Interregional Tax Competition, Intraregional Political Competition, and the Optimal Provision of Public Goods

Toshihiro Ihori*

Department of Economics, University of Tokyo

C.C. Yang**

Institute of Economics, Academia Sinica

Department of Public Finance, National Chengchi University

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[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. In contrast to Hoyt's (1991) finding that the extent to which public goods are undersupplied is monotonically increasing in the number of competing regions, we show that the relationship between the level of public good supply and the number of competing regions is non-monotonic if political as well as tax competition is considered. Interestingly, some certain interaction between interregional tax competition and intraregional political competition can result in the optimal provision of public goods.

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* Department of Economics, University of Tokyo, Hongo, Tokyo 113-0033, Japan
E-mail: ihori@e.u-tokyo.ac.jp
** Corresponding author, Institute of Economics, Academia Sinica, Nankang, Taipei 115, Taiwan
Email: ccyang@econ.sinica.edu.tw

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. The literature on tax competition for mobile factors largely leaves out this stylized form of political competition.[1] In this paper we incorporate the stylized 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 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)

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[1] Persson and Tabellini (1992) is a notable exception, but their focus is not on the provision of public goods. 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. There are two studies that are most related to our paper. Bruckner (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. The focuses and results of both studies are different from ours. For surveys of political economy approaches to tax competition, see Wilson (1999) and Fuest et al. (2005).

and formally modeled by Wilson (1986) and Zodrow and Mieszkowski (1986).[2] In an important contribution, Hoyt (1991) shows that the extent to which public goods are undersupplied is monotonically increasing in the number of competing regions. In contrast to this monotonic finding, we show that the relationship between the level of public good supply and the number of competing regions is non-monotonic if political as well as tax competition is considered. Interestingly, some certain interaction between interregional tax competition and intraregional political competition can result in the optimal provision of public goods.

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. 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 literature,[3] except for the extension from homogeneous to heterogeneous individuals.

Consider an economy in which there are *n* identical regions, where $n \in \{1,...,\infty\}$. Each region is inhabited by *N* individuals. There are two factors of production: perfectly immobile labor and perfectly mobile 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.

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

$$\sum_i k_i = \sum_i \bar{k}_i \,. \qquad (1)$$

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

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

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 its region. Perfectly mobile capital implies

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

where r is the after-tax rate of return on capital, which depends on $t_1,...,t_n$ and is equalized across the economy. Using (1)-(2) and the assumption that all regions are identical, we have[4]

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

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

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

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.[5] 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

[4] See Hoyt (1991).

[5] See, for example, Besley and Coate (2003) and Batina and Ihori (2005).

uniquely determine the optimal level of public goods in general when individuals are heterogeneous.[6] 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 per unit of labor 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). First, 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.

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

3.1. Second stage: tax competition

Let the elected individual in region *i* own $\bar{k}_{ij}$ units of capital. Given $t_1,...,t_{i-1},t_{i+1,}...t_n$, the chosen tax policy t_i satisfies

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

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 benefit 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 that there is a unique $t_i(\bar{k}_{ij})$ satisfying (6).[7]

Using (3) and 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 $s_{ij} \equiv \bar{k}_{ij} / \bar{k}_i$ (the share of capital owned by individual *j* in region *i*), $\tau_i \equiv t_i /(r+t_i)$ (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

[7] $\partial^2 u_{ij} / \partial t_i^{\ 2} < 0$ 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.

$[1-(1/n)]\theta$ corresponds to the marginal cost of a decrease in the wage rate due to an increase in t_i.

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)).

(ii) $n \to \infty$

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 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 holding does not matter for the determination of the tax rate and the level of public goods.

(iii) $n = 1$

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

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

where the elected individual *j* in region *i* will choose the public good level that equates the marginal benefit 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 in which there is no tax competition (i.e. no mobile tax base).

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

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

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

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.

Comparison

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

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

When $s_{ij} = \theta \equiv 1/N$, (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.[8] 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 ($n = 1$).[9]

(ii) 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 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 of $s_{ij} < 1/N$, 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

[8] By our assumptions imposed on $v(.)$, $\tau_i > 0$ 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 $\varepsilon_i > 0$ must hold as well.

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

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 provision of public goods and, perhaps more interestingly, there may exist an intensity of tax competition to support the optimal level 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 policymaker via election. There are two questions that need 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.

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

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

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

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

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, observe 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 assumption 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 $t_i(\bar{k}_{ij})$ 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 obviously exhibits single-peakedness over capital endowments $\bar{k}_{ij}$. Then, invoking the median voter theorem, 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 a standard result of political competition: the median voter is a decisive voter in selecting the policy-maker.

Strategic delegation

Persson and Tabellini (1992) point out that a decisive voter may not wish to elect him- or herself as the policymaker. The reason behind this result is that policymakers 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, voters in region *i* take the reaction of t_{-i} to t_i as given in the first stage of the game. Thus, the tax rate preferred by the decisive voter satisfies

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

where u_{ij} is evaluated at s_{ij}^m, the median share of $\bar{k}_i$. It is assumed that $\Delta \equiv \partial[\partial u_{ij}/\partial t_i+\sum_{-i}(\partial u_{ij}/\partial t_{-i})(\partial t_{-i}/\partial t_i)]/\partial t_i<0$ so that the second-order conditions are met and that there is a unique $t_i(s_{ij}^m)$ satisfying (11).

Using (3) gives

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

where we have utilized the property that $k_i=\bar{k}_i$ in a symmetric Nash equilibrium. Since positively skewed distributions of capital income are typically observed in the real world, we shall impose the inequality $s_{ij}^m<\theta\equiv 1/N$. This then implies from (12) that $\partial u_{ij}/\partial t_{-i}>0$ when it is evaluated at s_{ij}^m.

As long as $\partial t_{-i}/\partial t_i>0$, which is reasonable in the context of tax competition and particularly true in our symmetric model, (11) and the positive sign of (12) together yield: $\partial u_{ij}/\partial t_i<0$ when it is evaluated at s_{ij}^m. Appealing to (10), $\partial u_{ij}/\partial t_i<0$ at s_{ij}^m plus $\partial^2 u_{ij}/\partial t_i^{\,2}<0$ then implies

Lemma 2. *The decisive median voter in each region will select a policy-maker whose capital share is lower than* s_{ij}^{m} *if* $n > 1$, *but will select him- or herself as the policy-maker if* $n = 1$.

That is to say, when $n > 1$, the decisive voter will not select him- or herself as the policy-maker but will strategically delegate the policy-making to other individuals whose capital share is lower than his or her own share s_{ij}^{m}. The intuition is as follows. The tax rate preferred by the decisive voter satisfies (11), which is the optimal condition *ex ante* (before/during elections). By contrast, the tax rate preferred by the policy-maker satisfies (6), which is the optimal condition *ex post* (after elections). The optimal ex ante tax rate is higher than the optimal ex post tax rate, since $\partial u_{ij} / \partial t_i < 0$ at the ex ante optimum whereas $\partial u_{ij} / \partial t_i = 0$ at the ex post optimum. To implement the higher optimal ex ante tax rate, the selected policy-maker must have a lower capital share than the median voter (see Eq. (10)). This outcome results simply because the decisive voter takes the reaction of t_{-i} to t_i as given, while the policy-maker takes t_{-i} as given. Anticipating an increase in t_i will induce an increase in t_{-i}, the decisive voter is better off via delegating the policy-making to an individual with a capital share lower than his or her own.

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.

The decisive voter takes the reaction of t_{-i} to t_i as given. From (11), we then have

$$\Delta dt_i + [\frac{\partial(\partial c_{ij} / \partial t_i)}{\partial \bar{k}_{ij}} + \sum_{-i} \frac{\partial(\partial c_{ij} / \partial t_{-i})}{\partial \bar{k}_{ij}} \cdot \frac{\partial t_{-i}}{\partial t_i}] d\bar{k}_{ij} = 0 \ \ \forall \ i. \tag{13}$$

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

$$\frac{\partial t_i(s_{ij}^{m})}{\partial \bar{k}_{ij}^{m}} = \frac{(1/n) + \sum_{-i} (1/n)(\partial t_{-i} / \partial t_i)}{\Delta} < 0 \ \ \forall \ i \tag{14}$$

where $\bar{k}_{ij}^{m} = s_{ij}^{m} \cdot \bar{k}_i$. Let s_{ij}^{p} denote the share of capital owned by the policy-maker, who is selected by the decisive median voter with $s_{ij} = s_{ij}^{m}$. Putting (10) and (14) together yields

Lemma 3. *The lower the s_{ij}^{m}, the lower is the s_{ij}^{P}.*

In words, the lower the share of capital owned by a decisive voter, the higher is the tax rate preferred by the decisive voter (see Eq. (14)); 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)).

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[10]

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

Note that $\partial(\partial c_{ij}/\partial t_i)/\partial n = (1/n^2)(\bar{k}_{ij} - \theta \bar{k}_i)$ 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

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

where we utilize $k_i = \bar{k}_i$ in a symmetric Nash equilibrium. This result implies that $(\partial t_i(\bar{k}_{ij})/\partial n) < 0$ if $\bar{k}_{ij} < \theta \bar{k}_i$; that is, the equilibrium tax rate chosen by the policy-maker is

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

monotonically decreasing in the number of competing regions if $s_{ij} < 1/N$. From Lemma 2, the decisive median voter selects a policy-maker who owns a capital share s_{ij}^P equal to or lower than the median share s_{ij}^m, which is lower than the mean share $1/N$. Thus, we have

Lemma 4. $(\partial t_i(\bar{k}_{ij})/\partial n) < 0$ *holds in equilibrium in our economy.*

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 also have

Lemma 5. $(\partial g_i/\partial t_i) > 0$ *holds in equilibrium in our economy.*

With Lemmas 1-5 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 Widasin (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.

4.2. Optimal interregional tax competition

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

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

where we have utilized Lemmas 1-2. 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 $n \to \infty$. 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 $n = 1$. Putting them together and appealing to Lemmas 4-5, one would conjecture that there exists an $n = n^*$ with $1 < n^* < \infty$ under which public goods in a region will be optimally supplied. This conjecture is verified below.

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

$$n^* = 1 + \frac{1 - N s_{ij}^p}{\tau_i \varepsilon_i} \ \ \forall \ i. \tag{17}$$

This resulting n^* will be greater than 1 but smaller than infinity if the inequality $s_{ij}^P < 1/N$ holds.[11] By Lemmas 1-2, we indeed have $s_{ij}^P \leq s_{ij}^m < 1/N$ in equilibrium.

To sum up, we obtain

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

Proposition 1-T (Tax competition). *Given* $s_{ij}^m < (1/N)$ *(intraregional political competition), there is an* $n = n^*(s_{ij}^m)$ *(the optimal interregional tax competition) with* $1 < n^*(s_{ij}^m) < \infty$ *under which public goods will be optimally supplied (* $g_i = g^F$ *).*

Mathematically, $n = 1$ must hold if one wants to reduce (7-1) to (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 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) to (7-4) with $n > 1$ in our heterogeneous-individual economy when political competition is present.

Proposition 1 immediately leads to

Corollary 1-T. *Given* $s_{ij}^m < (1/N)$ *, increased interregional tax competition (an increase in n) will "correct" the oversupply of public goods caused by intraregional political competition if* $n < n^*(s_{ij}^m)$.

By Lemma 3, we know that $ds_{ij}^P / ds_{ij}^m > 0$, that is, s_{ij}^P is a strictly increasing function of s_{ij}^m . Thus, (17) gives the following characterization for $n^*(s_{ij}^m)$.

Proposition 2-T. *Other things being equal (i.e., N and* $\tau_i \varepsilon_i$ *are given), the lower the* s_{ij}^m *, the higher will be the optimal tax competition* $n^*(s_{ij}^m)$.

The policy implication of Proposition 2-T is that the higher the income inequality in a region, the higher is 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.

4.3. Optimal intraregional political competition

Replacing n^* with an arbitrary *n*, there is an $s_{ij}^P = s_{ij}^{P*}$ that satisfies (17). From Lemmas 1-2, this s_{ij}^{P*} is selected by the decisive voter with $s_{ij}^m = s_{ij}^{m*}$ via intraregional political competition. Thus, Proposition 1-T can be put differently:

Proposition 1-P (Political competition). *Given $n > 1$ (interregional tax competition), there is an $s_{ij}^m = s_{ij}^{m*}(n)$ (the optimal intraregional political competition) under which public goods will be optimally supplied ($g_i = g^F$).*

Corollary 1-T can also be put differently:

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

Using (17), we obtain

$$Ns_{ij}^{P*} = 1 - (n-1)\tau_i \varepsilon_i \quad \forall \ i. \tag{18}$$

Because $ds_{ij}^P / ds_{ij}^m > 0$ from Lemma 3, we have the following characterization for $s_{ij}^{m*}(n)$.

Proposition 2-P. *Other things being equal (i.e., N and $\tau_i \varepsilon_i$ are given), the higher the n, the lower will be the optimal intraregional political competition $s_{ij}^{m*}(n)$.*

The policy implication of Proposition 2-P is that the higher the interregional tax competition facing a region, the higher is 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.

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. In contrast to Hoyt's (1991) finding that the extent to which public goods are undersupplied is monotonically increasing in the number of competing regions, we have shown that the relationship between the level of public good supply and the number of competing regions is non-monotonic 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 competitions together can result in the optimal provision of public goods. In this sense, considering either competition in isolation is indeed incomplete, if not misleading.

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. We obtain the standard result of political competition that the median voter is a decisive voter in selecting the policy-maker. We also obtain that the decisive voter will not select him- or herself as the policy-maker but will strategically delegate the policy-making to other individuals whose capital share is lower than that of the median voter.

Our model is admittedly highly stylized and abstracts from several possible directions of generalization, such as asymmetric country size, heterogeneous labor income, other taxes in addition to the capital income tax, incumbency effects, and the role of bureaucrats.

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.

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