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Publication date:
1993

REPRINT

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Reprinted from The Scandinavian Journal of Economics, Vol. 95, No. 2, 1993

Reprint Series
no. 139

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ISSN 0924-7874

1993

CentER REPRINT
for
Economic Research

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Scand. J. of Economics 95(2), 133–156, 1993

Promoting Investment under International Capital Mobility: An Intertemporal General Equilibrium Analysis*

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Abstract

Efficiency and distributional effects of two investment-oriented policies, an investment tax credit (ITC) and a reduction in the statutory corporate income tax rate, are compared using a disaggregated general equilibrium model that uniquely combines intertemporal decision-making and international capital mobility. The domestic welfare consequences of these policies depend not only on intertemporal and intersectoral efficiency effects but also on international transfer effects which favor (in terms of domestic welfare) the ITC over cuts in the corporate tax rate. Simulations reveal important differences between policies in the consequences for balance of payments accounts, the real exchange rate and industrial structure.

I. Introduction

Over the past decade most industrial economies have become considerably more integrated with other national economies, especially in capital markets. The EC and the Scandinavian countries, for example, have taken important steps in recent years toward liberalizing capital flows. Increased economic integration complicates the analysis of domestic fiscal policies by introducing new channels through which domestic policies affect the economy. When capital is internationally mobile, domestic tax policies can affect national welfare through impacts on the trade balance, on the

*We are grateful to two anonymous referees and participants at seminars at Stanford University, UCLA, the University of California at San Diego, and the NBER for helpful comments, and to Philippe Thalmann for excellent research assistance. Financial support from the National Science Foundation (Grant No. SES-9011722) is gratefully acknowledged. This is a revised and shortened version of NBER Working Paper No. 3139.

foreign ownership of domestic assets, and (via changes in exchange rates) on the international competitiveness of import-competing and export-oriented sectors. In addition, international capital mobility creates a new channel through which domestic policy initiatives can impose (adverse) spillover effects on other nations. The potential for such spillovers heightens the significance of international policy coordination and has prompted a number of recent proposals aimed at alleviating potential adverse consequences from unilateral decisionmaking by individual countries. For example, the Ruding Committee, appointed by the European Commission, recently proposed specific limits on the extent to which EC countries may cut their own corporate income tax rates.[1]

Policymakers' concerns about these issues have been reinforced by results from analytical studies indicating that the presence of internationally mobile capital can substantially expand differences in the impacts of growth-oriented fiscal initiatives. For example, Slemrod (1988) shows that when capital is internationally mobile, policies that stimulate domestic savings may differ dramatically from policies that promote domestic investment in terms of their impacts on the domestic capital stock, trade flows, and international competitiveness. To date, the analytical work has been accompanied by very few attempts to evaluate numerically the significance of international capital mobility to the effects of domestic tax initiatives.[2] This paper addresses the need for empirical work by evaluating numerically, in an open-economy framework, the positive and normative differences between two investment-oriented policies: the introduction of an investment tax credit (ITC) and a reduction in the corporate income tax (CIT) rate.

In assessing the welfare effects of investment-oriented policies, standard closed-economy analyses concentrate on the implications for the intertemporal and intersectoral efficiency of resource allocation. To the extent that pre-existing capital taxes imply savings rates and capital-output ratios below the social optimum,[3] the fundamental issue for intertemporal efficiency is which policy induces more capital accumulation per dollar of lost revenue. In this respect the ITC may seem more efficient, since it is

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[1] EC countries would not be permitted to cut their corporate income tax rates below 30 per cent. Member states would still be permitted to retain selected investment incentives but they would have to cast these in the form of tax credits.

[2] Mutti and Grubert (1985) explore numerically the differences between saving- and investment-oriented policies. Goulder, Shoven and Whalley (1983) examine effects of savings incentives generated by a move toward consumption-based taxation in the U.S.

[3] In an economy where households' effective time horizons are infinite, resource allocation is intertemporally efficient in the absence of taxation. If the effective tax rate on marginal investments is positive, however, the social benefits associated with marginal investment exceed social costs. Hence, at the margin, capital accumulation enhances welfare.

oriented exclusively toward new (or marginal) capital, while CIT rate reductions apply not only to new capital but to old (previously installed) capital as well. In terms of intersectoral efficency, a cut in the CIT rate may seem to offer the largest improvement since such a rate cut tends to be more successful than the ITC in reducing tax disparities across various production sectors.[4] We examine these two efficiency margins and find that the ITC yields larger efficiency gains than CIT cuts because its advantages in terms of intertemporal resource allocation are quantitatively more important than its disadvantages on the intersectoral margin.[5]

We extend standard analyses by evaluating these policies in an open-economy setting. The open-economy analysis reveals that relative welfare effects depend importantly on international transfer effects as well as the previously mentioned efficiency margins. These transfer effects, which we term the *relative capitalization* and *relative rate of return* effects, depend on international cross-holdings of capital. Such effects are likely to become increasingly important in European countries as the EC removes remaining barriers to international equity flows. We show these international transfer effects increase the attractiveness (in terms of domestic welfare) of the ITC relative to a CIT rate cut.

We adopt a numerical simulation approach; analytical approaches are unable to generate unambiguous results in the complex, realistic economic environment that we consider here. We employ a multisector general equilibrium growth model of the U.S. economy and the rest of the world. This model has distinct features that make it especially suitable for analyzing investment-oriented policies in an open-economy context. Behavioral relationships in the model are grounded in intertemporal optimization, and the model solves for a full intertemporal equilibrium generated by households and producers endowed with perfect foresight. External current account imbalances, representing the gap between domestic saving and investment, emerge as the outcome of optimizing responses to changes in intra- and intertemporal prices. The model simulates the entire transition path to a new steady-state equilibrium, incorporating adjustment costs in the investment process as well as imperfect substitution between domestic and foreign assets in portfolio demands. The model's attention to intertemporal decisionmaking and adjustment dynamics distinguishes it from other disaggregated general equilibrium models that have allowed for

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[4] An equipment-oriented ITC could worsen resource allocation by enlarging the disparities between effective tax rates on equipment and those on other assets (particularly structures).

[5] Other studies, including Jorgenson and Yun (1986), Fullerton and Henderson (1989) and Goulder and Thalmann (1993) have used general equilibrium models to investigate the relative importance of intertemporal and intersectoral distortions generated by these and other capital income tax instruments. These studies do not incorporate international capital flows, however.

international capital mobility.[6] The model's disaggregated treatment of production enables us to explore intersectoral distortions induced by capital income taxes and to investigate how economy-wide policies yield different sectoral impacts. Our simulations reveal substantial differences in effects on export-oriented and import-competing industries, especially in the short run.

The rest of the paper is organized as follows. The main features of the model are described in Section II. The simulation results in the absence and presence, respectively, of international capital flows are reported and interpreted in Sections III and IV. The final section concludes.

II. The Model

The structure of the model outlined in this section is discussed in more detail in Goulder and Eichengreen (1989). An appendix to the present paper, available on request, includes a complete list of variable definitions and equations.

Producer Behavior

Ten U.S. industries are distinguished; the industries differ in their dependence on the export market, in the degree to which they compete with foreign imports, and in the significance of foreign inputs in their production costs (see Table 1). At each point in time, domestic and foreign producers combine cost-minimizing levels of labor and intermediate inputs with the existing capital stock. Intermediate inputs can be obtained both at home and abroad. Industry outputs serve both as intermediate inputs and as final goods for purchase by the government. These outputs also combine in fixed proportions to create 17 consumer goods and new capital goods used in investment. Each intermediate input is a constant-elasticity-of-substitution (CES) composite of foreign- and domestically-supplied intermediate goods.

Industry capital stocks evolve as a reflection of managers' forward-looking investment strategies aimed at maximizing the value of the firm. This equity value (V) can be expressed as the discounted value of after-tax dividends (DIV) net of share issues (VN):

$$V_t = \int_t^{\infty} \left[\left(\frac{1-\theta}{1-\kappa} \right) DIV_s - VN_s \right] \exp \left[\int_t^s \frac{-r_u}{1-\kappa} \, du \right] ds, \qquad (1)$$

[6] Goulder, Shoven and Whalley (1983) incorporate neither forward-looking expectations nor explicit forward-looking investment behavior by firms. Mutti and Grubert (1985) consider international capital flows using a steady-state model, which disregards the transition to the long-run equilibrium.

where θ is the marginal income tax rate, κ is the accrual-equivalent capital gains tax rate, and r is the risk-adjusted rate of return that the firm must offer to stockholders.

We assume that firms pay dividends equal to a constant fraction of after-tax profits net of economic depreciation, that they issue debt to maintain a constant debt-capital ratio, and that they issue new shares as the marginal source of finance. Following Summers (1981), we model adjustment costs in investment as internal to the firm. The adjustment cost function, ϕ, is convex in the ratio of investment (I) to the capital stock (K):

$$\phi(I/K)=\frac{(\beta/2)(I/K-\xi)^2}{I/K}, \tag{2}$$

where β and ξ are parameters. Optimal investment balances the costs of new capital (both the acquisition costs and the adjustment costs associated with installation) against the benefits in terms of the higher future profits made possible by a larger capital stock; see e.g. Hayashi (1982) and Summers (1981).

Household Behavior

Forward-looking domestic and foreign households make consumption and portfolio decisions stemming from intertemporal utility maximization. Labor supply is exogenous. We discuss the structure of the domestic household's maximization problem here; the structure of the foreign household's problem is perfectly analogous. In each period t, the domestic household maximizes a utility function of the form:

$$\int_t^{\infty} \exp[-\delta(s-t)]\,\frac{\sigma}{\sigma-1}\,(C_s^{\beta}A_s^{1-\beta})^{(\sigma-1)/\sigma}\,ds, \tag{3}$$

where δ is the rate of time preference, σ is the intertemporal elasticity of substitution, C is an index of overall consumption at a given point in time, and A is a portfolio satisfaction index, a function of the household's asset holdings. Overall consumption at time s, C_s, is a composite of specific consumption good types which in turn are composites of domestically-produced and foreign-made goods of each type. When relative prices change, households alter the proportions of domestic and foreign consumer goods making up each composite in accordance with utility maximization.

Households' portfolio decisions include choosing utility-maximizing shares of domestic and foreign assets in financial wealth. We model these portfolio decisions by introducing the portfolio satisfaction index, A. This index enables us to capture observed home-country preference and permits us to integrate the portfolio decision within the overall utility-

maximization problem.[7] We specialize A_s to a CES function of α_s and $1-\alpha_s$ the time-dependent shares of the household's portfolio devoted to domestic and foreign assets:

$$A_s = k[\alpha_0^{1-\rho}\alpha_s^{\rho} + (1-\alpha_0)^{1-\rho}(1-\alpha_s)^{\rho}]^{1/\rho}. \tag{4}$$

If foreign and domestic assets yield the same return, households maximize utility by choosing the asset shares α_0 and $1-\alpha_0$. When rates of return differ, however, maintaining the portfolio shares α_0 and $1-\alpha_0$ has a cost in terms of a lower overall return than that which could be obtained if the household held more of the asset with the higher return. The household chooses the path of α that balances the rewards of approaching preferred shares against the costs in terms of a lower overall return.[8]

Government Behavior

The model incorporates very specific elements of the U.S. tax system. Overall real government spending (transfers plus purchases) is exogenous and increases at the steady-state growth rate, g. In the base case, government revenues equal expenditures in each period. In policy simulations, budget balance is maintained through lump-sum adjustments to personal taxes on labor income. The foreign government performs the same functions and has the same tax instruments as the domestic economy government.

Equilibrium

The model is calibrated to exhibit steady-state growth in the base-case equilibrium. Following a policy shock, temporary equilibria with market-clearing are generated in every period. These temporary equilibria form a transition path which gradually approaches a new long-run, steady-state equilibrium.[9] To solve for the temporary equilibrium of each period, we

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[7] An alternative way to model the portfolio problem would be to incorporate risk explicitly. However, the integration of portfolio choice and consumption demands in the face of uncertainty presents difficult and unresolved theoretical issues when there are many time periods and many consumption goods.

[8] The parameter ρ in the portfolio satisfaction index is related to σ_A, the elasticity of substitution between asset shares ($\rho = 1 - 1/\sigma_A$). When $\sigma_A = 0$, households maintain shares α_0 and $1-\alpha_0$ of domestic and foreign assets irrespective of differences in rates of return. As σ_A approaches infinity, household behavior approaches the limiting case of perfect substitutability, where the slightest difference in return leads households to hold only the asset offering the higher return.

[9] The requirements of temporary equilibrium are that in each country and in each period: (1) the demand for labor equal its supply, (2) the demand for output from each industry equal its supply, (3) total external borrowing by firms equal total saving by residents of the given country plus the net capital inflow, and (4) government revenues equal government spend-

employ the Powell (1970) algorithm for solving systems of nonlinear equations. Since households and firms are forward-looking and have perfect foresight, solution of the model requires that expectations conform to the actual future values. Using an approach similar to that of Fair and Taylor (1983), we repeatedly revise expectations variables until expectations match realized values. This yields perfect foresight expectations and the consistent intertemporal equilibrium path.

Data and Parameters

A detailed documentation of the model's data sources and parameterization methods is in Goulder and Eichengreen (1989). We benchmark the model to the year 1983, drawing extensively from the general equilibrium data set assembled by Scholz (1987). We supplement Scholz's data on consumption and production with information on capital taxes and the financial behavior of firms, as well as with information on industry capital stocks from the *Survey of Current Business* of the U.S. Department of Commerce.

Calibrating the model involves selecting certain parameters from outside sources and deriving the remaining ones from identifying restrictions. Exogenous parameters include the growth rate of effective labor (g), the growth rate of each country's nominal wages (π_0), and the benchmark gross-of-tax nominal interest rate (i_0). These variables take the values 2.5 per cent, 6.0 per cent, and 8.3 per cent, respectively. For the β and ξ parameters of the adjustment cost function, we use the values of 19.61 and 0.076, respectively. These parameters, which regulate the sensitivity of investment to tax changes, are taken from time-series estimates reported in Summers (1981). We employ a value of 0.5 for the intertemporal elasticity of substitution in consumption (σ), which regulates the sensitivity of private saving to changes in after-tax rates of return.[10] Other parameters are obtained through a calibration procedure in which the requirements of utility maximization, cost minimization, and balanced growth serve as identifying restrictions. The calibration procedure includes the restriction that in the base (or status quo) case, the current and capital accounts of the balance of payments are both zero. The fully parameterized data set generates a base case simulation in which the domestic and foreign economies exhibit balanced growth at a rate of 2.5 per cent (the value of g) per year.

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ing. Equilibrium is established by adjustments in the nominal exchange rate, in domestic and foreign interest rates and output prices, and in lump-sum adjustments to domestic and foreign taxes.

[10] Econometric estimates of σ vary considerably. Estimates from time series tend to be lower than our value of 0.5, while cross-section estimates tend to be higher.

Policy shocks cause growth rates to differ from 2.5 per cent during the transition but to return asymptotically to that rate.

III. Old and New Capital Taxes in the Absence of International Capital Mobility

We compare two unilateral policies aimed at stimulating investment in the domestic economy. The two policies are an investment tax credit of 8.38 per cent on equipment and a cut in the corporate income tax from 34 to 30 per cent. The two policy shocks have been scaled so that they involve the same present value of lost tax revenues. Each of the two policies is introduced in the first simulation period and is treated as unanticipated and permanent.

Although the domestic economy in our model is the U.S., the key structural differences between the two policies apply to virtually all industrial nations. Two structural features of the ITC deserve emphasis. First, the ITC applies only to equipment investment (as opposed to investment in other forms of physical capital such as structures). The focus on equipment disproportionately benefits industries that are especially equipment-intensive in their investment (see Table 1). In addition, investments by corporations and proprietorships are eligible for the ITC, but investments in new housing capital by individual homeowners are not. Thus the ITC discriminates against the housing sector: because of the large share of housing investments carried out by owner-occupants, the effective ITC rate is quite small in the housing sector (Table 1).

The second investment-promoting policy is the reduction of the statutory corporate income tax rate in all domestic industries. The corporate tax is treated as a source-based tax.[11] The effective corporate tax rate in the housing industry is significantly lower than the statutory rate because only a small percentage of housing capital faces the corporate tax.[12]

The alternative policies in the absence of international capital flows are examined in this section. Here, households' portfolios consist only of home-country assets.

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[11] Given the model's focus on portfolio capital flows, the specification of the tax as source-based is appropriate. Even in the case of direct investments, the corporate tax may be effectively source-based, i.e., the tax system of the host country determines the effective corporate tax rate on marginal investment. This is the case, for example, if the residence country has a territorial system of corporate taxation.

[12] The corporate tax applies only to rental housing owned by corporations, which represents 2.5 per cent of the housing stock. Capital income to noncorporate rental housing faces the personal income tax. Implicit rentals from owner-occupied housing are not taxed.

Table 1. *Industry characteristics* (all rates expressed as percentages)

Industry	Export intensity[a]	Import substitution[b]	Import dependency[c]	ITC rates[d]
Agriculture	13.52	1.55	2.49	6.02
Oil refining	6.16	24.85	15.82	2.74
Construction	0.03	0.00	3.45	7.91
Textiles	2.66	1.23	1.80	5.93
Metals	2.86	15.21	5.63	5.79
Machinery	16.13	2.06	5.11	6.20
Motor vehicles	7.12	2.26	4.67	6.58
Misc. manufacturing	10.81	1.42	2.75	6.60
Services	4.64	0.50	1.89	5.36
Housing	—	—	—	0.36
U.S. average[e]	6.61	3.13	3.05	2.98

[a]Share of exports in total demand for gross output.
[b]Imports as share of total demand for corresponding industry output.
[c]Imported intermediates as share of industry's total inputs.
[d]These apply only in ITC policy simulations.
[e]Weighted average, using industry gross outputs (columns 1 and 2), total inputs (column 3), and investment (column 4) as weights. Except in column 4, weights are calculated after excluding the housing industry.

Welfare Effects

Table 2 contains the welfare effects measured as the dynamic equivalent variation as a per cent of base case wealth. The introduction of the ITC yields domestic welfare gains that are more than twice as large as those produced by a lower CIT rate with the same revenue cost. The three factors that determine domestic welfare are inter*temporal* efficiency, inter*sectoral* efficiency, and the inter*national* distribution of welfare over domestic and foreign households. In the flow diagram (Figure 1), which illustrates some major relationships in the model, the boxes labelled C1, C2, and C3 represent these three factors.

The different inter*temporal* welfare effects are mainly due to differential effects on investment. Table 3 reveals that the ITC is most effective per dollar of lost revenue in stimulating domestic investment and saving and, thus, in alleviating the intertemporal distortions that are due to initial taxes on capital income (see footnote 2). Whereas a lower CIT raises domestic investment by 0.88 per cent in the first period and by 2.24 per cent in the new steady state, the ITC boosts domestic investment more than twice as much — both in the short and long run. The long-run percentage increases in investment correspond to the steady-state additions to the capital stock. Compared to introducing the ITC, lowering the CIT rate stimulates investment less because it focuses less sharply on marginal investment. A lower CIT reduces the tax not only on marginal but also on inframarginal (pre-

Table 2. *Welfare effects*

	Welfare gains[a]			Domestic residents' welfare gain normalized by change in capital[b]
	Domestic residents (1)	Foreign residents (2)	Ratio [(2)/(1)] (3)	(4)
No international capital mobility				
(a) CIT rate reduction	0.245	0.014	0.057	0.187
(b) ITC	0.590	0.037	0.063	0.186
(c) Ratio (b)/(a)	2.41	2.65		
International capital mobility, actual cross-holdings[c]				
(a) CIT rate reduction	0.219	0.027	0.123	0.172
(b) ITC	0.570	0.047	0.082	0.179
(c) Ratio (b)/(a)	2.60	1.74		
International capital mobility, higher cross-holdings[c]				
(a) CIT rate reduction	0.154	0.057	0.370	0.139
(b) ITC	0.513	0.071	0.138	0.168
(c) Ratio (b)/(a)	3.33	1.24		

[a]Welfare gain is expressed as the dynamic equivalent variation as a percentage of base case wealth. Policy changes are scaled so as to imply the same present value of revenue cost as in the no-mobility scenario.
[b]Ratio of domestic welfare gain to change in the present value of domestically located capital along the entire transition path.
[c]In central case simulations, foreigners initially own 9 per cent of nonhuman wealth located in the U.S. In bottom panel, foreigners are assumed to own 20 per cent of this wealth initially.

viously accumulated) capital; hence, much of the lost revenue is associated with lower nondistortionary (unanticipated) wealth taxes rather than lower effective tax rates on marginal investment.

Differences in the two policies' effects on the inter*sectoral* margin can be ascertained by controlling for the changes in the domestic capital stock. The CIT policy's slightly higher ratio of welfare gains to changes in the domestic capital stock (see Table 2) indicate that it may be slightly superior in terms of intersectoral efficiency. However, the differences after normalizing in this way are extremely small. Hence, most of the differences between the overall efficiency gains of the ITC and a reduced CIT appear to be attributable to differences in effects on the intertemporal margin.

As regards the inter*national* distribution of welfare, both policy experiments improve not only domestic but also foreign welfare. In both cases, the foreign gain in relative welfare amounts to about 6 per cent of the relative domestic gain (Table 2). Investment promoting policies are transmitted positively abroad because they improve the present value of the foreign terms of trade; domestic capital accumulation boosts the supply of domestic goods compared to that of goods supplied abroad and, therefore,

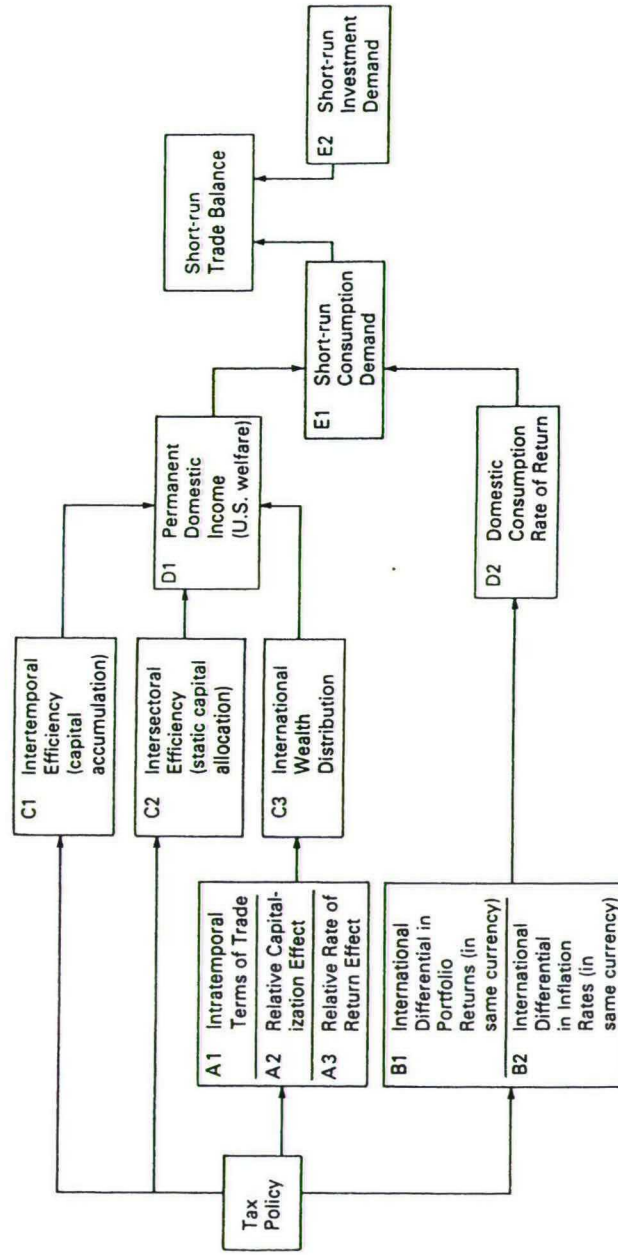

Fig. 1. Tax policy transmission channels.

raises the price of foreign commodities relative to that of domestically produced commodities.

Overall, the ITC's larger welfare gains are due mainly to this policy's ability to improve intertemporal efficiency by generating larger increases in the capital stock (per dollar of lost revenue).

Intra-Country Distributional Effects

The distributional effects across capital and labor correspond to differences in the treatment of existing capital. Decreasing the CIT rate boosts the value of the domestic capital stock by 1.61 per cent in the initial period (Table 3). This capitalization effect reflects the higher stream of after-tax earnings on the existing capital stock. Human wealth, in contrast, falls by 1.22 per cent in the first period after reducing the CIT rate. Hence, most of the welfare gains accrue to capital rather than labor. In contrast to decreasing the CIT rate, introducing the ITC reduces the value of domestic capital (by 0.46 per cent).[13]

IV. The Influence of International Capital Mobility

Welfare Effects

The relative domestic and foreign welfare gains of the two policies are quite different once international capital mobility is allowed for. In the initial steady state, net foreign assets are zero but foreigners own 9 per cent of the domestic capital stock. Table 2 reveals that, in terms of domestic welfare, international capital mobility widens the ITC's advantage over a CIT rate cut. Specifically, without capital mobility, the ITC yields a 141 per cent larger increase in domestic welfare than the CIT cut; with capital mobility, this percentage rises to 160 per cent.[14] In addition, capital mobility reverses the rankings of the CIT rate cut and the ITC in terms of their domestic welfare gains per unit of increase in the domestic capital stock.

Foreigners obtain a larger share of the global welfare gains under a lower CIT rate. Introducing the ITC yields a relative foreign welfare gain

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[13] The effect of the ITC on the equity value of existing capital is theoretically ambiguous; see, for example, Summers (1981). If adjustment costs are sufficiently high, the ITC could actually increase the value of old capital because substantial rents to inframarginal capital could then be sustained for an extended period of time. In our standard simulations, adjustment costs are not high enough to produce this result: the ITC lowers the value of existing capital.

[14] The ITC rates and the CIT rate reduction are of the same magnitude as in the no mobility case. The different economic environment here leads to only slight differences in revenue costs.

Table 3. *Aggregrate effects in the absence of international capital mobility*[a]

	ITC				CIT			
Year	1	4	15	INF	1	4	15	INF
Real exchange rate[b]	−0.13	−0.15	−0.23	−0.57	−0.05	−0.05	−0.08	−0.22
Terms of trade[c]	−0.02	−0.16	−0.45	−0.80	−0.01	−0.06	−0.17	−0.29
Real consump. rate of int.								
Domestic	6.27	6.12	6.07	5.96	6.08	6.04	6.01	5.96
Foreign	6.00	6.00	5.98	5.96	6.00	5.98	5.97	5.96
Equity value of capital								
Domestically located	−0.46	−0.07	0.94	2.69	1.61	1.77	2.20	2.90
Foreign located	0.26	0.17	0.08	0.51	0.10	0.06	0.02	0.21
Human wealth								
Domestic	−2.12	−1.76	−0.65	1.66	−1.22	−1.05	−0.53	0.45
Foreign	−0.03	−0.02	0.01	0.07	−0.01	−0.01	0.01	0.03
Investment								
Domestic	2.06	2.45	3.51	5.50	0.88	1.03	1.46	2.24
Foreign	−0.01	−0.01	0.01	0.06	−0.01	−0.00	0.01	0.02
Consumption								
Domestic	−0.63	−0.40	0.31	1.76	−0.30	−0.19	0.13	0.74
Foreign	0.01	0.01	0.03	0.07	0.01	0.01	0.01	0.03
Exports	0.17	0.46	1.19	2.37	0.07	0.16	0.40	0.82

[a]All figures are percentage changes from base case path, except for those corresponding to consumption rates of interest (which are in percentage points).
[b]Ratio of the domestic producer price index to the foreign PPI (in dollars).
[c]Terms of trade are computed as the export-weighted index of domestic prices divided by the import-weighted index of net-of-tariff foreign prices.

equal to only 8 per cent of the relative domestic gain while the foreign gain exceeds 12 per cent of the domestic gain in the case of reducing the CIT rate (Table 2).

We compare the central case with the case where (as in many European countries) initial cross-holdings are considerably larger than 9 per cent of the domestic capital stock. If, initially, foreigners own 20 per cent of the domestic capital stock, the CIT rate cut becomes even less attractive from a domestic point of view. In that case, the ITC generates a 233 per cent larger increase in domestic welfare (Table 2). From a foreign point of view, however, a lower CIT rate becomes more attractive and the relative foreign gain amounts to 37 per cent of the relative domestic gain.

To explain the domestic and foreign welfare gains, we need to examine the factors which influence the distribution of wealth and welfare between the domestic and foreign economy. These "international transfer effects" correspond to the boxes labelled A1, A2, and A3 in Figure 1. They include not only changes in the commodity terms of trade but also two other transfer effects whose size depends on the extent of cross-holdings of capital. These additional transfer effects play an important role in explaining the relatively small domestic welfare gains and relatively large foreign gains associated with a lower CIT rate. Such effects can be expected to gain in importance as the international integration of share markets encourages more cross-holding of equity. Transfer effects may become especially important for European countries as the EC removes all remaining barriers to international equity flows.

1. *The relative capitalization effect.* The first additional transfer effect — the relative capitalization effect — operates through changes in asset prices. It occurs because foreign owners of domestic capital benefit directly from the lower CIT rate through a higher value of domestic capital reflecting increased after-tax earnings. Hence, a large portion of the welfare gains from lower intertemporal and intersectoral distortions accrues to foreigners. The ITC, in contrast, amounts to an implicit wealth tax on the owners — including the foreign owners — of the existing capital stock.[15]

The relative capitalization effect is related to distribution of wealth across capital and labor. As indicated in Section III, reducing the CIT rate favors capital over labor. In an integrated world capital market, some of

[15] Adopting a life-cycle model of a closed economy, Auerbach and Kotlikoff (1987) emphasize the consequences of capitalization effects associated with the tax treatment of existing capital for the distribution of wealth across generations. Our open economy model, which abstracts from life-cycle considerations, draws attention to how the tax treatment of old capital influences the international distribution of wealth.

the owners of domestic capital are foreigners. Hence, foreigners benefit from a larger share of global welfare gains.

Short-run changes in the net foreign asset position of the domestic economy reflect the relative capitalization effect. The ITC reduces the value of capital located domestically relative to that located abroad. Consequently, the value of foreign claims on domestic capital falls relative to the value of foreign assets owned by domestic residents. Thus, the net foreign asset position of the domestic economy improves (Table 4). A lower CIT rate, in contrast, depresses the value of net foreign assets on impact by raising the value of domestic capital owned by foreigners relative to the value of the initial domestic holdings of foreign capital.

2. *The relative rate of return effect.* The second additional transfer effect involves international differentials in rates of return and, in particular, differential rates of return paid on international cross-holdings of capital. If assets are imperfect substitutes, policy shocks affect the domestic rate of return paid to foreigners who hold domestic assets relative to the foreign rate received by domestic owners of foreign capital. If the domestic rate of return increases relative to the foreign rate, for example, net income flows transferred abroad increase because capital income remitted abroad rises relative to investment income received from foreigners.

The relative rate of return effect also contributes to the smaller domestic and larger foreign welfare gains under a lower CIT rate. In particular, for each unit of additional capital that is accumulated in the domestic economy, a lower CIT rate puts more upward pressure on domestic returns than the ITC does. Figure 2 indicates that beginning 6 years after the policy shock, the ITC produces larger rate of return differentials in favor of domestic assets. Relative to the changes in capital accumulation produced by the two policies, however, the CIT cut continues to yield the largest rate of return differentials.[16]

Aggregate Effects

1. *Balance of payments accounts.* The short-run effect on the account registering international income flows reflects the two international transfer effects identified above. As can be seen from Table 4, in the first period following the ITC's introduction, the net income account is in

[16] The relatively large effect on the domestic economy rate of return in the case of a lower CIT rate is closely related to the treatment of old capital, which affects the value of domestic relative to foreign assets. As discussed earlier, lowering the CIT rate raises the value of assets located domestically relative to foreign assets, thereby increasing the value share of domestic assets in portfolios. As a result, the rate of return on domestic assets has to rise relative to the foreign rate in order to induce households to hold a larger proportion of their wealth in domestic assets.

Table 4. *Aggregate effects in the presence of international capital mobility*[a]

	ITC				CIT			
Year	1	4	15	INF	1	4	15	INF
Real exchange rate[b]	0.11	−0.11	−0.36	−0.51	−0.22	−0.19	−0.12	−0.15
Terms of trade[c]	0.19	−0.12	−0.56	−0.74	−0.15	−0.18	−0.21	−0.23
Real consump. rate of interest								
Domestic	6.20	6.08	6.06	5.96	6.08	6.03	6.01	5.96
Foreign	6.00	6.00	5.98	5.96	5.98	5.97	5.97	5.96
Equity value of capital								
Domestically located	−0.23	−0.06	0.78	2.95	1.44	1.65	2.22	3.23
Foreign located	−0.08	0.16	0.33	0.36	0.38	0.28	0.07	0.03
Human wealth								
Domestic	−1.64	−1.41	−0.51	1.70	−1.22	−1.05	−0.55	0.49
Foreign	−0.12	−0.06	0.05	0.06	0.05	0.05	0.05	0.02
Balance of payments (In % GDP)								
Trade balance	−0.11	−0.02	0.06	−0.03	0.08	0.07	0.02	−0.04
Net income flow	0.01	−0.02	−0.02	0.07	−0.02	−0.01	0.02	0.07
Capital account	0.11	0.04	−0.04	−0.03	−0.05	−0.05	−0.04	−0.03
Net foreign asset position	0.04	−0.30	−0.38	0.55	−0.28	−0.15	0.19	0.71
Investment								
Domestic	2.29	2.59	3.50	5.55	0.81	0.96	1.40	2.28
Foreign	−0.08	−0.04	0.04	0.05	0.04	0.04	0.05	0.02
Consumption								
Domestic	−0.57	−0.40	0.25	1.83	−0.40	−0.28	0.08	0.82
Foreign	−0.04	−0.01	0.06	0.05	0.04	0.04	0.03	0.01
Exports	−0.67	0.32	1.65	2.13	0.67	0.64	0.55	0.55

[a]All figures are percentage changes from base case path, except for those corresponding to consumption rates of interest (which are in percentage points) and balance of payments accounts (which are in changes from the base path relative to GDP).
[b]Ratio of the domestic producer price index to the foreign PPI (in dollars).
[c]Terms of trade are computed as the export-weighted index of domestic prices divided by the import-weighted index of net-of-tariff foreign prices.

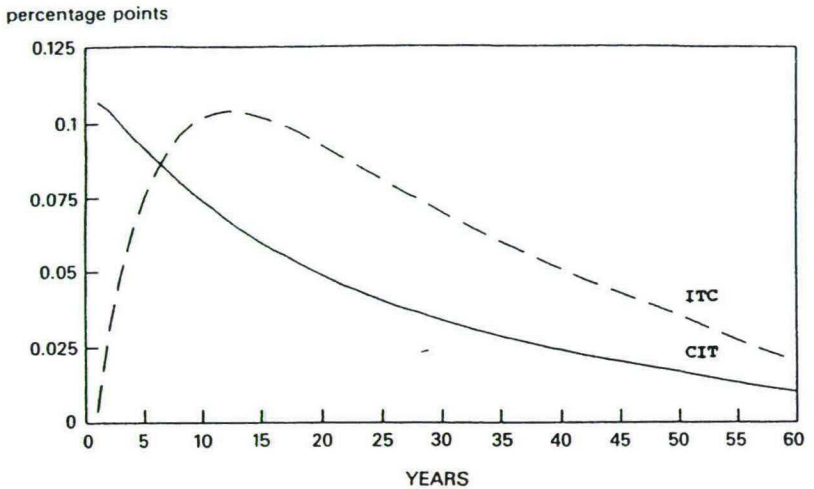

Fig. 2. International differences in rates of return (domestic minus foreign; in dollar terms).

surplus mainly because the relative capitalization effect improves the net foreign asset position of the domestic economy. Lowering the CIT rate, in contrast, worsens the income account initially not only because the value of net foreign assets falls but also because domestic firms have to pay higher yields to foreigners than domestic residents receive from foreign firms.

Figure 3 shows the effects of the two alternative policies on the trade balance (which is zero along the base case equilibrium path). Whereas reducing the CIT causes the trade balance to go into surplus in the first 25 years, introducing the ITC moves the trade account into deficit during the first five years. The initial trade balance depends on the response of domestic absorption because domestic supplies are essentially fixed in the short run since domestic capital accumulates only gradually and total labor supply is exogenous. Consumption and investment demand, which correspond to the boxes labeled E1 and E2 in Figure 1, are the two components of absorption that can change. Accordingly, the trade balance improves on impact if domestic consumption demand falls enough to offset the effect of larger investment demand on domestic absorption. Hence, the short-run effect on the trade balance depends on the consumption response per unit of additional investment, which we explore presently.

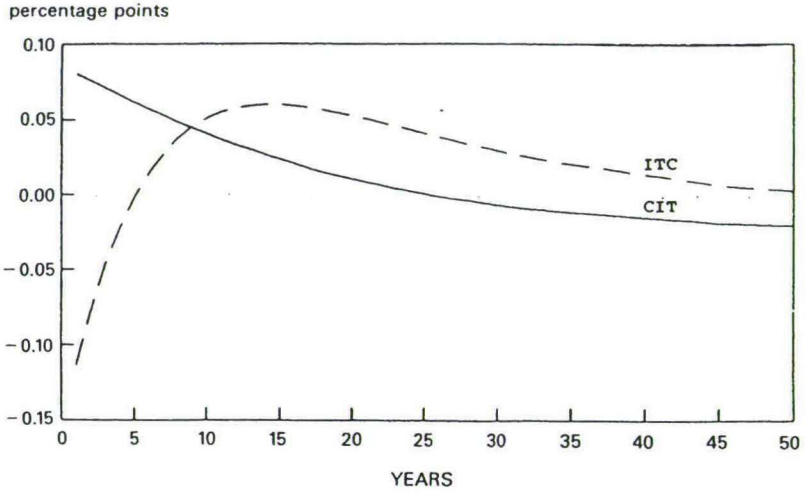

Fig. 3. Trade balance (change from base case as percentage of base case GDP).

2. *Consumption.* Figure 4 shows the influence of these policies on real domestic consumption. Compared to introducing the ITC, cutting the CIT reduces short-run consumption more for each additional unit of investment demand. Two factors, which correspond to the boxes labelled D1 and D2 in the flow diagram, explain the differences across the two policies in the initial consumption response per unit of additional investment. The first is the level of domestic permanent income and reflects the international transfer effects identified above. In particular, in the case of a lower CIT rate, the weaker net foreign asset position together with higher domestic rates of return negatively affect domestic permanent income and require the domestic economy to transfer more real resources abroad by running larger trade surpluses than in the case of the ITC. Hence, the trade balance effects of investment-promoting policies depend on how those policies treat foreign-owned capital and how they affect capital income transferred abroad.

The second explanatory factor is the consumption rate of return, which affects the intertemporal allocation of consumption. As indicated in the discussion of the relative rate of return effect, a lower CIT rate puts relatively heavy pressures on domestic rates of return for a given increase in domestic capital accumulation. As a result, returns on domestic portfolios rise in view of the large share of domestically located assets in the portfolios of domestic households. This, in turn, encourages domestic house-

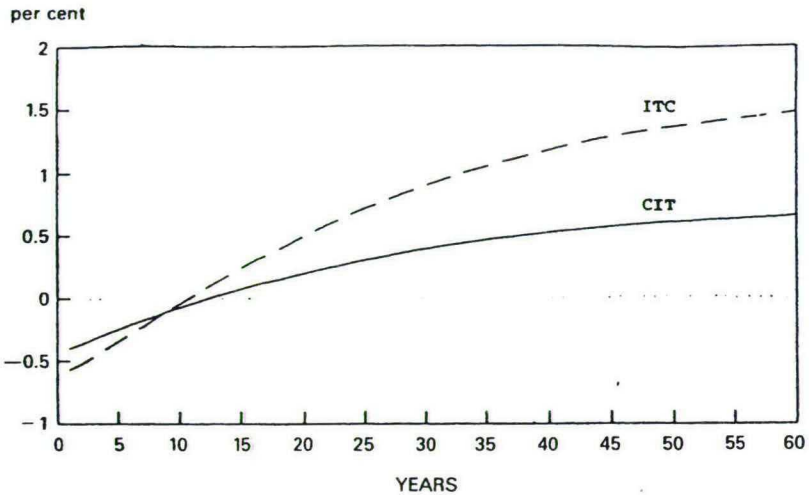

Fig. 4. Real consumption (percentage change from base case).

holds to shift more of their consumption to the future, thereby financing a larger share of domestic capital accumulation through higher domestic saving. Thus, compared to introducing the ITC, reducing the CIT rate yields a stronger short-run performance of the trade balance through both intertemporal substitution effects and effects on permanent income.

3. *The real exchange rate.* The real exchange rate is measured by the ratio of the producer price index for domestically produced goods to the producer price index for foreign-made goods. The initial movements in the real exchange rate reflect the consequences for the short-run trade balance. The introduction of the ITC causes an initial appreciation of the real exchange rate corresponding to the initial trade deficit — although the appreciation is reversed within three years (Figure 5 and Table 4). The initial trade deficit indicates that global absorption is redistributed to the domestic economy. This raises the price of domestic goods because additional domestic spending falls primarily on home goods. The reduction in the CIT rate, in contrast, depreciates the exchange rate in the first period as the trade balance moves into surplus and domestic spending falls. In both policy experiments, the real exchange rate is lower in the long run than in the initial steady-state equilibrium. This development is due to the accumulation of domestic capital, which raises the supply of domestically produced goods compared to that of foreign goods and therefore depresses the relative price of domestic goods. The decline in the real

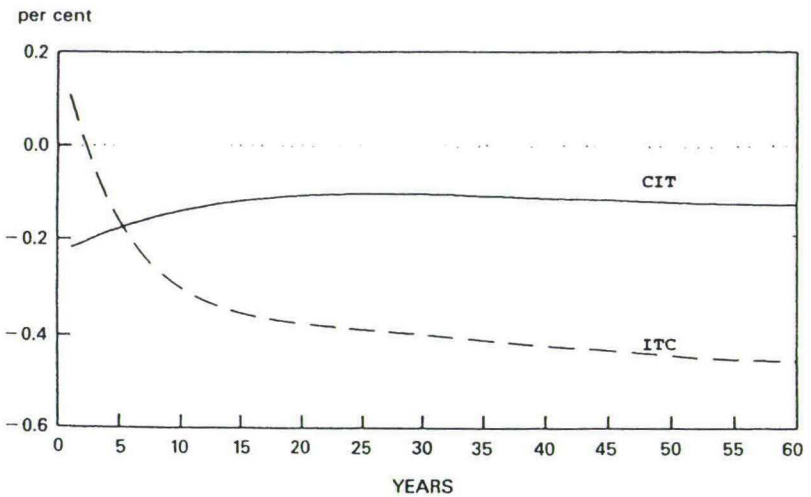

Fig. 5. Real exchange rate (percentage change from base case).

exchange rate is especially large in the ITC case, reflecting this policy's larger effects on the capital stock.

Industry Effects

Table 5 presents disaggregated effects on investment, output, and equity values across the ten U.S. industries. Three factors underlie these effects. The first is the share of investment demand in total demand for the outputs of the various industries. The investment promoting policies especially benefit industries producing capital goods. In the short run, output rises in the construction, metal, and machinery industries, while output falls in other non-housing industries. All outputs rise in the long run.

The second determinant of interindustry differences is the sectoral structure of the investment incentives. Both the ITC and the lower CIT rate apply only to a small portion of the housing sector. Consequently, housing investment is crowded out in the short run as domestic interest rates rise in response to higher investment in the rest of the domestic economy.

The third factor affecting industry performance is the interaction of the trade orientation of the various sectors with movements in the real exchange rate. The differences in sectoral effects between the two alternative investment promoting policies illustrate this channel. Table 5 indicates

Table 5. *Industry effects in the presence of international capital mobility* (percentage changes from base case)[a]

	Investment		Equity value	Output		Investment		Equity value	Output	
	SR	LR	SR	SR	LR	SR	LR	SR	SR	LR
Agriculture	3.14	4.84	−0.51	−0.18	2.98	1.47	2.08	4.94	−0.02	1.20
Oil refining	2.12	4.59	−0.61	−0.17	3.04	2.90	3.96	4.87	−0.01	2.42
Construction	4.88	10.06	1.68	1.25	3.46	1.58	3.74	5.75	0.43	1.42
Textiles	4.46	9.79	0.11	−0.68	2.17	1.04	2.86	4.79	−0.18	0.62
Metals	5.35	10.87	1.71	0.55	3.39	1.76	3.80	5.45	0.36	1.20
Machinery	4.75	9.08	1.09	0.06	2.82	1.47	2.85	5.53	0.36	0.80
Motor vehicles	4.26	9.02	0.64	−0.04	2.56	1.44	3.34	5.36	0.00	0.90
Misc. manufacturing	4.81	9.03	0.39	−0.18	2.34	1.49	3.16	5.09	−0.03	0.85
Services	5.44	10.61	0.53	−0.25	2.25	1.61	3.60	4.84	−0.13	0.83
Housing	−0.41	1.53	−1.42	0.18	1.48	−0.12	1.07	−0.43	0.05	1.04
Total	3.29	5.55	−0.57	−0.03	2.46	0.81	2.28	2.08	0.01	1.01

[a]"SR" and "LR" denote the short run (first period) and long run (steady state).

that export-oriented industries perform better relative to other sectors under a lower CIT rate than under the ITC — especially in the short run. With a lower CIT rate, the equity values of export-oriented sectors (such as agriculture, machinery, and motor vehicles) are higher relative to those of other sectors than with the ITC. At the same time, compared to the ITC case, the equity values of sectors less dependent on the export market (such as services and textiles) perform worse relative to the equity values of other sectors. Export-oriented sectors benefit most from the lower CIT rates because this policy yields a lower real exchange rate (reflecting the need to transfer more resources abroad).

V. Conclusions

The simulations presented in this paper indicate that alternative investment promoting policies differ in their consequences for foreign and domestic welfare, the balance of payments accounts, international competitiveness, and industrial structure. The ITC generally produces larger domestic welfare gains than a CIT rate reduction of equal revenue cost. This is mainly because the ITC is much more effective in reducing intertemporal distortions.

The relative attractiveness of the ITC in terms of domestic welfare is enhanced when international capital mobility is taken into account. The reason is that the favorable treatment of old capital under a lower CIT rate transfers wealth to foreign owners of domestic capital; this offsets some of this policy's positive domestic welfare effects resulting from lower intertemporal and intersectoral distortions. These transfer effects contribute to the different implications of the two policies for the balance of payments accounts and the relative performance of export-oriented, import-competing, and non-tradable industries. A sensitivity analysis, available from the authors upon request, shows these results to be fairly robust to changes in the parameters that regulate investment, saving, and portfolio behavior.

Our results highlight the importance of considering how tax policies treat old capital — especially when the integration of world capital markets allows foreigners to acquire a significant share of the domestic capital stock. These findings suggest that policy makers will need to pay increasing attention to international cross-ownership of capital and asset price effects when they contemplate capital tax reforms. The results also suggest that international agreements on capital taxation, for example in the EC, not only should deal with the level of statutory rates but also should apply to investment incentives. This is the case because investment incentives raise the relative tax burden on old capital and thereby harm the foreign owners of the domestic capital stock. These issues will become increasingly important as European sharemarkets become more integrated and

international cross-holdings of equity become more substantial. As foreign ownership of domestic capital increases, governments face growing incentives to adopt policies that discriminate against old capital. International capital flows may be discouraged if foreigners anticipate such policies. Hence, just as governments have concluded the General Agreement on Tariffs and Trade (GATT) to ensure that "beggar-thy-neighbor" policies do not inhibit international trade in commodities, they may have to enter into international agreements involving the tax treatment of foreign holdings of domestic assets.

This paper has demonstrated that incorporating international capital flows in general equilibrium models can yield fresh insights into the ways that domestic tax policies transmit effects internationally. Still, the existing model cannot capture certain sources of international spillovers that may give further impetus to international policy coordination. Specifically, the model does not incorporate direct investment by multinational corporations. Furthermore, it exogenizes some aspects of firms' financial behavior — including debt-equity ratios and dividend-payout ratios — that may influence international spillovers. Modeling multinational corporations and their investment and financing decisions could shed further light on the potential for gains from international coordination. To illustrate: cutting the statutory corporate tax rate reduces the tax advantages of debt financing, while investment incentives, in contrast, do not directly affect the debt-equity choice. Hence, compared to investment incentives, a lower statutory rate may be more effective in expanding the domestic corporate tax base because it reduces debt financing and therefore limits interest deductions. While domestic governments might therefore tend to favor corporate tax cuts, such policies could harm foreign governments since the foreign corporate tax base would tend to erode as multinational corporations shifted their interest deductions to the (foreign) jurisdictions where statutory rates were not lowered. Hence the tax-avoidance behavior of multinationals is another potentially important source of spillovers. In light of such spillovers, countries may want to consider cooperative arrangements, such as those proposed by the Ruding Committee, which restrict the extent to which corporate tax rates may be reduced.[17]

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First version submitted October 1991;
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