Finnish Economic Papers-Volume 1, Number 1-Spring 1988

CAPITAL MOBILITY, THE COST OF CAPITAL UNDER CERTAINTY AND EFFECTIVE TAX RATES IN EUROPE

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1. Introduction

The degree of integration between financial markets has increased substantially in recent years. Casual observation of simple correlations of changes in nominal interest rates, such as those shown in Tables 1 and 2 suggest that since the mid-1970s co-movements of long-term and to a lesser extent short-term nominal interest rates have tended to increase markedly, particularly during the 1980s and most noticeably amongst countries in the European Monetary System. Moreover, closer study of this question by Obstfeld (1986a, 1986b) have confirmed the basic trends implied by Tables 1 and 2 and cast doubt on an earlier empirical study by Feldstein and Horioka (1980) which suggested indirectly through simple correlations of national savings and investment that capital markets were segmented.[1]

Such a growing degree of integration means that it is no longer possible to assume that fiscal policies affecting interest rates in a single country will be without repercussions abroad and at the same time that they would have the same impact as in a closed economy. Whilst the effects of financial integration on the conduct of macroeconomic policy are well known, they have hardly been examined with respect to resource allocation and cross-country investment decisions.

The purpose of this paper is twofold. Firstly, it sets out the issues involved in defining a financial equilibrium in an open economy with a high degree of inter-country capital mobility and a distortionary tax system. We shall demonstrate that even under the simplifying assumption of certainty many alternative equilibria are possible depending on the interaction amongst interest parity conditions, the type of tax systems considered and the limitations set on tax arbitrages.

The specification of the equilibrium in the international financial markets is relevant to the second objective of this paper, namely to determine what is the appropriate measure-

* *We appreciate the comments on a previous version of this paper from several colleagues and from participants of the Helsinki Conference on »Perspectives on Capital Income Taxation in Europe». Paul Van den Bergh kindly supplied us with the figures shown in Tables 1 and 2. The views expressed in this paper are our own and not necessarily those of the Bank for International Settlements.*

[1] *There are three possible arguments against the finding of Feldstein and Horioka. Firstly, if the rate of time preference and technology are sufficiently similar across countries, domestic savings and investment would be brought into equality even in a perfectly integrated world [Stulz (1986)]. Secondly, for most of the sample period used by Feldstein and Horioka the major countries operated with fixed exchange rates. Under the »rules of the game» of the fixed exchange rate system countries followed macro-economic policies aimed at maintaining current-account balance, thus leading to equalisation of saving and investment. The »rules of the game» have not changed markedly since the inception of floating rates and this may help to explain the continuing balance between saving and investment which has been reported for more recent years. Finally, common cross-country exogenous shocks may affect savings and investments in a similar fashion [Summers (1985)].*

Table 1. Cross-country correlations of changes in money market interest rates.

Period: 1971—74

	US	CA	JP	GB	DE	FR	IT	NL	BE
US	1.00	0.51	0.15	0.19	0.19	0.22	0.32	0.36	0.39
CA		1.00	0.17	−0.23	0.18	0.02	0.24	0.41	0.27
JP			1.00	0.12	0.05	0.32	0.21	0.26	0.29
GB				1.00	0.07	0.14	0.13	0.19	0.12
DE					1.00	0.23	−0.03	0.36	0.06
FR						1.00	0.31	0.38	0.36
IT							1.00	0.13	0.59
NL								1.00	0.29
BE									1.00

Period: 1975—79

	US	CA	JP	GB	DE	FR	IT	NL	BE
US	1.00	0.64	0.19	0.24	0.42	0.22	0.19	0.07	0.24
CA		1.00	0.07	0.06	0.23	0.08	0.37	0.10	0.30
JP			1.00	0.04	0.24	0.43	0.23	0.23	0.20
GB				1.00	0.34	0.28	0.10	0.10	0.26
DE					1.00	0.52	0.21	0.27	0.36
FR						1.00	0.26	0.28	0.48
IT							1.00	0.07	0.39
NL								1.00	0.49
BE									1.00

Period: 1980—86

	US	CA	JP	GB	DE	FR	IT	NL	BE
US	1.00	0.72	0.26	0.13	0.09	0.25	−0.01	0.13	0.28
CA		1.00	0.15	0.30	0.29	0.26	0.15	0.29	0.35
JP			1.00	0.06	0.18	0.24	0.01	0.04	0.25
GB				1.00	−0.03	0.05	−0.02	0.08	0.24
DE					1.00	0.22	0.21	0.48	0.55
FR						1.00	0.30	0.23	0.17
IT							1.00	0.04	0.24
NL								1.00	0.10
BE									1.00

ment of effective tax rates in an open economy. As has been shown in studies of marginal effective tax rates in a closed economy, the actual values of effective rates hinge to a considerable extent on the nature of market arbitrages and of capital market equilibria which are assumed (Bradford and Fullerton (1981) and King and Fullerton (1984)). In the third section of this paper we shall examine how the effective tax rates obtained using the King and Fullerton framework need to be modified in an open economy when domestic savings and investments need no longer be equal. The countries which are used as benchmarks for this exercise are five of the original EC countries plus the United Kingdom. The simulation results obtained are preliminary because of data imperfections and the difficulties in modelling many complex interactions across countries. Although they cannot be taken as firm indications of the actual impact produced by the tax changes,[2] our findings suggest that

[2] *The effective tax rates computed in this paper, like those commonly produced in the literature, assume unchanging tax rules and do not take account of expectational factors or adjustment costs.*

Table 2. Cross-country correlations of changes in bond yields.

Period: 1971—74

	US	CA	JP	GB	DE	FR	IT	NL	BE
US	1.00	0.61	0.04	0.13	0.26	0.10	—0.02	0.26	0.29
CA		1.00	0.06	0.17	0.30	0.25	0.13	0.29	0.27
JP			1.00	0.08	0.04	0.32	0.02	0.34	0.28
GB				1.00	0.03	0.30	0.21	—0.10	0.17
DE					1.00	0.16	0.24	0.39	0.08
FR						1.00	0.27	0.20	0.35
IT							1.00	—0.05	—0.06
NL								1.00	0.28
BE									1.00

Period: 1975—79

	US	CA	JP	GB	DE	FR	IT	NL	BE
US	1.00	0.56	0.24	0.17	0.26	—0.23	0.07	0.22	0.32
CA		1.00	0.10	0.24	0.18	0.10	0.23	0.23	0.15
JP			1.00	0.06	0.48	0.06	0.12	0.20	0.34
GB				1.00	0.28	0.29	0.36	—0.03	0.15
DE					1.00	0.17	0.18	0.45	0.29
FR						1.00	0.28	—0.03	0.19
IT							1.00	0.00	0.14
NL								1.00	0.02
BE									1.00

Period: 1980—86

	US	CA	JP	GB	DE	FR	IT	NL	BE
US	1.00	0.72	0.50	0.42	0.56	0.37	0.03	0.57	0.39
CA		1.00	0.34	0.41	0.36	0.21	0.10	0.36	0.30
JP			1.00	0.27	0.45	0.31	—0.08	0.46	0.11
GB				1.00	0.18	0.20	0.08	0.13	0.17
DE					1.00	0.46	0.15	0.71	0.38
FR						1.00	0.28	0.47	0.46
IT							1.00	0.06	0.20
NL								1.00	0.34
BE									1.00

the existence of capital mobility alters the value of the effective tax rates in a significant manner. The final section draws some tentative conclusions and suggests some possible areas of future research.

In order to address these issues we have restricted the scope of our study in several respects. Firstly, only foreign portfolio investments are considered. Direct investment through multinationals is not examined because a number of questions concerning the specific tax treatment of multinationals need to be taken into account (Alworth, 1987b) and because the bulk of cross-border flows are of a portfolio nature (in particular if banking flows are considered).[3] Secondly, although the paper is concerned with the interaction of policies amongst countries, strategic issues relating to how the tax system should be designed in order to respond to foreign taxes have not been addressed. In particular, questions such as »tax wars» and the relationship between

[3] *We do not, however, consider the manner in which the specific tax treatment of banks might affect cross-border lending decisions (see Frankel (1984) and Alworth (1984)).*

taxes and tariffs are not examined.[4] Finally only certainty is considered. As shown recently by Gordon (1985) and Bulow and Summers (1984), the computation of effective tax rates can be affected by the precise treatment of the interactions of uncertainty and the tax code.

2. *Effective tax rates and capital market equilibria*

In King and Fullerton (1984) the measurement of effective tax rates is based on the computation of the tax wedge between p, the before tax marginal product on a selected stand-alone project, and s the after tax return received by a final investor. The wedge (p—s) is meant to capture all the elements of government fiscal policies which create a divergence between the returns to investment and savings. The »tax-inclusive» measure of the effective tax rate, t, is defined as this tax wedge divided by the pre-tax return[5]:

$$t = \frac{p - s}{p}$$

The value of p is equal to the gross marginal return on a project (MRR) less the (exponential) rate of economic depreciation (δ). In equilibrium the present value of the gross marginal return net of company tax is equal to the cost of the project (set arbitrarily equal to unity) net of the present discounted value of tax allowances (A).

$$1 - A = \frac{(1-\tau)\,MRR}{(\rho + \delta - \pi)}$$

The left-hand side of this expression is equal to the net cost of the project. The right-hand side is the present value of net returns where ρ is the discount rate used by the firm for its projects (or alternatively a measure of the internal rate of return), π is the rate of inflation and τ is the corporate tax rate. Solving for MRR and recalling that $p = MRR - \delta$, we obtain that

$$p = \frac{(1-A)}{(1-\tau)}(\rho + \delta - \pi) - \delta$$

On the other hand, savers receive a post-tax rate of returns given by:

(1) $s = (1-m)\,i - \pi - w_p$

where i is the nominal interest rate, w_p is the personal wealth tax and m is the marginal personal tax rate on the particular type of finance.

This framework is very general and can be applied to any form of »tax wedge» between pre and post-tax returns. The studies carried out by King and Fullerton and by others using similar approaches have considered only investments carried out within a closed economy. It is easy to see, however, that this exercise could also apply to investments which are made in countries other than those where the saver resides.

The computation of effective tax rates in the framework developed by King and Fullerton assumes that companies and individual investors operate as if there were only one form of finance at the margin. In order to »close» the model, either of two different »pseudo-equilibrium» conditions are imposed on the financial markets depending on whether profitability (fixed-p) or real interest rates ($r = i - \pi$) are considered exogenous (fixed-r).[6] Under the fixed-p case, the value of the internal rate of return on a project (ρ) is determined assuming a fixed value of the pre-tax rate of return p. The value of ρ is therefore independent of financial policy and the ownership structure of the firm. The fixed-p solution avoids problems with respect to the determination of a capital market equilibrium at the cost of entailing that a different nominal market rate of interest i prevails for each project.

As we shall see below, although the fixed-p case cannot be said to be satisfactory with respect to the nature of the capital market equilibrium condition, it helps to analyse the

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[4] *See Slemrod (1987) for a survey of these issues.*

[5] *In their study King and Fullerton compile effective tax rates on 81 different projects broken down by asset, industry, source of finance and ownership. Overall country-wide effective tax rates are averages weighted by the estimated importance of each of these projects in total capital stock.*

[6] *An alternative procedure would be to specify a general equilibrium model having production technologies and intertemporal utility functions.*

extent to which differences in the tax base across countries lead to implicit divergences of interest rates. Furthermore, it is possible to reconcile the fixed-p case with another pseudo-capital market equilibrium by weighting each of the values of i according to the relative importance of individual projects and sources of finance (Brennan (1971)). The overall effective tax rates in this case would depend solely on the taxation of different types of ultimate investors. As we shall show below in section 2 an alternative version of this assumption is intuitively plausible in the open economy case.

On the other hand, the fixed-r case assumes a capital market equilibrium in which the marginal yield on financial investments of different types is equilised, except for differences in tax treatment amongst owners of financial assets: »causality» runs from an exogenous, given fixed interest rate to marginal products. Here, too, the capital market equilibrium appears somewhat arbitrary, since firms face different discount rates according to the source of finance and, possibly, final ownership.[7]

The link between p and s is provided through the capital market, i.e. via the relationship between ρ and i. In the absence of taxes these two values would be equal. In general the value of ρ and i will diverge because of the different tax treatment of various sources of finance, and because the personal tax rates levied on ultimate savers may vary markedly. In order to compute a value for the effective tax rates, some authors have assumed that ρ can be determined from a weighted average of tax adjusted values of i across the various possible sources of finance and ownership. This is, however, not the only possible type of »cum-tax» equilibrium. The presence of shareholders facing different marginal tax rates and the existence of appropriate constraints can lead to equilibria in which individuals will prefer different financial policies depending on their tax characteristics. Miller (1977) and DeAngelo and Masulis (1980) have described some such segmented equilibria by constraining individuals from engaging in tax arbitrages and by assuming constraints on borrowing and short sales.

[7] *See Scott (1987) for critique of the fixed-r equilibrium and an alternative procedure.*

2.1 The closed economy

The approach followed by King and Fullerton, which is replicated here, is to consider separately each potential source of finance. The interrelation between ρ and i is analysed independently for each type of investor. The aggregate measures of effective tax rates are then obtained by weighting each effective tax rate by the relative importance of individual projects in the economy.

In the absence of some form of equilibrating mechanism, financial policies will be corner solutions dictated by the values of tax parameters and for a given market interest rate (i) the discount rate for valuing alternative projects (ρ) will be uniquely determined. The values of the discount rate in these circumstances are by now familiar (King (1977)). For debt finance, since nominal interest is tax deductible at a rate φ, which is generally equal to unity unless the firm is »tax exhausted» or there is a cash flow type corporation tax, the value of the discount rate is given by:

$$(2) \quad \rho = i\,(1 - \varphi\,\tau)$$

When financing the firm via new share issues, investors will require a net of tax dividend yield equal to the investor's opportunity cost, i.e. the rate of return on an alternative investment. The latter is given by $(1-m_b)\,i$ where m_b is the marginal personal tax rate which applies to interest income. The net of tax dividend yield is $\rho\,\Theta\,(1-m_s)$, where m_s is the marginal personal tax rate on shares and Θ equals the additional *gross* dividends shareholders could receive if one unit of post tax earnings were distributed (King, 1977).[8] Hence the firm's discount rate is given by:

$$(3) \quad \rho = \frac{(1-m_b)}{\Theta\,(1-m_s)}\,i$$

In the case of retained earnings, for a given tax rate on accrued capital gains z[9] the representative investor will require $\rho\,(1-z) = i\,(1-m_b)$ so that

[8] *The value of Θ will be greater than unity if there is some form of integration between company and personal taxes. For example, under the imputation system the tax credit received by the shareholder is equal to (Θ—1).*

[9] *See King and Fullerton (1984) for a discussion on how to transform realised into accrued tax rates.*

$$(4)\quad \rho = \frac{(1-m_b)}{(1-z)}\, i$$

Under certainty, firms will in general be pushed to finance all their investments by following at the margin the financial policy having the lowest value of ρ. The choice will be dictated by the interaction between the personal, capital gains and the company tax systems. Indifference amongst alternative financial policies for the firm is achieved only for a specific set of tax parameters.[10]

2.2 The open economy

In an open economy with full capital mobility domestic savings and investment need not be equal to one another. Interest rates are determined in the world capital market where savers and investors from all countries are brought together. This section describes the characteristics of capital market equilibrium for various sources of finance in an open economy consisting for expository purposes of two countries: country j, the capital importer, and country k, the capital exporter. In the case of debt-financed investments by firms in country j by funds coming directly from country k, there would be no change as regards the discount rate ρ^j if borrowing continued to be in domestic currency and any foreign exchange gains and losses were borne by savers in country k.[11]

In the case of a purchase of new shares by foreign shareholders, the value of ρ will differ in three important respects from its domestic counterpart. Firstly, ρ^j depends on the tax treatment of foreign investors in the capital-importing country and the system of double taxation relief in the investor's home country.

The net of tax dividend yield is given by $(1-m^j_{sk})\,\Theta^j_k\,\rho^j$. The parameter Θ^j_k defines the additional dividends which shareholders would receive before personal tax if one unit of post tax earnings in country j were distributed to shareholders of country k. The value m^j_{sk} is the marginal personal tax rate in country k on dividends received by shareholders in country k after allowance for double taxation relief on foreign withholding taxes levied in country j.

The value of m^j_{sk} and Θ^j_k differ by country in which the income originates, by the country of residence of shareholders and by type of final owner. Table 3 sets out the matrix of the average values of $\Theta^j_k\,(1-m^j_{sk})$ across different types of final investors (households, tax-ememept institutions, insurance companies) from the capital-exporting country for a select group of OECD countries. The value of Θ^j_k depends on the system of integration of personal and company taxes in the capital-importing country. With a »classical system», such as that which exists in the Netherlands and the United States, the value is always unity. Under the imputation system, in most cases the value of Θ^j_k equals unity because tax credits are not provided to foreign shareholders. However, under certain double taxation treaties, such as that between the United Kingdom and France, the imputation credit is passed on to final shareholders. For Germany and Japan, where the integration between the company and personal tax system operates in part through a split-rate system, no distinction is made between domestic and foreign shareholders, and in this case too $\Theta^j_k > 1$. The value of m^j_{sk} used in the computations shown in the table depends on the interaction between withholding taxes in the capital-importing country, the personal tax system in which the final beneficiaries reside, and the method by which double taxation relief is provided. If foreign income is exempt from personal tax, as it is in the case of the Netherlands, the withholding tax in the capital-importing country determines the final tax burden. On the other hand, if foreign taxes can be credited in full against personal taxes, then the value of m^j_{sk} will be given by the marginal personal tax in the capital-exporting country. It should be noted that a very important exception to the credit system applies for tax-exempt institutions which cannot claim the tax credit for foreign withholding taxes be-

[10] The nature of market equilibrium with respect to the financial policies followed by the firm and the specific value taken by the cost of capital depends on two sets of factors: the tax laws and legal constraints on arbitrages. In practice, these two sets of factors interact because tax laws not only impose corner solutions with respect to financial policies but also encourage arbitrages amongst similar streams of income having a differential tax treatment. Legal constraints are necessary to prevent firms from fully exploiting tax avoidance strategies (King, 1977).

[11] However, domestic interest rates are linked to world interest rates via interest parity as shown below.

Table 3. Average value of Θ^j_k $(1-m^j_{sk})$ for dividend payments (for domestic shareholders average value of Θ^j_j $(1-m^j_{sj})$ taken).

Capital exporting country (k)	Capital importing country (j)							
	Belgium	France	Germany	Italy	Japan	Netherlands	United Kingdom	United States
Belgium	0.750[1]	0.990[2]	1.932	0.660	0.750	0.660	0.720	0.660
France	0.681	0.912	1.571	0.681	0.774	0.681	0.962[2]	0.681
Germany	0.603	0.911[2]	1.280	0.559	0.686	0.603	0.641	0.603
Italy	0.672	0.672	1.420	0.919	0.764	0.732	0.732	0.672
Japan	0.748	0.748	1.700	0.748	0.759	0.748	1.042[2]	0.748
Netherlands	0.850	1.275[2]	1.930	0.676	0.966	0.688	1.233[2]	0.850
United Kingdom	0.715	1.073[2]	1.626	0.663	0.813	0.715	1.064	0.715
United States[3]	0.608	0.913[2]	1.383	0.608	0.692	0.608	0.851[2]	0.644
Geometric mean of Θ^* $(1-m^*_s)$ weighted by								
external assets	0.675	0.906	1.524	0.658	0.746	0.669	0.905	0.685
weighted by GNP	0.651	0.883	1.469	0.650	0.724	0.650	0.878	0.670

[1] Assumes all shareholders choose précompte liberatoire.
[2] Shareholders receiving »avoir fiscale» or tax credit.
[3] Before US tax refore of 1986.

Note: Weighted average for individual cell assumes that the ownership composition of foreing portfolios is the same as that for domestic investments. If the withholding tax in the capital importing country is greater than the marginal personal tax rate, the withholding tax is considered as final payment.

Source: Coopers and Lybrand (1986) *International Tax Summaries*.

cause they lack taxable income.[12] As far as possible the values shown in Table 3 take account of these complications.[13]

Foreign shareholders may suffer a capital loss (gain) on their purchases of shares owing to an exchange rate depreciation (appreciation) $\hat{e}^j_k$ $(-\hat{e}^j_k)$. If this loss is allowed as an offset against capital gains tax levied at an accrual rate of z^j_k, the total return for financing through new share issues will be given by $(1-m^j_{sk})\ \Theta^j_k\ \rho - (1-z^j_k)\ \hat{e}^j_k$.

The final important difference between the closed and open economy arises with respect to the opportunity cost of alternative security investments. For foreign shareholders this value will be given by $(1-m^k_{bk})\ i^k$ where the m^k_{bk} and i^k are respectively the marginal personal tax rate on domestic interest income and the domestic interest rate in country k. The values $1-m^k_{bk}$ for the same select group of OECD countries are shown along the principal diagonal of Table 4.

Equating the net-of-tax return on bonds in country k with the after-tax dividend yield on shares issued in country j and purchased by residents in country k, the discount rate in country j depends on the foreign rate of interest as follows:

$$(5)\quad \rho^j = \frac{i^k\ (1-m^k_{bk}) + (1-z^j_k)\ \hat{e}^j_k}{\Theta^j_k\ (1-m^j_{sk})}$$

Similar arguments apply in the case of retained earnings so that the value of ρ^j will be given by:

$$(6)\quad \rho^j = \frac{i^k\ (1-m^k_{bk}) + (1-z^j_k)\ \hat{e}^j_k}{(1-z^j_k)}$$

Our discussion to this point is summarised in Table 5, which shows the value of ρ^j for different sources of finance depending on the country of residence of the final investor. As the table makes readily clear, a link is needed between domestic and foreign interest rates in order to obtain an overall equilibrium in the international financial market.

[12] *This also applies to those shareholders whose marginal personal tax rate is less than the foreign withholding tax.*

[13] *See Alworth (1987b), Chapter 4, for a more complete description of provision concerning double taxation relief in various countries.*

Table 4. Average value of $(1-m^j_{bk})$ for interest payments (for domestic interest payments average value of $(1-m^j_{bj})$ taken).

Capital exporting country (k)	Capital importing country (j)							
	Belgium	France	Germany	Italy	Japan	Nether-lands	United Kingdom	United States
Belgium	0.769	0.776	0.791	0.769	0.769	0.791	0.769	0.791
France	0.582	0.603	0.603	0.582	0.589	0.603	0.589	0.603
Germany	0.715	0.780	0.780	0.780	0.738	0.780	0.780	0.780
Italy	0.775	0.783	0.798	0.760	0.783	0.798	0.700	0.798
Japan	0.767	0.775	0.790	0.767	0.790	0.790	1.775	0.790
Netherlands	0.706	0.723	0.757	0.706	0.723	0.757	0.757	0.757
United Kingdom	0.726	0.733	0.747	0.726	0.733	0.747	0.747	0.747
United States	0.768	0.804	0.804	0.768	0.780	0.804	0.804	0.804
Geometric mean of $(1-m^*_b)$ weighted by								
external assets	0.742	0.766	0.775	0.750	0.756	0.775	0.766	0.775
weighted by GNP	0.745	0.773	0.779	0.750	0.760	0.779	0.769	0.779

Note: Weighted average for individual cell assumes that the ownership composition of foreing portfolios is the same as that for domestic investments. If the withholding tax in the capital importing country is greater than the marginal personal tax rate, the withholding tax is considered as final payment.

Source: Coopers and Lybrad (1986) *International Tax Summaries.*

Table 5. Marginal cost of finance (ρ) in a closed and open economy.

	Closed economy	Open economy
Debt	$i^j(1-\varphi\tau)$	$i^j(1-\varphi\tau)$
New share issues	$i^j \dfrac{(1-m^j_{bj})}{\Theta^j_j(1-m^j_{sj})}$	$i^k \dfrac{(1-m^k_{bk})+(1-z^j_k)\,\hat{e}^j_k}{\Theta^j_k(1-m^j_{sk})}$
Retained earnings	$i^j \dfrac{(1-m^j_{bj})}{(1-z^j_j)}$	$i^k \dfrac{(1-m^k_{bk})+(1-z^j_k)\,\hat{e}^j_k}{(1-z^j_k)}$
memo: »open« interest parity		$i^j=\dfrac{i^k(1-m^k_{bk})+(1-z^j_k)\,\hat{e}^j_k}{(1-m^j_{bk})}$

2.3 *Linking domestic and foreign markets*

In the absence of taxes and under certainty this link is provided by the open interest parity condition which states that the interest in country j equals the interest rates in country k plus the expected depreciation of the currency of country j.[14]

[14] *Under certainty and with perfact foresight open interest parity is equivalent to covered interest parity which states that $i^j - i^k + f$, where f is the forward discount on the exchange rate. In the presence of uncertainty and risk aversion, covered and open interest parity may differ on account of potential risk premia.*

$$(7)\quad i^j = i^k + \hat{e}^j_k.$$

With personal taxes this equilibrium condition needs to be modified. After tax, bondholders in country k receive net interest income on investments in country j equal to

$$(8)\quad i^j(1-m^j_{bk}) - (1-z^j_k)\,\hat{e}^j_k.$$

Equating expression (8) with the after-tax return on domestic debt in country k $[(1-m^k_{bk})\,i^k]$, in the presence of taxation the equilibrium condition for debt instruments becomes:

(9) $i^j(1-m^j_{bk})-(1-z^j_k)\,\hat{e}^j_k = i^k(1-m^k_{bk})$

As can be seen from (9), open interest parity (expression (7)) occurs only if the same marginal tax rate applies to both types of interest payments and to foreign exchange gains (and losses). If $m^k_{bk} = m^j_{bk}\ (\neq z^j_k)$ this condition is reminiscent of the Fisher Hypothesis modified for taxes as suggested by Darby (1976), Feldstein (1976) and Tanzi (1976).[15] Indeed, if purchasing power parity holds, whereby changes in nominal exchange rates are determined by inflation differentials ($\hat{e}^j_k = \pi^j-\pi^k$), and if world interest rates and inflation are given:

$$\frac{\delta i^j}{\delta \pi^j} = \frac{1-z^j_k}{1-m^k_{bk}}$$

Unfortunately, the relationship between domestic and foreign interest rates is more complicated and depends in a crucial manner on the interaction between four sets of factors:

— the entities carrying out the interest rate arbitrage and limitations which are set thereon;
— whether the country is small in the sense that it takes interest rates as given abroad;
— the tax treatment of capital gains on foreign exchange rate gains and losses;
— the specific type of interaction between interest rates, inflation, exchange rates and taxes.

(a) Two sets of general complications arise when considering the taxable entity operating at the margin and determining the implicit value of ρ. Firstly, different relative valuations with respect to coupon payments and capital gains by investors in various countries may give rise to asymmetries and »abnormal» two-way capital movements. In the case where marginal personal taxes in the two countries are equal for domestic and foreign investments, this may result in interest parity not being achieved if the following two conditions occurred:

(10a) $(1-m^j_{bj})(i^j-i^k) > (1-z^k_j)\,\hat{e}^j_k$

(10b) $(1-m^k_{bk})(i^j-i^k) < (1-z^j_k)\,\hat{e}^j_k$.

[15] *Assuming the average real return (r) is constant across inflation rates so that the average saver receives $s = i(1-m)-\pi$, the nominal interest rate must equal $i = r + \pi/(1-m)$.*

For example, investors with low m^j_{bj} and high z^k_j would prefer investing domestically, whereas investors with high m^k_{bk} and low z^j_k would prefer investing abroad. In this situation there would be no determinable tax equilibrium for certain values of $\hat{e}^j_k$.[16] This possibility was first noted by Levi (1977). Its full implications in a valuation model of international assets have been recently examined by Gordon (1987) who draws the analogy between a multi-country framework and the reasoning which applies to the determination of equilibrium interest rates in a closed economy in the presence of a progressive marginal tax rate with different treatments of various financial assets. In these circumstances, the equilibrium which emerges is one in which investors are segmented and specialise in different tax (and country) preferred assets. Indeed, unless the tax parameters and exchange rate changes are correctly aligned, Gordon concludes that foreign securities are generally the tax preferred asset.

The second set of elements affecting the determination of the international equilibrium concerns the group of domestic or foreign investors carrying out the arbitrage between domestic and foreign interest rates across countries. Expression (8) assumes implicitly that this is done by individual investors; however, in all likelihood this arbitrage will be carried out by companies taxed at a rate τ which differs from that on interest earnings of the personal sector. Furthermore, even amongst individual investors the values of m and z may differ widely. For example, in the United States and the United Kingdom pension funds are not taxed domestically and are therefore very responsive to the level of foreign withholding taxes.

(b) In expression (7) the value of i^k — which can be interpreted as the world interest rate — is assumed as fixed and, given a value of $\hat{e}^j_k$, it is possible to determine i^j. However, this small country assumption is unsatisfactory for most of the countries being considered in this paper because of their size and be-

[16] *To put this conclusion somewhat differently, if domestic interest rates are determined by the behaviour of foreign investors (expression 10b), for specific constellations of interest and exchange rates domestic investors would have incentives to borrow without limit in the international capital market to buy up domestic bonds. See Sorensen (1986) for similar arguments.*

Table 6. Taxation of foreign exchange gains and losses in selected countries.

	Assets		Liabilities	
	Short term	Long term	Short term	Long term
Belgium	I—R[1]	I—R[1]	I—R[1]	I—R[1]
Canada	I—A[2]	C—R	I—A[2]	C—R
France	I—A	I—A	I—A	I—A
Germany	I—R[1]	I—R[1]	I—R[1]	I—R[1]
Italy	I—R	I—R	I—R	I—R
Japan	I—R	I—R	I—R	I—R
Netherlands	I—R[1]	I—R[1]	I—R[1]	I—R[1]
United Kingdom	I—R	E[3]	I—R	E
United States	I—R	C—R	I—R	C—R

Note: A — treated on accrual basis; R — treated on realisation; I — taxed or relieved as ordinary income; C — taxed or relieved as capital gains; E — excluded from tax treatment. Definitions of short term or long term may differ. In Canada, for example, the distinction is based on whether the gain or loss on foreign exchange was associated with a purchase or sale of a *capital asset.*

[1] Unrealised losses deductible; realised gains may be deferred.

[2] The tax authorities permit the reporting of short-term gains and losses on a realisation basis. The tax treatment must be consistent over time.

[3] Taxable as capital gains if equity, »debt on a security», bank deposit (Capital Gains Tax Act 1979 s. 135) or cash.

Source: Alworth (1987b).

cause of the considerable interaction between their financial markets.

Intuitively, the value of the world interest rate could be determined as an average of domestic interest rates ($\Sigma_j \alpha_j i^j$), weighted by the relative importance (α_j) of individual countries in international financial markets. Under conditions of uncertainty Solnik (1973) derived such weights explicitly for the international equivalent of the capital asset pricing model. In his model world interest rates depended on national wealth, net investment abroad, the co-variance of exchange rates and the degree of risk tolerance of investors. Because of open interest parity and complete certainty, in Section 3 of this paper we have neglected risk aversion and the co-variance of exchange rates in modelling world interest rates. Two alternative weighting schemes have been used as proxies for national wealth and the foreign investment position. GNP has been used as the closest approximation to the relative value national wealth, whereas gross foreign investments of the private sector have been taken as a mixed measure of wealth and foreign presence.[17]

[17] *The values of the weights employed in the simulations of Section 3 are available on request from the authors.*

(c) As shown in Table 6, the tax treatment of foreign exchange gains and losses differs markedly across countries and is very complex because it often relies heavily on case law. There is also no evidence of the revenue implications of these provisions. Therefore in the empirical section of this paper we have abstained from calculating any value for z^j_k from existing tax laws.

In addition to these implications for capital market equilibrium, the tax treatment of foreign exchange gains and losses enters into the returns to savers in country k (s^j_k) unless purchasing power parity adjustments are made. Accordingly, expression (1) becomes:

$$s^j_k = (1 - m^j_k)\, i^j + (1 - z^j_k)\, \hat{e}^j_k - w^j_k$$

or $$s^j_k = (1 - m^j_k)\, i^j - \hat{e}^j_k - w^j_k$$

where w^j_k is the wealth tax in country k on investments in country j.

3. *Empirical results*

Using the methods described above, we now turn to various empirical simulations which were carried out to assess the impact of capi-

Table 7. Effective tax rates for each country under the existing tas system (end-1986) fixed-p case.

0 per cent inflation

	Belgium	France	Germany	Italy	Nether-lands	United Kingdom
Asset						
Machinery	18	32	26	−13	− 1	17
Buildings	23	47	44	− 7	26	34
Inventories	41	53	47	36	52	38
Industry						
Manufacturing	25	41	37	3	19	22
Other industry	24	36	46	− 1	16	33
Commerce	29	44	39	3	24	36
Source of finance						
Debt	5	29	− 0	−28	1	12
New share issues	53	54	59	36	52	25
Retained earnings	36	22	67	18	31	31
Owner						
Households	30	54	54	6	38	42
Tax-exempt institutions	23	29	7	6	−23	8
Insurance companies	12	22	2	−24	2	25
Overall	26	41	37	2	19	27

10 per cent inflation

	Belgium	France	Germany	Italy	Nether-lands	United Kingdom
Asset						
Machinery	37	90	34	4	15	58
Buildings	31	93	33	1	30	72
Inventories	34	79	24	27	32	61
Industry						
Manufacturing	34	89	31	10	24	59
Other industry	33	90	51	7	24	72
Commerce	36	89	23	9	24	69
Source of finance						
Debt	−12	67	−58	−50	−13	39
New share issues	94	113	79	75	93	62
Retained earnings	58	93	102	41	49	70
Owner						
Households	44	113	71	17	61	91
Tax-exempt institutions	28	70	−39	16	−59	27
Insurance companies	3	57	−62	−42	− 6	60
Overall	34	89	31	9	24	63

tal mobility on effective tax rates for the principal EC countries. The study is limited to the effective tax rates within each single country as in King and Fullerton, and not for the full range of possible combinations of countries and investors. Effective tax rates are computed for the same 81 investments as in King and Fullerton with the major effect of »openness» being that of altering the value of interest rates faced by domestic savers and investors. Hence no measure of the effective tax rates on cross-border investments is provided.[18]

[18] *For such estimates in the case of direct investment see Alworth (1987b).*

Table 8. Effective tax rates under the existing tax system (end-1986) fixed-r case.

0 per cent inflation

	Belgium	France	Germany	Italy	Nether-lands	United Kingdom
Asset						
Machinery	—12	21	52	—413	—176	13
Buildings	14	59	55	—48	33	52
Inventories	43	59	65	37	48	39
Industry						
Manufacturing	17	46	57	—37	10	29
Other industry	13	35	61	—50	5	38
Commerce	24	52	57	—24	26	46
Source of finance						
Debt	—12	37	14	—103	—21	23
New share issues	52	58	69	24	53	33
Retained earnings	—28	47	73	—13	26	39
Owner						
Households	23	67	69	—31	39	50
Tax-exempt institutions	14	29	33	—30	—51	19
Insurance companies	1	21	30	—77	—20	35
Overall	18	47	58	—36	12	36

10 per cent inflation

	Belgium	France	Germany	Italy	Nether-lands	United Kingdom
Asset						
Machinery	47	83	69	—17	20	67
Buildings	39	85	60	—10	48	74
Inventories	33	81	70	25	34	65
Industry						
Manufacturing	41	83	69	1	34	68
Other industry	41	83	73	— 3	35	72
Commerce	43	84	62	1	34	72
Source of finance						
Debt	—70	80	—238	—411	—100	62
New share issues	85	88	91	79	83	69
Retained earnings	66	83	94	52	60	71
Owner						
Households	59	102	94	18	89	95
Tax-exempt institutions	29	69	9	12	—123	39
Insurance companies	— 8	60	— 31	—129	—28	67
Overall	41	83	69	0	34	70

Before turning to the open economy it is useful to review briefly the value of effective tax rates for the closed economy under both the fixed-p and fixed-r cases. Table 7 reports the value of effective tax rates for the fixed-p case[19] at end-1986 under the assumptions of zero and 10 per cent inflation. As can be seen from the bottom line in the top and bottom panels, there were pronounced differences in the overall value of the effective tax rates across countries. Most of this variation does not result from differences in company tax rates or system of integration between the corporate and personal taxes. Rather, the dif-

[19] *p is assumed to equal 10 per cent.*

ferences are accounted for by varying types depreciation allowances, regional investment incentives, and other levies such as wealth taxes.[20]

As far as country rankings are concerned, at zero inflation the Italian tax system displays the lowest rates because of the generous system of depreciation allowances and investment incentives but also because of the low personal tax rates on interest income. By contrast, the French tax system is particularly onerous in view of high marginal personal tax rates. Inflation tends to widen the range of effective tax rates between the various countries (particularly between France and Italy) and across assets. Differences in effective tax rates on particular assets because of inflation result from the extent to which tax provisions allow implicitly for some form of adjustment against price movements. For example, the taxation of inventories is unaffected by inflation in countries having LIFO valuation methods. Another interesting finding is that in the case of Germany the overall effective tax rate declines with inflation. This is due essentially to the deductability of interest payments and of wealth taxes on debt finance, the benefit of which increases markedly with inflation.[21] Since debt finance accounts for a sizeable share of German firms' sources of finance these effects overwhelm the negative impact recorded for other sources of finance. In the case of the United Kingdom, which until 1984 was a low tax country because of the generous depreciation provisions and stock allowances, inflation increases effective tax rates quite markedly.

Table 8 reports similar computations for the fixed-r case. The numerical values of the effective tax rates differ from those shown in Table 7 although qualitatively the ranking of countries remains unchanged. In particular, under the fixed-r case in several instances the effective tax rates take on extreme values such as the case of Italy and the Netherlands for investments in machinery. In several cases not shown in this table these values were even more extreme for certain projects financed via debt.[22]

It is useful to examine the open economy implications for the fixed-p and fixed-r cases separately since each of these type of simulations can be used to answer different sets of questions in the presence of capital mobility. However, several common assumptions to both sets of simulations should be mentioned. Firstly, for lack of better information exchange rate gains and losses are assumed to be untaxed ($z_k^i = 0$). Secondly, it should be noted that in all the simulations we have assumed that US and Japanese investors take part in the European capital market and therefore affect the average values of interest rates. In the fixed p-case, however, these effects come only from the tax treatment of savings and do not take account of the effect on world interest rates coming from the tax treatment of companies in these two countries.[23] Finally, we have allowed for the foreign influence on domestic interest rates to occur only through the average values of taxes on cross-border transactions weighted by GNP as computed in Tables 3 and 4.

3.1 *Capital mobility and effective tax rates: the fixed-p case*

The fixed-p case assumes a uniform value of p across countries from which the value of the internal rate of return ρ is derived independently of financial markets and the degree of capital mobility. Figure 1 shows the different values of ρ for the EC countries against domestic rates of inflation. In the fixed-p case these lines can be interpreted as the highest cost of capital which firms are willing to pay for a given real marginal product. As can be seen from the graph the values of ρ are highest for Italian firms and rise by roughly 0.9 per cent for every percentage point increase in the rate of inflation. Similar behaviour with respect to changes in the rate of inflation occurs for Belgium and the Netherlands albeit at lower absolute values of ρ. For high taxed countries having the lowest values

[20] *See Alworth (1987a).*

[21] *This result contrasts markedly with that reported in King and Fullerton. The additional benefits from leverage due to the deductability of borrowings from wealth tax assessments was not considered in that study.*

[22] *See section 2.2 for a possible explanation of this result.*

[23] *It would, for example, not be possible to examine the impact of US tax changes with respect to depreciation allowances on interest rates in Europe. See Sinn (1985) for some conjectural exercises along these lines.*

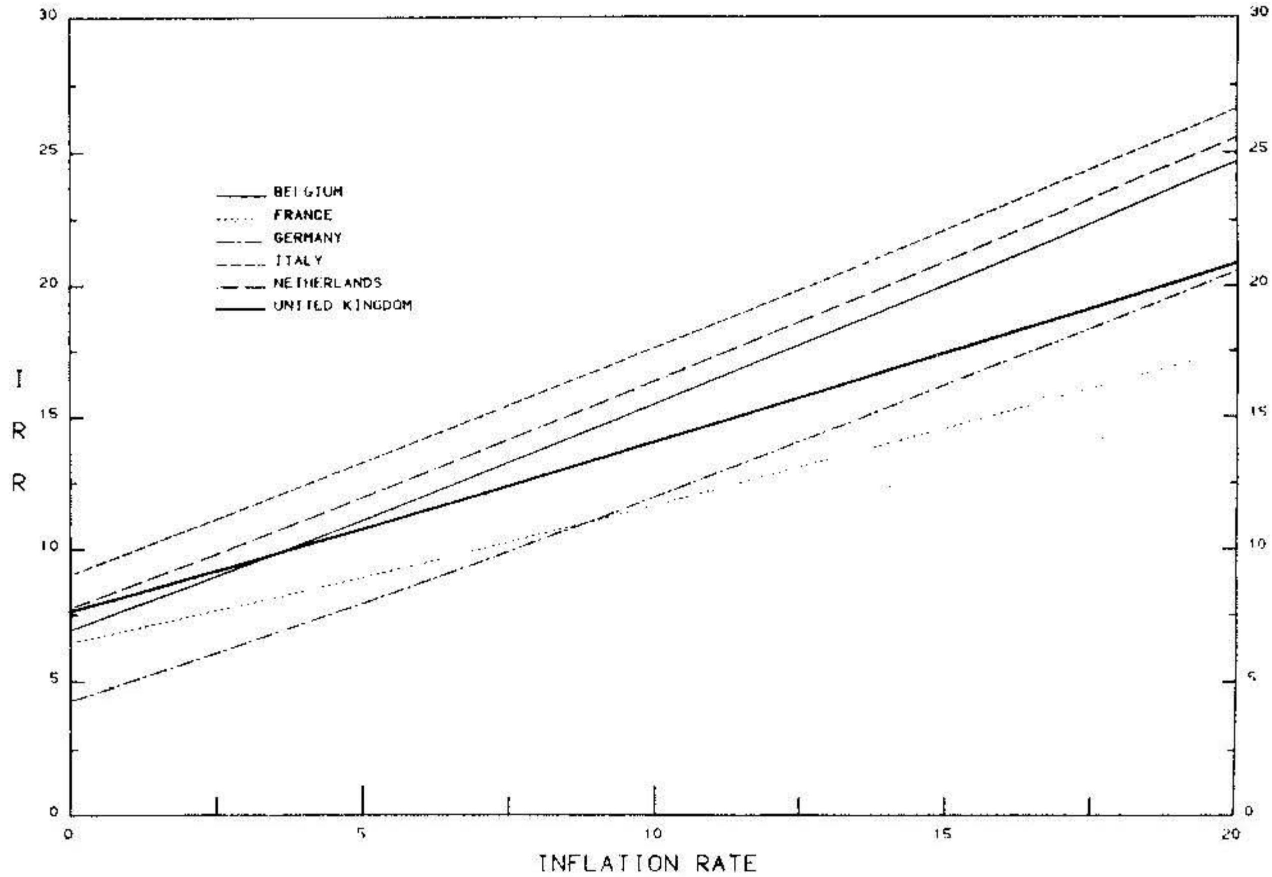

Fig. 1. Internal rate of return (IRR) at different inflation rates (weighted average for investments in all sectors).

of ρ the ranking changes with the rate of inflation. At low rates of inflation France has a higher value of ρ than Germany; however, as inflation rises, for Germany, ρ increases by nearly 0.9 for every percentage point change in inflation, whereas for France the value of ρ goes up comparatively slowly (only by .55 per cent.). These differing values of ρ in the fixed-ρ case which apply to both the closed and open economy provide us with the potential range of variation in interest rates coming from differences in tax systems applying to corporate income before firms face the financial markets.

In order to derive the values of effective tax rates in the open economy we need to take account of the constraints imposed by the existence of foreign shareholders and by the exchange rate on the value of i^j. For equity finance, the values of i^j in each country can be computed in a relatively straightforward fashion by inverting the values of expression (5) and (6), and by employing the average values of $(1-m^j_{bk})$ and $\Theta\,(1-m^j_{sk})$ shown in Tables 3 and 4. In the case of debt finance, however, the existence of foreign investors does not affect the value of i^j which is determined solely by the tax rate on corporate profits (expression 2). The computed values of i^j then enter into the returns to savings for domestic shareholders shown in expression (1). Thus, the impact on effective tax rates of moving to an open economy with full capital mobility results solely from the differences in the tax rates on equity finance for domestic investors and the weighted average of international investors.

Table 9 reports the *changes* in effective tax rates resulting from the assumption of an open economy. As can be seen from the table in the case of zero inflation the most significant effect of assuming capital mobility is that the range of differences across countries narrows significantly. This result is what would be expected and is implicitly built into the model since the confluence of investors into a uni-

Table 9. Effective tax rates assuming full capital mobility minus effective tax rates assuming no capital mobility fixed-p case.

0 per cent domestic inflation and 0 per cent world inflation

	Belgium	France	Germany	Italy	Nether-lands	United Kingdom
Source of finance						
Debt	0	0	0	0	0	0
New share issues	6	—9	—7	10	2	2
Retained earnings	27	38	—9	43	30	2
Overall	16	13	—5	19	15	2

10 per cent domestic inflation and 10 per cent world inflation

	Belgium	France	Germany	Italy	Nether-lands	United Kingdom
Source of finance						
Debt	0	0	0	0	0	0
New share issues	26	11	3	29	14	12
Retained earnings	60	40	—29	69	63	7
Overall	33	24	—12	43	33	7

que market tends to reduce relative variations of alternative financial policies across countries.

Although Italy remains the country with the lowest overall effective tax rate, on average the rates increase by 19 per cent and in the case of retained earnings the increase is even larger (43 per cent.). At the other extreme, Germany actually displays a reduction in marginal effective tax rates. The reason for the differences between the closed and open economy simulations result from the after tax relative valuations placed by domestic and international shareholders on streams of income, i.e. m^j_{bk}, m^j_{sk} and Θ^j_k are not equal to their domestic equivalents. In a closed economy these relative valuations are determined by the rates of tax on personal income in individual countries. In an open economy they depend in an intricate fashion on withholding taxes in the capital importing country, on the rate of personal income taxes in the capital exporting countries, and on the relative weight of each economy in the world. Moreover, these differences are not simply the result of aggregating marginal personal tax rates across countries since the tax treatment of foreign source income may differ very markedly from that which applies to domestic income. It is, therefore, not possible to make a one-for-one correspondence between the burden of domestic taxes appropriately weighted by GNP and that which applies to foreign investment.

Turning to the lower panel of Table 9, with domestic and world inflation rates of 10 per cent in most instances the convergence of effective tax rates is even more striking. However, in the case of Germany, capital mobility has the effect of raising nominal interest rates received by final shareholders above the level which would exist in the absence of capital mobility and thereby to reduce effective tax rates.

3.2 *Capital mobility and effective tax rates: the fixed-r case*

In the fixed-r case it is possible to allow for a greater number of effects deriving from capital mobility on the determination of domestic interest rates than the fixed-p case is capable of capturing. Firstly, interest rates across countries are linked through open interest parity (expression (9)). It is therefore possible to consider the effect of openness on all forms of finance. Secondly, it is possible to derive a single world nominal interest rate i^* given by the weighted average of domestic inflation rates adjusted by the weighted

Table 10. Effective tax rates assuming full capital mobility minus effective tax rates assuming no capital mobility fixed-r case.

0 per cent domestic inflation and 0 per cent world inflation

	Belgium	France	Germany	Italy	Nether-lands	United Kingdom
Source of finance						
Debt	0	0	0	0	0	0
New share issues	11	4	—1	26	9	22
Retained earnings	10	9	4	24	8	—10
Overall	9	7	4	22	8	— 5

10 per cent domestic inflation and 10 per cent world inflation

	Belgium	France	Germany	Italy	Nether-lands	United Kingdom
Source of finance						
Debt	—	19	—	—	—78	1
New share issues	10	10	14	17	17	5
Retained earnings	21	14	8	36	13	13
Overall	—24	14	16	45	17	—2

— = undefined.

average of marginal personal tax rates as follows:

$$i^* = \bar{r} + \frac{\Sigma \alpha_j \pi^j}{1 - \Sigma \alpha_j m^j_{bk}}$$

where $\Sigma \alpha_j m^j_{bk}$ refers to the worldwide GNP-weighted average personal tax rate on bonds[24] and $\bar{r}$ (= .05) is the after-tax real interest rate. The values of nominal interest rates in individual countries are linked to this world interest rate according to expression (9). Finally, it is possible to examine the impact of having different rates of inflation across countries on the measurement of effective tax rates.

Table 10 displays the *difference* between the simulations shown in Table 8 and the new simulations carried out assuming capital mobility. With zero inflation the findings confirm our previous results that capital mobility brings about convergence of effective tax rates across countries and at the same time raises their value. The lower panel for an inflation rate of 10 per cent at home and abroad displays somewhat different findings from the fixed-p case. These differences result to a large extent from the extreme values taken in the case of Belgium, Germany and Italy by some debt financed investments. As already noted in King and Fullerton this occurs because the advantages of debt finance are so great that the revenue generated by a project need not cover even depreciation costs to produce the stimulated rate of return. Very low and possibly negative real rates of return (net of depreciation) may be consistent with equilibrium in the capital market with investors earning positive real returns on their savings.

A special set of simulations were carried out for the fixed-r case to examine the effects of having significant inflation differentials between the domestic economy and the »rest of the world». The results shown in Table 11 suggest that the rate of domestic inflation is the main determinant of the rate of effective tax rates for these countries.

4. Conclusions

During the 1960s, much attention was paid to devising systems of commodity taxes which

[24] *The value of $\bar{r}$, the real after tax interest rate, is taken as fixed and exogenous.*

Table 11. Effective tax rates assuming full capital mobility minus effective tax rates assuming no capital mobility fixed-r case.

0 per cent domestic inflation and 0 per cent world inflation

	Belgium	France	Germany	Italy	Nether-lands	United Kingdom
Source of finance						
Debt	—3	0	0	—13	1	0
New share issues	10	4	—1	25	9	6
Retained earnings	9	9	4	19	8	—7
Overall	7	7	3	17	8	—5

10 per cent domestic inflation and 10 per cent world inflation

	Belgium	France	Germany	Italy	Nether-lands	United Kingdom
Source of finance						
Debt	—78	19	—	—	—93	1
New share issues	9	10	14	16	8	5
Retained earnings	18	14	8	32	14	—3
Overall	21	14	16	43	17	—2

— = undefined.

would be non-distortionary with respect to trade, which at the time was expanding very rapidly. The EC countries went further and established a significant degree of harmonisation by adopting a value added tax based on a destination principle. The growth of capital movements and deregulation of financial markets in the eighties is of equal importance to the opening up of trade during the postwar period and raises similar questions for tax policy.

Most of the discussions regarding international comparisons of tax burdens on savings and investment have focused attention on the taxation of corporate entities and on the personal tax treatment of savings. These are indeed the areas in which it is likely that agreement across countries can be easily reached with respect to some broad form of tax harmonisation. They are also the most visible types of taxes. It is a merit of the King-Fullerton study to have extended the cross country comparison to include local taxes as well as wealth taxes. However, even that study has assumed a closed economy and this might have seriously biased upward the actual extent of cross-country differences. Indeed, King and Fullerton concluded that there were major differences in effective tax rates across countries.[25] This paper extends their findings to an open economy in an attempt to examine some of the possible implications of operating widely divergent tax systems within a highly integrated capital market.

The principal conclusion that can be derived from the simulations carried out in section 3 is that the existence of an international capital market tends to reduce differences in effective tax rates across countries resulting from the tax treatment of alternative types of savings and investment. Differences, however, do remain and may be the source of competitive inequalities.

Another finding which needs to be examined more closely is that capital mobility, under the existing tax systems and types of double taxation agreements, tends to raise effective tax rates. This result is probably a reflection of our literal interpretation of existing tax provisions rather than of the reality of the tax treatment of international flows of funds. In-

[25] *Another problem with assessing the results of King and Fullerton resides in other differences across countries. Some result from the interaction of the macro-economy with tax rules which are not fully captured in King and Fullerton, such as the phenomenon of tax exhaustion; others, from differences in the character of the provision of public goods.*

dividual investors often shelter their income from foreign investments in tax havens with a favourable tax climate or undertake transactions which transform a high taxed stream of income into another having a lower rate. These factors cannot be captured in our model.

It is clear that as we develop our model, it will be possible to subject the numerous other questions. In particular, it should be possible to examine the impact on our results of assuming varying degrees of openness to external shocks. In particular it should be possible to report the effects of tax reforms such as those recently carried out in the United States on effective tax rates in Europe and to examine some of the hypotheses put forward in Sinn (1985).

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