/ A useful extension would allow for a more refined aggregation of commodities. With such a refinement, the model could also shed light on the effects of international VAT harmonization on the structures of industry and trade as well as on the sectoral distribution of employment and investment.

Finally, our analysis of the world economy has been conducted within a two-country model. Since the effects of VAT harmonization among a subset of the countries may impact on the rest of the world, it would be useful to extend the analysis to more than two countries so as to allow for a more complete examination of the international spillovers of the VAT harmonization. Such an extension would facilitate an analysis of "trade creation" and "trade diversion" in both goods and capital markets associated with the establishment of the single market in Europe of 1992. 2/

1/ For an analysis of the effects of tax policies within a model which allows for such a commodity disaggregation see Frenkel and Razin (1987, 1988b, and Bovenberg (1990).

2/ Our preliminary simulations of such an extended three-country model reveal that if the two countries joining the single market differ from each other significantly in terms of their saving and investment propensities, then the VAT harmonization impacts significantly on the levels of investment, employment output and welfare in the rest of the world (the third country). Furthermore, with some configuration of parameters, the presence of a third country affects some of the qualitative changes within the countries forming the single market. In order to examine some dimensions of the debate on "fortress" versus "open and enlarged" Europe, we report in Appendix II some simulations of the effects of taxes on international borrowing within a three-country world.

The Solution of the Model

In this Appendix we present the formal solution to the model. The maximization of the utility functions subject to the life-time present-value budget constraint yields:

$$u_t = \left[\sum_{s=0}^T \delta^s \right]^{-1} \frac{W_0}{P_t} \frac{\delta_t}{d_t} \quad (1)$$

$$P_t = \left[\beta^\sigma \{1+r_{ct}\}^{1-\sigma} + (1-\beta)^\sigma ((1-r_{wt})w)^{1-\sigma} \right] \frac{1}{1-\sigma} \quad (2)$$

$$C_t = \frac{\beta^\sigma (1+r_{ct})^{-\sigma} p_t u_t}{\beta^\sigma (1+r_{ct})^{1-\sigma} + (1-\beta)^\sigma ((1-r_{wt})w)^{1-\sigma}} \quad (3)$$

$$1 - \ell = \frac{(1-\beta)^\sigma ((1-r_{wt})w)^{-\sigma} p_t u_t}{\beta^\sigma (1+r_{ct})^{1-\sigma} + (1-\beta)^\sigma ((1-r_{wt})w)^{1-\sigma}} \quad (4)$$

where u is the utility-based real spending, P denotes the associated price index, C denotes consumption of ordinary goods, and $1-\ell$ denotes leisure. In these equations $t=1, 2, \dots, T$, d_t is the tax-adjusted present-value factor applicable to period t ; that is, $d_t = (1+(1-r_{k1})(1+r_{s1})r_0)^{-1} (1+(1-r_{k2})(1+r_{s2})r_1)^{-1} \dots (1+(1-r_{kt})(1+r_{st})r_{t-1})^{-1}$, and wealth, W_0 , is:

$$W_0 = \sum_{t=0}^T d_t \left[(1-r_{wt})w + (1-r_{kt})(r_k - \theta)K_t - (1-r_{It})I_t \left(1 + \frac{b}{2} \frac{I_t}{K_t}\right) \right] \quad (5)$$

$$+ d_T (1-r_{kT})aK_T - [1 + (1-r_{k0})(1+r_{s0})r_{-1}] B_{-1}^P.$$

The investment equation, I_t , is obtained by a maximization of wealth, W_0 , with respect to investment, I_t . This yields

$$\begin{aligned}
 & - (1-r_{It})d_t(1+b\frac{I_t}{K_t}) + \sum_{s=t+1}^{T-1} d_s(1-\theta)^{s-1} \left[(1-r_{ks})(r_k-\theta) + (1-r_{Is})\frac{b}{2}\left(\frac{I_s}{K_s}\right)^2 \right] \\
 & + d_t(1-\theta)^{T-1}(1-r_{kT})(r_k+a-\theta) = 0
 \end{aligned} \quad (6)$$

Equation (6) represents an 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 future costs of investment (the terms associated with $(b/2) \cdot (I/K)^2$). To illustrate, in the two-period case the investment function implied by equation (6) is:

$$I_0 = \frac{1}{b} (\alpha_I(a+r_k-\theta)-1)K_0 \quad (6a)$$

Equation (6a) together with the assumption that $(a+r_k-\theta)$ 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 net of depreciation, $r_k-\theta$, 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 . Substituting equation (6a) into (5) yields the corresponding value of wealth (5a):

$$W_0 = \sum_{t=0}^1 d_t(1-r_{wt})w + q_0k_0-[1+(1-r_{k0})(1+r_{s0})r_{-1}]B_{-1}^P \quad (5a)$$

where q_0 denotes the tax adjusted market value of a unit of the capital stock (Tobin's q).

Tax on International Borrowing

In this appendix we extend the tax structure to include a tax on international borrowing, denoted by τ_b . With this added tax, the periodic budget constraint in equation (1) of the text becomes 1/

$$(1+\tau_{ct}) C_t + (1-\tau_{wt}) w (1-\ell_t) = (1-\tau_{wt})w + (1-\tau_{kt}) ((r_k - \theta)K_t) - (1-\tau_{It})I_t (1 + \frac{b}{2} \frac{I_t}{K_t}) + (1-\tau_{bt}) (B_t^P - B_{t-1}^P) - (1-\tau_{kt})(1+\tau_{st-1})r_{t-1} B_{t-1}^P$$

As formulated, the international borrowing tax applies to the accumulation of external debt. Letting total debt be $B^P = (1/(1-\tau_b))B^{HP} + B^{FP}$ and applying the arbitrage condition, by which the after-tax rates of return are equal so that $r_F = (1-\tau_b)r_H$, yields the last two terms on the right hand side of equation (1). Analogously, the life time present-value budget constraint applicable to the two-period case becomes

$$C_0 + \alpha_c C_1 = \left\{ \frac{1-\tau_{w0}}{1+\tau_{c0}} \right\} \left\{ w\ell_0 + \alpha_L w\ell_1 \right\} + \left\{ \frac{1-\tau_{I0}}{1+\tau_{c0}} \right\} \left\{ \alpha_I (r_k - \theta) - (1 + \frac{b}{2} \frac{I_0}{K_0}) \right\} I_0 \quad (2) \\ + \left\{ \left(\frac{1-\tau_{b0}}{1+\tau_{c0}} \right) (r_k - \theta_k) \left[\frac{1-\tau_{k0}}{1-\tau_{b0}} + \frac{1-\tau_{k1}}{1-\tau_{b1} + (1-\tau_{k1})(1+\tau_{s1})r_0} \right] \right\} K_0$$

1/ Equation (1) implicitly incorporates both external and internal debt. To verify, denote internal debt by B^{HP} and the corresponding rate of interest by r_H . Analogously denote the external debt by B^{FP} and the corresponding rate of interest by r_F . Debt flows in the budget constraint for period t are then

$$B_t^{HP} - B_{t-1}^{HP} = (1-\tau_{kt-1})(1+\tau_{st-1})r_{Ht-1}B_{t-1}^{HP} + (1-\tau_{bt})(B_t^{FP} - B_{t-1}^{FP}) - (1-\tau_{kt-1})(1+\tau_{st-1})r_{Ft-1}B_{t-1}^{FP}$$

As formulated, the international borrowing tax applies to accumulation of external debt. Letting total debt be $B^P = (1/(1-\tau_b))B^{HP} + B^{FP}$ and applying the arbitrage condition, by which the after-tax rates of return are equal so that $r_F = (1-\tau_b)r_H$, yields the last two terms on the right hand side of equation (1).

$$- \left\{ \frac{1 - \tau_{b0} + (1 - \tau_{k0})(1 + \tau_{s0})r}{1 + \tau_{c0}} \right\} B_{-1}^P$$

where

$$\alpha_c = \frac{(1 + \tau_{c1})}{(1 + \tau_{c0})} \frac{(1 - \tau_{b0})}{1 - \tau_{b1} + (1 - \tau_{k1})(1 + \tau_{s1})r_0}$$

$$\alpha_I = \frac{(1 - \tau_{k1})}{(1 - \tau_{I0})} \frac{(1 - \tau_{b0})}{(1 - \tau_{b1} + (1 - \tau_{k1})(1 + \tau_{s1})r_0)}$$

and

$$\alpha_L = \frac{(1 - \tau_{w1})}{(1 - \tau_{w0})} \frac{(1 - \tau_{b0})}{(1 - \tau_{b1}) + (1 - \tau_{k1})(1 + \tau_{s1})r_0}$$

The formulation of the periodic budget constraint illustrates the equivalence relation existing among the taxes on consumption, (cash flow) 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. Denoting the cash flow income tax by τ_y the budget constraint is:

$$(1 + \tau_{ct})C_t = (1 - \tau_{yt})Y_t + (1 - \tau_{bt})(B_t^P - B_{t-1}^P)$$

where Y_t denotes income net of investment. Now 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 $\tau_c/(1 + \bar{\tau}_c)$, 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 ($\tau_c=\bar{\tau}_c$, $\tau_y=\tau_b=0$.)

This analytical framework of taxes on international borrowing can be used to examine the effects of a removal of impediments on capital movements within Europe of 1992 (while maintaining the impediments between Europe and the rest of the world) on the key economic variables within and

outside Europe. In Table 4 we present preliminary simulations of such an experiment. Specifically, we consider the effects of an introduction of a common tax by the two countries forming the single market on international borrowing from the rest of the world (country R). In conducting the simulations we assume that the periodic budget balance in Europe (country E) is maintained through appropriate adjustments of either VAT or of cash flow income taxes. To highlight the external effects we chose to focus the simulations on the case in which the domestic and foreign economies (forming the single European market) are identical. The opposite welfare implications of such a tax for Europe and the rest of the world underscore the international concern regarding the specific modalities of the integration process.

Table 4. Effects of a 10 Percentage Point Rise in the
International Borrowing Tax Rate
between Europe and the Rest of the World

(Percentage deviations from baseline)

Variable	Budgetary balance obtains through VAT		Budgetary balance obtains through cash-flow income tax	
	SR	MR	SR	MR
τ_C^E	+0.30	-0.20	0	0
τ_Y^E	0	0	+0.23	-0.20
r	-0.23	-0.20	-0.24	-0.18
I^E	-0.6	+3.5	-0.5	+3.0
I^R	+3.4	+2.5	+3.0	+2.5
L^E	+3.2	-3.0	+3.0	-2.7
L^R	-6.0	+5.4	-5.2	+5.2
Y^E	+1.3	-1.3	+1.4	-1.2
Y^R	-2.5	+3.4	-2.0	+3.0
C^E	-1.0	+0.8	-0.9	+0.7
C^R	+1.5	-1.4	+1.4	-1.3
S^E/Y^E	+0.02	-0.02	+0.02	-0.02
S^R/Y^R	-0.04	+0.06	-0.03	+0.05
B^E/Y^E	-0.07	-0.10	-0.06	-0.10
U^E	-1.0	+1.0	-0.9	+1.0
U^R	+0.7	-1.8	+0.6	-1.6

Note: European and foreign variables are designated by superscript E and R, respectively. SR and MR are defined as in Tables 2 and 3.

References

- Auerbach, Alan J. and Laurence J. Kotlikoff, Dynamic Fiscal Policy, (London: Cambridge University Press, 1987).
- Blanchard, Oliver J., "Debt, Deficits, and Finite Horizons," Journal of Political Economy, 93, (April 1985), 223-247.
- Bovenberg, Lans A., "The Effects of Capital Income Taxation on International Competitiveness and Trade Flows," (1989) forthcoming in American Economic Review.
- Bovenberg, Lans A., and Lawrence Goulder, "Taxes on Old and New Capital Under International Capital Mobility: An Intertemporal General Equilibrium Assessment," (unpublished manuscript, International Monetary Fund, August, 1989).
- Buiter, Willem H., (1987), "Fiscal Policy in Open Interdependent Economies," in Assaf Razin and Efraim Sadka (eds.) Economic Policy in Theory and Practice, (London: Macmillan, 1987), 101-144.
- Cnossen, Sijbren, and Carl S. Shoup, "Coordination of Value-Added Taxes," in Cnossen Sijbren (ed.) Tax Coordination in the European Community, (Antwerp: Kluwer Law and Taxation Publishers, 1987).
- Emerson, Michael, Michel Aujean, Michel Catinat, Philippe Goybet, and Alexis Jacquemin, (1988), "Fiscal Barrier," The European Economy, (March 1988), 45-107.
- Feldstein, Martin, "Excess Debt and Unbalanced Investment: The Case for a Cash-Flow Business Tax," Testimony before the Committee on Ways and Means, Congress of the United States, (January 31, 1989).
- Frenkel, Jacob A., and Assaf Razin, "Fiscal Policies in the World Economy," Journal of Political Economy, 94, Part 1, (June 1986), 564-594.
- Frenkel, Jacob A., and Assaf Razin, (1988a), "Budget Deficits Under Alternative Tax Systems: International Effects," IMF Staff Papers, Vol. 35, No. 2, 297-315.
- Frenkel, Jacob A., and Assaf Razin, (1988b), Spending, Taxes and Deficits: International-Intertemporal Approach, (Princeton, New Jersey: Princeton Studies in International Finance), No. 63, International Finance Section.
- Frenkel, Jacob A., and Assaf Razin, Fiscal Policy and the World Economy: An Intertemporal Approach, (Cambridge Mass.: MIT Press, 1987).
- Frenkel, Jacob A., and Assaf Razin, (1989), "International Effects of Tax Reforms," The Economic Journal, Vol. 99 (March 1989), 38-59.

- Frenkel, Jacob A., Assaf Razin, and Efraim Sadka, International Taxation in an Integrated World, (Cambridge, Mass.: MIT Press, 1991, forthcoming).
- Frenkel, Jacob A., Assaf Razin, and Steve Symansky, "International Spillovers of Taxation," in Razin A. and Slemrod, J., (eds.) International Aspects of Taxation, (Chicago, Illinois, University of Chicago Press, 1990).
- Pechman, Joseph, A. (ed.), World Tax Reform: A Progress Report, (Washington, D.C., The Brookings Institution, 1988).
- Perraudin, W.P.M. and Pujol, T. "European Fiscal Harmonization and the French Economy," International Monetary Fund Working Paper, WP/90/96, October 1990.
- Tait, Alan A., Value Added Tax: International Practice and Problems, (Washington, D.C., International Monetary Fund, 1988).
- Tanzi, Vito and Bovenberg, Lans, "Economic Interdependence and the International Implications of Supply-Side Policies," in Fels, G. and von Furstenberg, George M. (eds.) A Supply-Side for Germany, New York, 1989, pp. 153-80.

