Tiebout with Politics: Capital Tax Competition and Constitutional Choices*

Carlo Perroni
University of Warwick, Coventry, U.K.

and

Kimberley A. Scharf
Institute for Fiscal Studies, London, U.K., and
University of Warwick, Coventry, U.K.

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Abstract

This paper examines how capital tax competition affects jurisdiction formation. We describe a locational model of public goods provision, where jurisdictions are represented by coalitions of consumers with similar tastes, and where the levels of taxation and local public goods provision within jurisdictions are selected by majority voting. We show that in this setting interjurisdictional tax competition results in an enlargement of jurisdictional boundaries, and can raise welfare for all members of a jurisdiction even in the absence of intrajurisdictional transfers.

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Correspondence should be addressed to Carlo Perroni, Department of Economics, University of Warwick, Coventry CV4 7AL, UK. E-mail: C.Perroni@warwick.ac.uk.

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I Introduction

The accelerating pace of international economic integration of recent years has brought about a shift of focus in the debate over tax policies. Traditional efficiency arguments in tax design relating to the behavioural responses of domestic firms and households have given way to concerns over the interjurisdictional implications of tax policies. These concerns have been reflected in theoretical research on tax competition, which has focused on the fiscal externalities arising from the independent fiscal choices of sovereign jurisdictions, and has stressed the efficiency costs of policy coordination failure.

Analyses of capital tax competition (Zodrow and Mieszkowski, 1986; Gordon and Wilson, 1986), in particular, have suggested that when capital can move across borders, lack of coordination can result in suboptimal levels of taxation and public goods provision. The overall conclusion from this literature is that there could be gains from coordination. Here we argue that this conclusion is unwarranted without the support of a positive theory of fiscal choices. The study of tax competition is arguably positive in nature; yet, earlier literature has maintained the assumption, inherited from a long normative tradition in public finance, that tax authorities act as benevolent planners and pursue well defined social objectives. The conclusion that tax competition amongst jurisdictions has undesirable efficiency consequences relies crucially on this assumption. If, for instance, governments directly engage in socially wasteful activities, tax competition could actually raise welfare, a point made by Edwards and Keen (1996). Assessing the implications of tax competition in an institutional vacuum can thus be misleading.

This paper casts the analysis of capital tax competition within a positive theory of jurisdiction formation and local fiscal choices. Our starting point is the hypothesis, pervasive in the local public finance literature since Tiebout's (1956) analysis, that the structure of jurisdictions is endogenous—reflecting a balance between the oppor-

tunities for exploiting economies of scale in public goods provision and the need to provide varieties of public goods that are tailored to different tastes—and that competition among a sufficiently large number of jurisdictions independently selecting tax/expenditure combinations, combined with free migration, can lead to efficiency in the provision of local public goods.

When it was first formulated, this conjecture appeared to provide a compelling foundation for a theory of fiscal federalism. Subsequent analyses, however, have shown this foundation to be fragile. There have been two main lines of attack to Tiebout's construction. The first is represented by the tax competition literature, with its focus on fiscal externalities, while the second has questioned the assumption, implicitly underlying Tiebout's analysis, that efficient public choice mechanisms are available within jurisdictions (Bewley, 1981; Bucovetsky, 1981; Epple and Zelenitz, 1981). These two lines of analysis have been viewed not so much as competing critiques but as reciprocally reinforcing indictments of Tiebout's theory, and have thus developed separately, albeit in clear sight of one other. The early literature on fiscal externalities (Boskin, 1973; Sonstelie and Portney, 1978) took a very stylized view of jurisdiction formation, positing that tax authorities aim at maximizing membership, while more recent analyses of capital tax competition treat jurisdictions as exogenous institutions. There has been some research on how, in the presence of capital tax competition, economic integration affects political equilibria within jurisdictions (Persson and Tabellini, 1992), but the linkage between capital tax competition and constitutional choices within a positive model of jurisdiction formation has so far not been explored.

In this paper we seek to bridge these two strands of literature, by providing a positive foundation to the analysis of capital tax competition. We describe a locational model of local fiscal choices, where jurisdictions consist of coalitions of consumers with similar preferences, and where levels of taxation and local public goods provi-

sion within jurisdictions are selected by majority voting. In this setting we explore the implications of interjurisdictional factor mobility and tax competition for constitutional choices.

We show that, if the choice of the median voter does not coincide with the choice favoured by peripheral individuals, the presence of interjurisdictional tax competition results in an enlargement of jurisdictional boundaries. This is because the downward pressure on taxation associated with tax competition reduces the gap between the median voter's choice and the level of taxation preferred by peripheral consumers, which makes joining a jurisdiction more attractive for peripheral consumers. We also show that the presence of tax competition, by constraining the median voter's fiscal choices, can raise welfare for all individuals within a given jurisdiction. These findings invite a reassessment of the role of tax competition in a fiscal federation, suggesting that it may play a positive disciplinary role, and that it may lower the costs of political coordination failure stemming from the presence of imperfect public choice mechanisms.

The paper is organized as follows. Section II describes our modelling setup; Sections III and IV focus on voting and on jurisdiction formation. Section V examines how tax competition affects jurisdiction size, while Section VI derives welfare implications. Section VII summarizes and concludes.

II Local preferences and local public goods

We develop a locational model of jurisdiction formation and interjurisdictional capital tax competition, where jurisdictions consist of groupings of individuals having similar preferences. We focus on a setup where there exist different varieties of local public goods, and where each individual prefers a certain variety to all other varieties. To model this idea, we assume that both public good varieties and individuals can

be ordered over the real line, which enables us to represent preferences in terms of location and distance. Thus, location is used in our model simply as a metaphor for individuals' preference orderings, and is exogenous.

Formally, consider a continuum of individuals uniformly distributed along the real line. Each individual $i \in (-\infty, \infty)$ consumes a private good and a local public good. Individuals' preferences over private consumption c and public good consumption l are described by a quasilinear utility function[1]

$$\hat{u}[c, l] \equiv c + \hat{h}[l], \tag{1}$$

with $\hat{h}' > 0$, $\hat{h}'' < 0$, which is identical across consumers. Individuals are partitioned into *jurisdictions*, i.e., groupings of contiguous consumers—which we shall assume to consist of right-closed intervals—and only consume the public goods provided in the jurisdiction to which they belong.[2]

There exist as many varieties $j \in (-\infty, \infty)$ of local public goods as individuals, but only one variety is provided in a given jurisdiction. All individuals can consume any of these varieties, but each individual i prefers variety $j = i$ to any other variety. This hypothesis can be captured by assuming that the effective amount of local public good consumption l that consumer i obtains from g units of variety j decreases with

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[1]We shall use a hat (ˆ), inverted hat (˘), or tilde (˜) to denote functions and we will enclose their arguments in square brackets, or simply omit them when there is no ambiguity. All functions are assumed to be continuous and twice differentiable. We shall use primes for derivatives of single-variable functions and subscripts for partial derivatives of multivariate functions.

[2]Our discussion focuses on pure local public goods, and abstracts from the possibility that benefits from public goods provided within a given jurisdiction may spill over to other jurisdictions across boundaries.

the distance $s \equiv |i - j|$ between i and j:

$$\hat{l}[g, s] \equiv \hat{y}[s]g, \tag{2}$$

where $\hat{y}[0] = 1$, $\hat{y}' < 0$, and $\hat{y}'' < 0$.[3]

To simplify the notation, let us define

$$\hat{v}[g, s] \equiv \hat{h}[\hat{l}[g, s]]. \tag{3}$$

Note that $\hat{v}_g > 0$, $\hat{v}_{gg} < 0$, $\hat{v}_s < 0$, $\hat{v}_{ss} < 0$, and

$$\hat{v}_{gs} = \hat{y}'(\hat{h}' + \hat{l}\hat{h}''). \tag{4}$$

One can verify that the sign of $\hat{v}_{gs}$ agrees with the sign of the expression $1 + \epsilon$, where $\epsilon \equiv \hat{h}'/(\hat{l}\hat{h}'') < 0$ is the inverse elasticity of the marginal valuation of the public good with respect to public good provision.

We shall assume that the marginal rate of transformation between public goods and private goods in production is constant and, without loss of generality, equal to unity. Each individual is endowed with z units of an immobile factor, which is situated in the jurisdiction to which the individual belongs, and e units of a mobile factor. Output is produced using both factors, according to constant-returns-to-scale technologies which are summarized by a quasiconcave production function; per capita output is $\hat{q}[z, k]$, where $k = e + m$ is the per capita input of the mobile factor, with m denoting the per capita net flow of mobile factor from and to other jurisdictions. To simplify notation, we shall represent production by means of a concave production function $\hat{f}[k] \equiv \hat{q}[z, k]$, with $\hat{f}' > 0$, $\hat{f}'' < 0$, and assume $e = 1$ (implying $k = 1 + m$).

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[3]If one were to interpret location in this model in a strict spatial sense, this specification would imply that individuals are residentially immobile and must incur transportation costs to gain access to the public good.

A Pareto efficient allocation in this economy can be characterized as follows. Let us focus on symmetric allocations where all jurisdictions have identical size n,[4] and where factor flows are zero ($m = 0$, satisfying production efficiency). It can be shown that the optimal choice of variety is the *median variety*, i.e., the variety located at the center of the jurisdiction, and that the optimal size $\underline{n}$ and the optimal level of public good provision $\underline{g}$ are identified by the following conditions:

$$1 + \hat{\delta}[\underline{n}/2] = 0, \tag{5}$$

where $\hat{\delta}[s] \equiv s\hat{y}'[s]/\hat{y}[s] < 0$ is the elasticity of $\hat{y}$ with respect to s; and

$$2\int_0^{\underline{n}/2} \hat{v}_g[\underline{g}, s]\, ds = 1. \tag{6}$$

Condition (5) identifies the size $\underline{n}$ which minimizes the per capita cost of securing any given minimum amount of effective local public good consumption to all individuals in a jurisdiction, whereas condition (6) states that the level of public good provision in each jurisdiction will be optimal when the marginal cost of provision equals the aggregate marginal valuation by all consumers in the jurisdiction (the Samuelson condition).[5]

How can such an optimal allocation be attained? Tiebout's original statement implicitly posited that each jurisdiction would somehow be able to maintain its pop-

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[4]Note that, since there is a continuum of individuals, jurisdiction size must be formally interpreted as representing mass, and all the magnitudes which refer to single points (individuals) are to be interpreted as densities.

[5]To derive the above conditions, suppose that all the members of a jurisdiction contribute an equal amount τ to cover the cost of providing the public good. Private disposable income per capita is then $\hat{f}[1] - \tau$, and the level of public good provided is $g = n\tau$. We can rely on Negishi's (1960) observation that maxima of social welfare functions are Pareto optima, and consider the maximization of a utilitarian social welfare function defined over the real line, or—equivalently—of the *mean* utility level, which, in a symmetric allocation with jurisdictions all of identical size, can

ulation at the optimal size. As earlier commentators (e.g., Bewley, 1981) have pointed out, such a construction is indefensible as a description of how constitutional choices are made in a decentralized setting.

In the following, we shall describe a positive model of jurisdiction formation, where jurisdictions are formed by coalitions of consumers, and where fiscal choices within jurisdictions are made by majority voting.

III Fiscal choices

We characterize tax competition in the presence of endogenous jurisdictional boundaries as a three-stage game: in the first stage individuals arrange themselves into jurisdictions; in the second stage public good provision choices are determined by majority voting within jurisdictions, with individuals voting first over varieties and then over taxes and public good provision levels; in the final stage the owners of the mobile factor make their investment decisions. This sequencing can be interpreted as reflecting a situation where the costs of changing jurisdictional affiliation are negligible in the long run, whereas the short-run costs of gaining access to public goods

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be expressed as

$$\frac{1}{n}\int_0^n \left(\hat{f}[1] - \tau + \hat{v}[n\tau, |i-j|]\right)\, di.$$

Maximizing this by choice of a combination of variety j, size n, and head tax τ, yields the above conditions. Note that (6) is independent of income distribution, owing to the fact that preferences are quasilinear. Thus, in this model the optimal level of public good provision does not depend on how the cost of providing the public good is distributed among individuals. Also note that the same outcome could in principle be attained by a central planner by using a mix of different tax instruments—including capital income taxes if levied at an (optimally chosen) uniform rate across jurisdictions.

provided in other jurisdictions are prohibitive.[6]

Consider a jurisdiction of size n, levying a source based, *ad valorem* tax at rate t on the mobile factor employed within its borders. If the jurisdiction in question is a small open economy, i.e., a price taker for the world net-of-tax rental price of the mobile factor, r, then arbitraging of investment opportunities across jurisdictions implies

$$(1-t)\hat{f}'[1+m] = r. \tag{7}$$

Condition (7) defines an implicit function $\hat{m}[t,r]$ linking factor inflows to the tax rate in the jurisdiction and to the world net-of-tax rate of return—thus capturing the third stage of the game outlined above. Totally differentiating (7) yields

$$\hat{m}_t = \frac{\hat{f}'}{(1-t)\hat{f}''} = \eta\,\frac{1+\hat{m}}{1-t} < 0, \tag{8}$$

where $\eta = \hat{f}'/\left((1+\hat{m})\hat{f}''\right)$ is the elasticity of demand for the mobile factor with respect to its gross-of-tax rental price. The elasticity of $(1+\hat{m})$ with respect to changes in t is $\zeta = \eta t/(1-t) < 0$, and is thus proportional to η.

As elsewhere in the tax competition literature, we assume that the immobile factor is untaxed and that lump-sum (i.e., residence based) taxation of the mobile factor is infeasible. This may reflect the fact that residence-based taxation distorts intertemporal investment decisions (Bucovetsky and Wilson, 1991), although this

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[6]The majority of earlier analyses of residential equilibria (e.g., Epple, Filimon, and Romer, 1984) have also assumed that jurisdiction formation precedes voting. In contrast, Hohaus, Konrad, and Thum (1994), postulate that voting precedes jurisdictional affiliation decisions, which implies that jurisdictions may compete for members. For an early discussion of this form of interjurisdictional competition, see also Boskin (1973).

aspect would not be captured by our static specification.[7] Public good provision thus equals the total revenue from the source based capital tax:

$$g = nt\frac{r}{1-t}\,(1+\hat{m}[t,r]) \equiv \hat{g}[n,t,r]. \tag{9}$$

Private per capita consumption (which equals net-of-tax income) is

$$c = \hat{f}\,[1+\hat{m}[t,r]] - \frac{r}{1-t}\,(t+\hat{m}[t,r]) \equiv \hat{c}[t,r]. \tag{10}$$

where $r/(1-t)$ represents the gross-of-tax rate of return (from (7)).

In the second stage of the game, the variety selected will be the *median variety*, which is located at a distance of $n/2$ from the boundaries of the jurisdiction. Given this choice of variety, the utility of an individual located at a distance $s \in [0, n/2]$ from the center will be

$$\hat{c}[t,r] + \hat{v}\,[\hat{g}[n,t,r], s]\,. \tag{11}$$

Individuals at different locations will have different preferred tax rates. Maximizing (11) with respect to t yields

$$\hat{v}_g[\hat{g}, s] = -\frac{\hat{c}_t}{\hat{g}_t}\,. \tag{12}$$

Note that $\hat{c}_t$ is unambiguously negative, and, since the left-hand side of (12)—the marginal valuation of public good provision by the consumer—is positive, $\hat{g}_t$ must also be positive at an optimum. The right-hand side of (12) represents the private marginal cost of public funds (i.e., the per capita social opportunity cost of public funds). Expanding the latter we obtain

$$-\frac{\hat{c}_t}{\hat{g}_t} \equiv \hat{p}[n,t,r] = \frac{1}{n(1+\eta t)} > 0. \tag{13}$$

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[7] If it were possible to tax the immobile factor or to use residence-based taxes, a small open economy would exclusively rely on such lump-sum instruments and capital tax competition would not arise.

The second order condition for (12) to be a maximum is $\hat{c}_{tt} + \hat{v}_g \hat{g}_{tt} + \hat{v}_{gg}(\hat{g}_t)^2 < 0$. The last term of this expression is negative. Using (12) we can rewrite the first two terms as $(\hat{g}_t \hat{c}_{tt} - \hat{g}_{tt}\hat{c}_t)/\hat{g}_t = -\hat{p}_t \hat{g}_t$, which will be negative if $\hat{p}_t > 0$. This in turn requires $\zeta\xi < 1$, where ξ is the elasticity of η with respect to k. In the following we shall assume η to be constant ($\xi = 0$).

Condition (12) defines an implicit function $\check{t}[n, s, r]$. Multiplying both sides of (12) by n, totally differentiating with respect to t and n, and noting that $n\hat{g}_n = \hat{g}$, we obtain

$$\check{t}_n = -\frac{1}{n}\,\frac{\hat{v}_g + \hat{v}_{gg}\hat{g}}{\hat{v}_{gg}\hat{g}_t - \hat{p}_t}. \tag{14}$$

Since $\hat{g}_t$ is positive at an optimum, the denominator is unambiguously negative. The numerator can be rewritten as

$$(1 + \epsilon)\ \hat{v}_{gg}\ \hat{g}. \tag{15}$$

If $|\epsilon| > 1$, $\check{t}_n > 0$. Thus, if the valuation for the public good with respect to the level of its provision is inelastic, the individual would prefer to exploit the scale economies brought about by an enlargement of her jurisdiction by increasing taxes; if the marginal valuation for the public good is sufficiently elastic ($|\epsilon| < 1$), on the other hand, she would prefer lower taxes.

Totally differentiating (12) with respect to s and t, we obtain

$$\check{t}_s = -\frac{\hat{v}_{gs}}{\hat{v}_{gg}\,\hat{g}_t - \hat{p}_t}. \tag{16}$$

The denominator of the above expression is negative. The sign of $\check{t}_s$ thus depends on the sign of $\hat{v}_{gs}$. If $\hat{v}_{gs} < 0$ (if $|\epsilon| > 1$) a consumer who is located farther from the center prefers lower taxes, whereas if $\hat{v}_{gs} > 0$ (if $|\epsilon| < 1$) a more peripheral consumer prefers higher taxes. If we assume ϵ to be constant, then the preferred tax rate will be a monotonic function of an individual's distance from the center. The median voter in taxes will thus coincide with the individual that is located at a distance of $n/4$ from

the center, and the chosen tax rate under majority voting will be $\hat{t}[n,r] \equiv \check{t}[n,n/4,r]$;[8] this defines an implicit function linking the optimal choice of tax rate by the median voter with the size of the jurisdiction and the world net-of-tax rental r.

Total differentiation of $\hat{t}[n,r]$ with respect to t and n yields

$$\hat{t}_n = \check{t}_n[n,n/4,r] + \check{t}_s[n,n/4,r]/4. \tag{17}$$

The two terms on the right-hand side of (17) have opposite signs: if $|\epsilon| > 1$ the first term is positive and the second negative, and vice-versa if $|\epsilon| < 1$. Their sum, however, can be written as

$$\hat{t}_n = -\frac{1}{n}\,\frac{(1+\hat{\delta}[n/4])(1+\epsilon)\hat{v}_{gg}[\hat{g},n/4]\hat{g}}{\hat{v}_{gg}[\hat{g},n/4]\,\hat{g}_t - \hat{p}_t}. \tag{18}$$

The sign of $\hat{t}_n$ depends on ϵ and on $\hat{\delta}[n/4]$. Although $\hat{\delta}$ varies from 0 to $-\infty$ (because of our assumptions on the derivatives of $\hat{y}$) we will show below that $|\hat{\delta}[n/4]|$ is always less than unity in an interjurisdictional equilibrium. We can thus establish the following result:

RESULT 1: If $|\epsilon| > 1$, the median voter responds to an enlargement of the jurisdiction by raising taxes ($\hat{t}_n > 0$); if $|\epsilon| < 1$ the median voter responds by lowering taxes ($\hat{t}_n < 0$).

Given the choice rule $\hat{t}[n,r]$, the utility of an individual located at a distance $s \in [0,n/2]$ from the center of a jurisdiction of size n is

$$\hat{c}\left[\hat{t}[n,r],r\right] + \hat{v}\left[\hat{g}[n,\hat{t}[n,r],r],s\right] \equiv \hat{w}[n,s,r]. \tag{19}$$

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[8] Preferences for tax rates will be single-peaked if (12) identifies a global optimum; this is indeed the case if η is constant.

Expression (19) is monotonically decreasing in s, i.e.,

$$\hat{w}_s < 0. \tag{20}$$

Thus, independently of whether their preferred tax rate is above or below the prevailing tax rate, as individuals move farther from the center of the jurisdiction they will experience progressively lower utility. In particular, the utility of a *border individual*, i.e., an individual who is located at a distance $n/2$ from the center is

$$\hat{w}[n, n/2, r] = \hat{c}\left[\hat{t}[n, r], r\right] + \hat{v}\left[\hat{g}[n, \hat{t}[n, r], r], n/2\right] \equiv \hat{b}[n, r]. \tag{21}$$

The second term in the above expression reflects the trade off between the scale economies in public good provisions ($\hat{g}$ is increasing in n) and the locational costs that larger jurisdictions entail for peripheral consumers ($\hat{v}$ is decreasing with the distance $n/2$).

IV Interjurisdictional equilibrium

We shall now describe an *interjurisdictional equilibrium* (the first stage of the game), representing the outcome of a process whereby the boundaries of jurisdictions are determined endogenously by the free movement of individuals. Note that, since location is exogenous in this model, a move is a change of jurisdictional affiliation, not a change of location. We will only consider jurisdictions formed by contiguous individuals,[9] focusing on symmetric equilibria with identical jurisdictions. This allows us to uniquely characterize an interjurisdictional equilibrium by means of a single value n. Note, however, that absolute location is indeterminate in our model

[9]For a different setting where individuals differ by their income levels, Westhoff (1977) has shown that communities always consist of compact intervals.

specification, which implies that there will exist an infinite number of equilibria for an equilibrium size n, all featuring the same symmetrical jurisdictional pattern, but each corresponding to a different absolute location of jurisdictional boundaries.

For a given world net-of-tax rate of return r, a configuration of contiguous jurisdictions of identical size n will represent a *stable coalition structure* if it is in the core—it is not possible for alternative coalitions to form and achieve an outcome that Pareto dominates the given outcome for all individuals belonging to the new coalition—and it admits no entry or exit—there exists no incentive for individuals to unilaterally move from one jurisdiction to another (Wooders, 1988; Greenberg and Weber, 1993).

The no-entry/no-exit condition for our model can be derived as follows. If an individual at distance s from the center of a jurisdiction of size n joins an identical contiguous jurisdiction, her distance from the center changes from s to $n - s$. The no-entry/no-exit condition can then be stated as

$$\hat{w}[n, n-s, r] - \hat{w}[n, s, r] \leq 0, \ \forall s \in [0, n/2]. \tag{22}$$

Because of (20), the left-hand side of (19) reaches a maximum of zero for $s = n/2$. Thus, (22) will always be satisfied in a symmetric equilibrium.

Next, let us focus on the core condition. We assume that the mechanism governing the internal distribution of resources within any alternative coalition is restricted to be the same as for the current coalitions (i.e., instruments of direct redistribution such as lump-sum transfers are not available to the alternative coalitions). The set of possible coalitions of contiguous individuals whose membership includes individuals belonging to a given current jurisdiction is represented by all the intervals of size n' whose center is displaced by a distance $d \leq (n + n')/2$ from the center of the current jurisdiction. None of these alternative coalitions will be able to block the current coalition structure if at least one individual is made worse off, i.e., if

$$\forall n' \neq n, \ \forall d \in [0, (n + n')/2],$$

$$\exists s \in [d - n'/2, n/2] \; s.t. \;\; \hat{w}[n', d - s, r] - \hat{w}[n, s, r] < 0. \tag{23}$$

Since $\hat{w}_s < 0$, the expression $\hat{w}[n', d - s, r] - \hat{w}[n, s, r]$ will achieve a minimum for $d = (n + n')/2$ and $s = d - n'/2$. Hence, (23) implies

$$\hat{w}[n', n'/2, r] < \hat{w}[n, n/2, r], \;\; \forall n' \neq n, \tag{24}$$

which, in terms of differentials, translates into the following *boundary indifference* condition

$$\hat{b}_n[n, r] = 0; \tag{25}$$

and the *second-order curvature* condition

$$\hat{b}_{nn}[n, r] < 0. \tag{26}$$

Condition (25) can be interpreted as stating that the border individual ($s = n/2$) must be indifferent between staying in her current jurisdiction and moving to a contiguous identical jurisdiction, while condition (26) states that (25) must identify a maximum for $\hat{b}[n, r]$.[10,11]

We can expand the boundary indifference condition (25) as follows:

$$\begin{aligned} \hat{b}_n &= \hat{w}_n[n, n/2, r] + \hat{w}_s[n, n/2, r]/2 \\ &= \hat{c}_t \hat{t}_n + \hat{v}_g[\hat{g}, n/2](\hat{g}_n + \hat{g}_t \hat{t}_n) + \hat{v}_s[\hat{g}, n/2]/2 = 0. \end{aligned} \tag{27}$$

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[10] An analogous characterization of interjurisdictional equilibria has been given, among others, by Westhoff (1977), and by Epple, Filimon, and Romer (1984). Here, however, we derive such conditions directly from the definition of coalitional stability.

[11] One can verify that the expansion of $\hat{b}_{nn}$ contains terms that are unambiguously negative, and terms that can be positive. Thus, the curvature conditions we have imposed on technologies and preferences are by themselves not sufficient to ensure that $\hat{b}_{nn} < 0$.

Using (12) (for $s = n/4$), this can be further expanded as

$$(1 + \hat{\delta}[n/2])\Gamma + (1 + \hat{\delta}[n/4])\Lambda = 0. \tag{28}$$

where

$$\Gamma \equiv \hat{v}_g[\hat{g}, n/2]\hat{g}_n, \tag{29}$$

and

$$\Lambda \equiv (\hat{v}_g[\hat{g}, n/2] - \hat{v}_g[\hat{g}, n/4])\hat{g}_t\hat{t}_n/(1 + \hat{\delta}[n/4]). \tag{30}$$

Since $\Gamma > 0$ and $\Lambda < 0$,[12] (28) requires $(1 + \hat{\delta}[n/2])(1 + \hat{\delta}[n/4]) > 0$. Let $\overline{n} = 2\underline{n}$ the value that solves $(1 + \hat{\delta}[n/4]) = 0$, where $\underline{n}$ (the optimal size) is the value that solves $(1 + \hat{\delta}[n/2]) = 0$. Then, since the absolute value of $\hat{\delta}[s]$ is increasing in s, (28) requires either $n < \underline{n}$ or $n > \overline{n}$. The latter regime can be ruled out for a maximum by noting that $\hat{b}_n < 0$ for $n \in [\underline{n}, \overline{n}]$. We can thus conclude that $n < \underline{n}$, and that the expressions $(1 + \hat{\delta}[n/2])$ and $(1 + \hat{\delta}[n/4])$ will both be positive in equilibrium.

RESULT 2: In an interjurisdictional equilibrium, jurisdiction size n will be less than the optimal size $\underline{n}$.

The term $(1 + \hat{\delta}[n/2])\Gamma$ in (28) represents the direct trade-off, for a given tax rate, between the scale economies associated with larger jurisdictions and the cost of conformity to the border individual. If the tax rate were independent of jurisdiction size, the second term in (28) would vanish, and the first-order condition would simply require $(1 + \hat{\delta}[n/2]) = 0$, implying $n = \underline{n}$.

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[12] To sign Λ we can note that the difference $\hat{v}_g[\hat{g}, n/2] - \hat{v}_g[\hat{g}, n/4]$ agrees with the sign of $\hat{v}_{gs}$, and that the sign of the expression $\hat{t}_n/(1 + \hat{\delta}[n/4])$ is opposite to the sign of $\hat{v}_{gs}$.

The term $(1 + \hat{\delta}[n/4])\Lambda$ describes how the border individual is affected by the median voter's reaction to a marginal increase in jurisdiction size. Since $(1+\hat{\delta}[n/4]) > 0$, the second term in (28) is always negative independently of the value of ϵ. If the border individual prefers lower taxes relatively to the median voter, a marginal increase in jurisdictional boundaries induces the median voter to raise taxes, thus hurting the border individual. If the border individual prefers higher taxes relatively to the median voter, a marginal increase in jurisdictional boundaries induces the median voter to lower taxes, which again hurts the border individual. Either way, the median voter's reaction to boundary changes discourages membership ($n < \underline{n}$). Thus, the lack of coordination between the median voter and the border individual within jurisdictions results in a suboptimal jurisdiction size, i.e., an excessive number of public goods varieties.

Throughout the above discussion, we have assumed that individuals take the world net-of-tax rate of return as given. This, however, is endogenously determined by market clearing. The boundary indifference condition (25) identifies an implicit function $\hat{n}[r]$, linking jurisdiction size n with the world net-of-tax return to the mobile factor:

$$n = \hat{n}[r]. \tag{31}$$

In a symmetric equilibrium, the tax rate will be identical across jurisdictions:

$$t = \hat{t}[n, r], \tag{32}$$

and interjurisdictional flows of the mobile factor will be zero, implying $k = 1$ and therefore

$$r = \hat{r}[t] \equiv (1 - t)\hat{f}'[1]. \tag{33}$$

Conditions (31)-(33) together define a non-cooperative equilibrium characterized by

an endogenous jurisdiction size n^*, a tax rate t^* and a world net-of-tax rental r^*.[13]

V Tax competition and size

In this section the model described in the first part of the paper is used to examine how the presence of tax competition affects jurisdictional boundaries. For this purpose, we devise a parametric representation of factor mobility, which will be directly reflected in the tax competition outcome.

To characterize factor mobility, we employ a class of concave, constant elasticity production functions $\hat{x}_{(\mu)}[k]$ with the following property:

$$\hat{x}'_{(\mu)}[1] = \rho, \tag{34}$$

$$\hat{x}''_{(\mu)}[1] = -\rho/\mu, \tag{35}$$

where μ is a positive scalar. Then the absolute value of the elasticity of demand associated with $\hat{x}_{(\mu)}$ is simply μ (i.e., $\eta = -\mu$). Next, let us define a family of constant elasticity production functions $\hat{f}_{(\mu,\mu^0,k^0)}$ as

$$\hat{f}_{(\mu,\mu^0,k^0)}[k] \equiv \hat{x}_{(\mu)}[k]\hat{x}'_{(\mu^0)}[k^0]/\hat{x}'_{(\mu)}[k^0]. \tag{36}$$

By construction, such functions have a constant elasticity equal to μ in absolute value. For $k^0 = k$ we have

$$\hat{f}'_{(\mu,\mu^0,k)}[k] = \hat{x}'_{(\mu^0)}[k], \tag{37}$$

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[13] An equilibrium will exist under quite general conditions. First note that n is bound in $[0, \bar{\bar{n}}]$, where $\bar{\bar{n}}$ solves $\hat{y}[n/2] = 0$. Combining (32) and (33) we obtain $r = (1 - \hat{t}[n, r])\hat{f}'[1]$. This defines an implicit function $\check{r}[n]$. Suppose that $\check{r}[n]$ and $\hat{n}[r]$ are both continuous and defined over $[0, \bar{\bar{n}}]$ (although $\hat{n}[0]$ is undefined, we can close the domain of $\hat{n}[r]$ by imposing that $\hat{n}[0]$ be equal to the limit of $\hat{n}[r]$ as r approaches 0.) Under such conditions, the mapping $\hat{n}[\check{r}[n]]$ will have a fixed point in $[0, \bar{\bar{n}}]$.

which is independent of μ; and for $k^0 = k$ and $\mu^0 = \mu$ we obtain

$$\hat{f}'_{(\mu,\mu,k)}[k] = \hat{x}'_{(\mu)}[k]. \tag{38}$$

Thus, starting from $k^0 = k$ and $\mu^0 = \mu$, a change in μ will only change the input demand elasticity η, without affecting the gross-of-tax return to the mobile factor. Such a change need not be strictly interpreted as a change in technology. The function $\hat{f}$ could be viewed as a reduced-form representation of technologies combined with nontariff barriers to factor movements, if these barriers only result in private real resource costs and generate no revenues.

If we parameterize the production function as described—with $k^0 = k$ and $\mu^0 = \mu$ in all cases—all the functional relations that we have derived also depend on μ. We shall thus include μ among the arguments and denote the functions thus augmented with a tilde ($\tilde{}$). Then, a change in μ can be equated to a change in η, and the derivatives of all functions with respect to μ can be found by differentiation with respect to η (changing sign). In particular, the effect on the median voter's choice of an increase in μ, for a given world net-of-tax rate of return, will be

$$\tilde{t}_\mu = \frac{\tilde{p}_\mu}{\tilde{v}_{gg}[\tilde{g}, n/2]\tilde{g}_t - \tilde{p}_t} < 0; \tag{39}$$

the tax rates preferred by all other individuals in a jurisdiction will also be lower. As expected, an increase in factor mobility will result in more tax competition and lower taxes.

Below, we shall compare different equilibria, each associated with a different value of μ. In equilibrium, we shall have $m = 0$, and the input of the mobile factor will be 1; thus, by construction, the gross-of-tax rate of return will be equal to ρ across all equilibria. The elasticity of import demand, however, will vary with μ: when $\mu = 0$ there is effectively no factor mobility and no tax competition; higher values of μ will lead to increasingly more intense tax competition. Output will also be different across equilibria, but, due to the quasilinear specification of preferences (which implies a zero

income effect for g), this will have no implications for either fiscal choices or the tax competition outcome.

Totally differentiating (31)-(33) with respect to n, t, r, and μ, we obtain

$$\frac{dn^*}{d\mu} = \frac{\tilde{n}_\mu(1+\rho\tilde{t}_r) - \rho\tilde{n}_r\tilde{t}_\mu}{(1+\rho\tilde{t}_r) + \rho\tilde{n}_r\tilde{t}_n}. \tag{40}$$

Let us focus on the sign of $\tilde{n}_\mu$, i.e., how n responds to a change in μ for a given net-of-tax return r. This is found by totally differentiating the boundary indifference condition (25) with respect to n and μ:

$$\tilde{n}_\mu = -\frac{\tilde{b}_{n\mu}}{\tilde{b}_{nn}}. \tag{41}$$

The denominator is negative because of (26). The numerator can be derived by rewriting (28) as

$$\tilde{b}_n = \tilde{v}_g[\tilde{g}, n/2]\Psi\left(\tilde{g}_n + \frac{\Phi}{\Psi}\tilde{g}_t\tilde{t}_n\right) = 0, \tag{42}$$

where

$$\Psi \equiv (1 + \tilde{\delta}[n/2]) \geq 0, \tag{43}$$

and

$$\Phi \equiv 1 - \frac{\tilde{v}_g[\tilde{g}, n/4]}{\tilde{v}_g[\tilde{g}, n/2]}. \tag{44}$$

Note that, because of our constant elasticity assumption, Φ only depends on n. Ψ will be strictly positive as long as $\tilde{t}_n \neq 0$, i.e., $\epsilon \neq -1$.

Differentiating (42) with respect to μ, and then substituting the expression $\Phi/\Psi = -\tilde{g}_n/(\tilde{g}_t\tilde{t}_n)$ from (42) (assuming $\Psi \neq 0$), we obtain

$$\tilde{b}_{n\mu} = \tilde{v}_g[\tilde{g}, n/2]\Psi\left(\tilde{g}_{nt}\tilde{t}_\mu - \frac{\tilde{g}_n\tilde{g}_{tt}\tilde{t}_\mu}{\tilde{g}_t} - \frac{\tilde{g}_n\tilde{g}_{t\mu}}{\tilde{g}_t} - \frac{\tilde{g}_n\tilde{t}_{n\mu}}{\tilde{t}_n}\right). \tag{45}$$

Proceeding in a similar way for $\tilde{n}_r$, we obtain

$$\tilde{n}_r = -\frac{\tilde{b}_{nr}}{\tilde{b}_{nn}}, \tag{46}$$

and

$$\tilde{b}_{nr} = \tilde{v}_g[\tilde{g}, n/2]\Psi \left(\tilde{g}_{nt}\tilde{t}_r - \frac{\tilde{g}_n \tilde{g}_{tt}\tilde{t}_r}{\tilde{g}_t} - \frac{\tilde{g}_n \tilde{g}_{tr}}{\tilde{g}_t} - \frac{\tilde{g}_n \tilde{t}_{nr}}{\tilde{t}_n} \right). \tag{47}$$

These expressions contain high-order polynomials in μ, ϵ, t, r, and cannot be signed unambiguously in the general case. However, in the case $\mu = 1$ ($\eta = -1$), $\tilde{b}_{n\mu}$ can be reduced to

$$\tilde{b}_{n\mu} = -\epsilon r \left(\frac{t}{1-t} \right)^2 \frac{1 - t^2 - \epsilon t^2}{(1 - t - \epsilon t)^2} \tilde{v}_g[\tilde{g}, n/2]\Psi, \tag{48}$$

which is unambiguously positive, implying $\tilde{n}_\mu > 0$. Furthermore, one can show that, in the case $\mu = 1$, $\tilde{b}_{nr} = 0 \Rightarrow \tilde{n}_r = 0$; which, provided $1 + \rho\tilde{t}_r \neq 0$, implies $n^*_\mu = \tilde{n}_\mu > 0$.[14]

RESULT 3: When the elasticity of demand for capital is equal to unity in absolute value, and the tax rate preferred by the border individual is not the same as the one chosen by the median voter ($\epsilon \neq -1$), an increase in interjurisdictional factor mobility (μ) raises the equilibrium size of jurisdictions.

More tax competition results in an expansion of jurisdictional boundaries. This is because tax competition generates a downward pressure on taxation, which reduces the gap between the tax rate chosen by the median voter choice and the tax rate favoured by peripheral individuals, thus making joining a jurisdiction more attractive. In other words, tax competition forces discipline to the fiscal choices of the median voter, which in turn encourages membership.

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[14]Note that just because the partial and general equilibrium effects on n of a change in μ are identical in this case, this does not mean that equilibrium values are unaffected by the general equilibrium closure.

To gain some insight on the general case ($\mu \neq 1$), we have performed numerical simulations with a parameterized version of the model. Functional forms and functional parameters were specified as follows. The production function $\hat{f}$ is modelled as a constant elasticity function of the form

$$\hat{f}[k] \equiv \theta + \rho \frac{\eta}{1+\eta} \left(k^{\frac{1+\eta}{\eta}} - 1 \right), \tag{49}$$

with $\eta < 0$.[15] One can verify that $\hat{f}' > 0$, $\hat{f}'' < 0$, $\hat{f}[1] = \theta$, $\hat{f}'[1] = \rho$, and $\hat{f}'/(k\hat{f}'') = \eta$. Similarly, for the utility function we specify $\hat{h}$ to be

$$\hat{h}[l] \equiv 1 + \gamma \frac{\epsilon}{1+\epsilon} \left(l^{\frac{1+\epsilon}{\epsilon}} - 1 \right), \tag{50}$$

with $\epsilon < 0$. Finally, the function $\hat{y}$ is assumed to be quadratic:

$$\hat{y}[s] \equiv 1 - \beta s^2, \tag{51}$$

with $\beta > 0$. In the numerical simulation reported here, we set $\theta = \rho = 1$, $\beta = 1$.

Figure 1 shows how the equilibrium tax rate varies with μ, for selected values of ϵ, and for $\gamma = 1/2$. In all cases, more factor mobility results in lower equilibrium tax rates and hence lower provision of public goods. Figure 2 shows how the equilibrium size of jurisdictions varies with μ. For $\epsilon \neq -1$, n is an increasing function of μ. For $\epsilon = -1$, the preferred tax rate is the same for all individuals independently of distance ($\check{t}_s = 0$ from (16)), and thus the voting equilibrium coincides with a Lindahl equilibrium. In this case jurisdiction size is independent of μ.[16]

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[15] When $\eta = -1$ the expression $(\eta/(1+\eta))k^{(1+\eta)/\eta}$ is undefined; however, its limit as η approaches -1 is $\log k$.

[16] If $\epsilon = -1$, the boundary indifference condition degenerates to $(1 + \hat{\delta}[n/2]) = 0$, which is independent of μ.

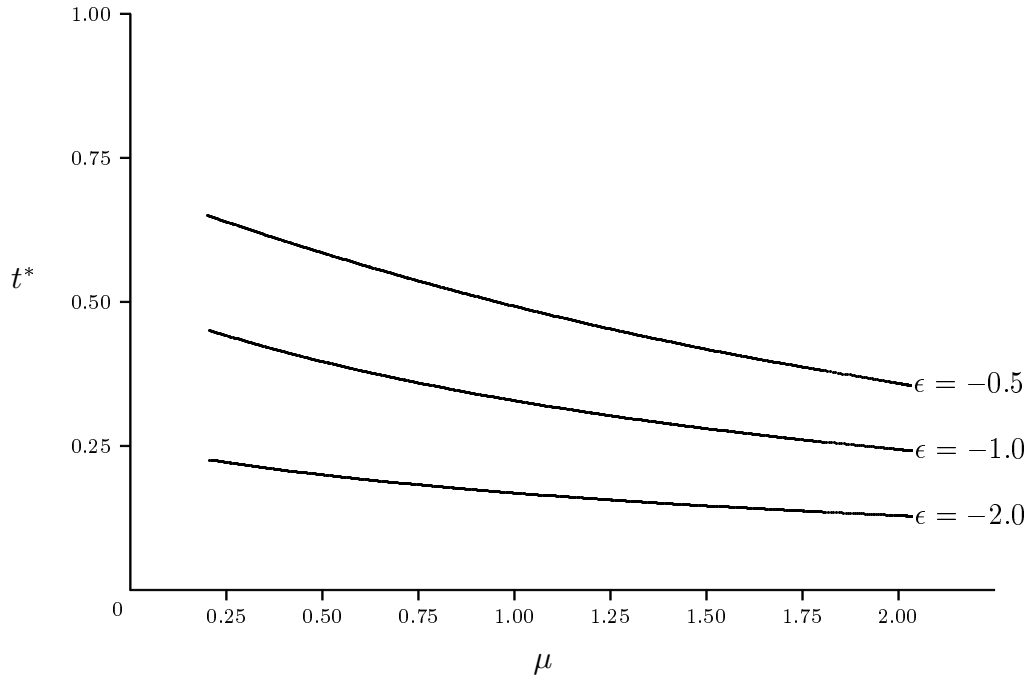

Figure 1: Equilibrium tax rates

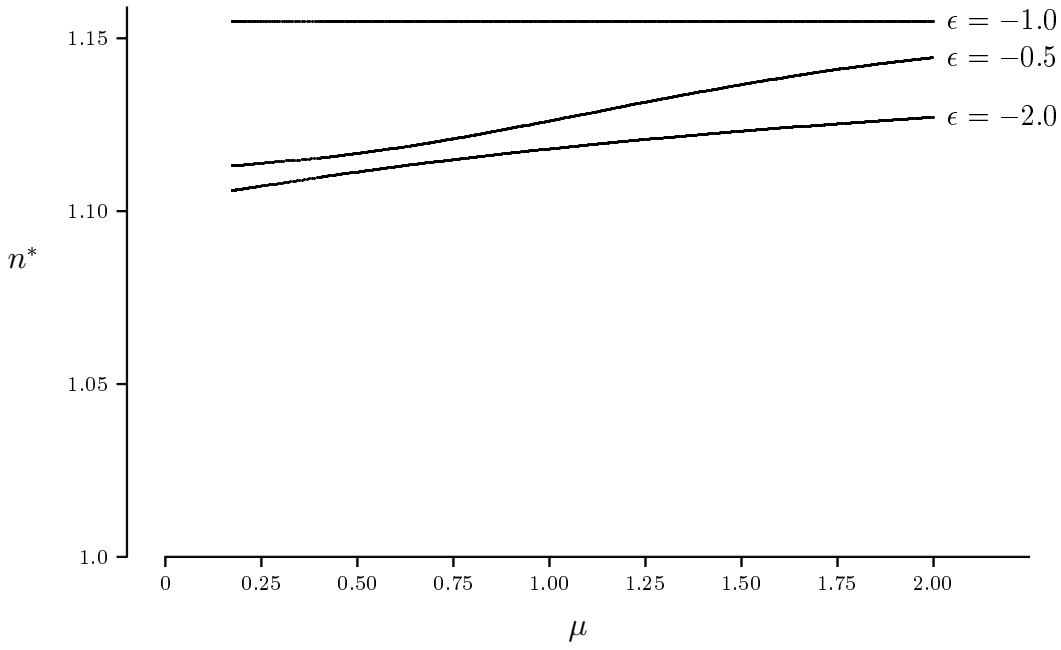

Figure 2: Tax competition and size

VI Tax competition and welfare

That noncooperative equilibria in Tiebout type models can be inefficient is well understood. In this model, the median voter's choice rule will not generally satisfy the Samuelson condition of equality between marginal cost and the aggregate marginal valuation of consumers; more importantly, the median voter and the border individual fail to coordinate their choices, which leads to a suboptimal jurisdiction size. This raises the possibility that tax competition could bring about a Pareto improvement within a given jurisdiction, even in the absence of transfers among individuals.

We should re-iterate at this point that, given our model assumptions, there exist an infinite number of equilibria for each value of μ, and stress that, since our characterization of an equilibrium contains no description of the *process* through which a given equilibrium is reached, any comparison of equilibria is to be interpreted in a strict comparative statics sense. Thus, to meaningfully compare welfare for individuals across two equilibria, we must focus on jurisdictions that are centered at the same location in the two equilibria. Furthermore, if we are to isolate the welfare impacts of changes in the intensity of tax competition, we must hold output constant across equilibria. This can be achieved by imposing the additional restriction

$$\hat{x}_{(\mu)}[1] = \theta. \tag{52}$$

Welfare for an individual located at a distance s from the center is

$$\tilde{w}\left[n^*[\mu], s, r^*[\mu]\right] \equiv \tilde{\pi}[\mu, s]. \tag{53}$$

The condition for an increase in μ to bring about a Pareto improvement is then

$$\tilde{\pi}_\mu[\mu, s] \geq 0, \quad \forall s \in [0, n^*[\mu]/2]\,. \tag{54}$$

We shall show that such a Pareto improvement can occur using a numerical exam-

ple, under the specification described in the previous subsection.[17] To compare welfare across two equilibria associated with values μ^0 and μ^1, we use a measure $\hat{\Omega}[\mu^0, \mu^1, s]$ defined as the opposite of the change in disposable income that is required to compensate the individual for the move from μ^0 to μ^1, expressed as a proportion of initial private consumption. Because of the assumed utility function, this can be obtained simply as

$$\hat{\Omega}[\mu^0, \mu^1, s] = \frac{\tilde{\pi}[\mu^1, s] - \tilde{\pi}[\mu^0, s]}{\tilde{c}[t^*[\mu^0], r^*[\mu^0]]}, \quad \forall s \in \left[0, n^*[\mu^0]/2\right]. \tag{55}$$

We have selected $\epsilon = -4$ and made $\mu^0 = 0.1$ and $\mu^1 = 0.2$, with $\gamma = 1$. Figure 3 shows the welfare effects associated with the change in μ, as a function of distance from the center of the jurisdiction. All individuals are made strictly better off.

RESULT 4: An increase in interjurisdictional factor mobility (μ) can bring about a Pareto improvement within a given jurisdiction.

This result can be understood by observing that the presence of capital tax competition acts as a commitment device for the median voter, dampening her reaction to changes in jurisdiction size. Since constitutional choices precede fiscal choices, such commitment can result in improved coordination between the median voter and peripheral voters. In this example, the discipline in fiscal choices brought about by tax competition is sufficient to make even non-peripheral individuals better off ex-post, including the median voter (assuming that the center of the jurisdiction does not move).

In less extreme scenarios, tax competition will on balance reduce efficiency, and its direct welfare costs will be partially offset by the political coordination gains it

[17] Our specification of $\hat{f}$ in (49) satisfies (52).

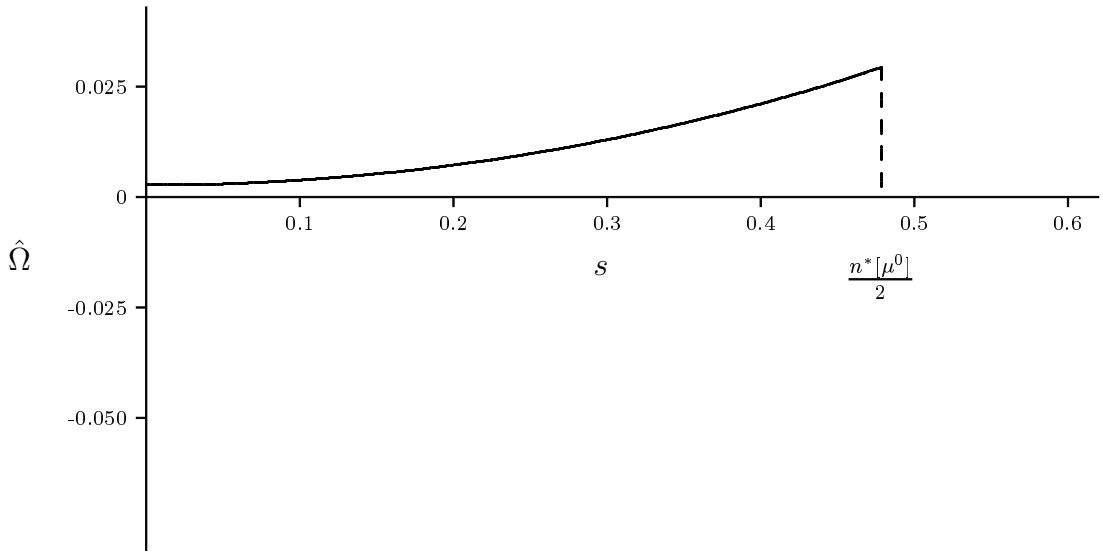

Figure 3: Welfare effects of an increase in factor mobility
$\epsilon = -4,\ \mu^0 = 0.1,\ \mu^1 = 0.2$

generates within jurisdictions. The latter will be larger, the farther ϵ is from -1. In the limit, when $\epsilon = -1$, the voting equilibrium degenerates to a Lindahl equilibrium; the political coordination failure disappears, and we are back in a standard tax competition setting. This case is illustrated in Figure 4, which refers to a scenario with $\epsilon = -1$ and $\gamma = 1$. As would be expected, in this case tax competition lowers welfare for all individuals.

In conclusion, capital tax competition, by constraining the median voter's fiscal choices, can bring discipline to fiscal choices within jurisdictions, mitigating the efficiency costs which arise from the imperfection of local public choice mechanisms and promoting rationalization in the provision of local public goods.

VII Summary and conclusion

This paper has examined how capital tax competition affects constitutional choices in a positive model of jurisdiction formation. We have described a locational model of public goods provision, where jurisdictions are represented by coalitions of contiguous consumers, and where the levels of taxation and local public goods provision within jurisdictions are selected by majority voting. We have shown that the presence of interjurisdictional tax competition results in an enlargement of jurisdictional boundaries, and can bring about an increase in welfare for all members of a jurisdiction, even in the absence of compensation.

Recent trends in decentralization can be viewed partly as a reaction to what is perceived as a "dictatorship of the majority". Large municipalities in North America have been experiencing pressure from suburban communities that increasingly reject the fiscal agendas set by the center and seek fiscal and administrative independence,

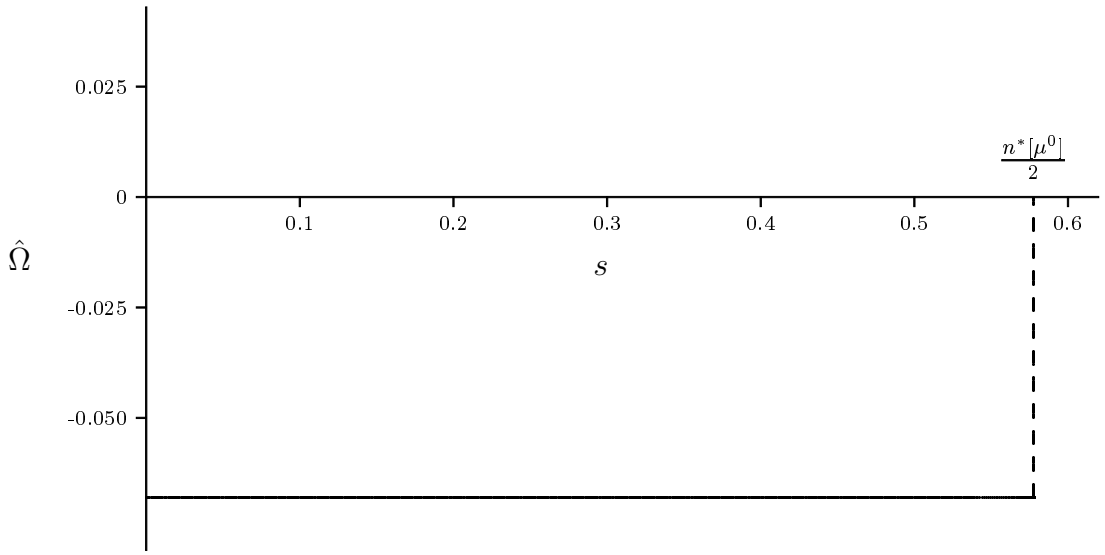

Figure 4: Welfare effects of an increase in factor mobility
$\epsilon = -1,\ \mu^0 = 0.1,\ \mu^1 = 0.2$

citing neglect by the center as one of the main reasons for their discontent.[18] Our findings suggest that the international integration of factor markets could offset these centrifugal tendencies by bringing discipline to local fiscal choices, thus exerting an upward pressure on the size of local jurisdictions and making local governments less viable *vis a vis* central tax and spending authorities.

Our analysis can be extended in several directions. Majority voting, while providing a useful benchmark for a positive study of local fiscal choices, is a rather stylized characterization of the political process. Our model could be adapted to include more realistic public choice mechanisms. Also, our model of jurisdiction formation, based on preferences, could be enriched to examine scenarios where jurisdictions are based on geography or income levels rather than tastes.

Finally, as recent literature on trade blocs has pointed out (Krugman, 1991), when jurisdictions are large enough to influence their terms of trade, a reduction in their number could affect the outcome and severity of tax competition. Thus, in addition to the mechanisms highlighted in our analysis, there may also be strategic reasons for expanding jurisdictional boundaries, which could be explored by abandoning the small open economy assumption adopted in this paper.

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[18] A recent example is San Fernando Valley's fight to secede from the Los Angeles City Government (Boland Bill, A.B. No. 2043). A similar secession attempt is beginning to take shape in Seattle, WA (LA Times, June 3, 1996).

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