Journal of Urban Economics 66 (2009) 210–217

Contents lists available at ScienceDirect

Journal of Urban Economics

www.elsevier.com/locate/jue

Interregional tax competition and intraregional political competition: The optimal provision of public goods under representative democracy ☆

Toshihiro Ihori [a], C.C. Yang [b,c,d,*]

[a] Department of Economics, University of Tokyo, Japan
[b] Institute of Economics, Academia Sinica, Taiwan
[c] Department of Public Finance, National Chengchi University, Taiwan
[d] Department of Public Finance, Feng Chia University, Taiwan

ARTICLE INFO

Article history:
Received 8 September 2008
Revised 29 July 2009
Available online 12 August 2009

JEL classification:
D72
F20
H41
H71

Keywords:
Tax competition
Political competition
Public goods

ABSTRACT

This paper explores the implications of the interaction between *inter*regional tax competition and *intra*regional political competition for the optimal provision of public goods under representative democracy *à la* Osborne and Slivinski (1996) and Besley and Coate (1997). As an extension of Hoyt's (1991) finding that intensified tax competition is always harmful and aggravates the extent to which public goods are undersupplied in a region, we show that intensified tax competition can be beneficial if political as well as tax competition is considered. In particular, we identify plausible conditions under which (i) there is an optimal intensity of tax competition such that the interaction between interregional tax competition and intraregional political competition will result in the optimal provision of public goods and (ii) intensified tax competition will be beneficial if and only if the degree of tax competition is less than this optimal intensity.

1. Introduction

Competition can be economic or political in nature. Economics tends to focus on the economic competition, while political science tends to focus on the political competition. Either focus alone may be incomplete, if not misleading.

Policy-makers are selected by voters via political competition between citizen candidates. This form of representative democracy is prevalent in the real world. Osborne and Slivinski (1996) and Besley and Coate (1997) emphasize the importance of this political competition, since citizen candidates who possess different policy preferences will implement different policies once selected to become policy-makers. In this paper we incorporate the stylized representative form of political competition into the stylized model of tax competition. Our focus is on the implications of the interaction between *inter*regional tax competition and *intra*regional political competition for the optimal provision of public goods. This focus echoes Frey and Eichenberger's (1996) emphasis that both economic and political distortions should be considered in the analysis of tax competition.

A fundamental result in the literature on tax competition is that interregional tax competition for mobile capital generates fiscal externalities and tends to result in an undersupply of public goods in a region. This result is originally articulated by Oates (1972) and formally modeled by Wilson (1986) and Zodrow and Mieszkowski (1986).[1] In an important contribution, Hoyt (1991) explores the impact of a number of competing regions on the provision of public goods, showing that the extent to which public goods are undersupplied is monotonically increasing in the number of competing regions. Following Epple and Zelenitz (1981), Hoyt (1991), Sato (2003), Keen and Kotsogiannis (2004) and others, an increase in the number of local regions (jurisdictions) can be viewed as increased fiscal decentralization, which induces intensified intergovernmental tax competition. Along this view, Hoyt's finding dictates that intensified tax competition is always harmful in that it aggravates the extent to which public goods are undersupplied. As an extension of this always-harmful finding, we show that intensified tax competition can be beneficial if political as well as tax competi-

☆ Earlier versions were presented at University of California, Irvine, University of Busan, the Public Choice Meetings in San Antonio, and Western Economic Association Meetings in Hawaii.

* Corresponding author. Address: Institute of Economics, Academia Sinica, Taiwan.
E-mail addresses: ihori@e.u-tokyo.ac.jp (T. Ihori), ccyang@econ.sinica.edu.tw (C.C. Yang).

[1] See Wilson (1999), Wilson and Wildasin (2004), and Fuest et al. (2005) for surveys of the literature.

0094-1190/$ - see front matter © 2009 Elsevier Inc. All rights reserved.
doi:10.1016/j.jue.2009.08.001

tion is considered. In particular, we identify plausible conditions under which (i) there is an optimal intensity of tax competition such that the interaction between interregional tax competition and intraregional political competition will result in the optimal provision of public goods and (ii) intensified tax competition will be beneficial if and only if the degree of tax competition is less than this optimal intensity.

On the basis of his finding, Hoyt (1991, p. 130) concludes:

> The existence of wasteful tax competition suggests that the optimal number of jurisdictions is one, thereby eliminating the externalities created by capital taxation. The traditional Tiebout literature argues that having many independent jurisdictions promotes efficiency and taste stratification by increasing the competition among jurisdictions. Thus, a tradeoff is faced, more jurisdictions increase the sorting of residents but at a cost of decreasing the public service provision because of tax competition.

He highlights the harmful aspect of tax competition on the provision of public goods. We show that the tradeoff may be mitigated once political as well as tax competition is considered. Specifically, our results suggest that more jurisdictions can be beneficial to not only the sorting of residents but also the public service provision. In this sense, our paper is an interesting extension of Hoyt's paper.

The literature on tax competition for mobile factors largely leaves out the stylized representative form of political competition as emphasized in this paper.[2] Persson and Tabellini (1992) is a notable exception, but their focus is not on the provision of public goods. In the presence of tax competition and in the context of public good provision, Edwards and Keen (1996) and Rauscher (1998) consider Leviathan models while Wilson (2005) considers a self-interested-government-official model. These papers take into account some elements of politics within a region, but they do not touch on the selection of policy-makers in a representative democracy. Perroni and Scharf (2001) consider a direct-democracy model in which the number of jurisdictions is endogenous. Our paper is complementary in the sense that we focus on: (i) representative rather than direct democracy and (ii) the optimal number rather than the equilibrium number of jurisdictions.

There are two studies that are most related to our paper. Brueckner (2001) considers a model in which both tax and political competition are present, and individuals are heterogeneous with respect to their valuation of public goods. He shows that, due to the voters' strategic delegation, capital tax rates under tax coordination may be lower than those under tax competition. Fuest and Huber (2001) compare tax competition with tax coordination in a median-voter model. They find that there may be an overprovision of public goods under tax competition and that tax coordination need not be welfare-improving. Although the two papers and our paper each consider both tax and political competition in a framework, there are several crucial differences in modeling between our paper and these other two. First of all, strategic delegation is indispensable for the results derived in the former paper, while we show that strategic delegation is not indispensable but may reinforce our results. Second, the latter paper addresses direct democracy, while we address representative democracy. Finally, and perhaps most importantly, the number of competing regions is fixed at two (a two-country model) in Brueckner (2001), and at infinity (a small-country model) in Fuest and Huber (2001). As a result, the degree of tax competition or fiscal decentralization (i.e., variations in the number of competing regions) plays no role in either paper. By contrast, as in Hoyt (1991), Sato (2003), and Keen and Kotsogiannis (2004), the degree of tax competition or fiscal decentralization is the key focus of our paper.

Some papers such as Burbidge and Myers (1994) and Kessler et al. (2002) have shown that tax competition need not imply a race to the bottom. Our paper contributes to this line of the literature, showing further that it is likely that there is an optimal intensity of tax competition to support the optimal provision of public goods in a region, and that the over- or undersupply of public goods can be "corrected" through various intensities of tax competition or degrees of fiscal decentralization.

The remainder of the paper is organized as follows. Section 2 presents our model. Section 3 exposes the connection between political competition and tax policy, and Section 4 explores the implications of tax-cum-political competition. Section 5 concludes.

2. Economy with tax competition

Our model of the economy is standard in the tax competition literature[3], except for the extension from homogeneous to heterogeneous individuals.

Consider an economy in which there are n identical regions, where $n \in \{1, \ldots, \infty\}$.[4] Each region is inhabited by N individuals. There are two factors of production: an interregional immobile factor and a perfectly mobile factor. This is a caricature of the real world situation in which some factors have much higher interregional mobility than others. We will refer to the former as "labor" and to the latter as "capital." Each individual in each region has the same claim to labor, but unequal claims to capital. Specifically, individual j in region i supplies $\theta \equiv 1/N$ units of labor and $\bar{k}_{ij}$ units of capital. This inequality feature in individual endowment is again a caricature of the real world situation in which incomes from mobile capital are typically more unequally distributed than incomes from immobile labor. Since positively skewed distributions of capital income are typically observed in the real world, we shall also impose the feature that the median claim to capital in a region is smaller than the mean claim.

Let $\bar{k}_i = \sum_j \bar{k}_{ij}$. By denoting the amount of capital employed in region i by k_i, capital market clearing requires

$$\sum_i k_i = \sum_i \bar{k}_i. \tag{1}$$

All regions produce a single private good whose price is normalized to unity. This private good can either be consumed directly as a private commodity, c, or be used to provide the regional public service, g. One unit of the private good produces one unit of the public service. The production in each region is given by $f(k_i)$ with $f'(k_i) > 0$ and $f''(k_i) < 0$, where a unit of the labor input in the region is suppressed. All markets are assumed to be perfectly competitive.

Each region levies a source tax at rate t_i on each unit of capital employed within the region. Perfectly mobile capital implies

$$f'(k_i) - t_i = r(t_1, \ldots, t_n) \quad \forall i \tag{2}$$

where r is the after-tax rate of return on capital, which depends on $t_1, \ldots, t_n$ and is equalized across the economy. Using (1), (2) and the assumption that all regions are identical, we have[5]

[2] For surveys of political economy approaches to tax competition, see Wilson (1999) and Fuest et al. (2005).

[3] The model is built on Wildasin (1988) and Hoyt (1991). It is a textbook, workhorse model of tax competition; see, for example, Wellisch (2000, Section 4.1) and Haufler (2001, Section 4.3).

[4] Regions can be referred to as "jurisdictions" in fiscal federalism or "countries" in the world. An increase in n is a "scaled up" version or replica of a smaller economy. This replica seems to be feasible in theory if the smaller economy is a proper subset of a country (say, an expanding metropolitan area) or of the world (say, the expanding European Union).

[5] See Hoyt (1991).

$$\frac{\partial r}{\partial t_i} = \frac{-1}{n} \quad \forall i \tag{3-1}$$

$$\frac{\partial k_i}{\partial t_i} = \frac{1-(1/n)}{f''(k_i)} \quad \forall i \tag{3-2}$$

$$\frac{\partial k_i}{\partial t_{-i}} = \frac{-(1/n)}{f''(k_i)} \quad \forall i, -i \tag{3-3}$$

where $-i$ denotes any region other than region i.

Let $u_{ij} \equiv u(c_{ij}, g_i)$ denote the preferences of individual j in region i over the private good c and the public service g. We shall work with the quasi-linear form: $u(c_{ij}, g_i) = c_{ij} + v(g_i)$ with $v' > 0$, $v'' < 0$, and $\lim_{g_i \to 0} v(g_i) \to -\infty$. For one thing, this form has become standard in the literature on public goods.[6] Perhaps more importantly, the quasi-linear form makes our work directly comparable with a large tax competition literature on the efficiency problems associated with the provision of public goods. It is known that the criterion of Pareto efficiency (i.e., the so-called Samuelson condition) alone is unable to uniquely determine the optimal level of public goods in general when individuals are heterogeneous.[7] A social welfare function is typically introduced to pin it down in such situations. However, this approach may be arbitrary in our context since different social welfare functions as a rule point to different optimal levels of public goods. The advantage of the quasi-linear form is that it enables us to stick to the criterion of Pareto efficiency and, at the same time, uniquely determine the optimal level of public goods even in the case of heterogeneous people.

The government budget constraint in each region implies

$$g_i = t_i k_i \quad \forall i \tag{4}$$

On the other hand, the individual budget constraint implies

$$c_{ij} = \theta[f(k_i) - (r + t_i)k_i] + r\bar{k}_{ij} \quad \forall ij \tag{5}$$

where $f(k_i) - (r + t_i)k_i$ is the wage rate in region i. By assumption, individual j in region i supplies θ units of labor and $\bar{k}_{ij}$ units of capital.

3. Political competition and tax policy

This section analyzes the endogenous formation of the capital tax rate within each region.

We apply the citizen-candidate model proposed by Osborne and Slivinski (1996) and Besley and Coate (1997). More specifically, we consider a two-stage game as in Besley and Coate (2003).[8] First, simple-majority elections in each region determine which individual is selected to govern the region. Second, tax policies are chosen simultaneously by the elected individuals in the economy. Following Osborne and Slivinski (1996), the political process of selecting a policy-maker is viewed as the "political competition" in our model.

We solve the game backward.

3.1. Second stage: tax competition

Let the elected individual in region i own $\bar{k}_{ij}$ units of capital or, equivalently, an s_{ij} share of capital with $s_{ij} = \bar{k}_{ij}/\bar{k}_i$. Given $t_1, \ldots, t_{i-1}, t_{i+1}, \ldots t_n$, the chosen tax policy t_i satisfies

$$t_i(s_{ij}) = \arg\max_{t_i}\{c_{ij} + v(g_i)\} \quad \forall i$$

where g_i and c_{ij} follow (4) and (5), respectively. The first-order conditions for the above program are given by

$$\frac{\partial u_{ij}}{\partial t_i} = \frac{\partial c_{ij}}{\partial t_i} + v'(g_i)\frac{\partial g_i}{\partial t_i} = 0 \quad \forall i \tag{6}$$

where $v'(g_i)$ is the marginal value of the public service. It is assumed that $\partial^2 u_{ij}/\partial t_i^2 < 0$ so that the second-order conditions are met and there is a unique $t_i(s_{ij})$ satisfying (6).[9]

Using (3) and noting that $k_i = \bar{k}_i$ in a symmetric Nash equilibrium, (6) leads to

$$v'(g_i) = \frac{(1/n)s_{ij} + [1-(1/n)]\theta}{1 - [1-(1/n)]\tau_i\varepsilon_i} \quad \forall i \tag{7}$$

where $\tau_i \equiv t_i/(r + t_i)$ (the ad valorem tax rate in region i) and $\varepsilon_i \equiv -[\partial k_i/\partial(r + t_i)][(r + t_i)/k_i]$ (the elasticity of demand for capital with respect to the before-tax rate of return in region i). The left-hand side (LHS) of (7) denotes the marginal benefit of raising g_i, while the right-hand side (RHS) refers to the corresponding marginal cost. The term $(1/n)s_{ij}$ corresponds to the marginal cost of a decrease in the after-tax rate of capital return r due to an increase in t_i, while the term $[1-(1/n)]\theta$ corresponds to the marginal cost of a decrease in the labor income due to an increase in t_i. As to the denominator of (7), it captures the marginal cost associated with a tax-induced outflow of capital.

3.1.1. Special cases

Condition (7) gives rise to several special cases:

(i) $s_{ij} = \theta$

This represents the case where individuals have the same claim to capital in each region. Then (7) reduces to

$$N \cdot v'(g_i) = \frac{1}{1 - [1-(1/n)]\tau_i\varepsilon_i} \quad \forall i \tag{7-1}$$

which is the standard public-good-provision condition in the presence of tax competition when individuals are homogeneous (see, for example, Wilson and Wildasin, 2004, Eq. (1)).

(i) $n \to \infty$

This implies that $\partial r/\partial t_i \to 0$ from (3). Thus, it represents the "price-taker" or "small region" case where the after-tax rate of return on capital is beyond the control of individual regions. Then (7) reduces to

$$N \cdot v'(g_i) = \frac{1}{1 - \tau_i\varepsilon_i} \quad \forall i \tag{7-2}$$

which corresponds to the result derived in the seminal work of Wilson (1986) and Zodrow and Mieszkowski (1986). It is interesting to observe that this result holds regardless of whether individuals are homogeneous or heterogeneous. That is, both (7) and (7-1) will reduce to (7-2) whenever $n \to \infty$. As $n \to \infty$, an increase in t_i does

[6] See, for example, Besley and Coate (2003) and Batina and Ihori (2005). As in Wilson (1986) and Zodrow and Mieszkowski (1986), we focus on the fiscal externality generated by mobile tax bases, leaving out the spillover effects of public services across regions for simplicity.

[7] See Varian (1992, p. 419).

[8] The citizen-candidate model employed by Besley and Coate (2003) is an abridged version of Besley and Coate (1997), in which the decision of whether to become a candidate is not explicitly modeled; instead, being a candidate is not costly and all citizens are candidates. Despite its abridgement, two key features of the citizen-candidate model are preserved. First, unlike the Weberian tradition in which politicians are distinct from citizens (Merlo, 2006), policy-makers are elected from among the citizens. Secondly, unlike the Downsian tradition in which policies are set to win elections (Downs, 1957), the elected citizens follow their preferences to set policies once in office.

[9] $\partial^2 u_{ij}/\partial t_i^2 < 0$ is equivalent to $-\theta(1-(1/n))(\partial k_i/\partial t_i) + v'(g_i)(\partial^2 g_i/\partial t_i^2) + v''(g_i)(\partial g_i/\partial t_i)^2 < 0$. A sufficient condition to uphold the inequality is that: (i) $\partial^2 g_i/\partial t_i^2 < 0$, which is a standard assumption imposed on the Laffer curve, and (ii) N is large so that $\theta = 1/N$ is small.

not change r at all (see Eq. (3-1)), and hence the effect on capital income $r\bar{k}_{ij}$ does not arise. It then follows that the initial distribution of capital holdings does not matter for the determination of the tax rate and the level of public goods.

(i) $n = 1$

Since there is only one region in the economy, this represents the case where there is no tax competition or the economy is closed. Then (7) reduces to

$$v'(g_i) = s_{ij} \quad \forall i \tag{7-3}$$

where the elected individual j in region i will choose the public good level that equates the marginal value of the public service with his or her share of capital. This result is not surprising since, by the government budget constraint (4), an individual's share of capital determines his or her share of the tax burden in a region when there is no tax competition (i.e., no mobile tax base).

(i) $s_{ij} = \theta$ and $n = 1$

This is the case where individuals are homogeneous and the economy is closed. Then (7) reduces to

$$N \cdot v'(g_i) = 1 \quad \forall i \tag{7-4}$$

which is the Samuelson condition for the optimal provision of public goods. Eq. (7-4) uniquely determines the first-best level of public goods, g^F.

3.1.2. Comparison

Let us compare standard homogeneous-individual models with our heterogeneous-individual model.

(i) Homogeneity ($s_{ij} = \theta$)

When $s_{ij} = \theta = 1/N$, (7) will reduce to (7-1), which will further be reduced to (7-4) if and only if $n = 1$; that is, when individuals are homogeneous, the level of public goods in a region will be optimally supplied if and only if tax competition is absent.[10] This is the benchmark case considered by most of the tax competition literature. Comparing (7-1) with (7-4) leads to the fundamental result in the literature: tax competition ($n > 1$) results in an undersupply of public goods, relative to the benchmark case where tax competition is absent ($n = 1$).[11]

(i) Heterogeneity ($s_{ij} \neq \theta$)

However, the above fundamental result need not hold in general when there are heterogeneous individuals. First, observe from (7-3) that the level of public goods in the absence of tax competition will be *oversupplied* rather than undersupplied if $s_{ij} < \theta \equiv 1/N$, that is, if the elected individual in a region owns a share of capital that is smaller than the average share in the region. This suggests that tax competition ($n > 1$) may have desirable effects to "correct" the oversupply of public goods in a closed economy ($n = 1$) in the presence of political competition. In the scenario where individuals are homogeneous, we must have $s_{ij} = 1/N$ and there is no political competition by definition. On the contrary, in the scenario where individuals are heterogeneous, we may well have the case where $s_{ij} < 1/N$, so that the consequence of political competition will become important.

Next, when $n \to \infty$, (7-2) indicates that the level of public goods will be undersupplied, relative to the first-best condition (7-4). By contrast, when $n = 1$, (7-3) indicates that the level of public goods will be oversupplied, relative to the first-best condition (7-4), if $s_{ij} < 1/N$. Putting together the undersupply if $n \to \infty$ and the oversupply if $n = 1$ suggests the possibility that there exists an optimal intensity of interregional tax competition, that is, there is an $n = n^*$ with $1 < n^* < \infty$ under which public goods in a region will be optimally supplied.

To sum up, in our heterogeneous-individual model with political competition, tax competition may exert desirable effects on the level of public good provision and, perhaps more interestingly, there may exist an intensity of tax competition to support the optimal provision of public goods. We explore both possibilities in Section 4.

3.2. First stage: political competition

In this stage, individuals in each region select a policy-maker via election. There are two questions that need to be answered. First, who is the decisive voter in selecting a policy-maker? Second, will the decisive voter select him- or herself as the policy-maker or strategically delegate the policy-making to other individuals? We address these two questions in turn.

3.2.1. Decisive voter

From the first-order conditions (6), we have

$$\frac{\partial(\partial u_{ij}/\partial t_i)}{\partial t_i} dt_i + \frac{\partial(\partial c_{ij}/\partial t_i)}{\partial \bar{k}_{ij}} d\bar{k}_{ij} = 0 \quad \forall i \tag{8}$$

From (3) and (5), we have

$$\frac{\partial c_{ij}}{\partial t_i} = -\left(1 - \frac{1}{n}\right)\theta k_i - \frac{1}{n}\bar{k}_{ij} \quad \forall i \tag{9}$$

Suppose the tax rate is raised. Then, the first RHS term of (9) represents the corresponding change in the labor income (the same effect across heterogeneous individuals), while the second RHS term of (9) represents the corresponding change in the capital income (varied effects across heterogeneous individuals). Both terms are negative.

Since $\partial(\partial c_{ij}/\partial t_i)/\partial \bar{k}_{ij} = -(1/n)$ by (9), Eq. (8) leads to

$$\frac{\partial t_i(s_{ij})}{\partial \bar{k}_{ij}} = \frac{(1/n)}{\partial^2 u_{ij}/\partial t_i^2} < 0 \quad \forall i \tag{10}$$

which implies that the lower the share of capital owned by an individual, the higher is the tax rate preferred by the individual. This result is intuitive because redistribution from the rich to the poor can take place through sharing the cost of the public good provision differently. Nevertheless, the redistributive incentives of the poor are qualified in the presence of tax competition since the RHS of (10) depends on the number of competing regions n as well. In particular, it should be observed that the rich and the poor will concur with each other on the tax policy when $n \to \infty$. This is so because, from (9), a change in the tax rate will not affect the after-tax rate of return on capital but will only affect the common labor income once $n \to \infty$.

By the second-order condition that $\partial^2 u_{ij}/\partial t_i^2 < 0$, the preferences of individuals qua voters exhibit single-peakedness over tax rates t_i. Since $t_i(s_{ij})$ is monotonic in $\bar{k}_{ij}$ according to (10), the individual preferences for t_i induce a preference ordering for $\bar{k}_{ij}$. This induced preference ordering obviously exhibits single-peakedness over capital endowments $\bar{k}_{ij}$. By our assumption of representative democracy, the citizens in each region do not vote directly on policy; instead, they elect a policy-maker who chooses policy. Since the induced preference over $\bar{k}_{ij}$ is single-peaked, it

[10] By our assumptions imposed on $v(\cdot)$, $\tau_i > 0$ must hold since $\tau_i = 0$ implies that $g_i > 0$. It can be seen from (2) that $\partial k_i/\partial(r + t_i) = 1/f''$ and so $\epsilon_i > 0$ must hold as well.

[11] This fundamental result is stated as Proposition 4.1 in Wellisch (2000, p. 64) and as Proposition 4.2 in Haufler (2001, p. 65).

follows that if a citizen who has $\bar{k}_{ij}$ prefers a type $(\bar{k}_{ij})'$ candidate to a type $(\bar{k}_{ij})''$ candidate with $(\bar{k}_{ij})' < (\bar{k}_{ij})''$ ($(\bar{k}_{ij})' > (\bar{k}_{ij})''$), then so must all citizens of types smaller (larger) than $\bar{k}_{ij}$. This implies that the individual who has a median share of $\bar{k}_i$ is the decisive voter in selecting the policy-maker in region i under a simple majority. Thus, we arrive at:

Lemma 1. *The lower the share of capital owned by an individual, the higher is the tax rate preferred by the individual. The decisive voter in political competition is the median voter, that is, the individual who owns a median share of* $\bar{k}_i$, denoted by s_{ij}^m.

This has a conventional flavor since it agrees with two standard results of political competition: (i) the median voter is decisive in selecting the policy-maker, and (ii) the median voter's income relative to average income is critical in the determination of the size of the public sector as developed by Meltzer and Richard (1981).[12]

3.2.2. Strategic delegation

It is important to explicitly incorporate strategic delegation under representative democracy into the analytical framework. Persson and Tabellini (1992) point out that a decisive voter may not wish to elect him- or herself as the policy-maker.[13] The reason behind this result is that policy-makers evaluate policy ex post (after elections), whereas voters evaluate policy ex ante (before/during elections). In terms of our model, this implies that while the policy-maker in region i takes t_{-i} as given in the second stage of the game (policy-makers move simultaneously in choosing their tax policies according to (6)), voters in region i take the reaction of t_{-i} to t_i as given in the first stage of the game (in choosing a policy-maker, voters realize that tax policies will be set according to (6)).

Let $U_{ij} \equiv u_{ij}(t_i, t_{-i}(t_i))$. While (6) characterizes a policy-maker's preferred tax rate, the tax rate preferred by the decisive voter satisfies

$$\frac{\partial U_{ij}}{\partial t_i} = \frac{\partial u_{ij}}{\partial t_i} + \sum_{-i} \frac{\partial u_{ij}}{\partial t_{-i}} \cdot \frac{\partial t_{-i}}{\partial t_i} = 0 \quad \forall i \tag{11}$$

where u_{ij} is evaluated at t_i^m, the decisive median voter's preferred tax rate. To implement t_i^m, the decisive median voter must elect a policy-maker s_{ij}^p such that $t_i^m = t_i(s_{ij}^p)$. Evaluating (6) at $t_i(s_{ij}^p)$ and using it to rewrite (11) gives rise to

$$\bar{k}_{ij}^m - \bar{k}_{ij}^p = \sum_{-i} n \cdot \frac{\partial u_{ij}}{\partial t_{-i}} \cdot \frac{\partial t_{-i}}{\partial t_i} \quad \forall i \tag{11-1}$$

where $\bar{k}_{ij}^m = s_{ij}^m \cdot \bar{k}_i$ and $\bar{k}_{ij}^p = s_{ij}^p \cdot \bar{k}_i$. Whether $s_{ij}^m \gtrless s_{ij}^p$ or $s_{ij}^m < s_{ij}^p$ thus depends on the sign of $(\partial u_{ij}/\partial t_{-i}) \cdot (\partial t_{-i}/\partial t_i)$. We examine $\partial u_{ij}/\partial t_{-i}$ and $\partial t_{-i}/\partial t_i$, respectively.

Using (3) gives

$$\frac{\partial u_{ij}}{\partial t_{-i}} = \frac{1}{n}\left[\bar{k}_i(\theta - s_{ij}^m) - \frac{v'(g_i)t_i}{f''}\right] \quad \forall i, -i \tag{12}$$

where we have utilized the property that $k_i = \bar{k}_i$ in a symmetric Nash equilibrium. Since the median claim to capital in a region is smaller than the mean claim by assumption, we have $s_{ij}^m < \theta = 1/N$. This together with $f''(k_i) < 0$ implies from (12) that $\partial u_{ij}/\partial t_{-i} > 0$.

It is readily seen from (3) that $\partial t_{-i}/\partial t_i$ will involve the term $f'''(k_i)$, the sign of which is not a primitive of our model.[14] As Brueckner (2003) notes, theory itself is silent regarding the sign of $\partial t_{-i}/\partial t_i$. Despite the lack of a definite sign in theory, Brueckner (2003, p. 181) observes in his overview of empirical studies on strategic interaction among governments: "In almost all the empirical studies above, the estimated reaction function is upward sloping. Thus, the decision variables of the interacting governments represent "strategic complements."" This supports $\partial t_{-i}/\partial t_i \geqslant 0$ rather than the other way round empirically.

On the basis of $\partial u_{ij}/\partial t_{-i} > 0$ from (12), we see from (11-1) that $s_{ij}^p \leqslant s_{ij}^m$ if and only if taxes are strategic complements (i.e., $\partial t_{-i}/\partial t_i \geqslant 0$).[15] This leads to:

Lemma 2. *The decisive median voter in each region will select a policy-maker whose capital share is not higher than* s_{ij}^m *if and only if taxes are strategic complements.*

That is to say, when $n > 1$, the decisive median voter will strategically delegate the policy-making to individuals whose capital shares are not higher than his or her own share s_{ij}^m, if and only if taxes are strategic complements. The logic behind this result is as follows. With $\partial u_{ij}/\partial t_{-i} > 0$ from (12), $\partial U_{ij}/\partial t_i = 0$ at t_i^m implies from (11) that $\partial u_{ij}/\partial t_i \leqslant 0$ at t_i^m if and only if taxes are strategic complements. Because $\partial^2 u_{ij}/\partial t_i^2 < 0$ by the second-order condition, $\partial u_{ij}/\partial t_i \leqslant 0$ at t_i^m implies that $t_i^m \geqslant t_i(s_{ij}^m)$ where $t_i(s_{ij}^m)$ is the solution of (6), that is, the tax rate chosen by the decisive median voter if he or she were the policy-maker. $t_i(s_{ij})$ is decreasing in s_{ij} according to Lemma 1. As a result, to implement t_i^m with $t_i^m \geqslant t_i(s_{ij}^m)$, the decisive voter must delegate the policy-making to individuals with $s_{ij} \leqslant s_{ij}^m$.

When $n = 1$, (11) will collapse to (6) since $-i$ does not exist. In such a case, it is obvious that the decisive voter will select him- or herself as the policy-maker and there is no strategic delegation.

From (11), we have

$$\frac{\partial^2 U_{ij}}{\partial t_i \partial \bar{k}_{ij}^m} = \frac{\partial(\partial c_{ij}/\partial t_i)}{\partial \bar{k}_{ij}^m} + \sum_{-i} \frac{\partial(\partial c_{ij}/\partial t_{-i})}{\partial \bar{k}_{ij}^m} \cdot \frac{\partial t_{-i}}{\partial t_i} \quad \forall i \tag{13}$$

Since $\partial(\partial c_{ij}/\partial t_i)/\partial \bar{k}_{ij}^m = \partial(\partial c_{ij}/\partial t_{-i})/\partial \bar{k}_{ij}^m = -(1/n)$, (13) leads to

$$\frac{\partial^2 U_{ij}}{\partial t_i \partial \bar{k}_{ij}^m} = -\left(\frac{1}{n} + \sum_{-i} \frac{1}{n} \cdot \frac{\partial t_{-i}}{\partial t_i}\right) \quad \forall i \tag{14}$$

If taxes are strategic complements, (14) implies that $\partial^2 U_{ij}/\partial t_i \partial s_{ij}^m < 0$ and so $\partial t_i^m/\partial s_{ij}^m < 0$ according to Topkis's monotonicity theorem.[16] By Lemma 1, $\partial t_i^m/\partial s_{ij}^m < 0$ then implies that $\partial s_{ij}^p/\partial s_{ij}^m > 0$. Thus, we have:

Lemma 3. *If taxes are strategic complements, then the lower the* s_{ij}^m *the lower the* s_{ij}^p *will be.*

In words, the lower the share of capital owned by a decisive voter, the higher will be the tax rate preferred by the decisive voter; as a result, the decisive voter will select a policy-maker who has a lower share of capital to implement the decisive voter's preferred tax rate (see Eq. (10)).

Eq. (9) gives $(\partial c_{ij}/\partial t_i) = -\bar{k}_i[\theta(1 - (1/n)) + (1/n)s_{ij}] < 0$ in equilibrium. Thus, from (6), we have:

Lemma 4. $(\partial g_i/\partial t_i) > 0$ *holds in equilibrium in our economy.*

[12] Fuest and Huber (2001) obtain a similar result with respect to labor income taxation in a tax competition model.

[13] See also Brueckner (2001), who shows that, to offset the tax decreasing (increasing) effect of competition (coordination), the decisive voter has an incentive to elect a policy-maker who has a high (low) valuation of public goods.

[14] This is somewhat analogous to the finding in the classical work of Roberts and Sonnenschein (1977) that the continuity of the reaction function depends on the third derivative of the utility function.

[15] For convenience, our definition of strategic complements includes the case where $\partial t_{-i}/\partial t_i = 0$. Let $f'''(k_i) = 0$ serve as a neutral benchmark and further assume that N is large enough so that $\theta = 1/N \to 0$. It can then be shown that with the popular form, $\frac{\partial t_{-i}}{\partial t_i} = \frac{1/nf''}{[1-(1/n)][f''+(k^2 \cdot f'')/\{[(1-(1/n)]k^2\}}$ which has a positive sign.

[16] Unlike standard comparative statics, Topkis's theorem dispenses with the assumption of strong concavity $\partial^2 u_{ij}/\partial t_i^2 < 0$; see Amir (2005). A key idea behind the application of the theorem is that whether t_i^m is monotonic in S_{ij}^m does not depend on the concavity of U_{ij}.

4. Implications of tax-cum-political competition

This section explores the implications of the interaction between interregional tax competition and intraregional political competition for the provision of public goods.

4.1. Preliminary analysis

From the first-order conditions (6), we obtain[17]

$$\frac{\partial(\partial u_{ij}/\partial t_i)}{\partial t_i}dt_i + \left[\frac{\partial(\partial c_{ij}/\partial t_i)}{\partial n} + v'(g_i)\frac{\partial(\partial g_i/\partial t_i)}{\partial n}\right]dn = 0 \quad \forall i \tag{15}$$

Note that $\partial(\partial c_{ij}/\partial t_i)/\partial n = (1/n^2)(\bar{k}_{ij} - \theta k_i)$ and that $\partial(\partial g_i/\partial t_i)/\partial n = (1/n^2)(t_i/f'')$ by (3)–(5), and hence Eq. (15) leads to

$$\frac{\partial t_i(s_{ij}^p)}{\partial n} = \frac{(1/n^2)[(\theta - s_{ij}^p)\bar{k}_i - v'(g_i)(t_i/f'')]}{\partial^2 u_{ij}/\partial t_i^2} \quad \forall i \tag{16}$$

where we have utilized $k_i = \bar{k}_i$ in a symmetric Nash equilibrium. This result implies that $(\partial t_i(s_{ij}^p)/\partial n) < 0$ if $s_{ij}^p \leqslant \theta = 1/N$. By Lemma 2, $s_{ij}^p \leqslant s_{ij}^m < \theta = 1/N$ if taxes are strategic complements. Thus, we have:

Lemma 5. $(\partial t_i(s_{ij}^p)/\partial n) < 0$ *if taxes are strategic complements.*

That is, the equilibrium tax rate chosen by the policy-maker (who is elected by the decisive median voter) is monotonically decreasing in the number of competing regions if taxes are strategic complements.

Lemma 5 considers policy variations in response to an increase in n when s_{ij}^p is given. We now investigate how the decisive voter may alter s_{ij}^p in response to an increase in n. Substituting (12) in (11-1) yields $\partial s_{ij}^p/\partial n \geqslant 0$ if $\partial^2 t_{-i}/\partial t_i \partial n \leqslant 0$.[18] This leads to:

Lemma 6. *If* $\partial^2 t_{-i}/\partial t_i \partial n \leqslant 0$, *then* $\partial s_{ij}^p/\partial n \geqslant 0$.

With $\partial t_{-i}/\partial t_i \geqslant 0$, $\partial^2 t_{-i}/\partial t_i \partial n \leqslant 0$ simply means that the degree of complementarity between t_i and t_{-i} is decreasing in the number of competing regions. This condition seems plausible and, in particular, it can be shown that $\partial t_{-i}/\partial t_i \to 0$ as $n \to \infty$. However, the possibility of $\partial^2 t_{-i}/\partial t_i \partial n > 0$ cannot be ruled out, at least a priori.[19]

With Lemmas 1–6 at hand, we now turn to the two possibilities mentioned in Section 3: the desirable effects of tax competition and the optimal intensity of tax competition. For ease of exposition in the following, we employ the terms "increased" interregional tax competition and "increased" intraregional political competition. We first explain what they mean.

The term "increased interregional tax competition" simply means an increase in the number of competing regions n. This follows Wilson and Wildasin (2004).

Following Meltzer and Richard (1981), we view the deviation between s_{ij}^m (the median share of capital) and $1/N$ (the mean share of capital) as a metaphor for income inequality in a region. The larger the deviation between s_{ij}^m and $1/N$, the higher is the degree of income inequality in the region. Given $1/N$, we interpret a decrease in s_{ij}^m (a deterioration in income inequality) as "increased" intraregional political competition, in the sense that the interest conflict between the mean and the median voter increases.

For ease of exposition in the following, we also define two conditions.

Condition 1. Taxes are strategic complements (i.e., $\partial t_{-i}/\partial t_i \geqslant 0$).

Condition 2. Tax complementarity is decreasing in the number of regions (i.e., $\partial^2 t_{-i}/\partial t_i \partial n \leqslant 0$).

While Condition 1 will be utilized throughout, we make use of Condition 2 only in the proof of a corollary.

4.2. Optimal and increased interregional tax competition

When there is no tax competition or the economy is closed (i.e., $n = 1$), we have in equilibrium

$$v'(g_i) = s_{ij}^m \quad \forall i \tag{7-3$*$}$$

where we have utilized Lemma 1. Eq. (7-3$*$) implies that $N \cdot v'(g_i) < 1$ in equilibrium since $s_{ij}^m < (1/N)$.

When $n \to \infty$, (7-2) indicates that the level of public goods in a region will be undersupplied, relative to the first-best condition (7-4). This outcome results because the force of tax competition completely dominates when $n \to \infty$ (as we have noted after (7-2), the initial distribution of capital holdings does not matter for the determination of the tax rate and the level of public goods in this case). By contrast, when $n = 1$, (7-3$*$) indicates that the level of public goods in a region will be oversupplied, relative to the first-best condition (7-4). This outcome results because the force of political competition completely dominates when $n = 1$ (as shown by (7-3), an individual's share of capital completely determines his or her preferred tax rate and level of public goods in this case). We now investigate if there exists an $n = n^*$ with $1 < n^* < \infty$ under which public goods in a region will be optimally supplied when neither tax competition nor political competition is completely dominating.

Replacing s_{ij} with s_{ij}^p in Eq. (7) and solving for n that satisfies the first-best condition $N \cdot v'(g^F) = 1$ leads to

$$n = 1 + \frac{1 - Ns_{ij}^p}{\tau_i \varepsilon_i} \quad \forall i \tag{17}$$

where $\tau_i \varepsilon_i$ is evaluated at the optimal tax rate that achieves the first-best public good provision g^F. The resulting n that satisfies (17) will be greater than 1 but smaller than infinity if the inequality $s_{ij}^p < 1/N$ holds.[20] By Lemmas 1–2, we indeed have $s_{ij}^p \leqslant s_{ij}^m < 1/N$ in equilibrium if Condition 1 holds.

From (17), we see that s_{ij}^p which is used to support g^F is strictly decreasing in n. On the other hand, Lemma 3 tells us that the policy-maker s_{ij}^p who is elected by the decisive voter is strictly increasing in s_{ij}^m if Condition 1 holds. Putting them together implies that, given s_{ij}^m, there exists a unique n^* to support g^F via the policy-maker selection by the decisive voter s_{ij}^m and that the lower that s_{ij}^m is, the higher that n^* will be.

To sum up, we obtain:

Proposition 1. T (Optimal tax competition). *Suppose that Condition 1 holds. Given* $s_{ij}^m < (1/N)$ *(intraregional political competition), there is a unique* $n = n^*(s_{ij}^m)$ *(the optimal interregional tax competition) with* $1 < n^*(s_{ij}^m) < \infty$ *under which public goods will be optimally supplied* $(g_i = g^F)$ *and* $n^*(s_{ij}^m)$ *is decreasing in* s_{ij}^m.

Mathematically, $n = 1$ must hold if one wants to reduce (7-1)–(7-4). In other words, to achieve the first-best provision of public goods in an economy with homogeneous individuals, there must be no tax competition. This leads to the fundamental result in the tax competition literature that tax competition $(n > 1)$ will result in an undersupply of public goods (relative to the first-best in a closed economy). By contrast, we have shown that it is possible to reduce 7, 7-1, 7-2, 7-3, 7-4 with $n > 1$ in our heterogeneous-individual economy when political competition is present.

[17] We treat n as a continuous variable as in Seade (1980).

[18] According to Topkis's monotonicity theorem, $\partial t_i^m/\partial n \leqslant 0$ if $\partial^2 U_{ij}/\partial t_i \partial n \leqslant 0$. Note that $\partial^2 U_{ij}/\partial t_i \partial n \leqslant 0$ is equivalent to $\partial^2 t_{-i}/\partial t_i \partial n \leqslant 0$ (substituting (12) in (11-1)), and that $\partial t_i^m/\partial n \leqslant 0$ implies $\partial s_{ij}^p/\partial n \geqslant 0$ by Lemma 1.

[19] Imposing the same assumptions as those in Footnote 14, it can be checked that $\partial^2 t_{-i}/\partial t - i\partial n < 0$ holds.

[20] The case where $\tau_i \epsilon_i \to 0$ is ruled out by default, otherwise (7-1) would reach the first-best regardless of n.

The policy implication of $n^*(s_{ij}^m)$ being decreasing in s_{ij}^m is that the higher the income inequality in a region, the higher will be the oversupply of public goods from intraregional political competition in the region and, therefore, the higher the optimal interregional tax competition that will be required to achieve the first-best provision of public goods.

Increased tax competition (i.e., an increase in n) will bring about two effects. First, the decisive median voter will alter the policy delegation via electing a different policy-maker. From Lemma 6, $\partial s_{ij}^p/\partial n \geqslant 0$ if Condition 2 holds; and from Lemma 1, $(\partial t_i(s_{ij}^p)/\partial s_{ij}^p) < 0$. Thus, this first effect will result in a lower tax rate and hence a lower level of public goods by Lemma 4 if Condition 2 holds. Second, a policy-maker will also alter the policy choice. From Lemma 5, $(\partial t_i(s_{ij}^p)/\partial n) < 0$ if taxes are strategic complements. Thus, this second effect will reinforce the first effect in reducing the level of public goods if Condition 1 holds. Putting them together, Proposition 1 then leads to:

Corollary 1. T (Increased tax competition). *Suppose that Conditions 1 and 2 hold. Given $s_{ij}^m < (1/N)$, increased interregional tax competition (an increase in n, denoted by Δn) will "correct" the oversupply of public goods caused by intraregional political competition if $n + \Delta n < n^*(s_{ij}^m)$.*

4.3. Optimal and increased intraregional political competition

Proposition 1 T reports the optimal interregional tax competition in which the extent of intraregional political competition is constant in the sense that there is a given distribution of capital holdings and, more specifically, a fixed median share of capital holdings (i.e., a given s_{ij}^m) in each region. One may ask a "dual" problem: given the extent of interregional tax competition with a fixed number of jurisdictions (i.e., a given n), is there a corresponding intraregional political competition that achieves the first-best provision of public goods? We address the dual problem in this section.

Given an arbitrary n with $n > 1$, there is an s_{ij}^p that satisfies (17) with $s_{ij}^p < (1/N)$. From Lemmas 1–3, this s_{ij}^p is elected by a decisive voter with $s_{ij}^m = s_{ij}^{m*} \geqslant s_{ij}^p$ via intraregional political competition if Condition 1 holds. Since s_{ij}^p is decreasing in n according to (17), from Lemma 3 we also have that the higher the n the lower the $s_{ij}^{m*}(n)$ will be if Condition 1 holds. Thus, Proposition 1 T can be put differently:

Proposition 1. P (Optimal political competition). *Suppose that Condition 1 holds. Given $n > 1$ (interregional tax competition), there is a unique $s_{ij}^m = s_{ij}^{m*}(n)$ (the optimal intraregional political competition) under which public goods will be optimally supplied $(g_i = g^F)$ and $s_{ij}^{m*}(n)$ is decreasing in n.*

The policy implication of $s_{ij}^{m*}(n)$ being decreasing in n is that the higher the interregional tax competition facing a region, the higher will be the undersupply of public goods in the region and, therefore, the higher the income inequality that will be required for intraregional political competition to achieve the first-best provision of public goods.Corollary 1 T can also be put differently:

Corollary 1. P (Increased political competition). *Suppose that Condition 1 holds. Given $n > 1$, increased intraregional political competition (a decrease in s_{ij}^m, denoted by $-\Delta s_{ij}^m$) will "correct" the undersupply of public goods caused by interregional tax competition if $s_{ij}^m - \Delta s_{ij}^m > s_{ij}^{m*}(n)$.*

By Lemma 3, a decrease in s_{ij}^m will cause a decrease in s_{ij}^p if Condition 1 holds. This, through Lemmas 1 and 4, will bring about an increase in the tax rate and the level of public good provision. As long as $s_{ij}^m - \Delta s_{ij}^m > s_{ij}^{m*}(n)$, the increase is moving toward g^F. Since n is fixed in the above corollary, there is no need to impose Condition 2 as Corollary 1 T.

5. Conclusion

This paper has explored the implications of the interaction between interregional tax competition and intraregional political competition for the optimal provision of public goods. As an extension of Hoyt's (1991) finding that intensified tax competition is always harmful and aggravates the extent to which public goods are undersupplied in a region, we show that intensified tax competition can be beneficial if political as well as tax competition is considered. Interestingly, we have found that interregional tax competition alone tends to lead to an undersupply of public goods, while intraregional political competition alone tends to lead to an oversupply of public goods; however, putting both forms of competition together can define the optimal degree of tax competition, which may result in the optimal provision of public goods. There have been several papers that incorporate both forms of competition. However, there has been no attempt to explore the normative role of the degree of political and/or tax competition on the provision of public goods. In this sense, our paper is an important extension of Hoyt's paper.

In the presence of political competition, tax competition may have desirable effects and, perhaps more interestingly, there may be an optimal intensity of tax competition. Our result suggests that Hoyt's (1991) emphasized tradeoff between Tiebout sorting and the costs of tax competition may not exist once political as well as tax competition is considered.

Our model is admittedly highly stylized and abstracts from several possible directions of generalization, such as asymmetric country size, heterogeneous non-capital income, incumbency effects, the roles of bureaucrats and of interest groups, and taxes other than the capital income tax. Nevertheless, it is hoped that our model may have highlighted the importance of considering *both* tax and political competition in the analysis of public good provision.

Acknowledgments

We would like to thank Robin Boadway, Ami Glazer, Marty McGuire, Ray Batina, Joosung Jun, Genevieve Tellier, and other participants for their helpful comments. We would also like to thank two anonymous referees and the Editor for comments and suggestions that led to significant improvements in the paper. C.C. Yang gratefully acknowledges the financial support by the Taiwan NSC under Grant NSC97-2410-H-001-010.

References

Amir, R., 2005. Supermodularity and complementarity in economics: an elementary survey. Southern Economic Journal 71, 636–660.
Batina, R.G., Ihori, T., 2005. Public Goods: Theories and Evidence. Springer-Verlag, Berlin.
Besley, T., Coate, S., 1997. An economic model of representative democracy. Quarterly Journal of Economics 112, 85–114.
Besley, T., Coate, S., 2003. Centralized versus decentralized provision of local public goods: a political economy approach. Journal of Public Economics 87, 2611–2637.
Brueckner, M., 2001. Strategic delegation and international capital taxation. Manuscript, University of Bonn.
Brueckner, M., 2003. Strategic interaction among governments: an overview of empirical studies. International Regional Science Review 26, 175–188.
Burbidge, J.B., Myers, G.M., 1994. Population mobility and capital tax competition. Regional Science and Urban Economics 24, 441–459.
Edwards, J., Keen, M., 1996. Tax competition and Leviathan. European Economic Review 40, 113–134.
Downs, A., 1957. An Economic Theory of Democracy. Harper and Row, New York.
Epple, D., Zelenitz, A., 1981. The implications of competition among jurisdictions: does Tiebout need politics? Journal of Political Economy 89, 1197–1217.
Frey, B., Eichenberger, R., 1996. To harmonize or to compete? That is not the question. Journal of Public Economics 60, 335–349.
Fuest, C., Huber, B., 2001. Tax competition and tax coordination in a median voter model. Public Choice 107, 97–113.

Fuest, C., Huber, B., Mintz, J., 2005. Capital mobility and tax competition. Foundations and Trends in Microeconomics 1, 1–62.
Haufler, A., 2001. Taxation in a Global Economy. Cambridge University Press, Cambridge.
Hoyt, W.H., 1991. Property taxation, Nash equilibrium, and market power. Journal of Urban Economics 30, 123–131.
Keen, M.J., Kotsogiannis, C., 2004. Tax competition in federations and the welfare consequences of decentralization. Journal of Urban Economics 56, 397–407.
Kessler, A.S., Lulfesmann, C., Myers, G.M., 2002. Redistribution, fiscal competition, and the politics of economic integration. Review of Economic Studies 69, 899–923.
Meltzer, A., Richard, S., 1981. A rational theory of the size of government. Journal of Political Economy 89, 914–927.
Merlo, A., 2006. Wither political economy? Theories, facts and issues. In: Blundell, R., Newey, W., Perrson, T. (Eds.), Advances in Economics and Econometrics, Theory and Applications: Ninth World Congress of the Econometric Society, vol. I. Cambridge University Press, Cambridge.
Oates, W.E., 1972. Fiscal Federalism. Harcourt Brace Jovanovich, New York.
Osborne, M.J., Slivinski, A., 1996. A model of political competition with citizen candidates. Quarterly Journal of Economics 111, 65–96.
Perroni, C., Scharf, K.A., 2001. Tiebout with politics: capital tax competition and constitutional choices. Review of Economic Studies 68, 133–154.
Persson, T., Tabellini, G., 1992. The politics of 1992: fiscal policy and European integration. Review of Economic Studies 59, 689–701.
Rauscher, M., 1998. Leviathan and competition among jurisdictions: the case of benefit taxation. Journal of Urban Economics 44, 59–67.
Roberts, J., Sonnenschein, H., 1977. On the foundations of the theory of monopolistic competition. Econometrica 45, 101–113.
Sato, M., 2003. Tax competition, rent-seeking and fiscal decentralization. European Economic Review 47, 19–40.
Seade, J., 1980. On the effects of entry. Econometrica 48, 479–489.
Varian, H.R., 1992. Microeconomic Analysis, third ed. Norton & Company, New York.
Wellisch, D., 2000. Theory of Public Finance in a Federal State. Cambridge University Press, Cambridge.
Wildasin, D.E., 1988. Nash equilibrium in models of fiscal competition. Journal of Public Economics 35, 229–240.
Wilson, J.D., 1986. A theory of interregional tax competition. Journal of Urban Economics 19, 296–315.
Wilson, J.D., 1999. Theories of tax competition. National Tax Journal 52, 269–304.
Wilson, J.D., 2005. Welfare-improving competition for mobile capital. Journal of Urban Economics 57, 1–18.
Wilson, J.D., Wildasin, D.E., 2004. Capital tax competition: bane or boon. Journal of Public Economics 88, 1065–1091.
Zodrow, G.R., Mieszkowski, P.M., 1986. Pigou, Tiebout, property taxation, and the under-provision of public goods. Journal of Urban Economics 19, 356–370.