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Factor Taxation, Income Distribution and Capital Market Integration

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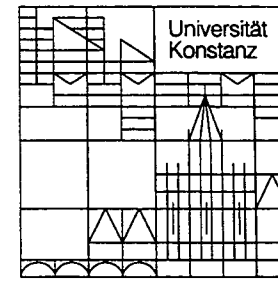

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Abstract

The paper analyzes the optimal mix of capital and wage taxation when policymakers maximize the political support of workers and capitalists, subject to a fixed revenue requirement. Capital market integration increases the efficiency costs of a tax on capital but simultaneously changes the political equilibrium through its effect on the distribution of factor incomes. These distributional effects are directly opposed in the capital importing and the capital exporting region. While the capital tax rate will always be lowered in the capital importing region, the tax rate in the exporting country will rise when the political resistance to market-induced changes in the distribution of income is sufficiently high.

JEL classification: H21, H22, F15, D33

Key words: capital tax competition, income distribution

1 Introduction

Given the rapid integration of world capital markets, and the expected fierce competition for internationally mobile capital, there has been surprisingly little change in the overall tax treatment of capital income since the 1980s. While many countries have reduced statutory tax rates on corporate and private capital income, tax bases have been broadened simultaneously, leading only to a very moderate drop in effective capital tax rates for the OECD average. Furthermore, there is no clear evidence that corporate taxes have converged in this time period as a result of market forces. For the European Union, the Ruding report (Commission of the European Communities 1992, p. 12) summarizes that most of the observed convergence "(...) was attributable to downward convergence of interest and inflation rates rather than deliberate action on the part of tax authorities". Controlling for these factors, the cost of capital has actually risen in a number of EU countries such as Denmark, Italy, the Netherlands, Spain, and the United Kingdom (1992, Table 8.19). A recent update that also incorporates other taxes (Commission of the European Communities 1996) shows a somewhat clearer shift from capital to labour taxation in the EU average, but also confirms the exceptions to this general trend.

These mixed empirical findings contrast with the strong result of economic theory that it is optimal for small countries to completely exempt capital income from tax, if the residence principle cannot be effectively enforced worldwide and if capital is perfectly mobile internationally (Gordon 1986, Razin and Sadka 1991, Bucovetsky and Wilson 1991). The conflict is only partially resolved by empirical studies that find a relatively low degree of international capital mobility (see Gordon and Bovenberg 1994). While this may explain why capital taxes do not fall to zero, one would still expect an unambiguous downward trend in tax rates as market integration proceeds. This applies in particular in Europe where most obstacles to international capital flows have been removed as part of the internal market program and where the scheduled monetary union is expected to further lower the extra costs and risks associated with international investments.[1]

Most of the literature on capital tax competition has, however, focused on one-consumer models in which the representative agent owns all factors of production. One possible explanation for the observed rigidity of tax rates on capital may therefore be a distributional motive. Persson and Tabellini (1992) use an endowment model where a positive tax rate on capital is levied for redistributive purposes, the median voter being in favour of income redistribution via this tax. In their model, the voting majority anticipates a process of downward tax competition and thus elects a more redistributive government to partly offset its effects. Nevertheless, the model still predicts a general reduction in the

[1] Other arguments for positive source taxes on capital have also been advanced in the literature. These include the role of corporate income taxes as a backstop for wage taxation (Gordon and MacKie Mason 1994), and as an indirect way of taxing pure profits (Huizinga and Nielsen 1996a).

level of capital taxation as a result of closer capital market integration, and a convergence of tax rates between different countries.

The interaction between efficiency and distributional aspects of capital taxation has also been taken up in some recent studies by Bjerksund and Schjelderup (1995), Huizinga and Nielsen (1996b) and Lopez, Marchand and Pestieau (1996). However, none of these papers analyses the effects of closer capital market integration and thus there is no theoretical model so far which can explain the divergent developments in capital taxation observed during the last decade.

The present paper contributes to this still new field of research by analyzing the effects of capital market integration in a two-country, two-class model of capital tax competition. Our model differs from the Persson and Tabellini analysis in two main respects. First, production is modelled explicitly and governments solve a conventional optimal tax problem, choosing between a wage tax and a source tax on capital in order to meet a fixed revenue constraint. This setup allows to compare the results of our analysis directly with those obtained in representative-agent models when the government has multiple tax instruments at its disposal. Second, and more important for our central result, we employ an alternative model of the political equilibrium by assuming that the government maximizes a political support function where workers and capitalists are the only two interest groups.

In this model, the effects of capital market integration on the distribution of factor incomes are exactly opposed for the capital exporter and the capital importer. We show that, in contrast to the findings by Persson and Tabellini, distributional effects may then lead to a capital tax increase in the exporting country, and to diverging rates of capital taxation. We also compare this pattern of results with some new findings in the parallel literature on tax-financed social insurance schemes (Lejour and Verbon 1996, Gabszewicz and van Ypersele 1996) and argue that this comparison suggests a more general difference between median-voter and interest-group models in assessing the effects of increased factor market integration.

The remainder of this paper is set up as follows: section 2 describes the model and the optimal tax problem faced by each country's government. The properties of the Nash equilibrium in capital tax rates are analyzed in section 3. The main results of the paper are in section 4, which derives the effects of capital market integration on optimal tax policy in each of the trading countries. Section 5 concludes.

2 The Model

The analysis is based on a static model of capital tax competition between two countries which produce a homogeneous output good using internationally mobile capital and internationally immobile labour. This model is extended to allow for mobility costs and

we distinguish between two income groups, workers and capitalists, in each country. Individuals in each group are homogeneous and workers supply only labour whereas capital owners do not work.[2] Countries are endowed with fixed amounts of labour and capital. All endowments are normalized to unity and hence are equal across countries.

Governments have two tax instruments at their disposal, a wage tax and a source tax on capital. The incorporation of residence-based taxes on capital (i.e., taxes on savings) would require a two-period framework and is thus excluded in the present analysis. This can be justified by arguing that there is no international cooperation to report foreign earnings to the investor's country of residence. Therefore, residence-based taxes can always be fully evaded and taxation at source represents the only way of taxing capital income. In the following, we first describe the production relationships and international arbitrage in the capital market and then turn to the optimal tax problem faced by each country's government.

A standard assumption in the literature on capital tax competition is that production functions are identical across countries. Furthermore, in the present context there is little to be gained from generality with respect to the underlying production structure. Following Bucovetsky (1991) we therefore assume a quadratic technology, which leads to several convenient simplifications and allows us to focus more closely on the issues specific to the present two-class model. Denoting countries by subscripted numbers $i \in \{1, 2\}$, these assumptions imply

$$f(k_i, 1) = (a - b\,k_i)\;k_i \quad \forall\; i \;\in \{1, 2\}, \qquad a > 0,\;\; b > 0,$$

where the input of labour is fixed at unity and k_i is the amount of capital used in each region (and is equal to the capital-labour ratio). Assuming that the technology parameter a is sufficiently large, relative to b, the quadratic production function exhibits the usual property of a positive but falling marginal productivity of capital

$$f' = a - 2bk_i > 0, \qquad f'' = -2b < 0. \tag{1}$$

With the capital endowment of each country normalized to one, the full employment condition for this factor is

$$k_1 + k_2 = 2. \tag{2}$$

Capital exports are subject to convex transaction costs, which reflect all extra complications of foreign operations such as additional information requirements or differing regulations across countries. These transaction costs are required for our analysis of the

[2]Taken literally, this rigid class structure is clearly not justified from an empirical perspective, nor from a lifecycle savings approach. However, all that is needed in our model is that, for example, a labour tax falls relatively more on one income group ("the poor") than on the other ("the rich"). Assuming that the second group earns no labour income at all is then merely a simplifying device that does not affect any of our results.

effects of capital market integration, which will be modelled as an exogenous decrease in the extra costs of foreign investment. Again, a convenient and frequently used specification is that transaction costs ϕ are quadratic in the volume of foreign investment

$$\phi = \frac{1}{2}\beta(1-k_i)^2, \qquad \beta > 0, \tag{3}$$

where we assume that the transaction cost function is identical for both countries (since ϕ is not indexed) and $(1-k_i)$ are the capital exports of country i. By equating gross and net trade flows, this specification implies that capital flows only in one direction in equilibrium. The derivatives of (3) with respect to $(1-k_i)$ are

$$\phi' = \beta(1-k_i), \qquad \phi'' = \beta. \tag{4}$$

Arbitrage by capitalists ensures that international differences in the net-of-tax return to capital must be equal to the marginal transaction costs incurred in equilibrium. Assuming for simplicity that the tax rates on capital, t_i, are unit taxes[3], the arbitrage condition is

$$f\prime(k_i) - t_i = f\prime(k_j) - t_j - \beta(1-k_i) \quad \forall\, i,j \in \{1,2\},\ i \neq j. \tag{5}$$

When country i is the capital exporter, $f'(k_j) - t_j > f'(k_i) - t_i$ must hold in the trade equilibrium. It then follows from the assumption of equal endowments and technologies and the falling marginal productivity of capital that the country with the higher tax rate on capital must always be the capital exporter in the present analysis.

From the capital market clearing condition (2) and the arbitrage condition (5), the capital employment in each region can be determined as a function of the two tax rates, the technology constant b, and the transaction cost parameter β. Using (1) gives after straightforward manipulations

$$k_i(t_i, t_j, \beta) = 1 - \frac{(t_i - t_j)}{4b+\beta} \qquad \forall\, i,j \in \{1,2\},\ i \neq j, \tag{6}$$

with first- and second-order derivatives

$$\frac{\partial k_i}{\partial t_i} = \frac{-1}{4b+\beta} < 0, \quad \frac{\partial k_i}{\partial t_j} = \frac{1}{4b+\beta} > 0, \quad \frac{\partial k_i}{\partial \beta} = \frac{(t_i - t_j)}{(4b+\beta)^2} \gtrless 0 \text{ if } t_i \gtrless t_j,$$

$$\frac{\partial^2 k_i}{\partial t_i\, \partial \beta} = \frac{1}{(4b+\beta)^2} > 0, \quad \frac{\partial^2 k_i}{\partial t_j\, \partial \beta} = \frac{-1}{(4b+\beta)^2} < 0. \tag{7}$$

In each country i, an increase in the domestic capital tax rate t_i causes a capital outflow and reduces the amount of capital employed in this country, whereas an increase in the foreign country's tax rate t_j has the opposite effect. An increase in the transaction cost parameter β reduces capital flows for any given tax differential; this increases the capital stock in the capital exporting region and decreases it in the capital importing region.

[3]This implies that transaction costs are not deductible from the capital tax base.

We assume that governments in both regions face a fixed, non-negative revenue constraint $g_i = \bar{g}_i$ and have two tax instruments at their disposal. These are the unit tax on capital (t_i) and a tax on wages (τ_i). Either of the two taxes (but not both) can be negative, as long as the overall revenue requirement is met. Since labour supply in each country is fixed and labour is immobile across countries, the wage tax represents a lump-sum instrument in the present model. To determine the optimal mix of tax rates (t_i, τ_i) we first derive the comparative static effects of each tax on the consumption levels of workers (denoted by a superscript L) and capitalists (superscript K). Using (1) the workers' budget constraint in each country is given by

$$c_i^L = f(k_i, 1) - f\prime(k_i)\, k_i - \tau_i = b\, k_i^2 - \tau_i \quad \forall\, i \in \{1, 2\}. \tag{8}$$

The income of capitalists must be determined separately for the two countries if mobility costs are present. Capitalists in the exporting state own some assets in both jurisdictions whereas capitalists in the importing country invest everything at home. Let us assume – exogenously, for the moment – that country 1 is the capital exporter whenever capital flows occur in equilibrium.[4] Thus $1 - k_1 \geq 0$ and $1 - k_2 \leq 0$. We also assume that all transaction costs ϕ [eq. (3)] must be borne by the capital exporter. Then the net income of capitalists in the two countries is

$$\begin{aligned} c_1^K &= k_1 \left[f\prime\left(k_1\right) - t_1\right] + \left(1 - k_1\right)\left[f\prime\left(k_2\right) - t_2\right] - \phi\,, \\ c_2^K &= 1[f\prime\left(k_2\right) - t_2]. \end{aligned} \tag{9}$$

The effects of the labour tax on the feasible consumption levels of workers and capitalists are determined by differentiating (8) and (9) with respect to τ_i. This yields

$$\frac{\partial c_i^L}{\partial \tau_i} = -1 \quad \forall\, i \in \{1, 2\}, \tag{10}$$

$$\frac{\partial c_i^K}{\partial \tau_i} = 0 \quad \forall\, i \in \{1, 2\}. \tag{11}$$

Since labour supply is fixed, the wage tax falls exclusively on labour and leads to a one-to-one reduction in the net wage while capital income remains unaffected.

Similarly, the effects of the capital tax are obtained by differentiating (8) and (9) with respect to t_i. These effects differ for the capital exporter (country 1) and the capital

[4] In section 3, we will *derive* this equilibrium from differences in the political weights of workers in the two countries.

importer (country 2). Substituting in for the derivatives $\partial k_i/\partial t_i$ using (7) gives[5]

$$\frac{\partial c_i^L}{\partial t_i} = \frac{-2bk_i}{4b+\beta} < 0 \quad \forall\, i \in \{1,2\}, \tag{12}$$

$$\frac{\partial c_1^K}{\partial t_1} = \frac{-2b - k_1\,\beta}{4b+\beta} < 0, \qquad \frac{\partial c_2^K}{\partial t_2} = \frac{-2b-\beta}{4b+\beta} < 0. \tag{13}$$

In each country, the imposition of a capital tax is borne jointly by capitalists and workers. The tax reduces wage income by lowering the capital-labour ratio and hence the marginal productivity of labour in the taxing jurisdiction. The net return to capital must also fall in both regions. For the capital exporter, this applies even if all capital is invested abroad since the tax reduces world demand for this factor. Note finally that the two equations in (13) coincide when the transaction cost parameter β is zero, or when the equilibrium is symmetric and $k_1 = k_2 = 1$.

We can now turn to the constrained optimization problem faced by the two regions. Each government maximizes a function $\Pi_i[u_i^L(c_i^L), u_i^K(c_i^K)]$ that depends positively on the utilities of both classes, which in turn are exclusively determined by the consumption levels (or net factor incomes) of each group. In principle, this function can be viewed either as a social welfare function or as a political support function. We adopt the latter interpretation here in order to link our analysis more closely to the recent literature on the political economy of taxation and social insurance under conditions of increasing factor market integration. Budget balance in each country requires $\bar{g}_i = \tau_i + t_i\, k_i$, leading to the Lagrangians

$$\mathcal{L}_i = \Pi_i[u_i^L(c_i^L), u_i^K(c_i^K)] + \lambda_i(\tau_i + t_i\, k_i - \bar{g}_i) \quad \forall\, i \in \{1,2\}. \tag{14}$$

Differentiating with respect to τ_i and substituting in from (10) and (11) gives the first-order condition for the wage tax

$$\frac{\partial \mathcal{L}_i}{\partial \tau_i} = -\frac{\partial \Pi_i}{\partial u_i^L}\,\frac{\partial u_i^L}{\partial c_i^L} + \lambda_i = 0 \quad \forall\, i \in \{1,2\}. \tag{15}$$

Thus the Lagrange parameter λ_i is simply the marginal political support that policymakers derive from an increase in labour income. This is intuitive since the Lagrange parameter gives the shadow price of public revenues and the wage tax offers an instrument to transfer one unit of income from workers to the government.

[5]For capitalists in country 1, the effects of a change in t_1 can be simplified using the arbitrage condition (5). This yields in a first step

$$\frac{\partial c_1^K}{\partial t_1} = k_1\left[-2b\,\frac{\partial k_1}{\partial t_1} - 1\right] + (1-k_1)\left[-2b\,\frac{\partial k_2}{\partial t_1}\right].$$

Substituting in from (1) and (7) gives the first equation in (13).

The first-order condition for the optimal use of the capital tax is derived analogously. Differentiating (14) with respect to t_i gives

$$\frac{\partial \mathcal{L}_i}{\partial t_i} = \frac{\partial \Pi_i}{\partial u_i^L} \frac{\partial u_i^L}{\partial c_i^L} \frac{\partial c_i^L}{\partial t_i} + \frac{\partial \Pi_i}{\partial u_i^K} \frac{\partial u_i^K}{\partial c_i^K} \frac{\partial c_i^K}{\partial t_i} + \lambda_i \left(k_i - t_i \frac{\partial k_i}{\partial t_i} \right) = 0 \quad \forall \quad i \in \{1, 2\}. \tag{16}$$

In the following analysis, it will be useful to specify the political support function Π_i in more detail. A frequently used formulation is that political support is a weighted average of the utility levels attained by different income groups, and the utility of each group is a concave function of its own level of income (cf. Peltzman 1976, Hillman 1982). In the present model this implies $\partial \Pi_i / \partial u_i^L = s_i^L$ and $\partial \Pi_i / \partial u_i^K = s_i^K$, where s_i^L and s_i^K represent exogenous political weights of workers and capitalists which may, for example, indicate the size of the two groups. The falling marginal utility of income is represented by a modified CES function of the form

$$\Pi_i = s_i^L \cdot (c_i^L)^\rho + s_i^K \cdot (c_i^K)^\rho \quad \forall \quad i \in \{1, 2\}, \quad 1 \geq \rho > -\infty. \tag{17}$$

This specification allows us to clearly distinguish between the political weights s_i^L and s_i^K and the elasticity parameter ρ, which is assumed to be equal across countries. The lower is ρ, the more concave is the utility function of each group, and the more difficult is it to substitute political support from workers for that of capitalists and vice versa. The marginal political impact of each income group is thus determined jointly by this group's exogenous political weight, its income level, and the elasticity ρ.

Next, we introduce the government's marginal rate of substitution between the support from workers and capitalists. Differentiating (17) with respect to the consumption levels of both income groups, this is given by

$$m_i(c_i^L, c_i^K) \equiv \frac{\partial \Pi_i / \partial c_i^K}{\partial \Pi_i / \partial c_i^L} = \frac{s_i^K}{s_i^L} \left(\frac{c_i^K}{c_i^L} \right)^{\rho - 1} \quad \forall \, i \in \{1, 2\}. \tag{18}$$

Country-specific first-order conditions for the capital tax are obtained by inserting the partial derivatives from (7), (12) and (13) into (16). Furthermore, we can substitute out for λ_i using (15) and multiply through by $(4b + \beta)/(\partial \Pi_i / \partial c_i^L)$. The resulting, modified first-order conditions are denoted by F_i. Using (18) these are given by

$$F_1 \left(t_1, t_2, \beta \right) = (2b + \beta) \, k_1 - t_1 - m_1 \left(2b + \beta \, k_1 \right) = 0, \tag{19}$$

$$F_2 \left(t_1, t_2, \beta \right) = (2b + \beta) \, k_2 - t_2 - m_2 \left(2b + \beta \right) = 0. \tag{20}$$

The functions F_i in (19)–(20) depend on the capital tax rate of region j through the terms k_i [cf. eq. (6)] and represent best response functions for the capital exporter and the capital importer, respectively. Incorporated in each country's best response for the capital tax rate is the optimal adjustment of wage taxes in the political equilibrium.

3 Nash equilibrium

A general problem in models of tax competition is that reaction functions may not be continuous, and hence a Nash equilibrium may not exist. This problem has not attracted much attention in the literature on capital tax competition, where the continuity of reaction functions is simply assumed by most authors (e.g. Wilson 1991, p. 433). The literature on commodity tax competition has shown, however, that the issue becomes important in the presence of transaction costs, and a critical point occurs when countries switch from the high-tax to the low-tax regime. In a model of cross-border shopping with a general specification of transportation costs, Mintz and Tulkens (1986, Proposition 5) show that reaction functions cannot be continuous at the switch of regimes, and give sufficient conditions when a Nash equilibrium nevertheless exists. For this type of model, Haufler (1996, Proposition 1) shows that a necessary and sufficient condition for reaction functions to be continuous at the switch of regimes is that marginal transaction costs are zero for a zero level of cross-border shopping, and that the slopes of the two countries' marginal transaction cost functions are equal in this point.

These results carry over to the present analysis, where the transaction cost parameter β is identical across countries in eq. (3) and $\phi'(0) = 0$. Consequently, best response functions for the capital exporter and the capital importer are identical, except for the term k_1 in the last bracket of (19), which is not present in (20). But since this term will just be unity at the switch of regimes, best response functions coincide – and hence must be continuous – in this point.[6] The continuity of reaction functions implies, in particular, the existence of a symmetric Nash equilibrium when countries are identical in all respects. In the symmetric equilibrium $k_1 = k_2 = 1$ and (19)–(20) simultaneously reduce to

$$F_i = (2b + \beta)\,(1 - m_i) - t_i = 0 \quad \Leftrightarrow \quad (1 - m_i) = \frac{t_i}{2b + \beta} \quad \forall\, i \in \{1, 2\}. \tag{21}$$

In the symmetric case both countries choose a positive tax rate on capital if and only if the policymaker's marginal rate of substituting labour income for capital income is less than unity. In the second formulation of equation (21), the left-hand side gives the marginal gains from using the capital tax instrument, i.e., the increase in political support when one dollar of tax revenue is raised from capitalists as opposed to workers. On the right-hand side are the marginal revenue losses to the economy incurred by levying a tax on internationally mobile capital as opposed to internationally immobile labour. These losses are increasing in the equilibrium capital tax t_i, which gives the wedge between the social return to one unit of capital employed in the home country (the sum of tax revenues

[6] To show this rigorously, one would have to explicitly introduce different regimes, allowing each of the two countries to be either the exporter or the importer of capital. The additional notation involved in this procedure has been saved in the present analysis. The reader interested in this more detailed treatment is referred to Haufler (1996).

and the net return earned by capitalists) and the social return to one unit of capital invested abroad (which is only the net return to domestic investors). In the optimum, each government balances the marginal political gains and the marginal efficiency losses of using the capital tax instrument, as opposed to an exclusive reliance on wage taxation.

To link the condition for a positive capital tax rate to the values of exogenous model parameters we substitute (1), (8), (9) and (18) into (21) and note that $k_1 = k_2 = 1$ in the symmetric equilibrium. Furthermore we assume as a benchmark that the government revenue requirement is exclusively financed by the wage tax ($g_i = \tau_i$) and consider the value of m_i at this point. The results are summarized in

Proposition 1: *Capital tax rates in the symmetric Nash equilibrium are determined by*

$$t_i \gtreqless 0 \quad \Longleftrightarrow \quad \frac{s_i^L}{s_i^K}\left(\frac{a-2b}{b-g_i}\right)^{1-\rho} \gtreqless 1.$$

From Proposition 1, it is straightforward to identify the conditions for positive tax rates on capital in the non-cooperative equilibrium. Consider first the special case $\rho = 1$, which implies a constant marginal utility of income for each group. This isolates the role of the exogenous political weights s_i^L, s_i^K and the capital tax rate will be positive if and only if workers have the higher weight in each country's political support function. In the special case where the weights of both income groups are just equal (and $\rho = 1$ still holds), the politician simply maximizes national income and the optimal source tax on capital is zero. This result is well known for representative-agent models of small open economies under conditions of perfect capital mobility (Gordon 1986, Razin and Sadka 1991, Bucovetsky and Wilson 1991). In the present model, the result holds even for 'large' countries and imperfect capital mobility because of our simplifying assumption that the labour supply is fixed and the wage tax is a lump-sum instrument.

In the more general case $\rho < 1$, additional factors enter the analysis. A high marginal productivity of capital [a high value of $(a - 2b)$; cf. eq. (1)] lowers the marginal utility of income for capitalists and tends to increase the optimal tax rate on capital. Furthermore, a high government revenue requirement g_i will also tend to imply positive tax rates on capital since an exclusive financing by wage taxes reduces labour income and thus increases the marginal political impact of this group. Similar results are obtained by Huizinga and Nielsen (1996b), who show that an increase in the government revenue requirement raises the optimal tax rate on investment when it is not possible to increase non-distortive (profit) taxes that fall on the *same* income group.

In the following, we assume that exogenous model parameters are chosen such that capital tax rates are positive in the symmetric Nash equilibrium. The next step is to introduce an asymmetry between the trading countries. We focus on the case where the exogenous political weight of workers is higher in country 1 than in country 2. Starting

from the symmetric equilibrium, this is modelled by a small increase in s_1^L holding s_2^L constant. From (18) we have $\partial m_1/\partial s_1^L < 0$. From (21) it then follows that the impact effect of this shock is to raise the capital tax rate in country 1. However, the tax rate in country 2 may also rise in the new Nash equilibrium. Establishing that the tax increase in country 1 must dominate in the neighbourhood of a symmetric initial equilibrium requires either a stability argument or the assumption that the Nash equilibrium is unique. This is discussed in the appendix and the result is stated in

Proposition 2: *For small differences between the two countries, there exists a Nash equilibrium in which the country with the higher political weight of workers (country 1) levies the higher tax rate on capital.*

Proof: See the appendix.

Using Proposition 2 in the arbitrage condition (5) shows that the high-tax country must be the capital exporter when endowments and production functions are identical across countries. In this asymmetric Nash equilibrium country 1 thus exports capital to the low-tax region 2 and the pattern of trade flows postulated exogenously in our discussion above is now motivated by cross-country differences in the relative political influence of the two income groups. While our analysis neglects all other reasons for international trade, there are examples where tax changes have crucially influenced the trade pattern. One such case is the 1981 tax reform in the United States, which – through accelerated depreciation allowances – has at least contributed to the switch in the net trade position of this country in the early 1980s (cf. Sinn 1987, Ch. 7.4).

4 Capital Market Integration

Capital market integration is modelled as an exogenous reduction in the transaction cost parameter β. Since this change increases the elasticity of the capital tax base, it tends to raise the costs of capital taxation in both countries, relative to the non-distortive wage tax. A complication arises from terms of trade effects, which tend to increase the tax rate of the capital importing region and thus counteract the tax base externality in this country.[7] It will be seen, however, that the quadratic specification of the production and mobility cost functions in the present model ensures that tax base effects dominate terms of trade effects in both countries. In representative consumer models, the outcome of capital market integration will then be an unambiguous shift away from capital and towards wage

[7] From the perspective of the capital importing country the terms of trade are given by the net return, $f'(k_j) - t_j$, that must be paid to foreign investors. Hence any reduction in this net interest rate represents a terms of trade improvement. This gives an incentive to the capital importer (country 2) to increase the source tax t_2 and thus reduce its import demand for capital.

taxation.[8] The issue here is whether and how this result is modified when effects on the distribution of income within each country are also taken into account.

The importance of distributional effects for tax policy depends crucially on the degree to which losers from the process of capital market liberalization are able to exert political pressure in order to reverse the effects of market forces. This is captured by the parameter ρ in the political support function (17). A low level of this parameter ($\rho \to -\infty$) leads to a rigid ratio of net labour income to net capital income. This implies that losers from capital market liberalization will vigorously oppose the income loss suffered and the distributional effects of market integration will have strong repercussions on optimal tax policy. On the other hand, if ρ is high ($\rho \to 1$), then a given change in the distribution of income has only minor effects on the policymaker's marginal rate of substitution between the support from different income groups.

We first analyze the effects on workers' and capitalists' consumption in each country induced by changes in the foreign tax rate and the transaction cost parameter, respectively. With one exception, these effects are unambiguous and follow directly from the private budget constraints (8)–(9), the set of partial derivatives (7), and Proposition 2 (which implies $t_1 > t_2$):

$$\frac{\partial c_1^L}{\partial t_2} > 0, \quad \frac{\partial c_1^K}{\partial t_2} < 0, \quad \frac{\partial c_2^L}{\partial t_1} > 0, \quad \frac{\partial c_2^K}{\partial t_1} < 0, \tag{22}$$

$$\frac{\partial c_1^L}{\partial \beta} > 0, \quad \frac{\partial c_1^K}{\partial \beta} = 2b(1-2k_1)\frac{(t_1-t_2)}{(4b+\beta)^2} - \frac{1}{2}(1-k_1)^2 <> 0, \quad \frac{\partial c_2^L}{\partial \beta} < 0, \quad \frac{\partial c_2^K}{\partial \beta} > 0. \tag{23}$$

Turning first to the terms collected in (22), we see that the effects of a foreign tax change are symmetric in the two countries. An increase in country j's capital tax rate causes capital to flow to region i and benefits workers in region i while making capitalists worse off. On the other hand, it is seen from (23) that the direct effects of a *reduction* in β on the incomes of the two classes are almost completely opposed in the capital exporting and the capital importing region. At unchanged tax rates, liberalization increases country 1's capital exports to country 2 and this hurts workers in country 1 while workers benefit in country 2. Also, capitalists in country 2 are hurt by the capital inflow whereas capitalists in country 1 will gain if they are relatively more engaged in their country of residence ($1 - 2k_1 > 0$). Recalling from Proposition 2 that tax rates are 'not too different' in the asymmetric initial equilibrium, we will make this last assumption in the following. For easier reference in the following discussion, these effects are summarized in Table 1.

In both countries, the change in the optimal domestic tax rate on capital in response to the exogenous variation in the transaction cost parameter β is given by the following

[8] Bucovetsky and Wilson (1991, sec. 3) show, for example, that any increase in the number of (identical) countries engaged in tax competition will reduce the level of capital taxation at source, relative to the level of wage taxation. A related result is derived in Hoyt (1991). Increasing the number of regions in a model without mobility costs raises the elasticity of capital supply in a way that is very similar to the reduction of mobility costs in the present two-country framework.

Table 1: Effects of Capital Market Integration ($\beta \downarrow$)
on Income by Group

	capital exporter (country 1)	capital importer (country 2)
workers	$c_1^L \downarrow$	$c_2^L \uparrow$
capitalists	$c_1^K \uparrow$	$c_2^K \downarrow$

equation, which is derived in the appendix:

$$\frac{dt_i}{d\beta} = \frac{1}{|J|}\left[-\frac{\partial F_j}{\partial t_j}\frac{\partial F_i}{\partial \beta} + \frac{\partial F_i}{\partial t_j}\frac{\partial F_j}{\partial \beta}\right] \quad \forall \quad i,j \in \{1,2\},\ i \neq j. \tag{24}$$

It is also argued in the appendix [eq. (A.3)] that the determinant of the Jacobian matrix J must be positive. For each country i, there are two effects in equation (24): the first term gives the direct response of country i's optimal capital tax rate to the change in the transaction cost parameter, whereas the second effect describes country i's best response to the induced change in the capital tax rate of country j.

From the second-order condition of each country's optimal tax problem we know that $\partial F_j/\partial t_j < 0\ \forall\ j \in \{1,2\}$. In the following, we determine the sign of the other partial derivatives in (24) in order to evaluate the overall effects. We first turn to the direct effect of the parameter change on the tax rate of the capital exporting country 1. Differentiating (19) with respect to β and using (18) gives[9]

$$\frac{\partial F_1}{\partial \beta} = \underbrace{(1-m_1)\,k_1 + [2b + (1-m_1)\,\beta]\,\frac{\partial k_1}{\partial \beta}}_{(+)} + \underbrace{(2b+\beta\,k_1)\,(1-\rho)\,m_1\,\frac{c_1^L}{c_1^K}\,\frac{\partial (c_1^K/c_1^L)}{\partial \beta}}_{(-,0)}, \tag{25}$$

where the first effect is signed with the help of Proposition 1 ($m_1 < 1$) and (7), whereas the signing of the last effect has used (23). From our discussion of the optimal tax condition in the symmetric Nash equilibrium [eq. (21)], the interpretation of (25) is straightforward. The first effect gives the increase in the efficiency costs of capital taxation as capital exports increase due to the lower mobility cost parameter. With a lower tax base, less revenue can be collected by the use of the capital tax and this effect tends to reduce the optimal level of t_1. On the other hand, a reduction in β also increases the political gains from capital taxation from the perspective of country 1's government by lowering labour income and raising the income of capitalists. This increases the marginal political impact of workers, relative to capitalists, and tends to push the capital tax rate upward. Note

[9] At this point the main reason for our use of quadratic production functions becomes clear, since this assumption eliminates *third* derivatives of the production function with respect to k_i.

that this effect is absent, and the second term equals zero, when the marginal utility of income is constant for each group ($\rho = 1$).

Next, we consider the direct effect of the reduction in β on the optimal tax rate in the capital importing country 2. Differentiating (20) and using (6) to simplify the first effect gives

$$\frac{\partial F_2}{\partial \beta} = \underbrace{(1 - m_2) - 2b\,\frac{\partial k_2}{\partial \beta}}_{(+)} + \underbrace{(2b + \beta)\,(1 - \rho)\,m_2\,\frac{c_2^L}{c_2^K}\,\frac{\partial (c_2^K / c_2^L)}{\partial \beta}}_{(+,0)} > 0. \tag{26}$$

As before, the signing of individual effects has used eq. (7) and (23) while $m_2 < 1$ must hold in the neighbourhood of a symmetric equilibrium. A lower level of β leads to increased efficiency costs of capital taxation for the capital importer, despite the fact that a source tax on capital improves country 2's terms of trade by reducing its net import demand for capital (cf. footnote 7). However under a quadratic specification of the production and mobility cost functions this terms of trade gain is dominated by the higher tax base loss incurred from capital taxation (cf. Haufler 1996, Proposition 3 for a similar result). In contrast to the capital exporter, a reduction in β also lowers the political benefits of capital taxation in country 2 (for $\rho < 1$) since capital market integration causes a redistribution of income from capitalists to workers. Hence, economic and political forces work in the same direction for the capital importer and the direct effect of a reduction in β unambiguously leads to a lower tax rate on capital.

Whether the positive sign of $\partial F_2 / \partial \beta$ tends to increase or reduce country 1's optimal capital tax rate through the indirect (second) effect in (24) depends on the slope of country 1's reaction function. This is given by the derivative

$$\frac{\partial F_1}{\partial t_2} = \underbrace{\frac{2b + (1 - m_1)\,\beta}{4b + \beta}}_{(+)} + \underbrace{(2b + \beta\, k_1)\,(1 - \rho)\,m_1\,\frac{c_1^L}{c_1^K}\,\frac{\partial (c_1^K / c_1^L)}{\partial t_2}}_{(-,0)}, \tag{27}$$

where the second effect is signed from (22). The slope of country 1's reaction function exhibits a similar ambiguity as the direct effect of a reduction in the mobility cost parameter [eq. (25)]. The fall in the tax rate of country 2 increases the capital outflow from country 1 and reduces this country's tax base. Thus the efficiency costs of capital taxation are increased for country 1 as a result of the initial tax response in the low-tax region. However, the capital outflow from country 1 also causes a redistribution of income from workers to capitalists, and this increases the political benefits of capital taxation.

Finally, we turn to the slope of country 2's reaction function, which is given by

$$\frac{\partial F_2}{\partial t_1} = \underbrace{\frac{2b + \beta}{4b + \beta}}_{(+)} + \underbrace{(2b + \beta)\,(1 - \rho)\,m_2\,\frac{c_2^L}{c_2^K}\,\frac{\partial (c_2^K / c_2^L)}{\partial t_1}}_{(-,0)}. \tag{28}$$

This partial derivative is also ambiguous: an increase in t_1 raises country 2's tax base and increases the economic incentive for capital taxation by the first effect. On the other hand,

Table 2: Effects of Capital Market Integration ($\beta \downarrow$)
on Optimal Capital Tax Rates

	capital exporter (country 1)	capital importer (country 2)
Case (a): $\rho \to 1$		
direct effect $(\partial F_j/\partial t_j) \times (\partial F_i/\partial \beta)$	$t_1 \downarrow$	$t_2 \downarrow$
indirect effect $(\partial F_i/\partial t_j) \times (\partial F_j/\partial \beta)$	$t_1 \downarrow$	$t_2 \downarrow$
Case (b): $\rho \to -\infty$		
direct effect $(\partial F_j/\partial t_j) \times (\partial F_i/\partial \beta)$	$t_1 \uparrow$	$t_2 \downarrow$
indirect effect $(\partial F_i/\partial t_j) \times (\partial F_j/\partial \beta)$	$t_1 \uparrow$	$t_2 \downarrow$

an increase in country 1's capital tax rate also redistributes income in country 2 from capitalists to workers and this reduces the political incentive to raise t_2.

Summarizing the effects that capital market integration has on optimal capital tax rates in both countries, it is obvious that the parameter ρ plays a crucial role. The value of this parameter, which measures the degree of "income stickiness" inherent in the political process, determines the size of the second terms in all partial effects (25)–(28). In the following, we consider the two benchmark cases where ρ is either at the upper or at the lower end of its permitted range. In both instances, this leads to *unambiguous* changes in optimal capital tax rates as a result of capital market integration. The results are summarized in

Proposition 3: *(a) When the political support from workers and capitalists are close substitutes from the government's perspective ($\rho \to 1$), then capital market integration will reduce optimal tax rates on capital in both countries.*

(b) When it is very difficult for policymakers to substitute between the political support from workers and capitalists ($\rho \to -\infty$), then capital market integration will reduce the optimal tax rate on capital in the capital importing country, but increase the capital tax rate in the exporting country.

Proof: As $\rho \to 1$, the second effects in (25)–(28) approach zero and $\partial F_i/\partial \beta > 0, \partial F_i/\partial t_j > 0 \; \forall \; i \in \{1,2\}, \; i \neq j$. Substituting these partial effects into (24) demonstrates part (a) of the proposition. For $\rho \to -\infty$, the second effects in (25)–(28) become arbitrarily large and dominate the first effects. This gives $\partial F_1/\partial \beta < 0, \partial F_2/\partial \beta > 0, \partial F_1/\partial t_2 < 0, F_2/\partial t_1 < 0$. Substituting these partial effects in (24) gives part (b) of the proposition. □

To explain these results in some more detail, Table 2 summarizes the partial effects (25)–(28) for each of the two cases. In case (a) ($\rho \to 1$), distributional effects of capital market integration do not effectively feed back into the policymakers' optimal tax

problems, and the increased efficiency costs of capital taxation dominate in both countries. The direct effect of a reduction in mobility costs is to intensify the competition for the internationally mobile capital tax base, and this lowers capital tax rates in both countries. In addition, both reaction functions are upward sloping in this case: other things being equal, the initial reduction in each country's tax rate reduces the capital tax base in the other region, and this further weakens the incentive to employ source taxes on capital. Therefore direct and indirect effects work in the same direction and both countries will unambiguously reduce the level of capital taxation.

In case (b) ($\rho \to -\infty$), distributional effects are central to policymakers' optimal tax problems since resistance to income changes caused by capital market integration is very high in both countries. In this case, political considerations dominate the effects of increased efficiency costs of capital taxation. The initial response to a reduction in mobility costs is then a tax reduction in the capital importing country 2 (where, from Table 1, workers gain from the additional capital inflow while capitalists lose) and a tax increase in country 1 (where the capital outflow hurts labour and benefits capital). Also, both reaction functions are downward sloping in this case and indirect effects again reinforce the direct effects in both countries. The additional capital inflow to country 2 resulting from the initial tax increase in country 1 benefits workers and hurts capitalists in the capital importing region. To counteract these income changes, the tax rate on capital must further fall in country 2. On the other hand, the initial tax reduction in country 2 attracts capital to this region, and this hurts workers and benefits capitalists in country 1. Therefore, country 1's capital tax rate must further rise – and the wage tax can accordingly fall – in order to shield workers from the income loss.

It remains to link Proposition 3 to related results in the literature. Part (a) of the proposition corresponds to the conventional notion that increased capital mobility will lead to a general reduction in the level of capital taxation. This result is typical for one-consumer models of capital tax competition (Bucovetsky and Wilson 1991, Hoyt 1991) and is reproduced in the present more general framework when policymakers can easily substitute increased political support from one income group for the reduced support of the other.

In contrast, Proposition 3 (b) shows that when distributional concerns are predominant, the optimal tax rate on capital *increases* in the capital exporting country. Since the capital exporter is the high-tax country in the present analysis, this result also implies a *divergence* of tax rates as a result of capital market liberalization. This finding differs not only from one-consumer analyses, but also from the results obtained by Persson and Tabellini (1992). In their analysis, changes in the political equilibrium mitigate the economic effects of capital market integration, but the net effect in both countries is a reduction in the rate of capital taxation. Also, Persson and Tabellini argue that capital market integration induces a larger tax rate reduction in the high-tax country, thus

implying a convergence of capital tax rates across countries.

These differences in results can be traced back to different assumptions regarding the political process. Persson and Tabellini model a median voter who anticipates the non-cooperative tax setting by national governments and delegates tax policy to a more "left-wing" (i.e, redistributive) government in order to (partly) offset the effects of capital tax competition. Stability conditions then dictate that this 'political effect' cannot dominate the 'economic effect' of increased tax competition, a constraint that is not present in our framework. To put it differently, voter behaviour in Persson and Tabellini is directed at overcoming the economic *inefficiencies* of capital tax competition, and this effect is clearly symmetric in the trading countries.[10] In contrast, the interest groups modelled in the present analysis respond solely to the *distributional* effects of capital market integration, and these effects are directly opposed in the capital importing and the capital exporting region. This comparison shows that the median voter and the interest group approach may lead to rather different conclusions, even if the underlying economic models are comparable.

Finally it is interesting to note that a similar difference between the results of median voter and interest group models emerges in the related literature on tax-financed social insurance schemes. Using an interest group approach similar to the one adopted here, Verbon (1990) and Lejour and Verbon (1996) show that the level of unemployment insurance provided to risk-averse agents need not fall, in general, as a result of increased factor mobility. In the model of Lejour and Verbon the degree of risk aversion towards unemployment plays a similarly central role for the results as does the elasticity parameter ρ in the political support function of the present analysis. In contrast, Gabszewicz and van Ypersele (1996) find in a median voter model that the level of social protection – which takes the form of a minimum wage in their model – always falls when capital mobility is introduced, even if the median voter receives wage income only.

While this brief discussion of results clearly cannot do justice to the specifics of individual models, it nevertheless suggests a more general difference between the median voter and the interest group approach in assessing the effects of factor market integration. As an example, interest group models – but not median voter models – allow for the case where trade unions in one country are able to enforce a compensation from the government for a market-induced decline in gross real wages. This decline may, as in the present model, be caused by a capital outflow, but it may also stem from an inflow of foreign labour.

[10] As Persson and Tabellini (1992, p. 698) explicitly note, the "delegation game" played by the median voter is welfare improving for a majority of agents, since it partially relaxes an ex post incentive constraint.

5 Concluding Remarks

The present paper has employed a two-country, two-class model of tax competition to discuss the effects that capital market integration has on the optimal mix of factor taxes. In this framework, policymakers have to weigh the increased efficiency costs of capital taxation in a world with higher capital mobility against the distributional effects that arise when interest groups try to reverse in the political arena the income changes brought about by market forces. The analysis has shown that the trade pattern introduces a systematic asymmetry to the effects that capital market integration has in the two countries, with distributional and efficiency implications working in the same direction for the capital importing country, but in opposite directions for the capital exporter. Therefore we would generally expect that capital exporting countries exhibit a less pronounced shift to labour taxation in response to liberalized capital markets, and possibly even increase the taxation of capital.

A first look at the data (International Monetary Fund 1987, 1994) shows that there may be some support for this proposition, but there are also counterexamples. Among the countries that have raised their effective tax rates on capital since the 1980s, the Netherlands and the United Kingdom have been exporters of long-term capital in most years. It is also interesting to note that Germany has significantly reduced the tax burden on capital in the 1990s, while at the same time turning to a large capital importer as a consequence of German unification. Counterexamples to the predicted pattern are Italy and Spain, both typical capital importers with rising effective tax rates on capital. However, in both of these countries the general level of taxation has markedly increased in the last decade so that the capital tax increase does not represent a structural shift away from labour taxation. This last example already shows that a careful econometric analysis is needed to isolate changes in the level vs. the structure of factor taxation in different countries. Moreover, our analysis has isolated the shocks to the distribution of income as a result of capital market integration. In practice these shocks will overlap with other exogenous disturbances to either wages or capital incomes, and possibly also with exogenous policy shifts as a result of changes in the political balance of power.

Limitations of our theoretical analysis also have to be pointed out. In line with most of the related work (including Persson and Tabellini 1992), it has been assumed here that capital flows are exclusively determined by tax differentials. This assumption is particularly relevant for the question of tax rate convergence. If the high-tax country is also the capital exporter, then distributional effects tend to cause diverging rates of capital taxation in the present model as a result of capital market integration. The same need not be the case, however, if production-related differences across countries are the main reason for international trade. Finally, the present model has oversimplified the government's equity-efficiency trade-off by assuming that the wage tax is a lump-sum instrument and that there is only one (distortive) instrument of capital taxation. A more general analysis of the

efficiency vs. distributional effects of capital market integration would have to endogenize the labour supply decision and allow for different forms of capital income taxation.

To summarize, the simple model used here clearly does not claim to 'explain' why the empirical evidence for falling and converging rates of capital taxation has been relatively weak since the 1980s. However it may nevertheless indicate one possible route through which distributional effects counteract the clear-cut predictions derived from conventional one-consumer models of capital tax competition.

Appendix

The general form of the best-response functions (19)–(20) is

$$F_1(t_1, t_2, \theta_1) = 0, \qquad F_2(t_1, t_2, \theta_2) = 0, \tag{A.1}$$

where θ_i are exogenous shift parameters. Totally differentiating (A.1) and inverting gives

$$\begin{bmatrix} dt_1 \\ dt_2 \end{bmatrix} = \frac{1}{|J|} \begin{bmatrix} -\frac{\partial F_2}{\partial t_2} & \frac{\partial F_1}{\partial t_2} \\ \frac{\partial F_2}{\partial t_1} & -\frac{\partial F_1}{\partial t_1} \end{bmatrix} \begin{bmatrix} \frac{\partial F_1}{\partial \theta_1} & d\theta_1 \\ \frac{\partial F_2}{\partial \theta_2} & d\theta_2 \end{bmatrix}, \tag{A.2}$$

where the Jacobian is

$$J = \begin{bmatrix} \partial F_1/\partial t_1 & \partial F_1/\partial t_2 \\ \partial F_2/\partial t_1 & \partial F_2/\partial t_2 \end{bmatrix}.$$

The determinant of the Jacobi matrix can be signed as

$$|J| = \frac{\partial F_1}{\partial t_1}\frac{\partial F_2}{\partial t_2} - \frac{\partial F_1}{\partial t_2}\frac{\partial F_2}{\partial t_1} > 0 \tag{A.3}$$

by assuming either that the Nash equilibrium is unique, and using the index theorem (Mas-Colell, 1985, pp. 201-204), or by interpreting (A.3) as a stability condition (Dixit, 1986, p. 110). For a symmetric initial equilibrium this stability requirement is equivalent to the familiar condition that the slope of best response functions must be less than one in absolute value.

Proof of Proposition 2: To analyze the effects of an increase in the political weight of workers in country 1, we substitute $d\theta_1 = ds_1^L$ and $d\theta_2 = 0$ in (A.2). Since the initial equilibrium is symmetric, (21) and (18) can be used to obtain

$$\frac{\partial F_1}{\partial s_1^L} = -(2b+\beta)\frac{\partial m_1}{\partial s_1^L} = (2b+\beta)\frac{m_1}{s_1^L} > 0. \tag{A.4}$$

Using (A.3)–(A.4) and the second-order conditions $\partial F_i/\partial t_i < 0 \; \forall \; i \in \{1,2\}$ in the first line of (A.2) gives $dt_1/ds_1^L > 0$. Combining this with the change in t_2 [the second line in (A.2)] gives

$$\frac{\partial F_2}{\partial t_1}\frac{dt_1}{ds_1^L} = -\frac{\partial F_2}{\partial t_2}\frac{dt_2}{ds_1^L}. \tag{A.5}$$

From the symmetry of the initial equilibrium ($\partial F_1/\partial t_1 = \partial F_2/\partial t_2$ and $\partial F_1/\partial t_2 = \partial F_2/\partial t_1$) and the stability condition $|J| > 0$ in (A.3) it follows that $dt_1/ds_1^L > dt_2/ds_1^L$, no matter whether dt_2/ds_1^L is positive or not. Since tax rates are equal initially, this demonstrates the proposition for small deviations from the symmetric equilibrium. □

Derivation of Equation (24): Equation set (A.2) simultaneously includes the solution for the more general case when best responses in both countries are altered by shift parameters. Setting $d\theta_1 = d\theta_2 = d\beta$ yields eq. (24) in the main text.

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