Redistribution, Fiscal Competition, and the Politics of Economic Integration*

Anke S. Kessler† *University of Bonn*

Christoph Lülfesmann *University of Bonn*

Gordon M. Myers *Simon Fraser University*

this version: December 2001

Abstract

The paper examines the consequences of the economic integration of factor markets in a model with two countries that redistribute income among their residents. The social benefits in each country are financed by a source based tax on capital which is democratically chosen by its inhabitants. If either capital or labour is internationally mobile, the countries engage in fiscal competition and the partial integration of capital or labour markets is detrimental to the countries' redistributive ability. A move from partial to full integration, however, may alleviate rather than intensify fiscal competition, particularly, if the two countries face sufficiently similar economic and political conditions. In such a situation, for example, tax competition for mobile capital is softened as the labour market becomes more integrated and even vanishes if both factors are fully mobile. As a result, there is more redistribution in equilibrium and a majority of the population

*This paper has benefitted from comments by Jan Brueckner, Ig Horstmann, Dave Wildasin, and various participants of seminars at Bonn, Heidelberg, Konstanz, Mannheim, the 2001 Verein für Socialpolitik meeting, the 2001 ASSA meetings, and the 2000 World Congress of the Econometric Society. We are also indebted to two anonymous referees and the Editor Mark Armstrong who provided valuable comments on earlier versions. A first draft of this paper was written when Gordon Myers visited the Universities of Bonn and Essex in 1997/1998. He wishes to thank both for their hospitality. Anke Kessler (corresponding author) and Christoph Lülfesmann wish to thank the Haas School of Business at UC Berkeley and Simon Fraser University for their hospitality. Financial support by the German Academic Exchange Service ('Hochschulsonderprogramm III'), the Deutsche Forschungsgemeinschaft through SFB 303 at the University of Bonn, SFHCR and SSHRC is gratefully acknowledged. Remaining errors are our own.

†Corresponding Author. University of Bonn and CEPR. Address: Department of Economics, University of Bonn, Adenauerallee 24-42, 53113 Bonn, Germany, e-mail: kessler@wiwi.uni-bonn.de, phone: +49-228-739246, fax: +49-228-739221.

in each country is strictly better off.

JEL Classification: D78, H23, H 77
Keywords: Tax Competition, Fiscal Federalism, Factor Market Integration, Welfare Migration

1. INTRODUCTION

In the past decades, the world economy has experienced a movement toward ever increasing economic integration. As new technologies have reduced migration and communication costs and institutional or political barriers to mobility have been removed, the mobility of goods, services, capital and – to a lesser extent – labour, has grown rapidly. While the efficiency gains from common markets are largely undisputed, economists and practitioners alike have expressed their concern with regard to the implications of this development for the ability and the willingness of countries to provide public services and to pursue redistributive policies at the national level.

The competition for mobile capital, in particular, is considered by some as one of the greatest dangers to the survival of the welfare state. As a CEPR report on subsidiarity within Europe (1993, p. 89) concludes: "the erosion of capital income as part of the general tax base clearly has important implications for income and wealth distribution". This view is supported both by empirical evidence and by the theoretical literature on tax competition. On average, corporate tax rates fell by 6 points and top tax rates on interest income by 13 points for OECD countries during the 1980s.[1] Formal models [Gordon (1983), Zodrow and Mieszkowski (1986), Wilson (1987)] show that competition for mobile capital results in suboptimally low levels of taxation and public good provision. As a consequence, countries could gain from centrally coordinating their national tax policies.

Although less pronounced, the integration of labour markets has also been seen as undermining the ability of governments to redistribute income among their citizens.[2] Sinn (2000, p. 6), for instance, predicts that "in the competition for the lowest possible

[1] See Edwards and Keen (1996), who also present evidence from Scandinavian countries. In the early 1990's, first Sweden, then Norway, then Finland reformed their capital income tax system, resulting in reduced flat rates in the range of 30% to 25%.

[2] Judging from the convergence in interest rates and the volume of capital flows, the integration of global capital markets is reaching a high level of maturity, particularly in the European Union. Clearly, the same cannot be said about the integration of labour markets [see, however, Sinn (2000) for a recent reassessment in the face of eastern EU enlargement]. Still, mobility costs are falling in labour markets as well and one might argue that a defining characteristic of a federation is free migration. This is also true in the European Union where the Single Act has removed any legal barriers to individual mobility across its member states.

standards, the European welfare state will be exposed to strong erosive forces which threaten its very substance" because "the benefits of the social welfare state will [...] attract migrants who are net recipients of public resources." This line of reasoning is formally captured in Wildasin (1991) who demonstrates that taxes directed at redistributing income from wealthy to poor households will be inadequately low in a common labour market. The logic is similar to that of tax competition for a mobile tax base: if those who benefit from redistribution are mobile, welfare migration leads to a 'race to the bottom' in the choice of social benefits.[3] Likewise, migration-induced inefficiencies emerge if local public expenditures are financed with revenues from a publicly-owned fixed factor as individuals move in seeking a share of the local rents.[4]

In the light of the above arguments, economic integration may seem less desirable than a simple consideration of the potential efficiency gains from common markets would suggest. The fundamental concern is the consequences of increased integration for redistributive policies and the resulting levels of inequality in our society. This paper provides a new perspective on the redistributive consequences of economic integration. We consider two jurisdictions (countries) that pursue redistributive policies at the local level. Heterogeneous individuals derive income from their given labour and capital endowments. Factor prices are endogenous and adjust to equilibrate domestic supply and demand of each factor. The countries redistribute income via a lump-sum transfer to resident-workers, financed by a source-based linear tax on capital. This policy is democratically chosen by majority vote of its inhabitants. Integration of factor markets is modelled as the removal of all explicit or implicit barriers to mobility.[5] With common

[3]Similar implications of labour mobility for the scope for redistribution within the EU are discussed in, e.g., Cremer and Pestieau (1996). That jurisdictions may be forced to lower taxes in order to avoid attracting low-income households and repelling high-income households has already been conjectured by Oates (1972). Brueckner (2000) provides a survey of the theoretical and empirical literature on welfare migration. A different view of mobility is taken by, e.g., Myers (1990) and Wellisch (2000). In line with Tiebout (1956)'s conjecture that 'voting with one's feet' invokes desirable competition among jurisdictions, these authors show that population migration may enhance the efficiency properties of equilibria. See the discussion in Section 3.

[4]See Flatters, Henderson and Mieszkowski (1974) and Boadway and Flatters (1982).

[5]In particular, the integration of labour markets requires each country to treat foreign individuals equally, i.e. immigrants cannot be subjected to discrimination on the basis of origin. In the European Union, for example, the equal-treatment principle is guaranteed by the Treaty of Rome.

factor markets, changes in the policy of one country have an impact on the other other country, because factors migrate to seek the highest income, net of taxes and transfers.

In this framework, we first study, in turn, the *partial* integration of capital markets and labour markets, respectively. The analysis is taken as a benchmark to compare against the case of *full* integration where both capital and labour are mobile. Relative to a situation of non-integration (autarky), redistributive taxes are reduced under capital market integration because countries seek to attract foreign capital, which adds to the domestic tax base and increases wages at home. Expressed differently, because the voters in each country ignore the effect of changes in their tax rate on the tax base of the other country, a coordinated increase in capital taxes would be strictly beneficial for a majority in each country. A similar result holds if we consider the integration of labour markets in isolation. Raising taxes increases social benefits and, hence, triggers immigration. In their attempt to reduce the number of foreign workers and beneficiaries of their national redistributive policy, countries set taxes relatively low. Again, this argument can be expressed in terms of an externality if one recognizes that policy-induced immigration benefits the voters abroad [see Wildasin (1991)]. Moreover, we show that further integration of labour markets, measured as a reduction in individual mobility cost, exasperates the problem of fiscal competition.

Having identified these two fiscal competition effects that arise from the integration of factor markets, we then ask in a second step whether the conclusions under partial integration carry over to the case of full integration. Our main result is that the two effects need not reinforce but instead may neutralize each other. That is, the composite effect may well be that the problem of fiscal competition is alleviated. Specifically, if countries are symmetric we demonstrate that further integration of labour markets always leads to an increase in equilibrium tax rates if capital markets are already integrated. As a consequence, there is *more* redistribution in equilibrium and a majority of the population in *each* country is strictly better off.

Although the finding may seem surprising at first glance, it has an intuitive explanation. The integration of labour markets reduces the incentives for voters to attract foreign capital through lowering national tax rates because it at the same time causes

an inflow of labour, which is detrimental to a majority. In other words, the perceived benefits from tax competition are reduced as it triggers detrimental immigration, precisely because additional capital raises both wage rates and per-capita social transfers. Moreover, the effect is strengthened the lower the migration costs, i.e., the more pronounced the integration of the labour market. Hence, ongoing integration need not heighten capital tax competition, provided it goes hand in hand with enhanced labour mobility. Conversely, the result also implies that fiscal competition in the presence of mobile individuals (labour) may be dampened as capital markets are integrated. By the same token as above, raising social benefits (taxes) now causes a capital outflow and no longer triggers undesirable immigration, thereby diminishing the incentives to repel the beneficiaries of taxation through cutting down on welfare programs.[6]

This reasoning is quite general when countries face identical conditions. We also demonstrate, however, that it cannot always be applied to asymmetric countries for reasons that will become clear below.[7] Intuitively, although tax competition is mitigated as a result of full integration, high mobility of capital and labour also forces countries to converge, both economically and politically. Therefore, countries that had an advantage under partial integration may lose if they remove existing barriers to the mobility of other factors as well. In other words, if countries are asymmetric, the efficiency gains and the gains from reduced inequality resulting from full integration come at a cost: economic and political conditions converge and so do the countries' shares of the economy wide surplus.

Beyond the seminal tax competition literature mentioned above, the present work is related to several contributions to the literature on fiscal federalism. Persson and Tabellini (1992) investigate the consequences of increasing capital market integration and interjurisdictional competition in the context of a representative democracy. Higher capital mobility is shown to influence the political choice of voters, which partially off-

[6]The concern that integration intensifies tax competition is prevalent, for example, in the policy coordination guidelines on capital tax competition recently issued by the OECD and the EU [see OECD (1998) and EU (1998)].

[7]One difficulty that arises is that countries may want to strategically manipulate their factor incomes in addition to the pure fiscal competition effect. The former incentive is not necessarily reduced by ongoing integration.

sets the effects of intensified fiscal competition. Bolton and Roland (1997) analyze the politico-economic conditions that cause nations to split up into separate countries. The authors note that separation cannot always be prevented by granting fiscal autonomy because of tax competition effects. Perroni and Scharf (2001) examine how competition for mobile capital affects jurisdiction formation. In their model, jurisdictions form endogenously and there exist scale economies in the provision of local public goods. Fiscal competition results in an enlargement of jurisdictional boundaries and can therefore be welfare improving. Finally, Huizinga and Nielsen (1998) consider a fiscal competition framework where labour and capital are locally taxed. The authors demonstrate that cooperatively choosing one of the tax rates can increase the incentives for non-cooperative tax competition on the other factor, which in turn may lower welfare. Hence, partial (piecemeal) policy coordination may be worse than no coordination at all.[8]

The remainder of the paper is organized as follows. Section 2 presents the basic model and provides an analysis of fiscal competition under the partial integration of capital and labour markets, respectively. Section 3 considers full integration. A final section discusses our results and concludes.

2. THE MODEL

The basic framework we use in our analysis allows both capital and labour to be internationally mobile. As a first step, however, we will only consider partial integration (either capital or labour mobility) in Subsections 2.2 and 2.3. These settings serve to illustrate the arguments of the existing literature on tax competition and inter-jurisdictional spillovers and formalize them in our model where majority voting determines policy outcomes. Subsequently, we consider full integration in Section 3 and show in which sense those arguments must be qualified.

2.1. The basic framework

[8]Fuest (1998) arrives at a similar conclusion in a different framework. Note that the focus here is on the benefits of cooperative (or centralized) policy determination, not on the benefits of full integration in a non-cooperative setting as in the present paper. Still, the results share the general insight that fiscal competition may be softened by policies that are undesirable if viewed in isolation (non-cooperation and increased integration, respectively).

Consider an economy that consists of two countries or regions $j = 1, 2$, inhabited by a continuum of heterogeneous individuals i with mass normalized to one. Individuals derive income from their factor endowments: each individual supplies inelastically one unit of labour and k^i units of capital. They are free to choose their residence and where to invest their capital. Thus, both labour and capital are internationally mobile. In what follows, we will assume that capital is perfectly mobile, i.e. there are no costs of investing abroad. Labour, in contrast, may be less mobile than capital internationally. This idea is captured by assuming that individuals have to incur a cost $m^i \geq 0$ when they emigrate from their home country, which is derived from the following spatial representation of the economy: suppose individuals reside on the closed interval $[0, 1]$ with i representing their initial location. The border is located at $i = \bar{n}_1 = 1 - \bar{n}_2$ so that all individuals of type $i \in [0, \bar{n}_1]$ initially live in country 1 whereas individuals with $i \in (\bar{n}_1, 1]$ are nationals of country 2. The individual cost of migration m^i can be expressed as a function of one's distance to the border $|i - \bar{n}_1|$, which we take to be linear for simplicity. Hence, $m^i = \theta(\bar{n}_1 - i)$ for $i \leq \bar{n}_1$ and $m^i = \theta(i - \bar{n}_1)$ otherwise where $\theta \geq 0$ measures the cost of mobility.[9]

By definition, $\bar{n}_j$ is the initial size of the labour force in country j. It is also equal to its initial share of the total population. We denote country j's initial capital stock by $\overline{K}_j$. In addition to capital and labour, we allow for a third factor of production which is immobile. For ease of exposition, we will refer to this factor as land although one may also think of it as any other fixed factor such as natural resources, entrepreneurial input, non-transferable know-how, or infrastructure. Country j is endowed with L_j units of this factor which we assume to be publicly owned.[10]

[9] As will become clear below, agents' residential decisions are independent of their investment decisions. Our analysis therefore allows for any correlation between initial locations i and capital endowments k^i. Also note that the migration costs can equivalently be interpreted as representing an 'attachment to home' (individuals have locational preferences for their home country because of cultural differences) by assuming that individual utility is given by consumption c^i, plus a non-pecuniary element m^i [see, e.g., Burbidge and Myers (1994)].

[10] Since we later analyze labour and capital mobility, it is necessary to include a third immobile factor to avoid unrealistic 'buy-out' results as discussed in Kuhn and Wooton (1987) and to preserve some locational fixity which is central to the definition of a jurisdiction. By assuming that the factor is owned or controlled by the national government we are also able to study migration in an environment where

Labour, land, and capital are used as inputs in production by competitive firms to produce a composite consumption commodity c. The technology $F(\cdot)$ is identical across countries, i.e., any technological differences can be attributed to differences in the countries' initial endowments of the productive factors. If K_j, n_j, and L_j are aggregate inputs in country j, aggregate output is given by $Y_j = F(K_j, n_j, L_j)$.

Assumption 1. *The production function $F(\cdot)$ is strictly increasing, concave, exhibits constant returns to scale, and satisfies (subscripts denote derivatives)*

a) $\lim_{K\to 0} F_K(\cdot) = \lim_{n\to 0} F_n(\cdot) = \infty$

b) $F_{Kn},\ F_{KL} \geq 0$.

Assumption 1. a) ensures that firms employ all inputs in positive quantities, even if some factors are mobile and the difference in productivity across borders is relatively large. Assumption 1. b) states that additional capital (weakly) increases the marginal productivity of other factors of production. In what follows, it will often be convenient to state the relevant variables in per-capita terms. Thus, let $k_j = K_j/n_j$, $l_j = L_j/n_j$ and $y_j = F(K_j/n_j, L_j/n_j, 1) \equiv f(k_j, l_j)$ be the per-capita values that correspond to K_j, L_j and Y_j, respectively. We denote by w_j the wage rate, by r_j the return to capital, and by π_j the return to the fixed factor in country j. The first-order conditions of profit maximization imply that each factor is paid its marginal product and that profits are zero,

$$r_j = F_K(K_j, n_j, L_j), \qquad w_j = F_n(K_j, n_j, L_j) \qquad \text{and} \quad \pi_j = F_L(K_j, n_j, L_j), \tag{1}$$

$$Y_j = r_j K_j + w_j n_j + \pi_j L_j \quad \Leftrightarrow \quad y_j = w_j + r_j k_j + \pi_j l_j \tag{2}$$

Countries pursue purely redistributive policies (t_j, g_j) that consist of a) a source based tax $t_j \geq 0$ on each unit of capital employed in country j and b) a uniform per-capita grant

the rent-sharing problem under labour mobility discussed in the Introduction is operative. Alternatively, we could assume that the fixed factor is distributed unequally among the population and that it can be taxed. The political process would then imply that the income accruing to owners of the fixed factor is taxed away in full for redistributive purposes. Obviously, the outcome is therefore identical to a situation where this factor is under public ownership.

$g_j \geq 0$ that redistributes public revenues (including those derived from the fixed factor) among the residents of country j.[11] Note that because individuals do not differ in their labour endowments, an additional tax on labour cannot serve redistributive purposes and can therefore be disregarded. The tax rate t_j is chosen by majority vote of the inhabitants of country j. The public budget constraint in country j is $g_j n_j = t_j K_j + \pi_j L_j$, or, expressed in per–capita terms,

$$g_j = t_j k_j + \pi_j l_j, \qquad j = 1, 2. \tag{3}$$

The consumption (net income) c^i of an individual with a capital endowment of k^i who lives and has invested in country j is

$$c_j^i = w_j + g_j + (r_j - t_j)k^i \tag{4}$$

$$= y_j - (r_j - t_j)(k_j - k^i), \tag{5}$$

where the last equality follows by substituting for g_j from (3) and using the expression for y_j in (2). Individuals choose where to invest their capital and where to live so as to maximize utility, taking prices and policies in each country as given.[12] The government collects the tax revenue and distributes social benefits to the residents according to the budget (3) which endogenously determines g_j once capital and labour have migrated. Given (t_1, t_2), the underlying model is therefore a simple general equilibrium economy augmented by a public sector. In equilibrium, consumers maximize (5), firms maximize profits and behave according to (1), the public budget (3) holds and prices adjust so as to clear markets. To see how the model works across countries for, e.g., capital consider the following. The firms' demand for capital depends on factor prices which leads to aggregate factor demand $K_j(\cdot)$ according to (1). The supply price (net return) of capital which an investor in j faces is $r_j - t_j \equiv \rho_j$. Because capital is fully mobile, however, its net return will be equalized across countries in any equilibrium, i.e., $r_1 - t_1 = r_2 - t_2 = \rho$.[13]

[11] Requiring t_j and g_j to be non-negative ensures that the effect of factor movements on the utility of individuals can be signed unambiguously, which simplifies the exposition and the analysis considerably.

[12] Agents take the behaviour of other agents as parametric when deciding where to invest and where to live. Because they are infinitesimally small, their individual decisions have no impact on factor prices and public budgets and they must take these as fixed.

[13] Otherwise, all investors are better off investing in the country with the higher net return, which would be inconsistent with an equilibrium as capital demand is positive due to Assumption 1 a).

For $\rho > 0$, aggregate (and average) capital supply to the economy is $\bar{k} = \overline{K}_1 + \overline{K}_2$. Hence, market clearing requires $K_1(\cdot) + K_2(\cdot) \leq \bar{k}$ with strict equality if $\rho > 0$.

The sequence of events is as follows. First, the inhabitants in each country j simultaneously vote on the tax rate t_j, taking the tax rate in the other country as given. The second stage is the general equilibrium economy described above, which voters take into account in their policy choice. That is, they foresee how changes in the national tax rate t_j affect factor prices and public budgets through migration and investment decisions. An equilibrium must satisfy the following conditions: a) the implemented tax policy is preferred to any other feasible tax policy by a majority in each country (political equilibrium), given the foreign tax rate, and b) for (t_1, t_2), the underlying economy is in equilibrium.

Before closing this section it is useful to establish the existence and the general properties of a political equilibrium. Note first that due to $r_1 - t_1 = r_2 - t_2$, the preferences of a voter in country j over t_j are unaffected by her decision where to invest her capital [see (4)]. Since we allow for positive cost of migration $\theta > 0$, however, this argument does not apply to voters' residential choices. In order to ensure that a political equilibrium exists, it is therefore necessary to assume that they disregard their own residential choice when going to the ballot (although they still take aggregate migration into account). This assumption on voter myopia eliminates the possibility of preference reversals that may occur when an individual anticipates her decision to emigrate, thereby prompting her to vote strategically in favour of the foreign country.[14] Once a voter i in country j does not take a (potential) change of residence into account, her preferences over t_j are thus given by (4), irrespective of her investment and migration decision. Then, we see from (5) that voters' preferences differ only through their individual capital endowments k^i. It is now straightforward to show that a majority rule outcome exists even though preferences may not be single peaked (see the Appendix). Furthermore, the political equilibrium in country j is the tax rate t_j^* that is most preferred by the individual with median capital endowment, k_j^m. Recall that $\bar{k}$ is the average (and

[14]See the remark for voter myopia in Section 2.3. for a discussion. It also provides an alternative assumption that is consistent with rational expectations and could be invoked to avoid this problem.

aggregate) capital stock in the economy as a whole. We assume in the remainder that the (initial) distribution of capital is skewed in the sense that the average capital stock in the economy as a whole exceeds the median individual's endowment in each country:

Assumption 2. $k_j^m < \bar{k}, \qquad j = 1, 2,$

Now suppose that Assumption 2 also holds in each country separately, i.e., $k_j^m < \bar{k}_j$, which is well in line with empirical observations. Given that capital owners need not invest their capital anywhere if the returns are negative (free disposal), it follows that under autarky where neither factor is mobile, capital income is taxed away in full: using (5), the solution to

$$t_j^* = \arg\max_{t_j} \; c_j^m = y_j - (r_j - t_j)(\bar{k}_j - k_j^m)$$

is $t_j^* = r_j$. Because y_j and r_j are fixed and evaluated at $\bar{k}_j$ and $\bar{l}_j$ under autarky, t_j is a non-distortionary (lump-sum) tax on capital that will be imposed to the maximum extent by a decisive majority endowed with less than the average capital stock. Although this outcome of expropriative capital taxation may be unrealistic, it implies full redistribution and complete equality within a country (though there may still be severe inequality across countries) and thus serves as a useful reference point against which the effects of capital and labour mobility as successive steps of integration can be judged.[15]

2.2. Tax competition for mobile capital

Suppose first that individuals can freely and costlessly invest their capital in either country but there are prohibitively high individual costs of migration. For $\theta \to \infty$, labour is completely immobile and thus $n_j = \bar{n}_j$, $j = 1, 2$. From the previous section, if capital is perfectly mobile we must have

$$r_1 - t_1 = r_2 - t_2 = \rho \qquad \rho \geq 0, \tag{IE}$$

in equilibrium (recall that ρ denotes the common after tax return to capital). Together with $K_1 + K_2 = \bar{k}$, the investment equilibrium condition (IE) defines country j's equi-

[15] One way to restore realism would be to introduce cost of raising public funds [see, e.g., Perotti (1993)] which, however, would complicate the analysis without providing any further insights.

librium capital stock K_j as a function of the policy variables t_1 and t_2.[16] Using $r_j = F_K^j$ from (1), we can implicitly differentiate (IE) to obtain the investment responses for $\rho > 0$,

$$\frac{\partial K_j}{\partial t_j} = \frac{1}{F_{KK}^1 + F_{KK}^2} < 0. \tag{6}$$

Accordingly,

$$\sigma_j \equiv \frac{\partial r_j}{\partial t_j} = \frac{F_{KK}^j}{F_{KK}^1 + F_{KK}^2} \in (0,1) \quad \text{and} \qquad \sigma_j - 1 = \frac{\partial \rho}{\partial t_j} \in (-1,0). \tag{7}$$

If capital is mobile, raising t_j lowers its net return ρ by less than under autarky where the corresponding change would be -1. Yet, because each country has some market power, its capital supply does not react fully elastic to changes in t_j so that $\partial\rho/\partial t_j < 0$.

Using (IE), the net income (consumption) of a voter i in country j is given by (5), irrespective of her investment decision. From the previous section, we know that the equilibrium policy in country j is equal to the preferred policy of the individual with median capital endowment in j, i.e., it maximizes her net income subject to (IE), and $K_1 + K_2 = \bar{k}$. The effect of a change in t_j on the utility of the decisive voter with capital endowment k_j^m in country j is

$$\frac{\partial c_j^m}{\partial t_j} = \left(k_j - k_j^m\right) + \frac{1}{n_j} t_j \frac{\partial K_j}{\partial t_j} - \frac{\partial r_j}{\partial t_j}(k_j - k_j^m). \tag{8}$$

The first term in (8) represents the direct 'redistributive' effect of capital taxation: if the median capital endowment k_j^m in country j falls short of its equilibrium per-capita capital stock k_j, the decisive voter is a net recipient of public transfers and this effect is positive for a majority of the population. In contrast, if k_j^m exceeds k_j, she is a net contributor to the redistributive system in j and the effect is negative for a majority. The second term in (8) is the indirect revenue or 'tax competition' effect: lowering taxes is attractive because of the resulting capital inflow and the corresponding increase in per-capita public expenditures. Finally, the last term captures the composite effect on factor prices and, hence, on an individual's gross income and the component of g_j

[16] See the Appendix for a formal argument why there can be no equilibrium where $K_1 + K_2 < \bar{k}$.

financed by revenues from the publicly owned fixed factor. An increase in the tax rate decreases wages and land rents and increases the gross return to capital because less capital is domestically employed. This 'factor price effect' is negative (positive) for the decisive voter if her individual capital endowment falls short of (exceeds) the average capital stock invested in j.

Employing (8) and (7), the first-order conditions of the corresponding program that characterize an interior solution can be written as

$$(1-\sigma_j)(k_j - k_j^m) + t_j \eta_k^j = 0, \qquad j = 1, 2, \tag{9}$$

where $\eta_k^j \equiv \frac{\partial k_j}{\partial t_j} = \frac{1}{n_j}\frac{\partial K_j}{\partial t_j}$ is the change in country j's per-capita capital stock as a response to a change in its domestic capital-tax rate. Equation (9) defines t_j as the best response of the electorate in country j to the policy t_h chosen by the other country. The equilibrium tax rates t_1^* and t_2^* can be found at a point where the two reaction functions intersect.

Proposition 1. *Consider an equilibrium with $\rho^* > 0$ and $t_j^* > 0$, $j \in \{1, 2\}$. In any such equilibrium, a majority of the population in each country would strictly benefit if both countries cooperatively chose to increase their tax rates.*

Proof. Let $c_j^i(t_1^*, t_2^*)$ be the equilibrium net income (utility) of a voter in j with a capital endowment of k^i and consider a change in both tax rates from t_j^* to $\tilde{t}_j^* = t_j^* + dt$, $dt > 0$. Since both countries change their tax rate by the same amount, investment decisions are unchanged [see (IE)] and so are factor prices. The corresponding change in a voter's utility is

$$dc_j^i = c_j^i(t_1^*, t_2^*) - c_j^i(\tilde{t}_1^*, \tilde{t}_2^*) = (k_j - k^i)dt,$$

after substituting for c_j^i from (5). Hence, $dc_j^i > 0 \Leftrightarrow (k_j - k^i)dt > 0$. In any equilibrium with $\rho^* > 0$ and $t_j^* > 0$, the equilibrium policies have to satisfy (9). Because the last term in this equation is strictly negative for $t_j^* > 0$, we must have $k_j^* > k_j^m$. Hence, $k_j^* > k^i$ for all individuals with less capital endowment than the median voter and $\Delta c_j^i > 0$ for a majority in j. ||

The proposition illustrates that competition for internationally mobile capital often leads countries to implement tax rates that are 'too low' relative to the cooperatively chosen levels. As a result, there is too little redistribution from the perspective of a majority in each country. Intuitively, each country has an incentive to lower taxes below the cooperative level because doing so causes a capital inflow which increases per-capita transfers and wages. Expressed differently, fiscal policy in the presence of a mobile tax base has two beneficial external effects on the foreign country. Raising taxes at home causes an outflow of capital which a) increases foreign revenues [the fiscal externality identified in Wildasin (1989)] and b) lowers the price of capital and increases wages and the returns to the fixed factor abroad. From (5),

$$\frac{\partial c_h^i}{\partial t_j} = \frac{1}{n_h} t_h \frac{\partial K_h}{\partial t_j} - \frac{\partial r_h}{\partial t_j}(k_h - k^i) = t_h \frac{\partial k_h}{\partial t_j} + (1 - \sigma_j)(k_h - k^i).$$

Clearly, this externality is positive for a majority of the population abroad if $t_h^* > 0 \Leftrightarrow k_h > k_h^m$ in equilibrium.[17] This line of reasoning also explains why the above result only holds for $t_j^* > 0$. To see why tax rates need not always be below the cooperative solution, suppose $k_h < k_h^m \Rightarrow t_h^* = 0$ for one country h. Again, it is easy to show that there exist changes in tax rates (dt_1, dt_2) which make a majority in each country better off. Yet, this will require $dt_j < 0$, i.e. the other country's tax rate may be 'too high'. The reason is that the above mentioned externality is negative: the external effect on factor prices caused by the inflow of capital is negative for the (necessarily capital rich) majority in h (if we allow for $t_h < 0$, the inflow of capital is also detrimental to the fiscal budget).

Due to Assumption 2, this possibility only arises if the equilibrium is asymmetric. It is therefore sensible to use a situation where countries are identical ex ante as a further

[17] In the case where $\rho^* = 0$, it is obvious that the taxation is already optimal from the view of a (capital poor) majority as any further increase in t_j would only lead to productive capital being withdrawn from the market (see also the Appendix). Straightforward conditions under which a unique equilibrium satisfying $\rho^* > 0$ and $t_j^* > 0$, $j = \{1, 2\}$ exists are derived in Kessler et. al (2001).

point of reference. In a symmetric equilibrium,[18] we can use $\sigma_j = \frac{1}{2}$ to obtain from (9),

$$\frac{1}{2}\left(\bar{k} - k^m\right) = -t^* \eta_k, \qquad \eta_k = \left(F_{KK}\right)^{-1} < 0,$$

where $t^* > 0$ is the commonly chosen tax rate and k^m is the median capital endowment in each country. Hence, as long as there is an economy-wide desire for a majority to redistribute ($\bar{k} > k_j^m$), we have $t^* > 0$ and there will be scope for a cooperative increase in tax rates as shown in Proposition 1.

2.3. Fiscal Competition in a common labour market

As a second prelude to our main objective of analyzing full integration of capital and labour markets, we next consider a situation where labour is mobile but capital is immobile. Although we do not believe this scenario to be descriptively accurate from an empirical point of view, it allows us to illustrate the arguments of inadequate redistribution in the presence of migration which have been put forward in the literature.

Thus, suppose capital owners are not allowed to invest their capital abroad (e.g. there are restrictions on foreign investment) so that the capital stock in country j is fixed and equal to its initial aggregate stock $\overline{K}_j$. Individuals can, however, decide to change their residence and move abroad in the migration stage, taking factor prices and policies as given. To derive the corresponding equilibrium condition, note first that an individual's migration decision is independent of her capital endowment k^i. It only depends on her mobility cost and the difference in wages and social benefits across borders. Because the costs of moving are monotonic, a migration equilibrium can be characterized by a marginal individual i^* who is indifferent between residing in either country. Then, all individuals with $i \leq i^*$ prefer to live in country 1 while individuals $i > i^*$ will live in country 2. The population sizes in both countries are

$$n_1 = \int_0^{i^*} di = i^* \quad \text{and} \quad n_2 = \int_{i^*}^1 di = 1 - i^*,$$

[18] As long as tax rates are strategic complements (the respective reaction functions are upward sloped) asymmetric equilibria cannot exist if countries are identical.

i.e., country 1's labour force n_1 also denotes the marginal individual in a migration equilibrium. We can therefore write the migration equilibrium condition as[19]

$$w_1 + g_1 = w_2 + g_2 - \theta(\bar{n}_1 - n_1). \tag{ME}$$

Together with (3) and $n_1 + n_2 = 1$, (ME) implicitly defines country j's labour force (population size) as a function of t_1 and t_2. Let $x_j = w_j + g_j$ be the part of an agent's consumption that is not individual specific and note that

$$x_n^j \equiv \frac{\partial x_j}{\partial n_j} = F_{nn}^j - \frac{1}{n_j}(t_j k_j + F_L^j l_j) + F_{Ln}^j l_j = -(\frac{1}{n_j} g_j + F_{Kn}^j k_j) < 0. \tag{10}$$

The last inequality of (10) follows from substituting back for g_j and the fact that factor prices adjust to maintain zero profits. As one would expect, an inflow of additional resident-workers reduces wages and the amount of the transfer that is available to the population of country j. Implicitly differentiating (ME) yields

$$\frac{\partial n_j}{\partial t_j} = -\frac{k_j}{x_n^1 + x_n^2 - \theta} > 0. \tag{11}$$

An increase in a country's taxation of capital raises social benefits and, hence, triggers immigration which the voters will have to take into account when voting over tax policies.

Under our assumption that voters are myopic with respect to their own residential decision, the preferred tax rate t_j^* of the median voter in j maximizes (5) subject to (ME). Individual consumption c_j^m varies with t_j according to

$$\begin{aligned} \frac{\partial c_j^m}{\partial t_j} &= \left(k_j - k_j^m\right) + x_n^j \frac{\partial n_j}{\partial t_j} + F_{Kn}^j k_j^m \frac{\partial n_j}{\partial t_j} \\ &= \left(k_j - k_j^m\right) - \frac{1}{n_j} g_j \frac{\partial n_j}{\partial t_j} - \frac{\partial r_j}{\partial t_j}(k_j - k_j^m), \end{aligned} \tag{12}$$

[19] To see why we can subsume migration flows in both directions by one equilibrium condition, note that if $w_1 + g_1 < w_2 + g_2$ initially, people will migrate from country 1 to country 2. The condition for the marginal individual $i^* = n_1 < \bar{n}_1$ to be indifferent is (ME) where the right-hand side represents her migration cost $\theta(\bar{n}_1 - i^*)$. Conversely, if $w_1 + g_1 > w_2 + g_2$ initially, there is migration from country 2 to country 1 and the marginal individual $i^* = n_1 > \bar{n}_1$ incurs $\theta(i^* - \bar{n}_1)$. The corresponding equilibrium condition then reads $w_1 + g_1 - \theta(i^* - \bar{n}_1) = w_2 + g_2$ which is again equivalent to (ME).

after substituting for the expression of x_n^j and using $\partial r_j/\partial t_j = F_{Kn}^j(\partial n_j/\partial t_j)$. Similar to the case where capital was mobile, we can decompose the change in c_j^m resulting from a marginal increase in the domestic tax rate into a direct redistributive effect [the first term in (12)] and an indirect effect that is due to policy-induced migration. The latter is captured by the last two terms: an additional immigrant (worker) reduces per capita revenues (social benefits) by $\frac{1}{n_j}g_j$ and the marginal productivity of labour (wage). Due to $F_{Kn} \geq 0$, this fall in wages is not offset by the rise in the prices of other factors for a voter with below average capital endowment, i.e., the factor price effect is again non-positive if $k_j > k_j^m$.[20]

Setting (12) equal to zero gives us the condition for an interior solution for the equilibrium tax rate, which defines the reaction functions

$$(1-\sigma_j)(k_j - k_j^m) - \frac{1}{n_j}g_j\eta_n^j = 0 \qquad j = 1, 2, \tag{13}$$

where, as before, $\sigma_j \equiv \partial r_j/\partial t_j \in (0,1)$ and $\eta_n^j \equiv \partial n_j/\partial t_j$ denotes the change in country j's population as a response to a change in its tax rate.

Proposition 2. *Consider an equilibrium with $t_j^* > 0$ and $\rho_j^* > 0$. In any such equilibrium, a coordinated increase in national tax rates would increase the welfare of a majority of the voting population in both countries.*

Proof. The proof is similar to that of Proposition 1. Consider a coordinated change in tax rates with $dt_1 = (k_2^*/k_1^*)dt_2 > 0$ such that $\tilde{t}_j^* = t_j^* + dt_j$ is the new equilibrium tax rate in j. Since both countries raise their tax rate in inverse proportion to their equilibrium capital-labour ratios, we have $d(g_1^* - g_2^*) = k_1^* dt_1 - k_2^* dt_2 = 0$, i.e., the difference in social benefits remains unaffected. As a consequence, residential decisions and factor prices are unchanged in the new equilibrium [see (ME)]. The change in the utility of a voter in j at date 0 is thus

$$\Delta c_j^i = c_j^i(t_1^*, t_2^*) - c_j^i(\tilde{t}_1^*, \tilde{t}_2^*) = (k_j^* - k^i)dt_j,$$

[20]Recall Assumption 1. b). Requiring $F_{Kn} \geq 0$ also ensures that the symmetric migration equilibrium we study below is stable [the denominator in (11) is always negative].

after substituting for c^i from (5). To show that $\Delta c_j^i > 0$ for a majority of voters in j if $t_j^* > 0$ and $\rho_j^* > 0$, one can use the same argument as in the proof of Proposition 1. ||

Again, taxes are inadequately low from the perspective of a majority in each country as long as $t_j^* > 0 \Rightarrow k_j^* - k_j^m > 0$ and $\rho_j^* > 0$ for $j = 1, 2$ in equilibrium. Each country has an incentive to lower taxes below the cooperative level because doing so causes some recipients of social benefits to leave, thereby increasing per-capita transfers and wages for the remaining population. From a different perspective, this phenomenon can be explained with positive spillovers from an increase in domestic public expenditures (taxation): the associated inflow of immigrants at home leads to higher wages and higher redistributive transfers [the fiscal externality in Wildasin (1991)] abroad, which benefits the majority of the population in the foreign country.

Similar to the capital tax competition case, however, the result requires $t_j^* > 0$ in equilibrium. Thus, there may in general exist asymmetric equilibria where taxation in one country is above the cooperative level.[21] Let us therefore briefly characterize a symmetric situation with ex ante identical countries. In a symmetric equilibrium, migration is zero. Imposing symmetry on the reaction functions (13) and substituting for the expressions of η_n^j using (11) yields

$$\bar{k} - k^m = \bar{k} \frac{g^*}{2g^* + \frac{1}{2} F_{Kn} \bar{k} + \frac{1}{2}\theta}, \tag{14}$$

where $g^* > 0$ is the common public transfer. Now assume that labour markets become increasingly integrated, represented by a fall in the cost of migration from θ to θ', say. Consider a symmetric equilibrium in tax policies as characterized by (14). By inspection, the left-hand side remains unchanged when considering a new (symmetric) equilibrium at θ'. Since the right hand side decreases in θ and increases in g^*, a drop in the cost of migration must be accompanied by a drop in the level of public services, holding all other variables constant at their symmetric equilibrium values. Hence, $\theta' < \theta$ implies $g^*(\theta') < g^*(\theta)$ and consequently $t^*(\theta') < t^*(\theta)$.

[21] This can best be seen in the case where countries can impose negative transfers (head taxes) $g_j < 0$ which we have ruled out by assumption. In such a situation, it may be preferable to attract – rather than to deter – immigrants.

Corollary. *Consider any symmetric equilibrium with $\rho^* > 0$ and suppose that labour becomes more mobile (increasing integration of labour markets). Then, there exists a new symmetric equilibrium in which the common tax rate on capital is lower than in the initial situation, i.e.,*

$$\theta' < \theta \qquad \Rightarrow \qquad t^*(\theta') < t^*(\theta).$$

As a consequence, a majority of the population in each country is strictly worse off.

As labour becomes more mobile, countries perceive a higher elasticity of immigrants with respect to a change in their level of social benefits (their tax rate). Since immigration is undesirable for a majority of the residents, this effect renders high taxes less attractive.[22] From Proposition 2, the accompanied change in the voter's utility is negative for a majority because a further reduction in social benefits is harmful if those already are at inadequately low levels. We can thus conclude that increasing labour market integration is *undesirable* from the perspective of the majority of the voting population in each country, at least if countries are symmetric.

A Remark on Voter Myopia

The preceding analysis has presumed that individuals vote myopically with respect to their own migration decision even though they correctly foresee aggregate equilibrium migration. As mentioned above, this restriction on voter rationality rules out preference reversals which may arise if individuals know that they will migrate to the foreign country given the domestic policy under consideration at the voting stage, and thus prefer policies that are beneficial from the perspective of their future country of residence (rather than their home country). A similar assumption is implicit in some Tiebout models on inter-jurisdictional competition [see, e.g., Epple and Romer (1991)] which employ a general equilibrium approach where individuals move and vote simultaneously. In this formulation voters do not take the migration decisions of their fellow citizens as given (although they are made simultaneously to their own) and voting takes place in the country of (future) residence, which is somewhat difficult to reconcile with any timing of actions. While it is readily verified that both formulations yield qualitatively similar

[22] An analogous argument for mobile capital can be found in Wilson (1987) and Wildasin (1988).

results, neither is fully satisfactory which illustrates the conceptual problems associated with settings where residential and political decisions are intertwined.

One possibility to eliminate those difficulties in our model would be to consider voting under the veil of ignorance. More specifically, suppose individuals when casting their vote know their home country and their own capital endowment but not their future type i which determines the cost of migration. An individual with home country j only knows that i is uniformly distributed over the interval $[0, \bar{n}_1]$ or $[\bar{n}_1, 1]$, respectively. Using the equilibrium migration condition (ME), one can easily show that the expected consumption of a voter in country j from a policy t_j, holding t_h fixed, is

$$E[c^i|t_1, t_2] = c^i_j + I_j \frac{\theta}{2}(\bar{n}_j - n_j)^2$$

where c^i_j and n_j are evaluated at (t_1, t_2) and I_j is an indicator function which is equal to one if $\bar{n}_j > n_j$ and zero otherwise.[23] Under the veil of ignorance, voters rationally maximize expected consumption in their home country, adjusted for the additional benefit they derive from emigration.[24] Therefore, an (additional) positive bias toward emigration emerges, preserving the monotonicity properties of preferences and leaving our results qualitatively unaffected.[25]

3. FISCAL COMPETITION AND FULL INTEGRATION

The previous analysis demonstrated that partial integration (of either capital or labour markets) is detrimental to fiscal policies directed at redistributing income from the wealthy to the poor. At first glance, one may therefore be tempted to conclude that

[23]From (ME), $x_j = x_k - \theta(\bar{n}_j - n_j)$. Adding $\rho_j k^i$ on both sides yields $c^i_j = c^i_h - \theta(\bar{n}_j - n_j)$ (note that it does not matter where the individual has invested her capital). The expected consumption of an individual with home country 1, for example, is then $E[c^i|t_1, t_2] = Prob\{i \leq n_1\}c^i_1(t_1, t_2) + Prob\{i > n_1\}[c^i_2(t_1, t_2) - E_{i>n_1}\theta(\bar{n}_1 - i)] = c^i_1 + I_1 \frac{\theta}{2}(\bar{n}_1 - n_1)^2$ after substituting for c^i_2 and computing expected migration cost.

[24]Because people leave their home country only if it is beneficial to do so, their utility abroad will exceed their utility at home with the difference being determined by the number of people who emigrated in equilibrium [see (ME)]. As a consequence, if an individual has been assigned very low migration costs (and thus emigrates), her expected gain over consumption at home is larger, the smaller n_j.

[25]Clearly, the conclusions under both alternatives are identical for $\theta \to 0$ or if one confines attention to symmetric equilibria. Moreover, the fiscal competition argument under labour mobility (which then translates into lower incentives to compete for mobile capital as we will show below) would be reinforced.

full integration of labour and capital markets intensifies fiscal competition. As will become clear shortly, however, this presumption is misleading. Specifically, this section demonstrates that there are plausible circumstances in which increasing labour market integration *alleviates* capital tax competition (and vice versa). We consider a situation in which individuals can both choose where to invest their capital, and where to live. Optimal investment and residential decisions now require

$$r^1 - t_1 = r^2 - t_2 = \rho, \qquad \rho \geq 0 \tag{IE}$$

$$w_1 + g_1 = w_2 + g_2 - \theta(\bar{n}_1 - n_1). \tag{ME}$$

Together with (3), $K_1 + K_2 = \bar{k}$ and $n_1 + n_2 = 1$, these two conditions define a country j's capital stock K_j and population size (labour force) n_j as a function of t_1 and t_2. Using the implicit function theorem one can deduce the investment and migration responses to a change in t_j for $\rho > 0$,

$$\frac{\partial K_j}{\partial t_j} = [g_1/n_1 + g_2/n_2 + F^h_{Kn}(k_h - k_j) + \theta]/D \qquad j \neq h, \quad j, h \in \{1, 2\} \tag{15}$$

and

$$\frac{\partial n_j}{\partial t_j} = [t_j/n_j + t_h/n_h - F^h_{KK}(k_h - k_j)]/D, \qquad j \neq h, \quad j, h \in \{1, 2\} \tag{16}$$

where $D \equiv (F^1_{Kn} + F^2_{Kn})(t_1/n_1 - F^1_{KK}k_1 + t_2/n_2 - F^2_{KK}k_2) - (F^1_{KK} + F^2_{KK})(x^1_n + x^2_n - \theta) < 0$ provided the equilibrium characterized by (IE) and (ME) is stable.[26]

As before, the equilibrium tax policy t^*_j maximizes the utility (5) of the individual with median capital endowment k^m_j, subject to (IE) and (ME). The change in the decisive voter's net consumption can be written as

$$\frac{\partial c^m_j}{\partial t_j} = \left(k_j - k^m_j\right) + \frac{1}{n_j} t_j \frac{\partial K_j}{\partial t_j} - \frac{1}{n_j} g_j \frac{\partial n_j}{\partial t_j} - \frac{\partial r_j}{\partial t_j}(k_j - k^m_j). \tag{17}$$

Again, there is a direct redistributive effect from taxation. Furthermore, because both capital and labour are mobile, there are now two indirect revenue effects that arise from an increase in t_j. Ignoring the factor price effect $\sigma_j = \partial r_j / \partial t_j$ for the moment, it

[26] All derivations in this section are relegated to the Appendix. Using standard fix-point arguments, it is straightforward to show that such a stable equilibrium always exists.

thus appears that the fiscal competition effects identified in the previous two sections combine so as to render taxation even more unattractive. Of course, this line of reasoning implicitly presumes that the investment and labour force responses are similar to those that prevail under partial integration, namely, $\partial K_j/\partial t_j < 0$ and $\partial n_j/\partial t_j > 0$. A closer look at (16), however, reveals that this need no longer be the case. In fact, if $t_j > 0$, $j \in \{1,2\}$, then $\partial n_j/\partial t_j < 0$ for $k_j < k_h$, i.e., a rise in the domestic tax rate now leads to *emigration* for at least one country j. This stands in sharp contrast to our earlier result that in a situation where capital is immobile, increases in a nation's tax rate triggers *immigration*. The puzzle can be resolved by observing that $k_j < k_h$ also implies $\partial K_j/\partial t_j < 0$ by (15). If capital is mobile, the capital outflow caused by higher taxation (and the corresponding decrease in wages and public benefits) suffices to offset any positive effect on the government's budget that such a raise in the tax rate might have. Expressed differently, precisely because the capital inflow associated with a decline in t_j negatively affects the well-being of individuals living in the foreign country, those foreigners with relatively small mobility costs will immigrate.

Before turning to asymmetric countries below, let us first examine in more detail a situation where countries are symmetric and set a common tax rate $t_j = t$, $j = 1,2$. As we have seen in the previous two sections, this special case yields the most clear-cut predictions about the effects of fiscal competition and partial integration on countries' ability to pursue redistributive policies. Imposing symmetry on the investment and migration responses (15) and (16), we obtain

$$\frac{\partial n_j}{\partial t_j}|_{t_j=t} = \frac{t}{2F_{KK}(\pi\bar{l} + \frac{1}{4}\theta - t\frac{F_{KL}}{F_{KK}}\bar{l})} \leq 0 \tag{18}$$

$$\frac{\partial K_j}{\partial t_j}|_{t_j=t} = \frac{g + \frac{1}{4}\theta}{2F_{KK}(\pi\bar{l} + \frac{1}{4}\theta - t\frac{F_{KL}}{F_{KK}}\bar{l})} < 0. \tag{19}$$

Hence, lowering the domestic tax rate now never results in (beneficial) emigration as would be the case if capital were immobile. Moreover, the inflow of capital *per capita* that can be generated by such a policy will generally be *smaller* than in the case where labour is perfectly immobile ($\theta \to \infty$). To see this, observe that $\frac{\partial k_j}{\partial t_j} = \frac{1}{n_j}[\frac{\partial K_j}{\partial t_j} - k_j\frac{\partial n_j}{\partial t_j}]$

using (19) and (18) reduces to

$$\eta_k = \frac{\partial k_j}{\partial t_j}|_{t_j=t} = \hat{\eta}_k m(\theta) < 0,$$

where $\hat{\eta}_k = (F_{KK})^{-1}$ is the corresponding change in a situation where labour is completely immobile (Section 2.2.), and

$$m(\theta) = \frac{\pi\bar{l} + \frac{1}{4}\theta}{\pi\bar{l} + \frac{1}{4}\theta - t\frac{F_{KL}}{F_{KK}}\bar{l}} \quad \in (0,1),$$

for $t > 0$ and $F_{KL} > 0$. We see that $m(\theta)$ increases in θ and approaches one as $\theta \to \infty$. Consequently, η_k^j will be lower in absolute value, the lower θ: the per-capita capital stock reacts less elastically to a change in fiscal variables because of the associated in– or outflow of labour. The underlying reason is the following: if $t > 0 \Leftrightarrow \partial n_j/\partial t_j < 0$, a drop in t_j increases labour supply in country j which encourages investment beyond the direct tax cut effect because the marginal product of capital increases. Hence, aggregate capital stock responds more elastically to changes in t when labour is mobile and $F_{Kn} > 0$. But if $F_{KL} > 0 \Leftrightarrow -F_{KK}k > F_{Kn}$, this effect is sufficiently small so that less capital per worker is additionally invested.[27]

Setting (17) equal to zero, imposing symmetry and using our usual notation, we find that the common tax rate $t^* > 0$ in a symmetric equilibrium with $\rho^* > 0$ is determined by

$$\frac{1}{2}(\bar{k} - k^m) + t^*\eta_k - 2\pi\bar{l}\eta_n = 0.$$

Observe that for $\theta \to \infty$, we have $\eta_n \to 0$, $\eta_k \to \hat{\eta}_k$ and this condition reduces to the corresponding condition for the case where only capital is mobile. The second term reflects the combined effect of the induced factor movements on the share of public benefits that is financed through capital taxation, while the third term represents the rent-seeking effect already mentioned in the previous section. As argued above, $\eta_n < 0$

[27]Recall from Assumption 1 that $F(\cdot)$ exhibits constant returns to scale. Marginal products are thus homogeneous of degree zero and $F_{KK}k + F_{Kn} + F_{KL}l = 0$ by Euler's law (factor prices adjust to maintain zero profits). The argument here can also be verified formally by differentiating (IE) and using $\partial k_j/\partial t_j = [\partial K_j/\partial t_j - k_j(\partial n_j/\partial t_j)]/n_j$. In what follows, however, we also allow for $F_{KL} = 0$ [see Assumption 1. b)] in which case η_k is unaffected by labour migration.

so that the latter effect is now positive rather than negative. Furthermore, the revenue effect η_k is now less pronounced than in the case where labour is not mobile. Since $|\eta_n|$ decreases and $|\eta_k|$ increases in θ, holding all other variables constant at their symmetric equilibrium values, it is straightforward to show

Proposition 3. *Consider a symmetric equilibrium with $\rho^* > 0$ and suppose that labour becomes more mobile. Then, there exists a new symmetric equilibrium in which the common tax rate on capital is higher than in the initial situation, i.e.,*

$$\theta' < \theta \qquad \Rightarrow \qquad t^*(\theta') > t^*(\theta), \qquad t^*(\theta') \leq \rho^*.$$

As a consequence, a majority of the voting population in each country strictly benefits from increasing integration of labour markets.

Proof. See the Appendix. ||

The intuition for this result has already been laid out in the preceding discussion: in a symmetric equilibrium under full integration, a unilateral reduction in the domestic tax induces (detrimental) immigration. At the same time, less capital per capita can be attracted relative to a situation where labour is not mobile. These two effects of increasing labour market integration, represented by a fall in θ, work in the same direction: both migration and investment responses tend to discourage tax competition. Contrary to the finding in the preceding section, a further integration of labour markets is therefore always *desirable* from the perspective of the majority of the voting population in each country, provided capital markets are already integrated.

While the result requires symmetry in the initial equilibrium, we expect a similar line of reasoning to hold more generally as well. In particular, suppose inadequately low taxation emerges because jurisdictions compete either a) to attract a mobile tax base or b) to repel mobile beneficiaries of taxation. Viewed in isolation, both fiscal competition effects obviously work in the same direction. Yet, the picture changes once they are jointly taken into account. If a country cuts taxes to attract the tax base, it will also attract those factors that benefit from an increase in the public budget. As

long as the perceived gains from the cut are thereby reduced, the incentives to engage in wasteful fiscal competition are diminished.[28] This line of reasoning is most clearly seen for vanishing cost of migration where it holds even if countries are not identical:

Proposition 4. *Suppose* $\theta \to 0$. *Then, there exists a unique equilibrium in tax rates* (t_1^*, t_2^*) *with the following properties. For* $j = 1, 2$,

a) $(t_j^*, g_j^*) = (t^*, g^*) > 0$, *where* $\rho^* = t_j^* - r_j^* = 0$,

b) $k_j^* = \bar{k}$, $l_j^* = \bar{l} \Rightarrow w_1^* = w_2^*$ *and* $r_1^* = r_2^*$,

c) $c_j^{i*} = f(\bar{k}, \bar{l}), \ \forall\, i$.

Thus, $\rho^* = 0$ *in the unique equilibrium, i.e. the returns to capital are fully redistributed among the residents in each country. Furthermore, the equilibrium is symmetric and there is no inequality within or across countries,* irrespective *of national endowments or income distributions.*

Proof. See the Appendix. ||

Although it builds on the strong assumption that both factors are fully mobile, Proposition 4 is important in several respects. First, perfect migration allows countries to pursue redistributive policies that are completely adequate from their (equilibrium) point of view. Like in autarky, income from capital is entirely taxed away and redistributed among all residents in the unique equilibrium [part a)]. In comparison to Section 2.2, we can conclude that labour mobility fully eliminates inter-jurisdictional competition to attract mobile capital, regardless of initial differences in countries' factor endowments or national income distributions. Moreover, the converse also holds: inter-jurisdictional competition to repel the mobile beneficiaries of taxation (labour) disappears once capital is fully mobile. Although we have not emphasized this point in the previous discussion, this can easily be seen by comparing Propositions 3 and 4 to the results in Section 2.3. where such detrimental competition emerged in a common

[28] Note that this logic neither depends on the nature of the tax base nor on the identity of the net recipients of tax revenues. See also the discussion in Section 4 below.

labour market without capital mobility. Second, when countries are asymmetric, there will be more redistribution than under autarky since all differences, both within *and* across countries, vanish [part c)].[29] This is because factor mobility helps not only to equalize prevailing economic disparities but also reduces the political differences among countries, i.e., it can act as a substitute for the harmonization of national tax policies [part b)].

This last observation holds the key to understanding the argument behind Proposition 4. In particular, one can show that in any potential asymmetric equilibrium, a majority of voters in the low-tax country strictly prefers to replicate the fiscal policy in the high-tax country because this a) results in an efficient international factor allocation which maximizes per-capita output at home and abroad and b) in addition increases their redistributive benefit from taxation.[30] Hence, (IE) and (ME) jointly ensure that only symmetric equilibria in which countries set identical tax rates and converge with respect to their per-capita factor employment can exist.

Once this result is established, the unique equilibrium must entail full taxation. To see this, consider again the revenue effect of raising one's tax rate, which for $(t_j, g_j) \equiv (t, g)$ and $\theta \to 0$ becomes [see (18) and (19)]

$$t\frac{\partial K_j}{\partial t_j} - g\frac{\partial n_j}{\partial t_j} = 0, \quad j = 1, 2.$$

Perfect factor mobility implies that any loss in tax revenue induced by a capital outflow is exactly offset by a reduced cost of paying the transfer because of emigration. Conversely, any gain in tax revenue from attracting capital is lost by having to distribute this gain to additional residents. Intuitively, given the result that any equilibrium is symmetric and therefore efficient with respect to the international factor allocation, economy-wide per capita output (factor income) is maximized and remains unaffected by small factor movements in any equilibrium. At the same time, perfectly mobile capital and labour ensure that this output is always divided up equally within the two countries. Hence, a marginal change in t_j must leave average output both economy-wide and – through the

[29] We are grateful to an anonymous referee for making us aware of this point.
[30] See the proof of Proposition 4 in the Appendix.

induced factor reallocation – for each country unchanged. But if factors change their location of employment so as to keep average income generated in each country constant and equal to maximal average income, no further redistribution across countries can take place.[31] For the individual voter, therefore, only the direct redistributive effect and the indirect factor price effect $\sigma_j \in (0,1)$ are operative and a majority in each country prefers full taxation [see (17)].

While the idea that mobility of individuals may be beneficial stands in contrast to the widely accepted view captured formally in Section 2.3., it has already been put forward by some contributions on fiscal federalism. In particular, Myers (1990) and Krelove (1992) show that welfare maximizing governments providing local public goods voluntarily propose transfer payments to achieve efficiency in public good supply and international factor allocation if households are perfectly mobile. The driving force in these models is that the constraints imposed by perfect mobility completely align interests across borders if the population is homogeneous. As Bucovetsky (1995) and Wilson (1999) correctly note, however, this result rests on the unrealistic assumption that individuals are identical in every respect. Moreover, inter-jurisdictional transfer payments must be feasible if countries are not identical. Proposition 4, in contrast, allows both individuals and countries to differ in their factor endowments and there is no need for countries to influence the factor allocation through international transfers. Even more importantly, spillover effects of a mobile population are a source of inefficiency in our framework: additional immigrants at home cause foreign (domestic) per-capita expenditures and wages to rise (fall). As Proposition 2 and its Corollary demonstrate, fiscal competition therefore cannot be avoided even if countries are identical and individuals are perfectly mobile. Indeed, the problem becomes *more severe* the more mobile the population is. This result is only reversed in Propositions 3 and 4, which consider full integration and draw on the very fact that (im)migration has undesirable consequences.[32]

[31] Note that the direct redistributive effect always cancels out in aggregate (average) accounts and so do terms of trade (factor price) effects in a symmetric equilibrium.

[32] It is this property of our model that, among others mentioned above, contrasts most with previous work on the benefits of population mobility. For instance, Burbidge and Myers (1994), Wellisch (2000, Ch. 7), and Hindricks (2001) show that mobility can help to internalize inter-jurisdictional externalities. When those externalities are absent, however, migration in these models either has a positive (efficiency)

From this perspective, it is the mobility of capital which causes the spillovers associated with migration to disappear. One can therefore not conclude from our analysis that migration is welfare (or efficiency) enhancing. Rather, we provide an intuitive explanation for why two externality effects emerging under partial integration can offset each other when being combined under full integration.

We close this section by noting that the result in Proposition 4 also provides a benchmark against which the residents' utilities in a pure tax- competition situation, that is, without labour mobility, may be compared. More specifically, it indicates that potential efficiency and welfare gains brought about by the international equalization of factor returns and the desired level of redistribution also come at a cost: if both capital and labour are perfectly mobile, convergence requires countries in equilibrium to share the economy-wide surplus equally in per capita terms. In other words, any economic advantage that countries might have enjoyed in a situation where labour markets were not fully integrated is levelled out. Still, it is evident that the symmetric equilibrium in Proposition 4 cannot be improved upon from the point of view of a majority in each country without harming a majority in the other country.[33] Clearly, this outcome is therefore one possible outcome of a situation where the countries set their tax rates cooperatively.

4. DISCUSSION AND CONCLUDING REMARKS

We can now turn to a more detailed discussion of our main results and their implications. Given that capital markets are already fully integrated and fiscal competition prevails, under which circumstances could we expect a majority in each country to favour labour market integration? Proposition 3 tells us that full integration is often strictly beneficial and never detrimental if countries are in a symmetric situation. This is true even though

effect or no consequences at all on the prevailing equilibrium.

[33]Expressed differently, this particular international allocation of productive factors and choice of tax policies is on the international 'Pareto frontier' for a majority, constructed by choosing fiscal policies and factor allocations so as to maximize the consumption of the decisive voter in the domestic country, holding the consumption of the decisive voter in the foreign country fixed. This is true regardless of whether or not international transfers can be made. Also, provided (t_j, g_j) are the only redistributive instruments within a country, it is easy to see that an allocation cannot be improved upon for a majority if and only if it cannot be improved upon for the decisive voter in each country.

there are no efficiency gains from common markets in this case. Full integration serves solely to soften the countries' incentives to engage in fiscal competition. If countries differ in important economic or political variables, however, the consequences of further integration are ambiguous. Although a full-fledged analysis has been beyond the scope of this paper, it is possible to identify several forces that work in opposite directions. On the one hand, there are now efficiency gains from a common labour market that can be realized. On the other hand, Proposition 4 suggests that full integration also tends to equalize economic conditions across countries.[34] Therefore, countries that enjoyed a relative advantage in the situation without population mobility will now be at a disadvantage, *ceteris paribus*.

Some informal insights in this regard may be gained if we draw on existing results from the tax competition literature. For example, it has been shown that countries with small populations gain from capital tax competition [Bucovetsky (1991) and Wilson (1991)]. This gain will be lost if the competition is alleviated and countries converge through migration. Thus, ex ante differences in population size can make integration detrimental to the smaller country.[35] Clearly, a similar argument applies if countries differ in their endowments of the fixed factor, which one can also interpret as an existing technology gap. In such a situation, the equilibrium where only capital is mobile will favor the resource-rich or technologically more advanced country because it can attract more capital at a given tax rate. The liberalization of labour markets reduces the gap as workers migrate from the poor to the wealthy country, driving down wages and welfare benefits. Hence, even though fiscal competition may be softened, only the poor country unambiguously benefits from full integration. In contrast, it is quite possible that a (capital-poor) majority of the population in the rich country looses and, therefore, ob-

[34]This tendency has been confirmed in the numerical simulations we conducted to investigate the characteristics of asymmetric equilibria under full integration and imperfect labour mobility. The calculations also indicate that full integration maintains its mitigating effect on fiscal competition relative to each partial integration case, albeit less pronounced.

[35]Wilson (1991) compares the outcome under tax competition to the cooperative solution that treats countries symmetrically. Translated to our framework, the latter is the unique equilibrium that emerges under perfect labour mobility (Proposition 4). The author shows that the smaller country may well refuse to implement this outcome. The reason is that the cooperatively optimal symmetric allocation is dominated by the asymmetric but suboptimal allocation under tax competition.

jects to such liberalization. This possibility is worth emphasizing because, in practice, national governments have faced stiff resistance to liberalize labour movements across the European Union, and still do in the light of the EU's eastern enlargement. Since full integration implies economic convergence, the observation that workers in countries with relatively high wages and generous welfare payments reject integration is not inconsistent with our model. Rather, the creation of a common labour markets only gains political support if the countries are sufficiently alike, either because they already share similar economic and political conditions from the outset, or because previous integration measures have already narrowed down prevailing national differences.

The central message, however, remains that fiscal competition among countries need not intensify as factor markets are successively integrated. Advocates of a coordination and harmonization of European tax rates conjectured the collapse of the welfare state as countries strive to attract taxpayers and to deter the recipients of social benefits in a world where both groups may be expected to be increasingly mobile within the EU. Our unified framework has allowed us to separately consider these two fiscal competition effects and their underlying rationale in a realistic setting. We have demonstrated that unilateral tax cuts are advantageous for a capital-poor majority in each country because wages and public revenues rise as additional capital is employed domestically (Section 2.2). The same is true if such tax cuts serve to prevent welfare migration because wages and per-capita revenues decrease if additional residents enter the domestic labour market and receive public transfers (Section 2.3). Since these two fiscal competition effects work in the same direction when considered separately, the concern is that they combine so as to render redistributive taxation even more unattractive. Our results in Section 3 and the accompanying logic indicate that this fear may be unwarranted. To the contrary, these effects may well work in opposite directions if they are effective at the same time under full integration. If the beneficiaries of social policy become mobile as well, wasteful competition for a mobile tax base that helps to finance the welfare state is likely to be diminished.[36] Similarly, if the tax base is mobile, competition to keep out

[36]Note that we have treated the decision of where to reside and where to supply one's labour (human capital endowment) as inseparably connected to one another. In doing so, we have implicitly disregarded the possibility that individuals choose to work abroad but continue to live at home (e.g., through tele-

those who benefit from the welfare state may be reduced. The underlying rationale is strong and quite intuitive: unilateral tax cuts, intended to attract the tax base or to deter those who collect welfare payments, can no longer serve both purposes at the same time because, e.g., a desirable capital inflow now results in undesirable immigration. As a consequence, the country's incentives to engage in such behaviour are weakened.

For this reason, we also think that our conclusions are fairly robust to various modifications and extensions of the analysis. In particular, they should qualitatively carry over to factors of production other than 'capital' and 'labour' among which countries redistribute factor income. As one natural variant of model, suppose for instance that individuals differ in their earning ability (productivity of labour) only and that countries levy taxes on labour income for redistributive purposes. Also, assume that the decisive voter in each country has less than average productivity so that a majority favors redistribution. Clearly, if only high-skilled individuals who are *net contributors* to the social system are mobile, there would be income tax competition to attract the mobile tax base [see Proposition 1]. That high-productivity workers who move to a country to save on income tax are eligible for the social benefits as well is immaterial in this regard: what matters for the question of whether such workers are worth competing for is their net contribution to the tax base, which is positive. Likewise, if only very low-skilled workers who are *net beneficiaries* of the system are mobile, social benefits would drop as the decisive majority in each country seeks to avoid welfare migration [Proposition 2]. Now suppose both groups can migrate. Although the outcome will generally depend on the specifics of the model under investigation (on how production and factor prices vary with factor movements), we expect the offsetting effect identified in Propositions 3 and 4 to play a non-negligible role. If reducing the income tax rate attracts high-skilled labour (net contributors) and this *ceteris paribus* benefits a majority in each country, low-skilled labour (net beneficiaries) should be attracted as well. Thus, a unilateral income tax cut directed at enticing the rich will cause poor individuals living abroad

commuting). If increased integration of labour markets does not go hand in hand with increasingly mobile beneficiaries of local social policies, our results on the desirability of such measures generally will not hold. A related disclaimer applies if migrating workers are not eligible for local public transfers (see below).

to immigrate, thereby reducing the perceived gain precisely because more people on welfare hurt the majority in each country. Hence, welfare migration of the poor can mitigate wasteful income tax competition for the rich (and vice versa).

This argument also provides some insight as to the possible effects of relaxing the assumption of homogeneous labour in our model. Specifically, assume that workers differ not only with respect to their capital endowment, but also in their labour productivity (which can be either high or low, say) and consider a source tax levied on total factor income. Continue to assume that the decisive voter favors redistribution and recall that capital investment decisions are independent of migration decisions. A negative fiscal competition effect then arises under the partial integration of either factor market (capital, high-skilled labour, low-skilled labour) in isolation. Whether successive integration now intensifies or alleviates fiscal competition is ambiguous and is likely to depend on the relative mobility of factors: consider for instance the integration of labor markets in a world where capital is already mobile. If low-skilled labour is less mobile that high-skilled labor, tax competition may intensify because the most responsive factors contribute (net) to the tax base (the two fiscal competition effects for capital and high-skilled labour should work in the same direction). But if further integration facilitates a common market for low-skilled labour, the third fiscal competition effect should work in the opposite direction. As before, this effect may generate enough political support for a *further* integration of labour markets, provided the countries economic and political conditions are sufficiently similar.

Second, we have assumed that domestic voters in j choose the capital tax rate t_j, taking as given the foreign tax rate t_h. Once factors have moved internationally, national per-capita grants (g_j, g_h) are determined residually from public budgets. As first noted by Wildasin (1988), this assumption is often not innocuous: equilibria will generally differ if instead governments choose expenditures g_j, taking as given the foreign g_h, and then passively adjust t_j to balance their budgets.[37] In this alternative scenario,

[37]Because the residual tax rate t_j cannot take arbitrary values, though, this approach suffers from the problem that the feasible range for g_j varies with the chosen g_h of the other country (admissible strategies are interdependent). Expressed differently, for some (g_h, g_j), there may be no tax vector (t_j, t_h) such that both countries' budgets balance ex post.

our results can be shown to hold as long as we continue to confine attention to stable equilibria in international factor movements. Then, equilibrium transfers again are 'too small' if either capital or labour is mobile. Moreover, these negative fiscal competition effects under partial integration run against each other as mobile workers follow mobile capital under full integration.

What is important for our results, however, is that individuals are treated equally everywhere. That is, there is no explicit or implicit discrimination against immigrants on the basis of origin. While the equal treatment principle naturally applies within a country, a different picture emerges if one considers an international context. Even in the European Union, informal barriers to free residential choice remain despite the fact that the Union guarantees free mobility and equal treatment in the Treaty of Rome and has since adopted a series of measures directed at promoting mobility across member states. Thus, our non-discrimination assumption may be quite strong. Yet, the observation that it is *necessary* for our argument to apply sheds light on the question of whether equal treatment is a desirable principle. From a partial integration point of view, for instance, one could argue that abandoning the equal-treatment doctrine serves as an instrument to moderate fiscal competition in common labour markets. Indeed, if migrating workers are not eligible for the local redistribute transfer payments, no fiscal competition would arise in equilibrium when capital is immobile. Our analysis, in contrast, indicates that such measures may well work in a quite different direction if labour *and* capital markets are integrated: the discrimination against immigrants in domestic social programs reduces the mitigating effect of labour mobility and may thus help to intensify rather than to alleviate fiscal competition.

APPENDIX

A1. Proof of the Majority Voting Equilibrium

We show that a tax rate t_j^* is preferred to all other tax rates t_j under majority voting in country j if and only if it is the most preferred tax rate of the individual with median capital endowment k_j^m. The argument follows Grandmont (1978). Under our assumption that voters are myopic with respect to their own moving decision (or, alternatively, if they vote under the veil of ignorance), only their capital endowment k^i matters for their preferred policy as can be

seen from (5). Using the second expression in (5), the preferences of a voter with endowment k^i in country j over t_j can be written as

$$c_j^i(t_j) = c_j^m(t_j) + \rho_j(t_j)(k_j^i - k_j^m), \tag{A1}$$

where $c_j^m(t_j)$ is the utility (consumption) of the voter with the median capital endowment k_j^m and $\rho_j(t_j) \equiv r_j(t_j) - t_j$. Now let t_j and t'_j be two different tax rates and assume without loss of generality that the median voter prefers t_j to t'_j, i.e. $c_j^m(t_j) \geq c_j^m(t'_j)$. Using (A1), this implies

$$c_j^i(t_j) - c_j^i(t'_j) \geq \left[\rho_j(t_j) - \rho_j(t'_j)\right](k_j^i - k_j^m). \tag{A2}$$

By inspection of (A2), $\rho_j(t_j) \geq \rho_j(t'_j)$ implies $c_j^i(t_j) \geq c_j^i(t'_j)$ for all i such that $k^i \geq k_j^m$ and $\rho_j(t_j) \leq \rho_j(t'_j)$ implies $c_j^i(t_j) \geq c_j^i(t'_j)$ for all i such that $k^i \leq k_j^m$. In both cases, a majority prefers policy t_j to t'_j. Observe that the converse is also true, i.e., if a majority of the population prefers t_j to t'_j, then $c_j^m(t_j) \geq c_j^m(t'_j)$. Hence, the tax rate t_j is preferred to all other tax rates t'_j under majority voting in country j if and only if it is the most preferred tax rate of the individual with median capital endowment k_j^m. ||

A2. Proof that the economy's capital stock is fully utilized in any equilibrium

To show that $K_1 + K_2 = n_1 k_1 + n_2 k_2 = \bar{k}$ in any equilibrium, suppose by way of contradiction, that t_1 and t_2 are such that $n_1 k_1 + n_2 k_2 < \bar{k} \Rightarrow \rho_j(t_1, t_2) = F_K^j - t_j = 0$ for some country j. Changes in the domestic tax rate t_j then correspond to changes in F_K^j. Since F_K^j is homogeneous of degree zero, we can write $r_j = F_K(K_j, L_j, n_j) = f_k(k_j, l_j)$, which implies $dF_K^j = f_{kk}^j dk_j - \frac{1}{n_j} l_j f_{kl}^j dn_j$. Setting $dF_K^j = dt_j$ yields

$$f_{kk}^j \frac{dk_j}{dt_j} - \frac{1}{n_j} f_{kl}^j l_j \frac{dn_j}{dt_j} = 1 \qquad \Rightarrow \qquad \left(\frac{dn_j}{dt_j} \geq 0 \;\Rightarrow\; \frac{dk_j}{dt_j} < 0 \right) \tag{A3}$$

Because $\rho_j = 0$, the consumption of a voter i in j is $c_j^i = \frac{1}{n_j} F(K_j, n_j, L_j) = f(k_j, l_j)$ for all i. Note that all labour is supplied in equilibrium because $g_j \geq 0$ and wages are positive by Assumption 1.a).

Suppose first individuals are immobile (Section 2.2), i.e., $dn_j \equiv 0$ so that $dk_j/dt_j < 0$ from (A3). Since lowering t_j strictly increases k_j and therefore c_j^i, the population in j would unanimously prefer a lower tax rate, a contradiction to our assumption that t_j constitutes an equilibrium.

Next, consider mobile individuals. Again, we show that dc_j^i/dt_j is strictly negative. Suppose by way of contradiction that $dc_j^i/dt_j \geq 0$. Totally differentiating the migration equilibrium condition $c_j^i = c_h^i - \theta(\bar{n}_j - n_j)$ then requires

$$\frac{dc_j^i}{dt_j} = \frac{dc_h^i}{dt_j} + \theta \frac{dn_j}{dt_j} \geq 0. \tag{A4}$$

If capital is immobile (Section 2.3), $dc_h^i/dt_j = -x_h \frac{dn_j}{dt_j}$ since $dn_h = -dn_j$ so that the right hand side of (A4) can only be non-negative if $dn_i/dt_i \geq 0$, which in turn implies $dk_i/dt_i < 0$ from (A3). But then, $dc_h^i/t_i < 0$, a contradiction.
Finally, suppose capital is mobile as well (Section 3). From (IE), $\rho_j = \rho_h = 0$ so that changes in t_j do not affect the return to capital F_K^h abroad. Setting $dF_K^h = 0$ and using $dn_h = -dn_j$, we obtain

$$f_{kk}^h \frac{dk_h}{dt_j} + \frac{1}{n_h} f_{kl}^h l_h \frac{dn_j}{dt_j} = 0 \qquad \Rightarrow \qquad \left(\frac{dn_j}{dt_j} \geq 0 \Leftrightarrow \frac{dk_h}{dt_j} \geq 0 \right) \tag{A5}$$

Now, as $c_h^i = f(k_h, l_h)$ due to $\rho_h = 0$, the right hand side of (A4) becomes

$$f_k^h \frac{dk_h}{dt_j} + (\frac{1}{n_h} l_h f_l^h + \theta) \frac{dn_j}{dt_j} \geq 0.$$

Together with (A5), we therefore must have $dn_j/dt_j \geq 0$ and $dk_h/dt_j \geq 0$. But (A3) then requires $dk_j/dt_j < 0$, which again contradicts $dc_j^i/dt_j \geq 0$ because c_j^i strictly decreases in n_j and strictly increases in k_j. ||

A3. Derivation of the Investment and Migration Responses (Section 3)

We already know that both factors are fully employed in any equilibrium so that $dn_1 = -dn_2$ and $dK_1 = -dK_2$. Total differentiation of (IE) and (ME) then yields the following system of equations:

$$\begin{pmatrix} F_{Kn}^1 + F_{Kn}^2 & F_{KK}^1 + F_{KK}^2 \\ x_n^1 + x_n^2 - \theta & x_K^1 + x_K^2 \end{pmatrix} \begin{pmatrix} dn_j \\ dK_j \end{pmatrix} = \begin{pmatrix} 1 \\ -k_j \end{pmatrix} dt_j,$$

where x_n^j is defined as in Section 2.3. and $x_K^j \equiv \partial x_j / \partial K_j = \frac{1}{n_j} t_j - F_{KK}^j k_j > 0$. Let $D \equiv (F_{Kn}^1 + F_{Kn}^2)(x_K^1 + x_K^2) - (F_{KK}^1 + F_{KK}^2)(x_n^1 + x_n^2 - \theta)$ be the determinant of the matrix on the left hand side. In what follows, we confine ourselves to those equilibria described by (IE) and (ME) that are stable and thus require $D < 0$. Using Cramer's rule and substituting the expressions for x_n^j and x_K^j yields (15) and (16).

If countries are symmetric and set identical tax rates $t_1 = t_2 = t$, we must have $K_1 = K_2 = \frac{1}{2}\bar{k}$, $L_1 = L_2 = \frac{1}{2}\bar{l}$, and $n_1 = n_2 = \frac{1}{2}$ which also implies $k_j = \bar{k}$, $l_j = \bar{l}$ and $g_1 = g_2 = g$. As we will need the migration and investment responses for $t_1 = t_2$ and symmetric per-capita factor supplies but arbitrary country sizes in the proof of Proposition 4 later, we will derive them using $k_1 = k_2 = \bar{k}$ and $l_1 = l_2 = \bar{l}$ without specifying n_j. To this end, note that because $F(\cdot)$ is homogeneous of degree 1, we can write $\frac{1}{n_j} F(K_j, n_j, L_j) = F(k_j, 1, l_j) \equiv f(k_j, l_j)$. Hence, $F_K^j(\cdot) = f_k^j(\cdot)$, $F_L^j(\cdot) = f_l^j(\cdot)$ and $F_{KK}^j = \frac{1}{n_j} f_{kk}^j$. As factor prices adjust to maintain zero profits, we also have $F_{Kn}^j = -k_j F_{KK}^j - l_j F_{KL}^j = -\frac{1}{n_j}(-k_j f_{kk}^j - l_j f_{kl}^j) \equiv \frac{1}{n_j} f_{kn}^j$.

If all functions are evaluated at their symmetric (per-capita) equilibrium values, we have $x_K^1 + x_K^2 = \frac{1}{n_1 n_2}(t - f_{kk}\bar{k})$ and $x_n^1 + x_n^2 = -\frac{1}{n_1 n_2}(g + f_{kn}\bar{k})$ from Section 2.3. The determinant

D becomes

$$D = \frac{1}{(n_1 n_2)^2} f_{kn}(t - f_{kk}\bar{k}) - \frac{1}{(n_1 n_2)^2} f_{kk}(-g - f_{kn}\bar{k} - n_1 n_2 \theta)$$
$$= \frac{f_{kk}}{(n_1 n_2)^2}(g + n_1 n_2 \theta + t\frac{f_{kn}}{f_{kk}}) = \frac{f_{kk}}{(n_1 n_2)^2}(\pi\bar{l} + n_1 n_2 \theta - t\frac{f_{kl}}{f_{kk}}\bar{l}) < 0,$$

where the last equality follows from substituting $g = t\bar{k} + \pi\bar{l}$ and using $f_{kn} = -f_{kk}\bar{k} - f_{kl}\bar{l}$. From (15) and (16),

$$\frac{\partial n_j}{\partial t_j}|_{t_j=t} = \frac{t/(n_1 n_2)}{D} \leq 0, \qquad \frac{\partial K_j}{\partial t_j}|_{t_j=t} = \frac{(g + (n_1 n_2)\theta)/(n_1 n_2)}{D} < 0. \tag{A6}$$

Inserting the expression for D into (A6), using $n_1 = n_2 = \frac{1}{2}$ and substituting back for $F_{KK} = 2f_{kk}$ and $F_{KL} = 2f_{kl}$ yields (18) and (19).

Finally, we derive the factor price effect $\sigma_j = \frac{\partial r_j}{\partial t_j}$ in an equilibrium characterized by (per-capita) symmetry. Note first that since $f^1_{kk} = f^2_{kk}$ and $f^1_{kn} = f^2_{kn}$ in such an equilibrium,

$$\frac{\partial r_h}{\partial t_j} = -F^h_{KK}\frac{\partial K_j}{\partial t_j} - K^h_{Kn}\frac{\partial n_j}{\partial t_j} = -\frac{1}{n_h}\left[f^h_{kk}\frac{\partial K_j}{\partial t_j} + f^h_{kn}\frac{\partial n_j}{\partial t_j}\right]$$
$$= -\frac{n_j}{n_h}\frac{1}{n_j}\left[f^j_{kk}\frac{\partial K_j}{\partial t_j} + f^j_{kn}\frac{\partial n_j}{\partial t_j}\right] = -\frac{n_j}{n_h}\frac{\partial r_j}{\partial t_j}.$$

Using $\partial r_j/\partial t_j - 1 = \partial r_h/\partial t_j$ from (IE) now yields $\sigma_j = n_h \in (0,1)$ and when countries are identical in size, $\sigma_j = \frac{1}{2}$, $j = 1, 2$.

A4. Proof of Proposition 3

Setting (17) equal to zero gives the first-order condition

$$(1 - \sigma_j)(k_j - k^m_j) + \frac{1}{n_j}t_j\frac{\partial K_j}{\partial t_j} - \frac{1}{n_j}g_j\frac{\partial n_j}{\partial t_j} = 0.$$

When considering a symmetric equilibrium with $t_j = t_h = t^*$, we can use $\sigma_j = \frac{1}{2} = n_j$, $k_j = \bar{k}$, (19) and (18). The condition reduces to

$$\frac{1}{2}(\bar{k} - k^m) = -\frac{\frac{1}{4}\theta t^*}{F_{KK}[\bar{l}(\pi - t^*\frac{F_{KL}}{F_{KK}}) + \frac{1}{4}\theta]}, \tag{A7}$$

which defines the common equilibrium tax rate $0 < t^* \leq r^*$. Holding all variables except t^* constant at their symmetric equilibrium values, the right-hand side (RHS) of (A7) approaches $-t/F_{KK}$ for $\theta \to \infty$ and (A7) reduces to the corresponding equilibrium condition in the pure tax competition case where labour is immobile.

Observe that RHS increases in both θ and t^*. Now consider an equilibrium where (A7) is satisfied and $\rho^* = r^* - t^* > 0$ with $r^* = F_K^*$, evaluated at $K^* = \frac{1}{2}\bar{k}$, $L^* = \frac{1}{2}\bar{l}$, and $n^* = 1/2$. Because all other variables do not vary with θ or the common tax t in a symmetric equilibrium, we can find for any $\theta' < \theta$ a tax rate $t' > t^*$ such that (A7) holds at θ' and t'. Therefore, if $\rho' = r^* - t' \geq 0$, there exists a new equilibrium satisfying (A7) with $t' > t^*$. If $\rho' < 0$, i.e., $t' > r^*$, let the new equilibrium tax rate be $t'' = r^*$. In either case, $t^*(\theta') > t^*(\theta)$ and the fall in θ strictly improves the welfare of a majority of the voting population in each country by the same argument as in the proofs of Propositions 1 and 2. Finally, note that $\theta \to 0$ implies that RHS $\to 0$, i.e. we approach full taxation for some $\theta >> 0$. ||

A5. Proof of Proposition 4

For the proof of this proposition, the following lemma is useful:

Lemma 1. Suppose $\theta = 0$. Then, for $j, h \in \{1, 2\}$, $j \neq h$, we have

$$\begin{aligned} t_j &= t_h \implies k_j = k_h \quad \text{and} \quad l_j = l_h; \\ t_j &< t_h \implies k_j > k_h \quad \text{and} \quad l_j \leq l_h, \end{aligned}$$

with strict inequality if $t_j > 0$.

Proof. Recall that $f_j = f(k_j, l_j)$ is per-capita output in country j. Since $f(\cdot)$ is concave,

$$f_j - f_h \geq f_k^j(k_j - k_h) + f_l^j(l_j - l_h), \qquad j, h = 1, 2.$$

For $\theta = 0$, the migration equilibrium condition (ME) can be written as $f_j - f_h = \rho(k_j - k_h)$. Inserting this equation into the inequality above, setting $f_l^j = \pi_j$ and $\rho = (f_k^j - t_j)$ yields $t_j(k_j - k_h) + \pi_j(l_j - l_h) \leq 0$, $j, h = 1, 2$, or, equivalently,

$$t_1(k_1 - k_2) \leq \pi_1(l_2 - l_1) \tag{A8}$$

$$\text{and} \qquad t_2(k_1 - k_2) \geq \pi_2(l_2 - l_1). \tag{A9}$$

Consider first $t_1 = t_2$ and suppose without loss of generality that $k_1 > k_2$. Because f_k^j is decreasing in k and increasing in l, the investment equilibrium condition (IE) then implies $l_1 > l_2$, which together with $k_1 > k_2$ contradicts (A8). Hence, for $t_1 = t_2$, we must have $k_1 = k_2$ and $l_1 = l_2$.

Next, consider $t_1 < t_2$ and suppose $k_1 \leq k_2$ (the case $t_2 < t_1$ is analogous). (IE) then implies $l_1 < l_2$. But $k_1 \leq k_2$ and $l_1 < l_2$ contradict (A9). Thus, we must have $k_1 > k_2$ which together with (A8) implies $l_1 \leq l_2$ with strict inequality if $t_1 > 0$. ||

Proof of Proposition 4. We proceed in two steps. First we show that for $\theta \to 0$ and $k_j^m < \bar{k}$, $j = 1, 2$, asymmetric equilibria cannot exist.

The proof uses a revealed preference argument and is by contradiction. Thus, suppose there exist an equilibrium with asymmetric tax rates and assume $t_1 < t_2$ without loss of generality. If this is an equilibrium, the median-income individual in country 1 must weakly prefer t_1 to any other tax rate t_1'. In particular this must be true for the equilibrium tax rate in the foreign country, t_2. From Lemma 1, if $t_1' = t_2$, $k_1 = k_2 = \bar{k}$ and $l_1 = l_2 = \bar{l}$. Hence,

$$c_1^m(t_1, t_2) = f_1 - \rho(k_1 - k_1^m) \geq \bar{f} - \bar{\rho}(\bar{k} - k_1^m) = c_1^m(t_2, t_2), \tag{A10}$$

where $\bar{f} = f(\bar{k}, \bar{l})$ and $\bar{\rho} = f_k(\bar{k}, \bar{l}) - t_2$. From (ME), $f_1 - \rho k_1 = f_2 - \rho k_2$. Inserting this expression into (A10) yields

$$f_2 - \rho(k_2 - k_1^m) \geq \bar{f} - \bar{\rho}(\bar{k} - k_1^m) \tag{A11}$$

Multiplying (A10) by n_1 and (A11) by n_2 and adding up, we obtain

$$n_1 f_1 + n_2 f_2 - \rho(\bar{k} - k_1^m) \geq \bar{f} - \bar{\rho}(\bar{k} - k_1^m).$$

Note that $\bar{f} \geq n_1 f_1 + n_2 f_2$ because total output is maximized for $k_j = \bar{k}$ and $l_j = \bar{l}$, $j = 1, 2$. Hence, the above inequality can be satisfied only if $\rho(\bar{k} - k_1^m) \leq \bar{\rho}(\bar{k} - k_1^m)$. Due to $\bar{k} > \bar{k}_1^m$ by assumption, this is equivalent to $\rho \leq \bar{\rho}$ or, using the expressions $\rho = f_k(k_2, l_2) - t_2$ and $\bar{\rho} = f_k(\bar{k}, \bar{l}) - t_2$, to

$$f_k(k_2, l_2) \leq f_k(\bar{k}, \bar{l}). \tag{A12}$$

From Lemma 1, however, $t_1 < t_2$ implies $k_1 > k_2$ and $l_1 \leq l_2$. Hence, $k_2 < \bar{k}$ and $l_2 > \bar{l}$, a contradiction to (A12).

Next, we show that for $k_j^m < \bar{k}$, $j = 1, 2$, there exists a unique equilibrium in which $t_j = \bar{r} = f_k(\bar{k}, \bar{l})$. We already know from Step 1 that any equilibrium must be symmetric in per-capita terms. Evaluating the migration and investment response functions at $\theta = 0$ and the (symmetric) equilibrium values (t, g) and $(\bar{k}, \bar{l})$ yields [see (A6)],

$$t \frac{\partial K_j}{\partial t_j} - g \frac{\partial n_j}{\partial t_j} = 0, \quad j = 1, 2. \tag{A13}$$

Inserting (A13) into (17), using $k_j = \bar{k}$ and $\sigma_j = n_h = 1 - n_j$, we find

$$\frac{\partial c_j^m}{\partial t_j}|_{t_j = t_h} = \bar{k} - k_j^m - \sigma_j(\bar{k} - k_j^m) = n_j(\bar{k} - k_j^m) > 0,$$

for any $t_j = t_h$ such that $n_1 k_1 + n_2 k_2 = \bar{k}$. Hence, a majority of voters in country j would prefer a higher tax rate than t_h for $t_h < \bar{r} \Leftrightarrow \rho > 0$. Conversely, for symmetric tax rates where $\rho = 0$ and $n_1 k_1 + n_2 k_2 < \bar{k}$, $\partial c_j^m / \partial t_j < 0$ because all voters in j prefer a lower tax than t_h (see A.2 above). It follows that the unique equilibrium is $t_j^* = \bar{r}$, $j = 1, 2$ which completes the proof. ||

REFERENCES

BOADWAY, R. and F. FLATTERS (1982), "Efficiency and Equalization Payments in a Federal System of Government", *Canadian Journal of Economics*, 15, 613-33.

BOLTON, P. and G. ROLAND (1997), "The Break-Up of Nations: A Political Economy Analysis", *Quarterly Journal of Economics*, 112, 1057-1090.

BRUECKNER, J. (2000), "Welfare Reform and The Race to the Bottom: Theory and Evidence", *Southern Economic Journal*, 22, 505-525.

BUCOVETSKY, S. (1991), "Asymmetric Tax Competition", *Journal of Urban Economics*, 30, 167-181.

BUCOVETSKY, S. (1995) "Rent Seeking and Tax Competition", *Journal of Public Economics*, 58, 337-63.

BURBIDGE, J.B. and G. M. MYERS (1994), "Population Mobility and Capital Tax Competition", *Regional Science and Urban Economics*, 24, 441-459.

CREMER, H. and P. PEESTIEU (1996), "Distributive Implications of European Integration", *European Economic Review*, 40, 747-757.

EDWARDS, J. and M. KEEN (1996), "Tax Competition and Leviathan", *European Economic Review*, 40, 113-134.

EPPLE, D. and T. ROMER (1991), "Mobility and Redistribution", *Journal of Political Economy*, 99, 828-58.

EUROPEAN COMMISSION (1998), *Conclusions of the ECOFIN Council Meeting on 1 December 1997 concerning taxation policy* (Brussels: The European Commission).

FLATTERS, F., V. HENDERSON, and P. MIESZKOWSKI (1974), "Public Goods, Efficiency and Regional Fiscal Equalization", *Journal of Public Economics*, 3, 99-112.

FUEST, C. (1995), "Interjurisdictional Competition and Public Expenditure: Is Tax-Coordination Counterproductive?", *Finanzarchiv*, 52, 478-496.

GORDON, R. H. (1983), "An Optimal Taxation Approach to Fiscal Federalism", *Quarterly Journal of Economics*, 98, 567-586.

GRANDMONT, J.-M. (1978), "Intermediate Preferences and the Majority Rule", *Econometrica*, 46, 317-330.

HINDRIKS, J. (2001), "Mobility and Redistributive Politics", *Journal of Public Economic Theory*, 3, 95-120.

HUIZINGA, H. and S. B. NIELSEN (1998), "Does Partial Tax Coordination Make Sense?" (Mimeo, Economic Policy Research Unit, Copenhagen).

KUHN, P. and I. WOOTON (1987), "International Factor Movements in the Presence of a Fixed Factor", *Journal of International Economics*, 23, 123-140.

KESSLER, A. S., C. LÜLFESMANN, and G. M. MYERS (2001), "Economic versus Political Symmetry and the Welfare Concern with Market Integration and Tax Competition", *Journal of Public Economics* (forthcoming).

KRELOVE, R. (1992), "Efficient Tax Exporting", *Canadian Journal of Economics*, 25, 145-55.

MYERS, G. M (1990), "Optimality, Free Mobility, and the Regional Authority in a Federation," *Journal of Public Economics*, 43, 107-121.

OATES, W. E. (1972), *Fiscal Federalism* (New York: Harcourt Brace Jovanovich).

OECD (1998), *Harmful Tax Competition: An Emerging Global Issue* (Paris: Organization for Economic Cooperation and Development).

PEROTTI, R. (1993), "Political Equilibrium, Income Distribution, and Growth", *Review of Economic Studies*, 60, 755-776.

PERRONI, C. and K. SCHARF (2001), "Tiebout with Politics: Capital Tax Competition and Constitutional Choices", *Review of Economic Studies*, 68, 133-154.

PERSSON, T. and G. TABELLINI (1992), "The Politics of 1992: Fiscal Policy and European Integration", *Review of Economic Studies*, 59, 689-701.

SINN, H.-W. (2000), "EU Enlargement and the Future of the Welfare State – Stevenson Lecture", *Scottish Journal of Political Economy* (forthcoming).

TIEBOUT, C. (1956), "A Pure Theory of Local Expenditures", *Journal of Political Economy*, 64, 416-24.

WELLISCH, D. (2000), *Theory of Public Finance in a Federal State* (Cambridge: Cambridge University Press).

WILDASIN, D. (1988), "Nash Equilibria in Models of Fiscal Competition", *Journal of Public Economics*, 35, 229-240.

WILDASIN, D. (1989) "Interjurisdictional Capital Mobility: Fiscal Externality and a Corrective Subsidy", *Journal of Urban Economics*, 25, 193-212.

WILDASIN, D. (1991), "Income Redistribution in a Common Labor Market", *American Economic Review*, 81, 757-774.

WILSON, J.D. (1987), "Trade, Capital Mobility, and Tax Competition", *Journal of Political Economy*, 95, 835-856.

WILSON, J.D. (1991), "Tax Competition with Interregional Differences in Factor Endowments", *Regional Science and Urban Economics*, 21, 423-451.

WILSON, J.D. (1999), "Theories of Tax Competition", *National Tax Journal*, 52, 269-304.

ZODROW, G.R. and P. MIESZKOWSKI (1986), "Pigou, Tiebout, Property Taxation, and the Underprovision of Local Public Goods", *Journal of Urban Economics*, 19, 356-370.