0440

IMF WORKING PAPER

WP/90/103 INTERNATIONAL MONETARY FUND

Fiscal Affairs Department

Corporate Income Tax Harmonization and Capital Allocation in the European Community

Prepared by Angel de la Fuente and Edward Gardner*

Authorized for distribution by George Kopits

November 1990

Abstract

This paper examines the potential distortionary effects of differences in company income taxation on the allocation of non-financial capital in an integrated European market. Effective company tax rates are constructed for EC member countries and the allocative effects are simulated through the use of a simple general-equilibrium model. The main conclusions are that: there is presently considerable dispersion of effective tax rates; meaningful convergence requires harmonization of both rates and tax base; and while the direct efficiency gain from harmonization is relatively small, the adjustment implied for some countries can be significant.

JEL Classification Numbers
122; 321; 520

---

* Research on this paper was conducted under a departmental project on Tax Harmonization in the European Community. Mr. de la Fuente is a doctoral candidate at the University of Pennsylvania and the paper was prepared, in part, while he was a summer intern in the Fiscal Affairs Department; Mr. Gardner is presently in the European Department. The authors gratefully acknowledge comments and suggestions by George Kopits, Lans A. Bovenberg, Krister Andersson and Julian Alworth.

Table of Contents

Appendix Tables

Summary

The paper argues that differences in the taxation of companies' income from capital are likely to emerge as the primary source of tax distortion in the allocation of nonfinancial fixed assets in an integrated European market. Concerns over allocative efficiency thus provide an important motivation for the harmonization of corporate tax systems in the European Community (EC). To assess the degree of dispersion of tax burdens under current tax systems, effective company tax rates are constructed taking into account the entire corporate tax structures of all 12 EC member countries--including statutory income tax rates, rules and rates of depreciation, investment grants, integration methods, wealth, and net worth taxes. Considerable differences are found, with effective tax rates varying from 5 percent in Ireland to 40 percent in Germany. Effective tax rates are then calculated under various harmonization scenarios to identify the degree of harmonization necessary to reduce the dispersion of effective tax rates. The results indicate that a significant convergence of effective tax rates can only be achieved through the harmonization of both tax rates and the tax base. Harmonization of the tax base alone alters the country ordering but has virtually no effect on the dispersion of tax rates.

In the third part of the paper, the allocative and efficiency implications of harmonization or non-harmonization are explored through a simple static general-equilibrium model in which a fixed capital stock is allocated so as to equalize after-tax rates of return. Using the calculated effective tax rates, we find that while the direct efficiency gain resulting from the complete equalization of effective tax rates is relatively small, the adjustment implied for some countries is considerable. The harmonization of the tax base alone, while insufficient to reduce the dispersion of effective tax rates, could improve economic efficiency by increasing the transparency of taxation and reducing compliance costs for enterprises operating within the European Community. Thus, base harmonization is worth pursuing on its own merits, quite apart from any agreement on concerted harmonization of statutory tax rates or explicit fiscal incentives (tax credits, grants, etc.) for investment.

I. Introduction

The effect of taxation of income from capital on economic growth and the allocation of capital is a subject of great interest to both academicians and policymakers. Economic theory suggests that high rates of taxation are likely to discourage capital formation and that differences in tax burdens across countries can be expected to induce an inefficient allocation of capital. This issue is particularly relevant to the European Community, as the drive to remove all barriers to the free flow of goods, people and capital, under the Single European Act of 1987, will fully expose investment decisions to differences in tax burdens across member countries.

Attempts to quantify the importance of these distortions have been complicated by the intricacy of modern tax systems, where the effective marginal tax rate on income from capital depends in a complex way on the statutory tax rates, depreciation allowances and other rules underlying the computation of the tax base, as well as on macroeconomic variables such as the rate of interest and the expected rate of inflation. Earlier studies used average tax rates computed from actual tax collections as approximations for the theoretically more relevant marginal tax rates. 1/ More recently, following a study by King and Fullerton (1984), researchers have constructed standardized measures of the marginal tax burden on capital directly from the tax code. 2/ In this approach, effective tax rates are based, more or less explicitly, on the user cost of capital formula derived by Jorgenson (1967) from the neoclassical theory of the firm. The user cost of capital provides a comprehensive measure of the real marginal cost of capital to the firm, inclusive of taxes and economic depreciation. By subtracting depreciation and the rate of return on the underlying financial asset from the user cost, one obtains a measure of the effective tax on the marginal unit of capital in the form of a wedge, driven by taxes between the net marginal product of capital and the return to the owners of the firm. The advantage of this approach is that it allows us to compare tax wedges across countries, sectors, or hypothetical changes in the tax code.

Section II discusses the conditions under which differences in company taxation (as opposed to personal taxation of income from capital) provide a sufficient description of potential tax distortions in the allocation of real capital. In Section III, we construct measures of effective tax burdens on corporate investment income for the twelve EC member countries under present tax rules and five alternative harmonization proposals. The dispersion of effective tax rates across countries serves to illustrate the potential allocative distortions of the tax systems. The analysis is based on the assumption that

---

1/ See, for example, Harberger (1966), and for cross-country comparisons, Kyrouz (1975).
2/ See, for example, Alworth (1988) and Bovenberg et al. (1990).

international capital movements take the form of portfolio flows but, under certain conditions, the same results would apply to the case of direct investment.

In Section IV, the estimated effective tax rates are used in the context of a simplified general equilibrium model to assess the long-run allocative effects of the different tax harmonization scenarios. Given the simplistic assumptions underlying our model, the exercise serves merely to indicate the direction and broad order of magnitude of the effects of the tax changes under scrutiny. Concluding remarks are contained in Section V. Differences in the taxation of income from capital also distort saving behavior and affect the location of financial intermediation. These issues remain, however, outside the scope of this paper.

II. Capital Income Taxation in the Open Economy

1. Corporate and personal tax wedges

Taxes on the income from capital drive a wedge between the gross rate of return on real assets (p) and the net rate of return received by households on their financial claims on those assets (s). 1/ The distortionary effects of taxation can, in turn, be related to this wedge: its size affects the degree of capital accumulation 2/, while differences across countries distort the international allocation of capital and of savings, and the location of financial intermediation.

Because income from capital is taxed at both the company and personal levels--with some degree of integration provided in certain countries--the total wedge can be broken down into two components: the corporate tax wedge, measured as the difference between the before-tax rate of return on the real asset (p) and the market rate of return on the underlying financial asset (r); and the personal tax wedge, measured as the difference between the market rate (r) and the after-tax rate of return on the financial asset (s) from the point of view of the final investor.

The decomposition of the overall tax wedge on investment income into a corporate and a personal component is analytically convenient in addressing allocative issues among small open economies when

---

1/ Alternatively, the tax can be expressed in terms of a rate by dividing the absolute value of the wedge (p-s) by any of the two rates of return (p or s).

2/ The welfare implications of this effect depend on whether, in the absence of taxation, private behavior leads to a socially optimal level of capital accumulation. In an overlapping generations model, life-cycle savers may in fact overaccumulate capital relative to the Pareto optimum and taxation can be Pareto improving.

international capital movements take the form portfolio flows, i.e., transactions in foreign financial assets normally not involving controlling ownership. The integration of financial markets implies that r, though affected by the average level of taxation, is determined in world markets. The personal and company tax wedges of each country will then have separate and specific effects only on the after-tax rate of return on domestic financial assets (s), and on the gross rate of return on domestic real assets (p), respectively. A tax on capital income at the personal level reduces s and only affects saving behavior. Differences in personal tax wedges across countries thus induce an inefficient allocation of saving, and distort the pattern of ownership of capital. A tax on capital income at the corporate level raises, instead, the level of p necessary to cover r, the cost of financing, and thereby reduces the size of the desired capital stock. Differential rates of taxation of capital income at the company level thus prevent equalization of the marginal rate of return from capital and induce an inefficient allocation of capital. 1/

The integration of personal and corporate tax systems, intended to alleviate the problem of double taxation, reduces the size of the overall wedge (p-s) but also complicates the breakdown into its two components. The reduction in the size of the overall wedge can either translate in a rise in s or a reduction in p, with very different implications for saving and investment. In a small open economy, the effect depends on the mode of application of integration: if the method of integration extends to foreign shareholders, it will effectively lower the required rate of return on the underlying financial asset, and the benefit will be entirely captured by domestic corporations in the form of a lower cost of capital (p); if the method of integration does not reach the foreign shareholder, then integration of the two tax systems has no effect on the rate of return on the financial asset and the benefit is fully captured by resident households in the form of a higher after-tax return (s). 2/

2. Implications for the European Community

In the section above it is argued that, with integrated financial markets and small open economies, the source of tax distortions to the allocation of capital can be reduced to differences in corporate tax

---

1/ In a closed economy and for a given total tax wedge, the breakdown between the personal and the corporate tax wedges only determines the level of r that clears the capital market, but has no effect on p and s.

2/ See Boadway and Bruce (1988).

wedges. 1/ The specific conditions under which this simplification holds for the European Community are examined in this section. The assumption of integrated financial markets appears to be broadly consistent with the abolition of capital controls and is, in any case, consistent with the goal of the Single European Act.

The small economy assumption is clearly more questionable since it cannot be supposed that all member countries of the European Community are price takers in capital markets. In larger countries, domestic demand and supply conditions could affect the rate of return on financial assets, and the personal tax system could, consequently, distort the relative cost of funding investment in domestic and foreign markets. Under these circumstances, the potential for allocative distortions could not be traced to differences in corporate tax wedges alone.

The integration of credit markets in the European Community provides an alternative condition that ensures the irrelevance of personal income taxation to the allocation of real capital. If domestic firms have access to foreign and offshore financial markets on the same terms as foreign enterprises, they can effectively avoid absorbing the gross-up effect of local personal and withholding taxes on financing costs. The lowest cost financial market would then become the marginal source of financing for all enterprises--the Eurobond market being a case in point--and taxes at the personal level affect inframarginal savers and investors and affect the location of intermediation.

Access to foreign and offshore markets cannot, however, neutralize the allocative distortions of taxes on financial investment income when the tax treatment of domestic assets is more favorable than that of offshore or foreign assets. Such is the situation of dividend taxation when integration of personal and corporate tax systems is limited to resident shareholders and/or to locally earned profits. 2/ In this case, through integration, the larger economies can effectively reduce the cost of equity financing of domestic investments. The problem

---

1/ In addition, domestic and foreign capital must be fully substitutable from the point of view of the saver. Failing this condition, personal taxation will also affect the allocation of the capital stock. Otherwise, differences in the taxation of income from capital at the personal level only affect saving and the pattern of ownership of the capital stock.

2/ This is one of the reasons offshore or foreign equity markets rarely provide a cheaper source of funds than domestic equity markets. Under a proposed EC directive for the harmonization of company taxation, a common withholding tax on dividends and a common system of integration extended to all EC residents would have eliminated differences in the cost of equity financing across markets in the EC. The proposed directive was, however, formally withdrawn in 1990. See Commission of the European Communities (1975).

cannot be easily resolved analytically and, in the calculations below, the small economy assumption is retained, i.e., any form of integration that does not reach the international investor is assumed to be passed on to domestic households in the form of higher after-tax returns, rather than to firms in the form of lower financing costs.

Another condition under which taxes on financial investment income would not affect the allocation of capital even among large countries is if the residence principle of taxation were enforced. 1/ Under this principle, taxes do not discriminate among assets but only on the basis of the residence of the investor. This guarantees the convergence of the rates of return on all financial assets and hence of the cost of capital to enterprises residing in different countries.

While investors in all EC countries are, in principle, taxed on this basis, the residence principle fails to hold for at least four reasons. First, uneven enforcement implies that financial investment income is often taxed at source only and differences in source taxation can therefore be reflected in asset prices. In many countries, the exemption of source taxation for non-residents has long provided an important conduit for tax evasion--especially under the shelter of anonymity provided by bank secrecy and bearer instruments. A second reason for the failure of the residence principle is that foreign assets may be subject to a heavier tax burden than domestic assets. This possibility arises when foreign withholding taxes are not fully creditable in the country of residence, a problem that applies mostly to tax-exempt institutions. A third reason is that, with differences in inflation rates and compensatory exchange rate adjustments, the effective taxation of foreign and domestic assets will diverge, even under the residence principle, if exchange rate gains and losses are taxed at a different rate than ordinary interest income, or simply taxed on a realized rather than on an accrual basis. Finally, the fact that integration of personal and corporate income taxes, when available at the national level, is usually not extended to nonresidents or to domestic recipients of foreign-source dividends creates another form of discrimination among assets, as discussed above.

In order to account for these complications, the allocative issue could be examined by constructing a matrix of tax wedges (or effective tax rates), inclusive of both personal and corporate taxes, associated with investment flows to and from each of the twelve EC member countries. This approach was adopted by Bovenberg et al. (1990), who construct bilateral tax wedges for portfolio investment flows between the U.S. and Japan. However, the inclusion of personal income taxation in the tax wedges may be misleading for our purposes. First, widespread tax evasion at the personal level, the proliferation of tax avoidance schemes (such as pension accounts and non-distributing mutual funds),

---

1/ Under the residence principle, a country exercises a tax claim on all income earned by residents, and taxes it at a uniform rate.

and the uneven tax treatment of individuals and institutional investors make it difficult to construct comparable effective rates of personal taxation. Second, as discussed above, the availability of offshore financing limits the adverse effect of personal taxes and withholding taxes on the cost of capital at the margin.

Our analysis supposes that foreign investment takes the form of portfolio flows but, under specific circumstances, the results would extend to investment channeled through financial intermediaries, or taking the form of corporate direct investment. In the case of foreign investment undertaken by financial institutions, the same allocative implications would obtain if these institutions were competitive and intermediated capital income were subject to the same tax treatment as personal portfolio income. 1/ The analysis of foreign direct investment can be subsumed by the present analysis if foreign direct investment income is taxed only in the source country. This effectively requires that the country of residence not exercise any claim on that income. While practices vary widely, there are two cases in which this condition is met if foreign source income is exempt outright in the country of residence, or if taxes in the country of residence can be postponed indefinitely by deferring the repatriation of foreign profits. The first condition is applied less frequently than the second one which normally can be used for subsidiary income. In general, however, the complexity of tax practices with regard to foreign direct investment income would require a separate analysis. Again, a matrix of effective tax rates would have to be constructed for flows to and from each of the EC member countries. 2/

III. Corporate Tax Wedges

1. Methodology

The methodology employed in this exercise is based on the concept of the required rate of return or user cost of capital. 3/ A profit-maximizing firm requires a gross return on the last unit invested that allows the firm to pay market returns on internal and borrowed funds after covering depreciation and corporate taxes. Subtracting

---

1/ This form of tax transparency fails to hold when financial institutions cannot credit withholding taxes paid abroad against their domestic tax liability, for instance, if they are tax-exempt.

2/ For some estimates of tax wedges on foreign direct investment income see Crooks, Devereux, Pearson and Wookey (1989).

3/ For a derivation from the objective function of the firm, see Hall and Jorgenson (1967). An international comparison of the required rate of return based on this methodology is given in Kopits (1982).

depreciation from the user cost (divided by the price of capital goods), a measure of the before-tax rate of return on capital is obtained 1/

$$p = [1/(1 - u)] * (1 - zu - k) * (\rho + \delta - \pi) - \delta \qquad (1)$$

where u denotes the statutory corporate income tax rate, z is the present value of the depreciation allowance, k is the present value of investment grants, ρ is the firm's marginal cost of capital, δ the rate of economic depreciation and π the expected rate of inflation. The discount factor (ρ) depends in turn on the market rate of return on the underlying financial instrument.

If we denote by r the market rate of return on the financial instruments sold by the firm to raise capital, we can define the corporate wedge as:

$$w = p - r \qquad (2)$$

This expression can be converted into an effective marginal corporate income tax rate, expressed in terms of the before-tax rate of return:

$$t = (p - r)/p \qquad (3)$$

In practice, there are as many "market" rates as there are sources of financing available to the firm. With debt and equity as the two broad forms of financing, a single composite market rate reflecting the financing mix of the enterprise can be constructed and a single wedge derived from it. The alternative, followed here, is to compute separate tax wedges for debt- and equity-financed projects and then calculate a weighted average. 2/

In the case of debt (subscript d), the appropriate measure of the real market return is clearly the nominal interest rate less the expected rate of inflation.

$$r_d = i - \pi \qquad (4)$$

Since interest payments are deductible as expenses for tax purposes, the (nominal) marginal cost of funds is given by:

$$\rho_d = (1 - u) * i \qquad (5)$$

1/ A detailed derivation is presented in the Appendix.

2/ The financing mix depends itself on the relative tax treatment of debt and equity financing. The analysis abstracts from this form of endogeneity and common fixed weights are attributed to debt and equity financing for all twelve countries, based on source of funds data for private non-financial corporations from OECD, Financial Statistics.

and the corporate wedge on a debt-financed investment project is given by

$$w_d = p_d - r_d = \qquad (6)$$

$$= [1/(1 - u)] * (1 - zu - k) * (\rho_d + \delta - \pi) - \delta - (i - \pi)$$

For equity (subscript e), the computation is complicated by the fact that the required market return (r_e) cannot be directly observed. A convenient way to derive r_e is to impose an arbitrage condition requiring that the net, risk-adjusted returns on debt and equity be equal from the perspective of a representative investor, willing to hold both instruments. 1/ This condition can be expressed as:

$$r_e = r_d + h \qquad (7)$$

where h is an exogenous risk premium. Consistent with the assumption of an internationally integrated capital market discussed in Section II, the arbitrage condition (7) must hold for the same representative investor for the whole of the EC. To make matters tractable, the representative investor is chosen to be an international (institutional) investor with a nonresident status in each EC member country. Since nonresident investors are generally exempt from withholding taxes on interest income, the net return from a debt instrument is then simply the real interest rate, r_d, as in eq. (4). 2/

We can now work back from r_e to determine the marginal cost of equity finance to the firm (ρ_e). We assume that a fixed fraction (v) of the firm's real yield on equity ($\rho_e - \pi$) is distributed as dividends. 3/ The real return paid out by the firm ($\rho_e - \pi$) and that received by the representative investor (r_e) can differ for three basic reasons. First, dividends paid to nonresidents are generally subject to

1/ Some studies approximate the marginal return to equity by the ex-post return on the stock market; see Auerbach (1983). Another possibility is to impose the arbitrage condition at the firm level, thus equating the marginal cost of debt and equity financing.

2/ Even where nonresidents are not exempt from interest from corporate bonds, as in Belgium and Portugal, it is assumed that such taxes do not alter the cost of debt because of the possibility of borrowing from banks or through the Euromarket. In fact, in Belgium, the corporate sector is virtually absent from the domestic bond market.

3/ Based on average data for the EC stock markets, the parameter v is set at 50 percent. Following the traditional view of dividend taxation, taxes and credits on dividends and other imputation measures are assumed to affect the cost of capital in proportion to the share of earnings distributed as dividends, rather than in proportion to the share of new equity issues in equity financing ("new view"). See Poterba (1987) for a discussion of the two views.

a withholding tax (wt) (Table 1). 1/ As a result, part of the firm's payout does not reach the investor, and for a given required return r_e and payout ratio v, this tends to raise the firm's cost of funding. Second, because of partial or full integration of the personal and corporate tax systems, dividends may receive a preferential tax treatment over retained earnings in the form of a dividend tax credit or deduction, or a split rate system (Table 2). 2/ In that case, each dollar distributed by the firm may be worth more than one dollar to the investor. This effect would tend to reduce the cost of equity financing. The degree of integration is measured by the integration variable θ, defined as the opportunity cost of retained earnings in terms of gross dividends foregone. Finally, the undistributed portion of earnings is presumably capitalized in the price of the stock and can be taxed, in principle, at the investor's level through a tax on capital gains. In practice, such taxes are virtually nil, either by statutory treatment or by virtue of the fact that they are levied on a realized rather than accrual basis. Considering all these factors, the firm's marginal cost (ρ_e) of providing the required return to the marginal shareholder can be expressed as:

$$\rho_e = (i + h - \pi) / (v * \theta * (1 - wt) + 1 - v) + \pi \qquad (8)$$

The before-tax rate of return on equity-financed capital (p_e) can then be computed by substituting (8) into (1) and the tax wedge on equity is then derived as:

$$w_e = p_e - r_e \qquad (9)$$

where r_e is defined as $(i + h - \rho_e)$.

The derived tax wedges provide a comprehensive measure of the effective tax burden on capital income but cannot, obviously, capture differences in the degree of enforcement of tax collection and in the scope for tax avoidance through financial transactions across member countries. Moreover, the tax wedges cannot account for differences in the tax treatment of losses.

2. Simulations

Simulations illustrate differences in the effective taxation of income from capital under current systems and alternative scenarios. The degree of dispersion of tax wedges measures the potential for distortions in the allocation of capital across countries, by type of

---

1/ For the institutional investors the tax is also a final tax. The rate varies and is generally lower under tax treaty. The values chosen for each country correspond to the most favorable rate generally applicable to nonresidents.

2/ Only the forms of integration that reach the representative investor are considered.

Table 1. European Community: Taxation of Equity Income, 1990 1/

	Statutory corporate income tax rate	Non-resident institutional investor: Integration variable	Non-resident institutional investor: Dividend withholding tax 2/	Non-resident institutional investor: Payout rate	Resident household investor: Payout rate 3/	Method of integration 4/
	u	θ	wt	(1-u)θ(1-wt)		
Belgium	0.39	1.0	0.15	0.52	0.46	--
Denmark	0.40	1.0	0.15	0.43	0.38	(Dividend credit)
France	0.37	1.38	0.15	0.74	0.54	Dividend credit
Germany 5/	0.57	1.28	0.15	0.47	0.58	Split rate (and dividend credit)
Greece	0.35 6/	1.54	0.42	0.58	0.58	Dividend deduction
Ireland	0.10 7/	1.0	0.00	0.90	0.45	(Dividend credit)
Italy 5/	0.46	1.0	0.15	0.46	0.57	(Dividend credit)
Luxembourg	0.37	1.0	0.15	0.54	0.26	--
Netherlands	0.35	1.0	0.15	0.55	0.26	--
Portugal	0.40	1.0	0.15	0.51	0.45	(Dividend credit) 8/
Spain	0.35	1.0	0.15	0.55	0.35	(Dividend credit)
United Kingdom	0.35	1.33	0.15	0.73	0.60	Dividend credit

Sources: International Bureau of Fiscal Documentation; OECD.

1/ Rates expressed in decimal form.

2/ Typical rate under treaty.

3/ Share of gross corporate income that reaches the resident shareholder after corporate and personal income taxes (top marginal tax rate) and any form of integration.

4/ In parentheses if it only applies to domestic shareholders.

5/ Corporate income tax inclusive of local taxes.

6/ Rate on industrial company quoted on the Athens stock exchange.

7/ Special rate for industrial enterprises.

8/ If the withholding tax on dividends is taken as a final tax, no dividend credit can be claimed; a 7 percent dividend credit can be claimed, otherwise, against regular income tax (at a top marginal rate of 40 percent).

Table 2. European Community:
Summary of Corporate Tax Systems, 1990

	Statutory corporate income tax rate 1/ (in percent of income)	Net worth and capital taxes tax rate 2/ (in percent of asset value)	Investment incentives D=tax deduction C=tax credit (in percent of income)	Loss carryover (years)	
				Carry forward	Carry back
Belgium	39	--	5 (D)	5	--
Denmark	40	--	--	5	--
France	37/42 3/	0.62 6/	--	5	--
Germany	57/45 3/	0.13/0.58 7/	--	5	2
Greece	35 4/	--	--	3	--
Ireland	10 5/	--	--	no limit	1
Italy	46	--	--	5	--
Luxembourg	37	0.11/0.88 8/	12 (C) 9/	5	--
Netherlands	35	--	--	8	3
Portugal	40	--	--	5	--
Spain	35	--	5 (C)	5	--
United Kingdom	35	--	--	no limit	1

Notes: -- = not applicable.

Sources: International Bureau of Fiscal Documentation; OECD; Price Waterhouse; and various national sources.

1/ National and local income tax combined.
2/ Staff estimates of effective tax rates on the value of capital, excluding local property taxes on land and buildings.
3/ Split rate system: first rate applies to retained earnings, second rate to distributed earnings.
4/ Rate for industrial companies quoted on the Athens Stock Exchange.
5/ Rate for industrial companies, to remain into effect till the year 2000. The standard rate for other companies is 43 percent.
6/ Taxe professionelle.
7/ Gewerbesteuer and net worth tax. Rates for debt and equity financed capital, respectively.
8/ Net worth tax and business capital tax. Rates for debt- and equity-financed capital, respectively.
9/ Machinery only.

Table 2 (Concluded). European Community:
Summary of Corporate Tax Systems, 1990

	Capital cost recovery allowances of depreciation — Methods: Straight line (SL), Declining balance (DB)				
	Machinery		Buildings		First year
	SL	DB	SL	DB	convention 6/
Belgium	10	20	5	--	Full year
Denmark 1/	--	30	6/2 4/	--	2/3 of year
France	10	25	5	--	Pro-rated 7/
Germany	10	25	4	10/5/2.5 5/	Half year
Greece	10	--	5	--	Pro-rated 7/
Ireland	--	50/25 3/	50/4 3/	--	Full year
Italy	15/10 2/	--	15/3 2/	--	Pro-rated 7/
Luxembourg	20	30	3	--	Half year
Netherlands	10	25	3	--	Pro-rated 7/
Portugal	15	--	4	--	Full year
Spain	8	16	3	--	Pro-rated 7/
United Kingdom	--	25	4	--	Full year

Notes: -- = Not applicable.

Sources: International Bureau of Fiscal Documentation; OECD; Price Waterhouse; and various national sources.

1/ Denmark allows depreciation to start at the time the capital is ordered or construction initiated. Also the depreciable base is indexed to the price level.
2/ The first rate applies to the first three years.
3/ The first rate applies to the first year.
4/ The first rate applies to the first ten years.
5/ The first rate applies to the first four years, the second one to the following three years.
6/ Share of the year over which depreciation is allowed in the first tax year.
7/ Prorated from date of acquisition or installation.

asset, and by form of financing. Corporate tax wedges for domestic investment are calculated under six scenarios for all EC member countries. Under each scenario, tax wedges are computed separately for buildings and machinery investment, financed with either debt or equity. The real interest rate is assumed to be constant at 5 percent in combination with two alternative inflation rate assumptions: 1/ a common inflation rate of 2 percent; and different inflation rates for three groups, namely, 2 percent for Belgium, France, Germany, Ireland, Luxembourg and the Netherlands, 5 percent for Denmark, Italy, Spain, and the United Kingdom, and 10 percent for Greece and Portugal. 2/

The six tax scenarios can be summarized as follows.

Scenario 1 is based on tax systems effective 1990, qualified by proposed tax reforms (Table 2). 3/

Scenario 2 assumes adoption of the following rules for the determination of taxable profits of enterprises by EC member countries: 4/ full first-year convention for depreciation, allowing enterprises to claim the full amount of depreciation the first tax year, irrespective of when in the year the investment actually takes place; reduction of the depreciable base by the amount of the subsidy received through investment tax credits and deductions; elimination of accelerated depreciation; elimination of depreciation of capital not yet in use (advance depreciation); elimination of indexation of the depreciable base; and straight-line or declining-balance methods of

---

1/ A full pass-through of inflation rates in nominal interest rates is assumed. Our calculations correspond to the fixed r case discussed in King and Fullerton (1984).

2/ In principle, the existence of the EMS, coupled with agreement on phase one of the Delors Committee's proposal for monetary integration, including the removal of capital controls, should result in the convergence of inflation rates for the members of the Community. With the deutsche mark continuing to play the role of nominal anchor for the system, such convergence would presumably be toward the lower level of the spectrum. A common inflation rate of 2 percent is therefore our benchmark assumption. On the other hand, it is plausible that such convergence may take time, with considerable inflation differentials prevailing during a transition period, making the second inflation scenario a reasonable alternative.

3/ In the case of Belgium, we use the corporate income tax rate announced for 1992, or 39 percent. For Denmark, the newly introduced tax rate of 40 percent is used.

4/ Based on the description in Kuiper (1988) of a draft proposal considered earlier by the EC Commission.

depreciation (assumed at 2.5 times the existing the straight-line rate) allowed for both buildings and machinery with switchover from declining balance to straight line during the life of the asset (Table 3). 1/

Scenario 3 includes equalization of corporate income tax rates at the weighted EC average rate of 43 percent and elimination of local income taxes, 2/ in addition to assumptions under Scenario 2 (Table 4).

Scenario 4 includes the elimination of taxes levied on the value of assets or net worth in France, Luxembourg and Germany, 3/ in addition to assumptions under Scenario 4, and assumes the adoption of a common imputation system consisting of credit on dividends equivalent to 50 percent of the corporate income tax extended to both residents and nonresidents, and a common withholding tax of 15 percent on dividends paid to nonresidents (Table 4); only differences in depreciation rates and investment grants remain.

Scenario 5 assumes the equalization of tax rates and imputation systems and the elimination of capital based taxes and investment grants, but maintains current differences in depreciation rates and in the definition of the depreciable base.

Scenario 6 assumes complete equalization of company income tax systems; only inflation rates differ among the three groups of countries.

For each scenario, 48 different tax wedges (12 countries, 2 types of assets, 2 sources of finance) are computed, summarized in Tables 5-9. Effective tax rates, calculated from the average wedges over both sources of finance and asset types, provide a normalized measure of the overall tax burden on capital income in each country (Tables 6 and 7). 4/ Standard deviations capture the degree of dispersion in tax burdens across countries. Differences in the tax wedges across sources of financing (Table 8) and asset types (Table 9) reflect the biases of the tax systems. (Detailed tables are contained in Appendix II.)

1/ For some countries the declining balance method is not currently allowed. In that case the declining balance rate is derived as a multiple (2.5) of the current straight line rate.

2/ Weights derived from national capital stocks. The German rate on distributed profits is kept at 36 percent.

3/ Local property taxes are not included in the analysis.

4/ The weights assigned (0.6 to machinery and equipment and 0.4 to buildings; 0.6 to equity and 0.4 to debt) are based on national accounting averages of financial flows and on the composition of fixed capital formation.

Table 3. European Community: Tax Base Harmonization 1/

	Effect on Effective Tax Rate				New Methods and Rates of Depreciation Permitted Under Scenario 2 Declining Balance = DB Straight Line = SL		
	Full First Year Convention	Reduction of Depreciable Base by Investment Grant	Elimination of Accelerated Depreciation	Elimination of Advance Depreciation	Buildings DB (= 2.5 SL)	Machinery SL	Machinery DB
					(In percent)		
Belgium	...	+	...	...	12.5	...	...
Denmark	-	...	...	+	12.5 2/	...	...
France	-	...	...	...	12.5	...	...
Germany	-	...	...	...	10.0 3/	...	...
Greece	-	...	...	...	12.5	...	25.0
Ireland	...	...	+	...	10.0	10.0	...
Italy	-	...	+	...	7.5	...	25.0
Luxembourg	-	+	...	...	7.5	...	...
Netherlands	-	...	...	...	7.5	...	...
Portugal	...	...	...	...	10.0	...	25.0
Spain	-	+	...	...	7.5	...	...
United Kingdom	...	...	...	...	10.0	10.0	...

Note:
+ = Increase in effective tax rate.
- = Decrease in effective tax rate.
... = No effect or no change relative to current practice.

1/ Scenario 2 relative to current systems (Scenario 1).
2/ In the SL case, Denmark is assumed to move from a two rate (.06,.02) system to a single rate of .05 over the life of the asset.
3/ The rate of 0.10 is in lieu of a system of three rates (0.10,0.05,0.02) over the life of the asset.

Table 4. European Community:
Statutory Tax Rate Harmonization 1/

	Effect of Elimination of Capital Taxes on Effective Tax Rate	Change in Statutory Corporate Income Tax Rate Common Rate = .43	Change in Payout Rate to Non-resident Shareholder 2/ Common Rate = .73 3/
Belgium	...	+0.04	+0.21
Denmark	...	+0.03	+0.30
France	-	+0.06	-0.01
Germany 4/	-	-0.14	+0.26
Greece	...	+0.08	+0.15
Ireland	...	+0.33	-0.17
Italy 4/	...	-0.03	+0.27
Luxembourg	-	+0.06	+0.19
Netherlands	...	+0.08	+0.18
Portugal	...	+0.03	+0.22
Spain	...	+0.08	+0.18
United Kingdom	...	+0.08	...

Note:
- = Decrease in effective tax rate.
... = No effect or no change relative to current practice.

1/ Harmonization of corporate tax rates (Scenarios 3-6) and of dividend withholding and dividend credit rates (Scenarios 4-6) relative to current systems (Scenario 1).
2/ Payout rate defined as share of profits reaching the shareholder after corporate and dividend taxation (inclusive of dividend credit).
3/ Derived assuming a common 15 percent withholding tax rate and a 50 percent dividend tax credit.
4/ National and local income taxes combined.

Table 5. Summary of Harmonization Scenarios

Scenarios	Descriptions
(1)	Current tax systems
(2)	Base harmonization
(3)	Base and rate harmonization
(4)	Base and rate harmonization, elimination of capital based taxes, and common imputation system
(5)	Rate harmonization, elimination of capital based taxes, and common imputation system
(6)	Complete harmonization (scenario 4 with common depreciation rates and elimination of investment grants).

Table 6. European Community: Average Corporate Tax Wedges 1/

(Percentage point difference between the gross and the net-of-tax real rate of return)

	Inflation rate (percent per annum)	Tax Scenarios (1)	(2)	(3)	(4)	(5)	(6)
Common Inflation Rate							
Belgium	2.0	1.3	1.3	1.5	0.2	0.8	0.4
Denmark	2.0	1.2	1.5	1.6	0.3	0.1	0.4
France	2.0	2.0	0.9	0.9	0.2	1.6	0.4
Germany	2.0	4.2	3.1	2.2	0.4	1.1	0.4
Greece	2.0	2.5	1.3	1.6	0.6	2.2	0.4
Ireland	2.0	0.3	0.1	1.4	0.4	1.7	0.4
Italy	2.0	3.0	2.9	2.5	1.2	1.3	0.4
Luxembourg	2.0	0.6	0.8	0.7	-1.4	0.8	0.4
Netherlands	2.0	2.6	1.5	2.1	0.7	2.1	0.4
Portugal	2.0	2.5	1.3	1.5	0.2	1.5	0.4
Spain	2.0	2.0	1.4	2.1	0.7	2.9	0.4
United Kingdom	2.0	1.3	0.5	0.4	0.4	1.6	0.4
Weighted average 2/		2.7	1.9	1.6	0.5	1.5	0.4
Standard deviation 2/		1.1	1.0	0.7	0.3	0.5	0.0
Different Inflation Rates							
Belgium	2.0	1.3	1.3	1.5	0.2	0.8	0.4
Denmark	5.0	0.4	1.6	1.8	0.5	-0.8	0.7
France	2.0	2.0	0.9	0.9	0.2	1.6	0.4
Germany	2.0	4.2	3.1	2.2	0.4	1.1	0.4
Greece	10.0	2.8	1.5	1.9	1.0	2.6	0.6
Ireland	2.0	0.3	0.1	1.4	0.4	1.7	0.4
Italy	5.0	3.3	3.2	2.8	1.4	1.5	0.7
Luxembourg	2.0	0.6	0.8	0.7	-1.4	0.8	0.4
Netherlands	2.0	2.6	1.5	2.1	0.7	2.1	0.4
Portugal	10.0	2.5	1.4	1.6	0.3	1.5	0.6
Spain	5.0	2.1	1.5	2.3	1.0	3.1	0.7
United Kingdom	5.0	1.4	0.6	0.7	0.7	1.7	0.7
Weighted average 2/		2.7	1.9	1.7	0.6	1.5	0.5
Standard deviation 2/		1.1	1.1	0.8	0.4	0.6	0.1

1/ Weighted average over buildings (0.4) and machinery (0.6) and over debt (0.4) and equity (0.6).

2/ Weighted mean and standard deviation, with weights corresponding to the countries' share of the EC capital stock.

Table 7. European Community: Effective Corporate Tax Rates 1/

(In percent of after-tax rate of return)

	Inflation rate (percent per annum)	Tax scenarios (1)	(2)	(3)	(4)	(5)	(6)
Common Inflation Rate							
Belgium	2.0	17.5	17.5	20.0	3.6	11.5	6.5
Denmark	2.0	16.7	19.1	20.8	5.0	2.0	6.5
France	2.0	24.5	13.0	12.5	3.0	20.1	6.5
Germany	2.0	40.2	33.3	25.8	6.5	14.6	6.5
Greece	2.0	29.0	17.6	20.4	9.2	26.1	6.5
Ireland	2.0	4.8	2.3	18.2	6.5	21.5	6.5
Italy	2.0	32.9	31.8	29.1	15.9	17.5	6.5
Luxembourg	2.0	8.7	10.9	9.7	-29.9	11.9	6.5
Netherlands	2.0	29.2	19.9	25.1	10.6	25.0	6.5
Portugal	2.0	29.0	17.7	19.3	2.9	19.0	6.5
Spain	2.0	24.0	18.1	25.2	10.6	31.8	6.5
United Kingdom	2.0	17.6	7.0	6.5	6.5	20.6	6.5
Weighted average 2/		29.1	21.9	20.2	7.5	18.6	6.5
Different Inflation Rates							
Belgium	2.0	17.5	17.5	20.0	3.6	11.5	6.5
Denmark	5.0	6.5	20.3	22.3	7.3	-14.4	9.5
France	2.0	24.5	13.0	12.5	3.0	20.1	6.5
Germany	2.0	40.2	33.3	25.8	6.5	14.6	6.5
Greece	10.0	31.0	19.2	23.4	13.3	29.8	9.3
Ireland	2.0	4.8	2.3	18.2	6.5	21.5	6.5
Italy	5.0	34.5	33.7	30.8	18.5	19.6	9.5
Luxembourg	2.0	8.7	10.9	9.7	-29.9	11.9	6.5
Netherlands	2.0	29.2	19.9	25.1	10.6	25.0	6.5
Portugal	10.0	29.0	18.6	20.6	5.0	19.5	9.3
Spain	5.0	25.6	19.9	27.4	14.0	33.7	9.5
United Kingdom	5.0	18.3	8.8	9.5	9.5	21.9	9.5
Weighted average 2/		29.4	22.6	21.1	8.6	19.0	7.7

1/ Weighted average over buildings (0.4) and machinery (0.6) and over debt (0.4) and equity (0.6).

2/ Weights correspond to the countries' share of the EC capital stock

Table 8. European Community: Corporate Tax Wedges, by Source of Financing 1/

(Percentage point difference between the gross and the net-of-tax real rate of return)

	Inflation rate (percent per annum)	Tax scenarios					
		(1)	(2)	(3)	(4)	(5)	(6)
Equity Financing							
Belgium	2	3.6	3.6	4.1	1.9	2.6	2.2
Denmark	2	3.5	3.8	4.2	2.0	1.8	2.2
France	2	3.5	2.3	2.5	1.9	3.4	2.2
Germany	2	8.0	6.8	4.8	2.2	2.8	2.2
Greece	2	4.6	3.2	4.0	2.4	4.2	2.2
Ireland	2	0.7	0.5	3.7	2.2	3.3	2.2
Italy	2	6.0	6.0	5.3	3.0	3.1	2.2
Luxembourg	2	3.3	3.4	3.4	0.0	2.6	2.2
Netherlands	2	4.7	3.6	4.8	2.5	4.0	2.2
Portugal	2	5.0	3.6	4.0	1.9	3.3	2.2
Spain	2	4.1	3.4	4.8	2.6	5.0	2.2
United Kingdom	2	2.8	1.9	2.2	2.2	3.4	2.2
Debt Financing							
Belgium	2	-2.1	-2.1	-2.3	-2.3	-1.9	-2.2
Denmark	2	-2.1	-2.0	-2.2	-2.2	-2.3	-2.2
France	2	-0.3	-1.2	-1.6	-2.3	-1.2	-2.2
Germany	2	-1.6	-2.5	-1.8	-2.2	-1.6	-2.2
Greece	2	-0.6	-1.5	-2.0	-2.0	-0.8	-2.2
Ireland	2	-0.2	-0.4	-2.2	-2.2	-0.6	-2.2
Italy	2	-1.4	-1.8	-1.6	-1.6	-1.3	-2.2
Luxembourg	2	-3.5	-3.2	-3.5	-3.6	-1.7	-2.2
Netherlands	2	-0.6	-1.5	-1.9	-1.9	-0.8	-2.2
Portugal	2	-1.1	-2.1	-2.3	-2.3	-1.2	-2.2
Spain	2	-1.3	-1.7	-2.0	-2.0	-0.3	-2.2
United Kingdom	2	-0.9	-1.7	-2.2	-2.2	-1.1	-2.2
Differential (equity-debt)							
Belgium	2	5.7	5.6	6.5	4.3	4.5	4.3
Denmark	2	5.6	5.8	6.5	4.3	4.1	4.3
France	2	3.8	3.6	4.2	4.2	4.6	4.3
Germany	2	9.5	9.4	6.6	4.3	4.4	4.3
Greece	2	5.3	4.8	6.0	4.4	5.0	4.3
Ireland	2	0.9	0.9	5.9	4.3	3.9	4.3
Italy	2	7.5	7.8	7.0	4.7	4.4	4.3
Luxembourg	2	6.8	6.6	6.9	3.7	4.3	4.3
Netherlands	2	5.3	5.0	6.7	4.5	4.8	4.3
Portugal	2	6.1	5.8	6.3	4.2	4.5	4.3
Spain	2	5.5	5.2	6.8	4.6	5.3	4.3
United Kingdom	2	3.7	3.5	4.3	4.3	4.5	4.3
Weighted average 2/		6.3	6.2	5.8	4.4	4.5	4.3

1/ Weighted average over buildings (0.4) and machinery (0.6).

2/ Weights correspond to the countries' share of the EC capital stock.

Table 8 (continued). European Community: Corporate Tax Wedges, by Source of Financing 1/

(Percentage point difference between the gross and the net-of-tax real rate of return)

	Inflation rate (percent per annum)	Tax scenarios					
		(1)	(2)	(3)	(4)	(5)	(6)
Equity Financing							
Belgium	2	3.6	3.6	4.1	1.9	2.6	2.2
Denmark	5	3.3	4.5	5.1	2.9	1.6	3.1
France	2	3.5	2.3	2.5	1.9	3.4	2.2
Germany	2	8.0	6.8	4.8	2.2	2.8	2.2
Greece	10	6.4	4.9	6.3	4.7	6.8	4.3
Ireland	2	0.7	0.5	3.7	2.2	3.3	2.2
Italy	5	7.1	7.1	6.3	4.0	4.0	3.1
Luxembourg	2	3.3	3.4	3.4	0.0	2.6	2.2
Netherlands	2	4.7	3.6	4.8	2.5	4.0	2.2
Portugal	10	6.8	5.5	6.1	3.9	5.3	4.3
Spain	5	4.8	4.1	5.8	3.6	6.0	3.1
United Kingdom	5	3.4	2.6	3.1	3.1	4.3	3.1
Debt Financing							
Belgium	2	-2.1	-2.1	-2.3	-2.3	-1.9	-2.2
Denmark	5	-3.9	-2.9	-3.1	-3.1	-4.3	-3.0
France	2	-0.3	-1.2	-1.6	-2.3	-1.2	-2.2
Germany	2	-1.6	-2.5	-1.8	-2.2	-1.6	-2.2
Greece	10	-2.7	-3.6	-4.7	-4.7	-3.6	-4.9
Ireland	2	-0.2	-0.4	-2.2	-2.2	-0.6	-2.2
Italy	5	-2.5	-2.8	-2.5	-2.5	-2.3	-3.0
Luxembourg	2	-3.5	-3.2	-3.5	-3.6	-1.7	-2.2
Netherlands	2	-0.6	-1.5	-1.9	-1.9	-0.8	-2.2
Portugal	10	-3.9	-4.7	-5.1	-5.1	-4.2	-4.9
Spain	5	-1.9	-2.4	-2.8	-2.8	-1.1	-3.0
United Kingdom	5	-1.6	-2.3	-3.0	-3.0	-2.1	-3.0
Differential (equity-debt)							
Belgium	2	5.7	5.6	6.5	4.3	4.5	4.3
Denmark	5	7.2	7.4	8.2	6.0	5.9	6.1
France	2	3.8	3.6	4.2	4.2	4.6	4.3
Germany	2	9.5	9.4	6.6	4.3	4.4	4.3
Greece	10	9.2	8.5	10.9	9.4	10.3	9.2
Ireland	2	0.9	0.9	5.9	4.3	3.9	4.3
Italy	5	9.6	9.9	8.8	6.5	6.3	6.1
Luxembourg	2	6.8	6.6	6.9	3.7	4.3	4.3
Netherlands	2	5.3	5.0	6.7	4.5	4.8	4.3
Portugal	10	10.7	10.1	11.2	9.0	9.6	9.2
Spain	5	6.8	6.5	8.6	6.4	7.2	6.1
United Kingdom	5	5.1	4.9	6.1	6.1	6.4	6.1
Weighted average 2/		7.0	6.9	6.6	5.2	5.4	5.1

1/ Weighted average over buildings (0.4) and machinery (0.6).
2/ Weights correspond to the countries' share of the EC capital stock

Table 9. European Community: Corporate Tax Wedges, by Type of Asset 1/

(Percentage point difference between the gross and the net-of-tax real rate of return)

	Inflation rate (percent per annum)	Tax scenarios (1)	(2)	(3)	(4)	(5)	(6)
Machinery							
Belgium	2	0.5	0.7	0.8	-0.4	0.0	-0.7
Denmark	2	0.7	-0.2	-0.2	-1.4	-0.4	-0.7
France	2	1.8	0.3	0.1	-0.7	1.2	-0.7
Germany	2	3.0	1.3	1.2	-0.7	0.2	-0.7
Greece	2	2.5	0.8	0.9	0.0	2.2	-0.7
Ireland	2	0.5	-0.0	0.2	-0.7	2.9	-0.7
Italy	2	3.2	1.5	1.3	0.0	1.4	-0.7
Luxembourg	2	-3.0	-2.3	-2.4	-4.3	-0.8	-0.7
Netherlnads	2	1.8	0.4	0.5	-0.7	1.2	-0.7
Portugal	2	1.8	0.1	0.1	-1.1	0.7	-0.7
Spain	2	1.4	0.6	1.1	-0.2	2.5	-0.7
United Kingdom	2	0.8	-0.4	-0.7	-0.7	1.0	-0.7
Buildings							
Belgium	2	2.6	2.2	2.6	1.2	2.0	2.1
Denmark	2	2.1	3.9	4.4	2.9	0.9	2.1
France	2	2.3	1.9	2.1	1.5	2.1	2.1
Germany	2	6.0	5.7	3.6	2.1	2.3	2.1
Greece	2	2.5	2.0	2.6	1.5	2.1	2.1
Ireland	2	0.0	0.4	3.2	2.1	-0.2	2.1
Italy	2	2.8	5.0	4.4	2.9	1.2	2.1
Luxembourg	2	5.9	5.4	5.3	2.9	3.4	2.1
Netherlands	2	3.7	3.2	4.4	2.9	3.4	2.1
Portugal	2	3.7	3.2	3.6	2.1	2.6	2.1
Spain	2	2.8	2.5	3.5	2.1	3.4	2.1
United Kingdom	2	2.1	1.7	2.1	2.1	2.6	2.1
Differential (machinery-buildings)							
Belgium	2	-2.1	-1.5	-1.8	-1.7	-2.0	-2.8
Denmark	2	-1.4	-4.1	-4.6	-4.3	-1.3	-2.8
France	2	-0.6	-1.6	-2.0	-2.3	-1.0	-2.8
Germany	2	-3.0	-4.4	-2.4	-2.8	-2.1	-2.8
Greece	2	0.0	-1.2	-1.6	-1.5	0.1	-2.8
Ireland	2	0.5	-0.5	-3.0	-2.8	3.1	-2.8
Italy	2	0.3	-3.5	-3.1	-2.9	0.3	-2.8
Luxembourg	2	-8.9	-7.8	-7.7	-7.2	-4.2	-2.8
Netherlands	2	-1.8	-2.8	-3.9	-3.6	-2.2	-2.8
Portugal	2	-1.9	-3.2	-3.5	-3.3	-1.8	-2.8
Spain	2	-1.4	-1.9	-2.4	-2.3	-0.9	-2.8
United Kingdom	2	-1.2	-2.1	-2.8	-2.8	-1.6	-2.8
Weighted average 2/		1.4	2.9	2.6	2.7	1.2	2.8

1/ Weighted average over equity (0.6) and debt (0.4).

2/ Weights correspond to the countries'share of the EC capital stock

3. Results

a. Current tax systems (Scenario 1)

Under the tax practices that are likely to prevail in the absence of any concerted harmonization, on average Germany appears by far as the highest corporate tax country (Tables 6 and 7). In the low tax range are, starting from the lowest wedge, Ireland and Luxembourg followed by Denmark, Belgium and the United Kingdom--the ordering of the last three depending on the underlying inflationary assumption. The other countries' wedges all lie well within one standard deviation from the mean. The ordering of countries according to the average wedge is quite sensitive to the weights assigned to the two types of assets and sources of financing.

As seen in Tables 8-9, tax systems generally discriminate in favor of machinery and in favor of debt financing. The relative tax advantage accorded to investment in machinery reflects more generous tax depreciation allowances, though the results also depend strongly on the assumed rates of economic depreciation. 1/ On the financing side, the corporate tax systems uniformly result in a subsidy at the margin for debt-financed investments. The subsidy results mostly from the deductibility of interest payments from the corporate tax which lowers the discount rate below the market rate of interest. Inflation raises the advantage of debt financing because of the deductibility of nominal rather than real interest payments. Under both debt and equity financing, inflation reduces the present value of depreciation allowances, based on historical cost, except for Denmark where the depreciable base is indexed for changes the price level. 2/ The difference between the debt and equity cases also depends on the chosen arbitrage assumption, which excludes any effect on the cost of capital of integration systems that are not extended to nonresidents. Hence, the wedge under equity financing and thus the distortion in favor of debt financing would be smaller in the cases of Germany and Italy, under a purely domestic arbitrage assumption. The average wedges do not change significantly under alternative inflationary assumptions. In countries with a higher inflation rate, the advantages of the increased nominal interest deductibility appear to be broadly offset by the reduced real value of depreciation allowances, although the distortion in favor of debt increases.

1/ The rates are 15 percent for machinery and 7 percent for buildings. In the case of Luxembourg, machinery investment also benefits from an investment tax credit not applicable in the case of buildings.

2/ For a discussion and estimates of the sensitivity of the required rate of return to inflation under various forms of indexation in industrial countries, see Kopits (1983).

b. Harmonization (Scenarios 2 through 5)

Under base harmonization (Scenario 2) most country wedges would fall, mostly on account of more liberal depreciation allowances--specifically, more than double declining balance for buildings and full first-year convention for all assets. Only Denmark, because of the elimination of advance depreciation and of indexation of the depreciable base, and Luxembourg, because of the reduction of the depreciable base by the value of the investment tax credit, would experience a rise in their average wedge. However, base harmonization would on balance contribute minimally to the convergence of effective tax rates, as reflected in the virtually unchanged standard deviation of country wedges. Germany would remain the highest tax country, and Ireland the lowest tax country followed by the United Kingdom, Luxembourg and France.

The equalization of income tax rates at 43 percent (Scenario 3), superimposed on base harmonization--but without equalizing depreciation rates--produces a more significant contribution to the convergence of country wedges with a reduction of the weighted standard deviation from 1.1 in Scenario 1 to 0.7. The remaining dispersion is due to country differences with respect to depreciation rates and, more significantly, to the degree of integration, investment tax credits, wealth and net worth taxes. Italy replaces Germany as the highest tax country, and the United Kingdom, Luxembourg and France assume the low tax positions.

The added elimination of wealth and net worth taxes and the equalization of the method and degree of integration (Scenario 4) cause a significant drop in both the average wedge and in the standard deviation. The drop in the average wedge is a direct result of the arbitrage assumption whereby the extension of the dividend credit to nonresidents is entirely passed on to firms in the form of a reduction in the cost of equity financing. Italy and Luxembourg appear as the two outlying countries at the high and low ends of the spectrum, respectively.

The harmonization of tax rates and methods of integration superimposed, however, on differing definitions of the tax base (Scenario 5), produces slightly less convergence of tax wedges than the previous case (the standard deviation falls to 0.5 percent instead of 0.3 percent). Moreover, the benefits arising from greater transparency of the tax systems and lower compliance costs for enterprises operating throughout the European Community would be lost as long as national definitions of the tax base continued to vary as they do at present.

c. Inflation non-neutralities (Scenario 6)

The distortionary effect of inflation differentials is illustrated with full harmonization of company tax systems. As mentioned above, inflation non-neutralities arising from the deductibility of nominal interest payments and from historical-cost depreciation allowances tend to work in opposite directions, and the resulting net effect of inflation on tax wedges is nonlinear. The tax wedge rises from 0.4 to 0.7 as the inflation rate is increased from 2 to 5 percent, but falls back to 0.6 as inflation is increased further to 10 percent.

In general, the results do not change markedly between the two inflation variants of the simulations, suggesting that the harmonization measures considered do not exacerbate the inflation non-neutralities inherent to the corporate tax systems. Also, the standard deviation of wedges under current or proposed systems (Scenario 1) is virtually the same under the two inflationary assumptions, indicating that present differences in tax systems do not, in an average sense, compensate for or enhance the distortionary effects of inflation differentials on effective tax rates.

IV. Estimates of Allocative Effects

1. The model

A simple computable general equilibrium model is derived in this section to explore the potential effects of differential effective tax burdens and of changes in tax systems on the allocation of capital in the EC. 1/ The model is based on fixed and immobile labor endowments and profit-maximizing competitive firms and uses the wedge calculations from the previous section to simulate the allocation of a perfectly mobile capital stock under various harmonization scenarios. Simulations are conducted under two different assumptions about the supply of capital. The first assumption is that of a fixed but mobile capital stock within the European Community. This assumption allows us to isolate and quantify, albeit in a very simplified way, the purely allocative and efficiency implications of harmonization, leaving aside the effects of tax changes on the total capital stock. 2/ In this framework, the interest rate--common to the whole EC--adjusts

---

1/ While excellent analytical work has been done in this area by Sinn (1987) and Bovenberg (1986), among others, there have been few attempts to integrate estimates of tax wedges into a general equilibrium model to provide numerical estimates of the effect of tax changes on the allocation of capital. An exercise similar to ours was carried out by Fukao and Hanazaki (1987).

2/ The introduction of capital accumulation would not eliminate the allocative distortions inherent to differential tax wedges, although the dynamics of capital accumulation could delay significantly convergence towards steady state.

endogenously to satisfy capital market equilibrium. 1/ Within each country the wage rate adjusts to clear the labor market, and the level of output of each country is endogenously determined. Given fixed factor supplies, changes in the level of output of the EC as a whole provide a convenient measure of the efficiency gains and losses of alternative scenarios in comparative static terms.

The second assumption is that capital is fixed but mobile worldwide--the world consisting of the EC, Japan and the United States. In this context, changes in effective company tax rates can alter both the total EC stock of capital and its allocation among member countries. The two effects cannot be isolated, but this exercise provides a gauge of the pressures exercised on the rest of the world by changes in the level of taxation in the EC.

Within each country we consider a representative firm that operates under competitive conditions. There is a single good produced under constant returns to scale, with production function F(K,L), where K and L are the capital and labor inputs respectively. The representative firm of country i maximizes profits, given in equation (10):

$$F(K_i, L_i) - g_i L_i - c_i K_i \qquad i = 1,2,...,n \tag{10}$$

where g_i is the gross real wage (inclusive of any tax on labor use or income) and c_i is the user cost of capital 2/

$$c_i = (r + \delta + w_i)q_i \tag{11}$$

where r is the real market rate of return on the underlying financial instrument, δ is the rate of economic depreciation and w_i is the corporate tax wedge and q is the real price of capital goods in country i. The model is solved using a Cobb-Douglas production function: 3/

$$Q_i = A K_i^{(1-\alpha)} L_i^{\alpha} \tag{12}$$

1/ An alternative would be to take the interest rate as given and allow the overall capital stock to change in response to changes in the average level of taxation in the European Community. This would correspond to the assumption of a small open economy, and seems unrealistic.

2/ This can be shown to be consistent with expressions (1) and (2), insofar as $p = c/q-\delta$.

3/ The unit elasticity of substitution between factors implied by Cobb-Douglas production function is broadly consistent with estimates in Kopits (1982).

with α estimated from labor's share in GDP, and the scale parameter A set to reproduce the real interest rate assumed to prevail under current tax systems (Scenario 1). 1/ A capital demand function can then be explicitly derived from profit maximization:

$$K_i(c_i) = L_i \; (A\alpha/c_i)^{1/(1 - \alpha)} \tag{13}$$

At the aggregate level, the model is closed by requiring that factor and good markets clear. With fixed and immobile labor endowments (N_i) in each country, and fixed but mobile global supply of capital (S), the factor market equilibrium conditions reduce to:

$$L_i = N_i \tag{14}$$

$$\textstyle\sum_i K_i(c_i) \quad \sum_i N_i[A\alpha/c_i(r)]^{1/(1 - \alpha)} = S \tag{15}$$

Given a fixed supply of capital, whether in the EC or in the world, the goods market clears implicitly in the absence of net saving or capital accumulation.

The equilibrium values of the interest rate, each country's wage rate, capital stocks and output levels can then be expressed as functions of factor endowments and tax parameters. The country corporate tax wedges from the previous section--averaged over the two types of financing and assets--are substituted for w_i in equation (11) and then in (13), so as to solve the model, subject to conditions (14) and (15). 2/

By construction, a uniform change in wedges ($\Delta w_i = \Delta w$) has no effect on the allocation of the capital stock across countries ($dK_i = 0$) and capital market equilibrium obtains through a one-for-one offsetting change in the interest rate ($dr = - dw$) so as to leave the cost of capital unchanged ($\Delta c = 0$) . Only relative changes in tax wedges have real effects. Specifically, the relative change of a country's capital stock attributable to a change in its tax wedge is inversely related to its size. A tax rate increase in a large country will reduce significantly both the world demand for capital and the world interest rate. The fall in the interest rate compensates partly for the rise in the cost of capital due to the tax change, with a consequently smaller proportional decline in the country's equilibrium capital stock.

1/ Estimates of the capital stock of each country for 1975 are obtained from Leamer (1984) and updated to a 1985 basis. The labor force is adjusted using the share of professional workers in the labor force as an index of quality. See United Nations (1988).

2/ Since the tax wedges are themselves functions of the interest rate, the solution process requires an iterative procedure: initial values of the tax wedges are used to derive an equilibrium interest rate. The values of the tax wedges are then recalculated, using the interest rate, until convergence.

Meanwhile, the other countries benefit in terms of lower interest rates and higher capital stocks. In the case of a small country, the induced effect of a tax rate increase on the world demand for capital, and by implication, on the interest rate is negligible. Menwhile, the loss of own capital is proportionately larger and the spillover effect on other countries is insignificant.

There are several limitations inherent to this exercise. First, the magnitude of the allocative effects of differential tax burdens depends entirely on the assumed technological parameters. Although the assumed form and the parameter values of the production function are broadly consistent with available estimates, more sophisticated specifications could alter the magnitude of the effects. Second, the assumption of a fixed capital stock ignores entirely the effect of taxation on capital formation, savings and growth. Thus, the results obtained are of a static general equilibrium nature. Third, the analysis does not provide an explicit treatment of the government sector; in particular, it is assumed that budgetary measures compensating for changes in corporate taxation--which anyway account for a relatively small share of general government revenue in most EC countries--do not affect the production function or relative labor costs. 1/ Fourth, international capital flows take the form of portfolio claims on foreign capital and only corporate taxation matters, a reasonable assumption in view of the large role of institutional investors and widely-held corporations. Finally, the absence of country-specific risk is being approximated by the creation of a Community-wide single market.

2. Results

The first column of Table 10 shows the equilibrium solution after the equalization of after-tax rates of return on capital, with capital stocks measured relative to their estimated current, stylized "autarchy" values, and the corresponding change in potential output, which are necessary as a benchmark for the harmonization scenarios. 2/ The reallocation of capital predicted by the model is considerable, with Portugal and Ireland more than doubling their capital stocks and Germany losing nearly 40 percent over the long run. The allocative results of the model are driven by the assumption that corporate taxes confer no associated benefits and by the fact that there are no other determinants of differences in the rate of return on capital across countries than taxes and factor proportions. If taxes were benefit charges, tax rate

---

1/ This would be generally true if corporate taxes were not benefit charges, or more specifically, if a constant expenditure level were maintained through compensating changes in labor income taxation, and fully absorbed in lower after-tax wages, without any consequences on labor supply and employment.

2/ Tax wedges for Japan and the U.S. are set to reproduce the equilibrium solution in Scenario 1, and held fixed thereafter.

Table 10. European Community: Allocative Effects of Tax Harmonization 1/

	"Autarchy" case	Tax Scenarios					
		EC context			World context		
		(2)	(3)	(6)	(2)	(3)	(6)
	(Index, actual capital and output = 100)	(Index, column (1) = 100)					
Capital Stock							
Belgium	94.9	93.5	90.6	91.2	96.8	94.4	99.6
Denmark	104.3	91.8	89.5	90.6	95.0	93.1	99.0
France	76.2	103.6	103.0	96.8	106.8	106.8	105.7
Germany, Fed.Rep	63.2	101.5	109.2	115.1	105.2	113.4	125.8
Greece	189.0	103.9	100.3	101.1	107.4	104.4	110.5
Ireland	211.3	95.9	84.2	83.2	98.8	87.5	90.9
Italy	99.3	94.3	96.2	105.3	97.8	100.2	115.0
Luxembourg	83.0	92.2	92.2	85.4	95.4	95.8	93.3
Netherlands	82.3	102.0	96.2	101.2	105.5	100.2	110.6
Portugal	247.0	103.5	101.1	101.1	107.2	105.3	110.4
Spain	152.8	98.4	91.3	96.3	101.8	95.1	105.2
United Kingdom	180.2	101.5	100.8	91.2	104.8	104.6	99.6
EC	100.0	100.0	100.0	100.0	103.4	103.9	109.2
United States	100.0	100.0	100.0	100.0	97.6	97.3	93.6
Japan	100.0	100.0	100.0	100.0	97.3	97.0	92.8
Output (net domestic product)							
Belgium	98.9	98.5	97.9	98.0	99.3	98.7	99.9
Denmark	100.9	98.1	97.6	97.9	98.9	98.5	99.8
France	94.7	100.8	100.7	99.3	101.4	101.4	101.2
Germany, Fed.Rep	90.7	100.4	102.1	103.4	101.2	103.0	105.4
Greece	118.4	100.9	100.1	100.3	101.6	101.0	102.2
Ireland	120.5	99.2	96.4	96.2	99.8	97.3	98.1
Italy	99.8	98.6	99.1	101.2	99.5	100.0	103.2
Luxembourg	96.6	98.3	98.3	96.7	99.0	99.1	98.6
Netherlands	95.9	100.5	99.1	100.3	101.2	100.0	102.3
Portugal	128.5	100.8	100.3	100.2	101.6	101.2	102.2
Spain	111.1	99.6	98.0	99.2	100.4	98.9	101.1
United Kingdom	115.9	100.3	100.2	98.0	101.0	101.0	99.9
EC	101.9	100.0	100.0	100.1	100.7	100.9	102.1
United States	100.0	100.0	100.0	100.0	99.5	99.4	98.5
Japan	100.0	100.0	100.0	100.0	99.5	99.4	98.5
World	100.0	100.0	100.0	100.0	100.0	100.0	100.1
Memoranda items:							
EC average wedge 2/	2.4	1.8	1.7	0.7	1.7	1.6	0.6
standard deviation 2/	1.0	1.1	0.9	0.0	1.1	0.8	--
Real interest rate	5.0	5.6	5.7	6.7	5.3	5.3	5.8

1/ Common 2 percent inflation rate.

2/ Weights are calculated from the capital stock distributions for each scenario. Average wedges differ from those of Table 6, because the weights and the interest rate are recalculated for each equilibrium solution differentials would have no allocative effects. Moreover, if appropriate consideration were given to all other nontax factors affecting returns, greater uniformity in after-tax rates of return adjusted for such factors may be found in the "autarchy" case. Alternatively, the result may be explained by the fact that capital has not yet fully adjusted to equalize expected rates of return, in which case capital tends to move toward countries with a higher than average after-tax rate of return. Higher than average after-tax rates of return may be the result, ceteris paribus, of either lower than average taxes--in which case the reallocation of capital would cause an efficiency loss--or of low capital-labor ratios--in which case an efficiency gain would ensue. The fact that overall EC output rises by nearly 2 percent indicates that the efficiency gain from the equalization of capital-labor ratios would outweigh the efficiency loss from tax-induced distortions, under this interpretation. An additional explanation for cross-country differences in the deviations shown in the first column is the likely measurement error inherent to the underlying factor proportions.

The allocative effects of harmonization are measured relative to the equilibrium results of column 1, i.e. after equalization of after-tax rates of return. The indices thus reflect solely the effect of changes in effective tax rates under selected harmonization scenarios. Because factor supplies are assumed fixed, albeit mobile in the case of capital, the aggregate output index provides a measure of the efficiency gain from harmonization. As discussed in the previous section, harmonization of the base (Scenario 2) does not significantly reduce the dispersion of effective tax rates and consequently produces no efficiency gain, i.e. the aggregate output index remains unchanged. In the EC context (i.e., EC isolated from the rest of the world), the reallocation of capital reflects the change in the country ordering , with the largest proportional loss for Denmark (8 percent) and the largest proportional gain for France (4 percent). Besides Denmark, Luxembourg, Belgium, Italy, Ireland and Spain would also lose capital. The reduction in the dispersion of effective tax rates under the added harmonization of statutory income tax rates (Scenario 3) would not be sufficient to produce a noticeable change in aggregate output. Tax rate harmonization would produce a relatively large gain in capital for Germany (9 percent), followed by France (3 percent) at the expense of all other countries; at the other end, Ireland would experience the largest proportional loss (16 percent). A small gain in overall output (0.1 percent) appears under complete harmonization (Scenario 6). Relative to base and rate harmonization (Scenario 3), most changes in capital stock would result on account of the elimination of investment tax credits (Luxembourg and Spain), the elimination of capital and net worth taxes (France, Germany, and Luxembourg) and the reduced cost of equity financing due to integration. The last change would affect all countries except France the United Kingdom where the effects of integration on the cost of capital are already accounted for in the arbitrage assumption.

By construction, the average wedge declines as harmonization is broadened from base to rates, with a consequent rise in the demand for capital. In the EC context, capital market equilibrium is restored through a rise in the interest rate. In a "worldwide" context, however, the rise in the interest rate spills over to the United States and Japan, forcing a reallocation of capital towards the Community. The net inflow of capital to the EC reduces the size of the capital losses--which in some instances turn into a gain--and raises the magnitude of the gains of individual countries. This effect derives purely from the specific (average) effective tax rate towards which the EC would converge. The large loss of capital for Japan and the United States due to complete harmonization (Scenario 6) relative to base and rate harmonization (Scenario 3), owes largely to the effect of integration on the cost of capital in the EC under the chosen arbitrage assumption. By assumption, the extension of corporate-personal tax integration to all EC residents (but not necessarily to non-EC residents) is fully passed on to the firm. How much the extension of integration to all EC residents can in practice contribute to a reduction in the cost of equity financing remains an open empirical question. The answer depends on the relative size of each country's capital market relative to the EC and the rest of the world and on the degree of integration among equity markets--factors that are not treated explicitly in our simplified arbitrage condition. This illustrates the important role of the arbitrage assumption and the associated empirical difficulties.

V. Summary and Conclusions

Differences in the taxation of income from capital are likely to become a determining factor in the allocation of capital as the remaining barriers to the free flow of goods, labor and capital are progressively removed within the European Community. With the complete liberalization of financial capital movements accomplished by mid-1990, differences in the taxation of financial investment income across countries may result in a misallocation of financial assets but, because of the parallel integration of credit markets, may not interfere significantly with the allocation of real assets. Differences in the tax treatment of company income are thus likely to become the primary source of allocative distortion in fixed capital formation; consequently, the harmonization of company tax systems could go a long way toward establishing allocative neutrality in the European Community.

Three major empirical policy questions are addressed in this paper: first, the magnitude of existing differences in effective company tax rates; second, the degree of harmonization that would be necessary to reduce the dispersion of effective company tax rates; and third, the allocative and efficiency implications of tax harmonization, or non-harmonization. In answer to the first question, our calculations show considerable divergence in effective company tax rates among member countries, with effective tax rates varying from 40 percent for Germany to 5 percent for Ireland. Second, it is shown that only the harmonization of both statutory tax rates and the tax base results in a meaningful convergence of effective tax rates. The harmonization of statutory tax rates without base harmonization results in a lower degree of convergence and in diminished transparency. Harmonization of the tax base alone, leaving statutory tax rates and investment grants in place, increases transparency but does not produce any significant reduction in the dispersion of effective tax rates.

As regards the third question, the allocative implications of differential effective tax rates and, conversely, of harmonization, depend on the elasticity of capital formation with respect to differential tax rates. In principle, investment flows should respond to tax-induced differences in the after-tax rate of return as they do to differences due to other components of the rental cost of capital. The empirical evidence is, however, mixed, with many authors finding only small effects. 1/ Using a simple computable general-equilibrium model, where capital is allocated to equalize after-tax rates of return, we derive steady-state allocative effects of company tax harmonization in the European Community. The results show a very modest efficiency gain from harmonization, with, however, very significant effects for individual countries. Holding the overall capital stock in the European Community unchanged, Germany's share would rise by 15 percent and Italy's by 5 percent, over the long run, relative to the equilibrium capital stock under the present tax systems. Ireland and Luxembourg would be the largest loosers, with 17 and 15 percent contraction in their shares, respectively.

The case for concerted harmonization of effective company tax rates has relied crucially on efficiency considerations. The results of this paper suggest that the overall efficiency gains from equalization of tax burdens may in fact be quite small, although it may imply substantial adjustments in some countries. In the event, the debate over company tax harmonization may have to rely primarily on fiscal considerations.

The case for concerted harmonization seems strongest as regards the definition of the tax base (capital cost recovery allowances, loss carryover, etc.). While the results of the paper indicate that harmonization of the tax base does not produce any significant convergence of effective tax rates, it may have very important efficiency implications for the European Community in terms of increased transparency and reduction of compliance costs for multinational enterprises. Harmonization of the tax base would not in any way constrain the determination of effective tax rates, as national

1/ See Snoy (1975), Kopits (1976), Caves (1982), Alworth (1988) and Slemrod (1989) for the effect of tax differentials on foreign direct investments, and Papke and Papke (1986) and Papke (1988) for the effect of cross-state differences in corporate taxation in the United States on business locational decisions.

authorities would continue to exercise sovereignty over statutory tax rates and explicit fiscal incentives for investment (tax credits, cash grants). 1/ In practice, however, with the advent of the single market, EC member countries are likely to be under considerable pressure to engage in spontaneous, downward harmonization of statutory rates. Such a trend has already been under way in most industrial countries since the early 1980s.

1/ This is the practice in Canada, where different rates at the provincial level are imposed on a commonly defined tax base.

The Cost of Capital and the Corporate Tax Wedge

The appendix develops the model of the firm underlying the tax wedge derivation. We consider a competitive firm operating in a stationary environment in a one-good neoclassical world with no adjustment costs and derive a demand for capital function from the necessary conditions for the maximization of the firm's market value. In a steady state, the optimal capital/labor ratio is a decreasing function of the user's cost of capital, itself a function of the rate of economic depreciation, corporate tax parameters, the rate of inflation and the market rate of return on the financial asset (r). For a firm with a mixed financial structure, r is given by a weighted average of the interest rate and the return on equity.

1. Firm optimization

The production technology is described by a production function F(K,L) where K is the firm's capital stock and L its level of labor input. The function F() is assumed to be concave and twice differentiable, with positive and decreasing marginal products and $F_{kL} > 0$. All firms produce a single homogeneous output that can also be used as capital in production and can be installed or dismantled instantaneously and at no cost. The evolution of a firm's capital stock over time is described by the equation

$$K' = I - \delta K \qquad (A1)$$

where K' is the time derivative of K, δ is the rate of economic depreciation and I is the level of real investment expenditures.

We consider a competitive firm operating in a stationary environment in which input and output prices increase at a constant rate of inflation π (alternatively, the firm has static expectations). At each point in time the firm chooses levels of labor input and investment expenditures and may raise financial capital by selling a single type of security defined as bonds (B). Output is sold at a price p and after tax profits plus the proceeds from the sale of new bonds are either paid out to security holders or used to finance investment:

$$p[F(K,L) - wL - T_c] + B' = iB + pI \qquad (A2)$$

where w is the real wage rate, i the nominal rate of interest on bonds, and T_c real corporate tax payments by the firm. Dividing both sides of this expression by p and rearranging, we get the firm's cash flow constraint in real terms: 1/

1/ By definition $b = B/p$, and hence $b' = d(B/p)/dt = (pB'-Bp')/p^2 = (B'/p) - \pi b$, and $B' = p(b' + \pi b)$

$$b' = (i-\pi)b - [F(K,L) - wL - I - T_c] \qquad (A3)$$

where b = B/p.

Corporate income is taxed at a flat rate t_c. However, the government provides a grant or investment tax credit at a rate g per unit of new capital purchased and allows the deduction of depreciation of the (nominal) book value of the firm's capital at a rate d. Finally, payments to security holders may also be subject to a tax or a subsidy at source. Real corporate tax payments are given by:

$$T_c = t_c\ [F(K,L) - wL] + \phi b - t_c Vd - gI \qquad (A4)$$

where ϕ is the unit tax/subsidy on payments to security holders 1/ and V is the deflated book value of the firm's capital stock, which evolves over time according to the equation:

$$V' = I - (d+p)V \qquad (A5)$$

Substituting (3) into (2) we have

$$b' = (i-\pi+\phi)b - \{(1-t_c)[F(K,L) - wL + t_c dV - (1-g)I\} \qquad (A6)$$

We will assume that the firm behaves so as to maximize the market value of its initial securities, 2/ b(0). Integrating (A6), the firm's problem can be written as:

$$\text{Max } b(0) = \int_0^\infty e^{-(\rho-\pi)t}\ \{(1-t_c)\ [F(K,L) - wL] + t_c dV - (1-g)I\}\ dt$$

$$\text{subject to} \qquad K' = I - \delta K$$
$$V' = I - (d+\pi)V$$

where $\rho = i+\phi$ is the cost of financial capital to the firm. The current value Hamiltonian for this problem is given by:

$$H = (1-t_c)\ [F(K,L) - wL] + t_c dV - (1-g)I + q(I-\delta K) + v[I-(d+\pi)V]$$

1/ For example, interest payments on debt are considered a deductible expense. In that case $\phi = - t_c i$, the tax-induced wedge between what the firm pays out and what the security holder gets is negative.

2/ The general solution to this differential equation can be written in the form

$$b(t) = ce^{(i-\pi+\phi)t} + {}_t\int^\infty e^{-(i-\pi+\phi)(s-t)}\ \{(1-t_c)[F(K,L) - wL + t_c dV - (1-g)I\}\ ds$$

where c is an arbitrary constant. Setting c = 0 is equivalent to the assumption that the value of the securities is determined by "fundamentals," i.e., reflects the underlying cash flow of the firm.

where q and v are the costate variables or multipliers associated with the dynamic constraints. The necessary and familiar conditions for an optimal solution to this problem are given by:

$$\partial H/\partial L = (1-t_c)\ [F_L(K,L) - w] = 0, \text{ hence: } F_L(K,L) = w \quad (A7)$$

$$F_k(K,L) = c(r,p,\tau_c) \quad (A8)$$

Here $r = i-\pi$ is the real interest rate, $\tau_c = (t_c,d,g,\phi)$ the vector of corporate tax parameters, and the user's cost of capital is defined as:

$$c(r,\pi,\tau_c) = (1-g-v)\ (\rho-\pi+\delta)\ /\ (1-t_c) \quad (A9)$$

where v is the present value of the tax savings from the depreciation of one unit of capital, given by:

$$v = t_c d/(\rho+d)$$

2. The demand for capital

If the production function exhibits decreasing returns to scale, the necessary conditions (A7) and (A8) can be solved for the optimal capital stock K* and the optimal level of employment as functions of factor prices and tax parameters (i.e., these equations characterize the firm's factor demand functions). From a partial equilibrium perspective (and in the absence of installation costs) there is nothing to prevent an individual firm from achieving its optimal input level at market determined prices, even if that involves a discrete jump in the capital stock. Hence, I will be set so as to reach maintain K*.

Under the assumption of constant returns to scale, the firm's size is indeterminate, but (A7) and (A8) characterize the optimal capital/labor ratio k* as a function of factor prices and tax parameters. At the national level, the size of the corporate sector will be determined by the size of the labor force, N, which we take as given. In that case K* = Nk* in a steady state, investment is set accordingly and (A8) evaluated with L = N determines the equilibrium wage. If there is population growth, on a balanced growth path investment will be set so as to maintain a constant stock of capital per worker.

To derive the per-capita demand for capital function it will be convenient to work with the per capita production function defined as:

$$f(k) \equiv F(K/L,1) \quad (A10)$$

where k a K/L is the capital/labor ratio.

This allows us to rewrite the marginal productivity conditions in the form:

$$f'(k) = c(r, \pi, \tau_c) \quad \text{(A11.a)}$$

$$w = f(k) - kf'(k) \quad \text{(A11.b)}$$

Eq. (A11.a) implicitly defines the per capita demand for capital as a function of the user's cost of capital, which is in turn a function of corporate tax parameters and the rates of inflation and interest, that is:

$$k^d = k[c(r, \pi, \tau_c)] \quad \text{(A12)}$$

Differentiating (A10.a) implicitly, we find that: 1/

$$k'(c) = -1/f''(k) < 0 \quad \text{(A13.a)}$$

$$\partial k/\partial r = k'(c) * (\partial c/\partial r) \quad \text{(A13.b)}$$

$$\partial k/\partial \tau_c = k'(c) * (\partial c/\partial \tau_c) \quad \text{(A13.c)}$$

$$\partial k/\partial p = k'(c) * (\partial c/\partial \pi) \quad \text{(A13.d)}$$

Thus, we may think of the firm as renting capital services from itself, the imputed rental on capital being equal to the user's cost. 2/ At any rate, the firm's optimal capital stock per worker is a decreasing function of the cost of capital, and inflation, interest rates and tax parameters affect the demand for capital only through their effect on c.

3. Capital market equilibrium and the arbitrage condition

One complication arises from the fact that the rate of return on the financial assets (r) is actually a function of the financing mix of the firm. Consider an economy in which firms and households trade two types of securities, debt (d) and equity (e). Income from each type of security (n = d, e) is taxed at both the corporate and personal levels. Thus, from the firm's marginal cost of funds (ρ_n), we subtract taxes on financial assets levied at source (ϕ_n) to arrive at a market return (i_n), and from this we deduct personal taxes on security income (η_n) to

---

1/ The cost of capital is generally a function of the whole time path of expected future interest rates. Thus, the demand for capital function derived here must be interpreted either as a steady state construct or as describing the behavior of a firm that myopically expects the current interest rate to remain constant over time.

2/ It is tempting to go one step further and think of the firm as renting capital from households, who retain title to it. This is somewhat misleading since what firms and households trade is not capital but bonds and in general their relative price can differ from unity. On the other hand, this procedure has been used because it simplifies the analysis by hiding financial variables and defining the equilibrium directly in terms of the demand for capital.

obtain the net return (s_n) to the security holder. Hence,

$$\rho_n = s_n + \phi_n + \eta_n \qquad (n = d, e)$$

We ask whether a systematic relationship can be expected to exist between the equilibrium returns on the two assets. One possible answer is based on arbitrage considerations: if in equilibrium both securities are held (or issued) by some agent, their return (or cost to the issuer) must be the same at the margin. 1/

A problem arises because existing tax systems typically treat income from equity and debt differently. The theory suggests that firms will only use both sources of finance if their marginal cost is the same ($\rho_e = \rho_d$) and that households will hold both types of securities only if their net of personal tax returns are the same ($s_e = s_d$). In general, however, $\phi_d + \eta_d \neq \phi_e + \eta_e$ and differences in the tax treatment of debt and equity make it impossible for both conditions to hold at once.

On theoretical grounds, then, there does not seem to be a clear-cut case for a specific arbitrage assumption. In practice, however, which particular assumption is chosen makes a big difference because tax wedges are quite sensitive to the discount rate. In this paper we have taken a "middle ground" and assumed that the arbitrage is done by an international (institutional) tax exempt investor which requires a risk premium (h) on equity.

4. The cost of capital for a firm with mixed financial structure

The overall cost of capital of a firm with a mixed financial structure can be computed in one of two ways. It can be taken as a (weighted) average of the pure equity and the pure debt cases, each derived separately, or it can be derived directly assuming that the firm finances itself by issuing a composite security, with weights corresponding to the financing mix of the firm. 2/ The two methods are not strictly equivalent. In the derivation that follows, a single composite security is used, but an average of the pure equity and pure debt cases--the approach followed in the computation of tax wedges--provides an adequate approximation.

1/ In a stochastic environment, returns are defined in expected utility terms and differences in asset return can be ascribed to differences in risk. In a certainty setting, differences in equilibrium rates of return can be explained by differences in the rates of taxation on interest income, dividends and capital gains among investors, with some investors favoring one type of asset over another. In this kind of segmented equilibrium, the returns on debt and equity need not be equalized at the personal level since no investor needs to hold them both.

2/ See Boadway, Bruce and Mintz (1987) for a discussion on the two approaches.

We will think of the firm's 'bonds' as composite securities, partly equity and partly debt, with exogenously determined weights (e, 1-e). Then, the nominal 'market' return to the holders of the firm's securities is given by

$$i = (1-e)i_d + ei_e \tag{A14}$$

where i_d is the nominal return on debt (the interest rate) and i_e the nominal return on equity. The cost of financial capital to the firm can then be written

$$\rho = i + \phi = (1-e)\ (i_d+\phi_d) + e\ (i_e+\phi_e) = (1-e)\ \rho_d + e\rho_e \tag{A15}$$

where

$$\phi = (1-e)\ \phi_d + e\ \phi_e$$

is the tax induced wedge between the firm's payout on one unit of the composite security and the return to its holders (before personal taxes). The parameters ϕ_e and ϕ_d depend on withholding taxes on interest and dividends and on the system of integration of personal and corporate taxes. Using the arbitrage condition to write i_e as a function of i_d, leaves us with a single rate of return to be determined endogenously. Using the arbitrage condition, the real return to holders of the composite security is given by:

$$r = (1-e)r_d + er_e = (1-e)r_d + e(r_d+h) = r_d + e\ h \tag{A16}$$

In conclusion, the discount rate for a firm with a mixed financial structure (with weights e for equity and 1-e for debt) can be written as:

$$\begin{aligned}\rho &= (1-e)\rho_d + e\rho_e = \\ &= (1-e)(1-t_c)(r_d+ \pi)+ e\ \{[(r_d+h)/\omega] + \pi\} = \\ &= r_d\ [(1-e)(1-t_c) + (e/\omega)] + e(h/\omega) + \pi[1-t_c(1-e)] \\ &= (r-e*h)\ [(1-e)(1-t_c) + (e/\omega)] + e(h/\omega) + \pi[1-t_c(1-e)]\end{aligned} \tag{A17}$$

where $\omega = [v\theta(1-t_d) + (1-v)]$

where v is the share of real earnings distributed as dividends and θ is the integration variable.

We are now in a position to derive the partials of the cost of capital function $c(r, \pi, \tau_c)$ with respect to the various tax parameters.

$$c = (1-g-v) * (\beta+\delta)/(1-t_c) \tag{A18}$$

where:

$$\beta = \rho - \pi = r_d \, [(1-e)(1-t_c) + (e/\omega)] + e(h/\omega) - \pi[t_c(1-e)] \quad \text{(A19)}$$

$$v = dt_c/(\rho+d) = dt_c/(\beta+\pi+d) \quad \text{(A20)}$$

$$\omega = [v\theta(1-t_d) + (1-v)] \quad \text{(A21)}$$

The cost of capital is a complex, non-linear function of the market interest rate, the rate of inflation and 'corporate' tax parameters $[\tau_c = (g,d,t_c,\omega)]$. The partial derivatives of this function are shown in Table 11.

As we would expect, increases in the investment tax credit and the rate of tax depreciation lower the cost of capital, while increases in the real interest rate increase it. On the other hand, the effects of inflation and of the corporate tax rate are, in principle, ambiguous.

The direct effect of an increase in the corporate tax rate on c is clearly positive, reflecting the decrease in the after tax marginal product of capital. On the other hand, an increase in t_c lowers the real discount rate (through the interest deductibility provision) and increases the present value of the tax savings from depreciation (as a result of both the lower discount rate and the increased value of the tax savings associated with any given d).

In the case of inflation, the situation is more or less analogous. Because nominal interest payments are tax deductible, an increase in π reduces the real discount rate and, other things equal, tends to lower the cost of capital. On the other hand, in the absence of indexation of the depreciable base, the increase in inflation reduces the present value of the tax savings from depreciation (even at the lower discount rate).

The "corporate tax wedge" is a natural by-product of the user cost of capital. Conceptually, we may think of the cost of capital as the sum of three components: economic depreciation, a return to the owners of the firm's securities (r) and the tax burden on the marginal unit of capital. This last component $(c - r - \delta)$ is what we refer to as the corporate tax wedge.

The wedge concept is useful in that it provides a summary measure of the corporate tax rate on the marginal unit of capital. It corresponds to the size of the tax-induced shift in the demand for capital relative to the net marginal product schedule and can therefore be interpreted as an indication of the incentive effect of corporate taxation.

Table 11. Partial Derivatives of the Cost of Capital Function

A. The Real Discount Rate Function:

$$\beta(t_c, \pi, r_d, \omega) = r_d\,[(1-e)(1-t_c) + (e/\omega)] + e(h/\omega) - \pi[t_c(1-e)]$$

with

$$\partial\beta/\partial t_c = -(1-e)(r_d+\pi) < 0$$
$$\partial\beta/\partial\pi = -t_c(1-e) < 0$$
$$\partial\beta/\partial r_d = \partial\beta/\partial r = (1-e)(1-t_c) + (e/\omega) > 0$$
$$\partial\beta/\partial\omega = -e(r_d+r\pi)/\omega^2 < 0$$

B. Present Value of the Tax Savings from Depreciation:

$$v[d, t_c, \pi, \beta(t_c, \pi, r_d, \omega)] = dt_c/(\beta+\pi+d)$$

with

$$\partial v/\partial\beta = -dt_c/(\beta+\pi+d)^2 < 0$$
$$\partial v/\partial\pi = -dt_c/(\beta+\pi+d)^2 < 0 \qquad \text{(holding } \beta \text{ constant)}$$
$$\partial v/\partial d = (\beta+\pi)t_c/(\beta+\pi+d)^2 > 0$$
$$\partial v/\partial t_c = d/(\beta+\pi+d) > 0 \qquad \text{(holding } \beta \text{ constant)}$$
$$(\partial v/\partial t_c)_{tot} = \partial v/\partial t_c + (\partial v/\partial\beta)\,(\partial\beta/\partial t_c) > 0$$
$$\partial v/\partial\omega = (\partial v/\partial\beta)\,(\partial\beta/\partial\omega) > 0$$
$$\partial v/\partial r_d = (\partial v/\partial\beta)\,(\partial\beta/\partial r_d) < 0$$
$$(\partial v/\partial\pi)d_{tot} = \partial v/\partial\pi + (\partial v/\partial\beta)\,(\partial\beta/\partial\pi) > 0$$
$$= -[dt_c/(\beta+\pi+d)^2]\,[1-t_c(1-e)] < 0$$

C. The Cost of Capital Function:

$$c[t_c, g, d, \beta(t_c, \pi, r_d, \omega), v(d, t_c, \beta, \pi)] = (1/1-t_c) * (1-g-v) * (\beta+\delta)$$

with

$$\partial c/\partial v = -(1/1-t_c)\,(\beta+\delta) < 0$$
$$\partial c/\partial\beta = (1/1-t_c) * (1-g-v) > 0$$
$$\partial c/\partial t_c = (1-g-v) * (\beta+d)\,/\,(1-t_c)^2 > 0 \qquad \text{(holding } \beta \text{ and } v \text{ constant)}$$
$$\partial c/\partial d = (\partial c/\partial v)\,(\partial v/\partial d) < 0$$
$$\partial c/\partial\omega = (\partial c/\partial\beta)\,(\partial\beta/\partial\omega) + (\partial c/\partial v)\,(\partial v/\partial\omega) < 0$$
$$\partial c/\partial g = -(1/1-t_c)\,(\beta+d) < 0$$
$$\partial c/\partial r_d = \partial\beta/\partial r = (\partial c/\partial\beta)\,(\partial\beta/\partial r_d) + (\partial c/\partial v)\,(\partial v/\partial r_d) > 0$$

$$\partial c/\partial\pi = (\partial c/\partial\beta)(\partial\beta/\partial\pi) + (\partial c/\partial v)\,(\partial v/\partial\pi)\,\Big|_{tot} \lessgtr 0$$

$$(\partial c/\partial t_c)\,\Big|_{tot} = \partial c/\partial t_c + (\partial c/\partial\beta)(\partial\beta/\partial t_c) + (\partial c/\partial v)*(\partial v/\partial t_c)\,\Big|_{tot} \gtrless 0$$

Table 12. European Community: Corporate Tax Wedges for Machinery, under a Common Inflation Rate

(Percentage point difference between the gross and the net-of-tax real rate of return)

	Inflation rate	Tax scenarios (1)	(2)	(3)	(4)	(5)	(6)
Debt Financing							
Belgium	2.0	-2.7	-2.5	-2.9	-2.9	-2.5	-3.0
Denmark	2.0	-2.3	-3.2	-3.5	-3.5	-2.5	-3.0
France	2.0	-0.4	-1.7	-2.2	-3.0	-1.4	-3.0
Germany	2.0	-2.3	-3.6	-2.4	-3.0	-2.2	-3.0
Greece	2.0	-0.6	-1.9	-2.5	-2.5	-0.8	-3.0
Ireland	2.0	-0.0	-0.6	-3.0	-3.0	0.4	-3.0
Italy	2.0	-1.4	-2.8	-2.5	-2.5	-1.2	-3.0
Luxembourg	2.0	-6.1	-5.5	-5.6	-5.8	-2.9	-3.0
Netherlands	2.0	-1.1	-2.3	-3.0	-3.0	-1.4	-3.0
Portugal	2.0	-1.5	-3.0	-3.3	-3.3	-1.7	-3.0
Spain	2.0	-1.7	-2.3	-2.7	-2.7	-0.5	-3.0
United Kingdom	2.0	-1.2	-2.3	-3.0	-3.0	-1.5	-3.0
Equity Financing							
Belgium	2.0	2.6	2.8	3.3	1.2	1.7	0.8
Denmark	2.0	2.7	1.8	2.0	0.0	1.1	0.8
France	2.0	3.2	1.6	1.6	0.8	2.9	0.8
Germany	2.0	6.5	4.6	3.6	0.8	1.8	0.8
Greece	2.0	4.6	2.7	3.2	1.7	4.2	0.8
Ireland	2.0	0.9	0.3	2.3	0.8	4.6	0.8
Italy	2.0	6.2	4.3	3.8	1.7	3.2	0.8
Luxembourg	2.0	-0.9	-0.3	-0.3	-3.3	0.5	0.8
Netherlands	2.0	3.8	2.2	2.9	0.8	2.9	0.8
Portugal	2.0	4.0	2.1	2.3	0.3	2.3	0.8
Spain	2.0	3.5	2.6	3.7	1.5	4.5	0.8
United Kingdom	2.0	2.2	0.9	0.8	0.8	2.6	0.8

Table 13. European Community: Corporate Tax Wedges for Buildings, under a Common Inflation Rate

(Percentage point difference between the gross and the net-of-tax real rate of return)

	Inflation rate	Tax scenarios					
		(1)	(2)	(3)	(4)	(5)	(6)
Debt Financing							
Belgium	2.0	-1.2	-1.4	-1.5	-1.5	-1.0	-0.9
Denmark	2.0	-1.8	-0.3	-0.3	-0.3	-2.0	-0.9
France	2.0	-0.2	-0.5	-0.8	-1.3	-0.9	-0.9
Germany	2.0	-0.5	-0.9	-0.9	-0.9	-0.6	-0.9
Greece	2.0	-0.7	-1.0	-1.3	-1.3	-0.9	-0.9
Ireland	2.0	-0.5	-0.2	-0.9	-0.9	-2.2	-0.9
Italy	2.0	-1.6	-0.4	-0.3	-0.3	-1.5	-0.9
Luxembourg	2.0	0.5	0.1	-0.2	-0.3	-0.0	-0.9
Netherlands	2.0	0.0	-0.2	-0.3	-0.3	0.0	-0.9
Portugal	2.0	-0.5	-0.8	-0.9	-0.9	-0.6	-0.9
Spain	2.0	-0.7	-0.8	-0.9	-0.9	0.0	-0.9
United Kingdom	2.0	-0.4	-0.7	-0.9	-0.9	-0.6	-0.9
Equity Financing							
Belgium	2.0	5.1	4.7	5.4	3.1	4.0	4.2
Denmark	2.0	4.6	6.7	7.6	5.0	2.8	4.2
France	2.0	4.0	3.5	4.0	3.5	4.2	4.2
Germany	2.0	10.3	10.1	6.6	4.2	4.3	4.2
Greece	2.0	4.7	4.1	5.2	3.5	4.2	4.2
Ireland	2.0	0.3	0.8	5.9	4.2	1.2	4.2
Italy	2.0	5.8	8.6	7.6	5.0	2.9	4.2
Luxembourg	2.0	9.5	8.9	8.9	5.0	5.6	4.2
Netherlands	2.0	6.1	5.6	7.6	5.0	5.7	4.2
Portugal	2.0	6.5	6.0	6.6	4.2	4.7	4.2
Spain	2.0	5.1	4.7	6.5	4.1	5.7	4.2
United Kingdom	2.0	3.7	3.4	4.2	4.2	4.7	4.2

Table 14. European Community: Corporate Tax Wedges for Machinery, under Different Inflation Rates

(Percentage point difference between the gross and the net-of-tax real rate of return)

	Inflation rate	Tax scenarios					
		(1)	(2)	(3)	(4)	(5)	(6)
Debt Financing							
Belgium	2.0	-2.7	-2.5	-2.9	-2.9	-2.5	-3.0
Denmark	5.0	-4.0	-3.9	-4.3	-4.3	-4.4	-3.8
France	2.0	-0.4	-1.7	-2.2	-3.0	-1.4	-3.0
Germany	2.0	-2.3	-3.6	-2.4	-3.0	-2.2	-3.0
Greece	10.0	-2.4	-3.7	-4.7	-4.7	-3.1	-5.3
Ireland	2.0	-0.0	-0.6	-3.0	-3.0	0.4	-3.0
Italy	5.0	-2.3	-3.5	-3.2	-3.2	-2.1	-3.8
Luxembourg	2.0	-6.1	-5.5	-5.6	-5.8	-2.9	-3.0
Netherlands	2.0	-1.1	-2.3	-3.0	-3.0	-1.4	-3.0
Portugal	10.0	-4.0	-5.2	-5.6	-5.6	-4.3	-5.3
Spain	5.0	-2.2	-2.9	-3.4	-3.4	-1.2	-3.8
United Kingdom	5.0	-1.9	-2.9	-3.8	-3.8	-2.4	-3.8
Equity Financing							
Belgium	2.0	2.6	2.8	3.3	1.2	1.7	0.8
Denmark	5.0	2.5	2.6	2.9	1.0	0.9	1.8
France	2.0	3.2	1.6	1.6	0.8	2.9	0.8
Germany	2.0	6.5	4.6	3.6	0.8	1.8	0.8
Greece	10.0	6.7	4.5	5.8	4.3	7.2	3.2
Ireland	2.0	0.9	0.3	2.3	0.8	4.6	0.8
Italy	5.0	7.5	5.6	4.9	2.8	4.3	1.8
Luxembourg	2.0	-0.9	-0.3	-0.3	-3.3	0.5	0.8
Netherlands	2.0	3.8	2.2	2.9	0.8	2.9	0.8
Portugal	10.0	6.0	4.1	4.6	2.6	4.6	3.2
Spain	5.0	4.3	3.4	4.8	2.7	5.7	1.8
United Kingdom	5.0	2.8	1.6	1.8	1.8	3.5	1.8

Table 15. European Community: Corporate Tax Wedges for Buildings, under Different Inflation Rates

(Percentage point difference between the gross and the net-of-tax real rate of return)

	Inflation rate	Tax scenarios					
		(1)	(2)	(3)	(4)	(5)	(6)
Debt Financing							
Belgium	2.0	-1.2	-1.4	-1.5	-1.5	-1.0	-0.9
Denmark	5.0	-3.8	-1.3	-1.4	-1.4	-4.2	-2.0
France	2.0	-0.2	-0.5	-0.8	-1.3	-0.9	-0.9
Germany	2.0	-0.5	-0.9	-0.9	-0.9	-0.6	-0.9
Greece	10.0	-3.2	-3.5	-4.6	-4.6	-4.3	-4.3
Ireland	2.0	-0.5	-0.2	-0.9	-0.9	-2.2	-0.9
Italy	5.0	-2.8	-1.6	-1.4	-1.4	-2.6	-2.0
Luxembourg	2.0	0.5	0.1	-0.2	-0.3	-0.0	-0.9
Netherlands	2.0	0.0	-0.2	-0.3	-0.3	0.0	-0.9
Portugal	10.0	-3.7	-3.9	-4.3	-4.3	-4.1	-4.3
Spain	5.0	-1.5	-1.6	-2.0	-2.0	-1.1	-2.0
United Kingdom	5.0	-1.3	-1.5	-2.0	-2.0	-1.7	-2.0
Equity Financing							
Belgium	2.0	5.1	4.7	5.4	3.1	4.0	4.2
Denmark	5.0	4.5	7.4	8.3	5.8	2.6	5.0
France	2.0	4.0	3.5	4.0	3.5	4.2	4.2
Germany	2.0	10.3	10.1	6.6	4.2	4.3	4.2
Greece	10.0	6.0	5.4	7.0	5.3	6.1	6.0
Ireland	2.0	0.3	0.8	5.9	4.2	1.2	4.2
Italy	5.0	6.6	9.4	8.3	5.8	3.6	5.0
Luxembourg	2.0	9.5	8.9	8.9	5.0	5.6	4.2
Netherlands	2.0	6.1	5.6	7.6	5.0	5.7	4.2
Portugal	10.0	8.0	7.5	8.3	6.0	6.5	6.0
Spain	5.0	5.6	5.2	7.2	4.9	6.5	5.0
United Kingdom	5.0	4.4	4.0	5.0	5.0	5.6	5.0

References

Alworth, Julian S., "Capital Mobility, the Cost of Capital under Certainty and Effective Tax Rates in Europe," Finnish Economic Papers, Vol. 1 (Spring 1988).

__________, The Finance, Investment and Taxation Decisions of Multinationls (Basil Blackwell, 1988).

__________, "Taxation and the Cost of Capital: A Comparison of Six EC Countries," in Tax Coordination in the European Community, ed. by Sijbren Cnossen (Kluwer Law and Taxation Publishers, Deventer, 1987).

Arrow, Kenneth and Mordecai Kurz, Public Investment, the Rate of Return and Optimal Fiscal Policy (Johns Hopkins University Press, 1970).

Auerbach, Alan J. "Taxation, Corporate Financial Policy and the Cost of Capital," Journal of Economic Literature, Vol. 21 (September 1983).

Boadway, Robin, "Long-run Tax Incidence: A Comparative Dynamic Approach," Review of Economic Studies, Vol. 46 (July 1979).

__________, "Federal-Provincial Transfers in Canada: A Critical Review of the Existing Arrangements," in Fiscal Federalism, ed. by Mark Frasnick (University of Toronto Press, Toronto, Canada 1986).

__________, "The Theory and Measurement of Effective Tax Rates," in The Impact of Taxation on Business Activity, ed. by Jack Mintz and Douglas Purvis (John Deutsch Institute for the Study of Economic Policy, 1987).

__________, and Neil Bruce, "Problems with Integrating Corporate and Personal Income Taxes in an Open Economy," Institute for Economic Research-Queen's University, Discussion Paper No. 735 (December 1988).

Bovenberg, A. Lans, "Capital Income Taxation in Growing Open Economies," Journal of Public Economics, Vol. 31 (December 1986).

__________, "International Coordination of Tax Policies," in International Economic Policy Coordination and Reality, ed. by H.J. Blommenstein (North-Holland, Amsterdam, the Netherlands, forthcoming 1990).

__________, Krister Andersson, Kenji Aramaki and Sheetal K. Chand, "Tax Incentives and International Capital Flows: the Case of the United States and Japan," in Taxation and the Global Economy, ed. by A. Razin and J. Slemrod (Chicago: NBER and University of Chicago Press, 1990).

Brock, William A. and Stephen J. Turnovsky, "The Analysis of Macroeconomic Policies in Perfect Foresight Equilibrium," International Economic Review, Vol. 22 (February 1981).

Caves, Richard E., Multinational Enterprise and Economic Analysis, (Cambridge University Press, Cambridge and New York, 1982).

Commission of the European Communities, "Draft Directive Concerning the Harmonization of Systems of Company Taxation and of Withholding Tax on Dividends," COM(75) 392 final (1975).

Crooks, E., M. Devereux, M. Pearson and C. Wookey, "Transnational Tax Rates and Incentives to Invest," mimeo (Institute for Fiscal Studies, London, March 1989).

Fukao, Mitsuhiro and Masaharu Hanazaki, "Internationalization of Financial Markets and the Allocation of Capital," OECD Economic Studies, No. 8 (Spring 1987).

Fullerton, Don, "The Indexation of Interest, Depreciation and Capital Gains: A Model of Investment Incentives," NBER Working Paper, No. 1655 (June 1985).

Hall, Robert E. and Dale W. Jorgenson, "Tax Policy and Investment Behavior," American Economic Review, Vol. 57 (June 1967).

Harberger, A. C. "Efficiency Effects of Taxes on Income from Capital," in Effects of Corporation Income Tax, ed. by M. Kryzaniak (Detroit, Wayne State University Press, 1966).

Horst, Thomas, "A Note on the Optimal Taxation of International Investment Income," Quarterly Journal of Economics, Vol. 94 (June 1980).

Jorgenson, Dale W. "The Theory of Investment Behavior," in Determinants of Investment Behavior, ed. by Robert Ferber (National Bureau of Economic Research - Columbia University Press, 1967).

Jorgenson, Dale W. and Kun-Young Yun, "Tax Policy and the Cost of Capital in the United States," paper delivered at the International Conference on the Cost of Capital (Kennedy School of Government, Harvard University, November 1987).

King, Mervyn, Public Policy and the Corporation, (Chapman and Hall, London, United Kingdom, 1977).

__________, and Don Fullerton (eds.), The taxation of Income From Capital: A Comparative Study of the United States, the United Kingdom, Sweden and West Germany (University of Chicago Press, 1984).

Kopits, George F., "Dividend Remittance Behavior Within the International Firm: A Cross-Country Analysis," Review of Economics and Statistics, Vol. 54 (August 1972).

__________, "Taxation and Multinational Firm Behavior: A Critical Survey," IMF Staff Papers, Vol. 23 (November 1976).

__________, "Factor Prices in Industrial Countries," IMF Staff Papers, Vol. 29 (September 1982).

__________, and L. Mutén, "The Relevance of the Unitary Approach for Developing Countries," The State Corporation Income Tax, ed. by E. McLure, Jr. (Hoover Institution Press, 1984).

__________, "Inflation, Income Taxation and Economic Behavior," in Cooperative Tax Studies: Essays in Honor of Richard Goode, ed. by S. Crossen (North Holland, 1983).

Kuiper, Willem, "EC Commission Proposes a Directive on the Harmonization of Rules for the Determination of Taxable Profits of Enterprises," European Taxation (October 1988).

Kyrouz, M.F. "Foreign Tax Rates and Tax Bases," National Tax Journal, Vol. 28 (March 1975).

Leamer, Edward E., Sources of International Comparative Advantage, (MIT Press, 1984).

Mintz, Jack and Douglas Purvis, "Taxation and Business Activity: An Introduction to the Conference Volume," The Impact of Taxation on Business Activity (John Deutsch Institute for the Study of Economic Policy, Queen's University, Kingston Ontario, Canada, November 1985).

Papke, James A., and Leslie E. Papke, "Measuring Differential State-Local Tax Liabilities and Their Implications for Business Investment Location," National Tax Journal, Vol. 39 (September 1986).

Papke, L.E. "Interstate Business Tax Differentials and New Firm Location: Evidence from Panel Data," mimeo (Boston University, December 1988).

Poterba, James M., "Tax Policy and Corporate Saving," Brookings Papers on Economic Activity, No. 2 (1987).

__________, and Lawrence H. Summers, "The Economic Effects of Dividend Taxation," NBER Working Paper Series, No. 1353 (May 1984).

Sinn, Hans-Werner, Capital Income Taxation and Resource Allocation (North-Holland, Amsterdam, the Netherlands, 1987).

Slemrod, Joel, "Tax Effects on Foreign Direct Investment in the U.S.: Evidence from a Cross-Country Comparison," NBER Working Paper, No. 3042, (July 1989).

Snoy, Bernard, Taxes on Direct Investment Income in the EEC: A Legal and Economic Analysis (Praeger, New York, N.Y., U.S., 1975).

Tanzi, Vito and Lans Bovenberg, "Economic Interdependence and the International Implications of Supply-Side Policies," in A Supply Side Agenda for Germany, ed. by Gerhard Fels and George M. von Furstenberg (Springer-Verlge, New York, N.Y., U.S., 1989).

United Nations, International Labour Office, Yearbook of Labour Statistics, (Geneva, 1988).