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YARDSTICK COMPETITION AND TAX COMPETITION -INTERGOVERNMENTAL RELATIONS AND EFFICIENCY OF PUBLIC GOODS-

Abstract:

Several branches of the literature focus on the advantages of the provision of public goods by a local government. Tiebout (1956) indicated that “voting with feet” leads to the optimal provision of local public goods if residents can emigrate from one municipality to another to maximize utility. Due to the free mobility of residents, local governments exhibit an inter-related performance in a competitive environment and are disciplined to achieve efficient provision of public goods, although rather unrealistic conditions, including perfect information and “free mobility” of residents, are pre-requested.

The theory of local yardstick competition, in the principal–agent setting with asymmetric information, states that the comparison of the public service level and tax rates of a government with that of nearby localities can provide a useful instrument to assess a government’s performance. By comparing the performance of similar jurisdictions, voters can elect good politicians and send non-performers packing. Due to such a yardstick comparison of residents, local governors are disciplined to exert maximum efforts toward supplying public goods (Besley and Case 1996, Besley and Smart 2007), although they fail in the optimal provision of public goods (Nishigaki et al. 2015).

Furthermore, a political inter-relation among neighboring jurisdictions causes interdependence in policy decisions and mimicking of policy variables or tax rates in the yardstick competition. This interdependence of policy or tax rates caused by informational externality is frequently used as evidence of yardstick competition in empirical studies (Besley and Case 1996, Revelli 2006, Nishigaki et al. 2014).

Tax competition among local governments, on the other hand, addresses interaction due to inter-jurisdictional mobility of the tax base. By using a competitive two-region model, studies have indicated that an unfavorable externality of loss in the tax base causes strategic behavior in tax setting and an undersupply of public goods arises as a result of intergovernmental competition (Wildersin 1988, Brueckner and Saavedra 2001). These studies have also indicated that even competition among benevolent governments with full information leads to unfavorable results.

By introducing the production of private and public goods using the inter-regionally mobile factor of capital stock, this paper investigates tax competition in a yardstick competition model. The harmful effects of under-provision of public goods caused by tax competition and political competition are synthesized in the yardstick equilibrium. Furthermore, it is indicated that the externality caused by the loss in capital stock is internalized through the informational externality of the yardstick comparison.

Keywords:

Local Public Goods; Asymmetric Information; Intergovernmental Externality; Yardstick Competition; Tax Competition

JEL Classification: D72, H41, H71

1. Introduction[1]

Several branches of the literature focus on the advantages of public goods provision by a local government. Tiebout (1956) indicated that "voting with feet" leads to the optimal provision of local public goods if residents can emigrate from one municipality to another to maximize their utility. Owing to the free mobility of residents, local governments exhibit interrelated performance in a competitive environment and are disciplined to achieve an efficient provision of public goods, although under fairly unrealistic conditions, including perfect information and "free mobility" of residents.

In the principal–agent setting with asymmetric information, the theory of local yardstick competition states that the comparison of the public service level and tax rates of a government with that of nearby localities can provide a useful instrument to assess a government's performance. By comparing the performance of similar jurisdictions, voters can elect good politicians and send non-performers packing. Due to such a yardstick comparison of residents, local governors are disciplined to exert maximum efforts in supplying public goods (Besley and Case 1996, Besley and Smart 2007), although they fail in the optimal provision of public goods (Nishigaki et al. 2015).

Moreover, a political interrelationship among neighboring jurisdictions causes interdependence in policy decisions and the mimicking of policy variables or tax rates in the yardstick competition. This interdependence between policy and tax rates caused by informational externality is frequently used as evidence of yardstick competition in empirical studies (Besley and Case 1996, Revelli 2006, Nishigaki et al. 2014).

On the other hand, tax competition among local governments addresses the interaction caused by the inter-jurisdictional mobility of the tax base. By using a competitive two-region model, some studies indicated that an unfavorable externality of loss in the tax base causes strategic behavior in tax setting, and an undersupply of public goods arises because of intergovernmental competition (Wildasin 1988, Brueckner and Saavedra 2001). Additionally, these studies pointed out that even competition among benevolent governments with full information brings unfavorable results[2].

By introducing the production of private and public goods using the inter-regionally mobile factor of capital stock, this study investigates tax competition in a yardstick competition model. The effects of a capital tax increase and efficiency of public goods provision are investigated in a multiple jurisdiction and a symmetrical two-jurisdiction yardstick competition models. In addition to the usual consumptive public goods, this

[1] The authors are grateful to the financial support of the Institute for Social Science, Ryukoku University and the Grant-in-aid of Japan Society for Promotion of Science (C: No. 15K03527).
[2] For the survey of the literature, see Wilson and Wildasin (2004).

study also focuses on productive public services. According to the authors' knowledge, this is the first study that investigates the effects of a capital tax competition and the efficiency of public goods provision in a yardstick competition model.

The harmful effects of the under-provision of public goods caused by tax competition and political competition are synthesized in the yardstick equilibrium. Furthermore, it is shown that the externality caused by the loss in capital stock is internalized through the informational externality of the yardstick comparison. The main results we obtain are as follows. The yardstick competition in the small jurisdictions' model generates additional cost of financing public goods and increases the seriousness of the under-provision of public goods caused by tax competition. On the other hand, the Nash equilibrium in the two-jurisdiction model shows that a change in the neighboring jurisdictions' utility is reflected in the decisions of the governor through the yardstick evaluations of voters. Hence, the positive production effects of capital inflow in the neighboring jurisdiction may reflect in the provision of public goods.

The rest of the paper is organized as follows. Section 2 describes the model and investigates the efficiency of the provision of public goods brought about by tax competition in the yardstick equilibrium. Section 3 investigates the efficiency in the case of productive public services. Section 4 concludes the paper.

2. Yardstick competition, tax competition and the efficiency of public goods

2.1 The many jurisdictions model

Consider an economy composed of N identical jurisdictions. Each jurisdiction has identical immobile n households having the same amount of labor and supplying a fixed unit to production. The total capital stock ($\overline{K}$) in the economy is fixed, and each resident holds the same amount of capital, which is perfectly mobile across jurisdictions; all capitals earn the same net return (ρ). Additionally, we assume that each jurisdiction has an identical production technology.

Output is produced in each jurisdiction by perfectly competitive firms having a twice differential, constant returns to scale production function.

$$F(K_i), \quad F_K > 0, F_{KK} < 0, \tag{1}$$

where K_i is the capital stock in a representative jurisdiction i ($NK_i = \overline{K}$) and the fixed input argument of the labor is suppressed for simplicity. Additionally, the firms maximize their profit.

Owing to the assumptions on capital mobility and the small jurisdiction, the elasticity of capital supply to each jurisdiction is infinite at the net capital return, ρ. In addition, a unit tax on the capital employed in jurisdiction i is levied by the local government. The profit maximization of the firms gives the following arbitrage condition for capital:

$$\rho + \tau_i = F_K(K_i). \tag{2}$$

From Equation (2), the demand function for capital is indicated as follows:

$$K_i = K(\rho + \tau_i). \tag{3}$$

By differentiating Equation (3), a change in the capital stock expected by the local jurisdiction is indicated as follows:

$$\phi_i = -dK_i / d\tau_i = -1 / F_{KK}^i > 0. \tag{4}$$

Equation (4) means that the demand for capital is decreased by the increase of the capital tax.

Households in each jurisdiction derive utility from the consumption of private goods x_i and the public goods g_i[3]. The residents' utility is also affected by unobserved locality-specific shocks ε_i. Thus, the residents' utility is represented as follows:

$$U_i = u(x_i, g_i) + \varepsilon_i, \tag{5}$$

where we assume that the utility function u satisfies the usual property of quasi-concavity, and ε_i is the noise, which is independently picked up from a continuous density function $h(\varepsilon)$ with zero mean. It is assumed that $h(\varepsilon)$ has an identical distribution among jurisdictions.

Equation (5) implies that utility is affected not only by the consumption of private and public goods, but also by locality-specific shocks ε_i. Here, random noise ε_i is

[3] We ignore the spillover effects for simplicity.

considered as a distinctive natural or economic environment.

Based on these assumptions, we assume the following asymmetric information structure: the values of g_i chosen by the local government are not directly observable by the residents and remain the private information of the government. The residents' utility, while observable by both the residents and local government, is not verifiable. This assumption means that the local government does not have full information about their residents' true public goods preference. Furthermore, the residents are not fully aware of the actual level of the local public goods provided by their local government; thus, they cannot determine the exact effort of their agent.

Since the residents supply the same amount of labor, we normalize the unit of labor input to be equal to 1. Each resident owns an equal share of the national capital stock, which is not necessarily employed in the jurisdiction of residence. Additionally, there is no other source of income.

Suppose that local governments levy a head tax T on the residents, a unit tax on the capital stock, and use these tax revenues to provide public goods. Further, the residents spend all their remaining income on private goods. Therefore, the budget constraint of the residents is indicated by the following equation:

$$nx_i = [F(K_i) - (\rho + \tau_i)K_i] + \rho(\overline{K}/N) - nT. \tag{6}$$

The first term on the right hand side of Equation (6) indicates total wage, while the second and third terms represent the total capital income accrued in the jurisdiction, and head tax on the residents, respectively.

The local government in jurisdiction i supplies local public goods g_i, which benefit only the residents of region i[4]. Since g_i is subject to the capital and head taxes, the local government's budget constraint is indicated as follows:

$$g_i = \tau_i K_i + nT. \tag{7}$$

[4] The marginal rate of transformation between private and local public goods in this model is $dx_i/dg_i = 1$. Therefore, the social optimal welfare for maximizing residents' utility is $n_i\,(u_g^i/u_x^i) = 1$.

The local governor's utility associated with the provision of public goods g_i is indicated by $v(g_i)$, which we assume is strictly decreasing and convex in g_i: $v'(g_i) < 0$, and $v''(g_i) < 0$. The logic behind this assumption is as follows. Since the local public goods supplied by the government are not directly observable by the residents, the higher values of g_i may be costly for the government because it involves "effort" to execute, but may not be directly reflected in their political reputation. In this simple model, we can directly interpret the public goods g_i as the level of effort undertaken by the government.

Residents are assumed to vote for their incumbent governor if their total utility is larger than the average of the neighboring locality (u_0). A local governor obtains a fixed rent R when he/she gets re-elected. Therefore, the local governor's expected utility maximization problem is formulated as follows:

$$\max \quad E[v(g_i) + R] = v(g_i) + R \cdot pr(u(x_i, g_i) + \varepsilon_i \geq u_0),$$

$$s.t. \quad \text{(6), (7)}$$

where $pr(\cdot)$ is the probability that the governor will be re-elected. Owing to the assumptions concerning the information structure, unlike the residents, local government i knows $v(g_i)$ and R. Residents in region i only observe private goods (x_i, g_i) and the utility level of U_i.

The first-order conditions for the maximization problem are as follows:

$$\frac{\partial E[v(g_i) + R]}{\partial \tau_i} = v'(g_i)\frac{dg_i}{d\tau_i} + R\left(u_x^i \frac{\partial x_i}{\partial \tau_i} + u_g^i \frac{\partial g_i}{\partial \tau_i}\right) f\big(u(x_i, g_i) - u_0\big) = 0, \tag{9}$$

By differentiating the budget constraints of the residents (6) and local governments (7), we get following equations:

$$dx_i / d\tau_i = -K_i / n, \tag{10}$$

$$dg_i / d\tau_i = \tau_i \, dK_i / d\tau_i + K_i. \tag{11}$$

Appling these equations to the first-order condition (9) yields the following:

$$v'(g_i)K_i(1-\frac{\tau_i\phi_i}{K_i})+RK_i\left(-u_x^i\frac{K_i}{n}+u_g^i(1-\frac{\tau_i\phi_i}{K_i})\right)f\left(u(x_i,g_i)-u_0\right)=0. \tag{12}$$

Rearranging Equation (12) and omitting the suffix[5], we get clearer expressions of the first-order condition as follows:

$$n\frac{u_g}{u_x}=\frac{1}{1-\tau\phi/K}-v'(g)\frac{n}{R\cdot f(\cdots)\cdot u_x}. \tag{13}$$

The left hand side of the equation indicates the marginal rate of substitution (MRS), and the right hand side indicates the marginal rate of transformation (MRTS) between public and private goods. The first term on the right hand side of (13) coincides with the MRTS adjusted by the loss of the tax base caused by the tax competition shown in Zodrow and Mieszkowski (1984)[6]. Since the capital outflow effect caused by the capital taxation ($\tau\phi/K$) is positive, this term is larger than one implying that the capital taxation raises the cost of financing public goods leading to their under-provision[7].

On the other hand, the second term in the right hand side of (13), indicates the yardstick competition effect as shown in Nishigaki, Higashi, and Nishimoto (2015). Since the sign of this term is negative, that is, $v'(g)<0$, yardstick competition also leads to the under-provision of public goods because there is asymmetric information between the local governor and residents[8].

Combining these considerations, yardstick competition in the small jurisdictions' model causes the additional cost of financing public goods and increases the seriousness of the under-provision of public goods caused by tax competition. However, in the Nash equilibrium of yardstick competition, a change in the neighboring jurisdictions' utility may affect the decisions of the governor through yardstick evaluations of voters. Thus, the positive production effects of capital inflow in the neighboring jurisdiction may reflect in the provision of public goods. In order to investigate this favorable interdependence, we will construct a two-jurisdiction model of yardstick competition, and study the property of the Nash equilibrium in the next subsection.

[5] By the assumption of the symmetrical jurisdictions, the equilibrium of this model is symmetric.

[6] Their first-order condition is indicated as $nu_g/u_c=1/(1-\tau\phi/K)$.

[7] Zodrow and Mieszkowski (1984).

[8] Since there is a random noise ε_i, the local governor's effort to supply public goods is not necessarily reflected in an increase of their re-election possibility, which increases the cost of providing public goods ($v'(g)<0$). Nishigaki, Higashi, and Nishimoto (2015).

2.2 Nash equilibrium in a symmetrical two-jurisdiction model

Consider an economy consisting of two symmetrical jurisdictions. As in the last section, it is assumed that the capital market is competitive and capital stock is freely mobile between jurisdictions. The market equilibrium of capital is indicated as: $\overline{K} = K_1 + K_2$. Each jurisdiction has the same number of identical residents where the population is assumed to be n. In addition, each jurisdiction's labor supply is normalized to 1.

Residents in each jurisdiction have the same amounts of capital stock, which is not necessarily employed in the jurisdiction of residence. The total capital stock ($\overline{K}$) is fixed, which is perfectly mobile across jurisdictions so that all capitals earn the same after tax return. As in the last section, the governor in each jurisdiction levies head and capital taxes in order to finance public goods.

We assume an identical production technology, perfectly competition firms, and a twice differentiable, constant returns to scale production function,

$$F(K_i), \quad F_K^i > 0, F_{KK}^i < 0. \tag{14}$$

Due to the assumptions on capital mobility, the after tax capital return in each jurisdiction is the same. Therefore, profit maximization of the firms gives the arbitrage condition between two jurisdictions as follows:

$$F_K^i(K_i) - \tau_i = F_K^j(K_j) - \tau_j. \tag{15}$$

By differentiating Equation (15) with capital tax in the jurisdiction i, a change in the capital stock expected by the local jurisdiction is indicated as follows:

$$\varphi_i = -dK_i/d\tau_i = -1/(F_{KK}^i + F_{KK}^j) > 0. \tag{16}$$

Equation (16) means that the demand for capital is decreased by the increase of the capital tax.

The utility function of the residents is also represented here as follows:

$$U_i = u(x_i, g_i) + \varepsilon_i,\ i = 1,2, \tag{17}$$

where we assume a quasi-concavity utility function and that the continuous density function $h(\varepsilon)$ has an identical distribution between the two jurisdictions.

The residents' budget constraint is indicated as the following:

$$nx_i = [F(K_i) - (F_K^i)K_i] + (F_K^i - \tau_i)(\overline{K}/2) - nT. \tag{18}$$

The residents vote for their incumbent governor if their utility is higher than that of the residents in the neighbor jurisdiction. Hence, the condition of yardstick voting is indicated in this section as follows:

$$u(x_i, g_i) + \varepsilon_i \geq u(x_j, g_j) + \varepsilon_j. \tag{19}$$

The local government in jurisdiction i supplies local public goods g_i subject to the capital and head taxes, and thus, its budget constraint is indicated as follows:

$$g_i = \tau_i K_i + nT. \tag{20}$$

The local governments set the capital tax (and hence the provision of public goods) in order to maximize their expected utility subject to the income constraint of the residents and their own budget constraints. Therefore, a local governor's expected utility maximization problem is formulated as follows:

$$\max \quad E[v(g_i) + R] = v(g_i) + R \cdot pr(u(x_i, g_i) + \varepsilon_i \geq u(x_j, g_j) + \varepsilon_j), \tag{21}$$

$s.t.$ (18), (20)

Re-arranging the $pr(\cdot)$ function, we obtain the following:

$$pr(u(x_i(g_i), g_i) + \varepsilon_i \geq u(x_j(g_j), g_j) + \varepsilon_j) = pr(u(x_i(g_i), g_i) - u(x_j(g_j), g_j) \geq \varepsilon_j - \varepsilon_i)$$

$$= \int_{-\infty}^{u(x_i(g_i), g_i) - u(x_j(g_j), g_j)} f(\xi) d\xi, \tag{22}$$

where $\xi \equiv \varepsilon_j - \varepsilon_i$, and $f(\cdot)$ is a probability density function.

The first-order conditions for the maximization problem are indicated as follows:

$$\frac{\partial E[v(g_i) + R]}{\partial \tau_i} = v'(g_i) + R\left((u_x^i \frac{\partial x_i}{\partial \tau_i} + u_g^i \frac{\partial g_i}{\partial \tau_i}) - (u_x^j \frac{\partial x_j}{\partial \tau_i} + u_g^j \frac{\partial g_j}{\partial \tau_i}) \right) f\left(u(x_i(g_i), g_i) - u(x_j(g_j), g_j)\right) = 0, \quad i = 1,2,$$
$$i \neq j. \tag{23}$$

From the budget constraint of the residents and government,

$$\frac{dg_i}{d\tau_i} = K_i + \tau_i \frac{dK_i}{d\tau_i}, \tag{24}$$

$$\frac{dg_j}{d\tau_i} = \tau_j \frac{dK_j}{d\tau_i} = -\tau_j \frac{dK_i}{d\tau_i}, \tag{25}$$

$$n\frac{dx_i}{d\tau_i} = -(K_i - \frac{\overline{K}}{2})F_{KK}^i \frac{dK_i}{d\tau_i} - \frac{\overline{K}}{2}, \tag{26}$$

$$n\frac{dx_j}{d\tau_i} = -(K_j - \frac{\overline{K}}{2})F_{KK}^i \frac{dK_i}{d\tau_i}. \tag{27}$$

After applying Equation (24-27) to (23), and rearranging, in the symmetrical Nash equilibrium ($x_i = x_j = x$, $g_i = g_j = g$, $K_i = K_j = \overline{K}/2$), the first-order condition is indicated as follows:

$$(n\frac{u_g^i}{u_x^i} - 1) = \frac{\tau_i\varphi_i/K_i}{1-\tau_i\varphi_i/K_i}(n\frac{u_g^j}{u_x^j} - 1) - \frac{v'(g_i)n}{Ru_x^i f(0)} > 0. \tag{29}$$

In general, since the right hand side of Equation (29) is positive in the symmetrical equilibrium, it appears that the public goods are under-provided again in the two-region model ($MRS_{xg} > MRT_{xg}(=1)$). In right hand side of the equation, the second term is related to yardstick competition. On the other hand, the denominator of the first term is captures tax competition. Additionally, the neighbor jurisdiction's first-order condition is in the numerator (that is, the MRS and MRTS between public and private goods). Therefore, the first term is reflects the change of a policy decision associated with the tax increase brought about by yardstick competition.

Since the terms in the bracket on the both sides of Equation (29) coincides each other in the symmetrical equilibrium, rearranging the equation yields a clearer expression of the results.

$$n\frac{u_g}{u_x} = 1 - \frac{1}{1-\alpha}\frac{v'(g)n}{Ru_x f(0)} > 0, \tag{30}$$

where, α is indicated as

$$\alpha = \frac{\tau\varphi/K}{1-\tau\varphi/K} > 0. \tag{31}$$

By comparing (31) to (13) in the last subsection, it is appeared that a part of the fiscal externality caused by the tax base loss is internalized through the yardstick evaluation of the voters. Furthermore, since α is smaller and larger than one, the second term on the right hand side of (31) may change its sign from positive to negative. Therefore, it suggests that public goods may be oversupplied when α is sufficiently large.

3. The productive public services model

In the previous section, this study considers the case where the government's expenditure enhances utility and not productivity. In this case, the production function in each region is given by

$$F(K,g), \quad F_K > 0, F_g > 0, F_{Kg} = F_{gK} > 0, F_{gg} < 0, \tag{32}$$

where g is the level of public input. The assumption that all inputs are complements ($F_{Kg} = F_{gK} > 0$) is reasonable given the aggregation of production in the model. Public input provision is financed with the revenue raised by head and capital taxes; hence, there is no user fee. Therefore, the government's budget constraint is

$$\tau K + T = g, \tag{33}$$

and the first-order condition for firm optimization is

$$\rho + \tau = F_K(K,g). \tag{34}$$

For the assumption of small jurisdictions, the net return to capital is given.

To examine how the change in the capital stock varies with a change in the capital tax perceived by each jurisdiction, substituting (33) into (34), and then totally differentiating the equation, obtains the following result:

$$\frac{dK}{d\tau} = \frac{1 - KF_{KG}}{F_{KK} - \tau F_{KG}} \equiv -\phi. \tag{35}$$

Following Zodrow and Mieszkowski (1989), we assume $1 - KF_{KG} > 0$ and $F_{KK} - \tau F_{KG} < 0.$ Therefore, an increase in the capital tax rate drives out the capital.

The utility of a representative resident is composed only of the private goods, that is, $u(x)$, which is a strictly quasi-concave and twice differentiable function with respect to the private goods. The budget constraint of representative resident is given by $x = F(K, \tau K + T) - (\rho + \tau)K - \rho \overline{K} / N - T.$

3.1 The competitive multiple jurisdiction model

The local government in the jurisdiction sets τ to maximize the indirect utility of their residents subject to the its budget constraint (16); thus, the state governments' maximizing problem is

$$\begin{aligned} &\max u(x), \\ &s.t. \; x = F(K, \tau K + T) - (\rho + \tau)K - \rho \overline{K} / N - T, \qquad g = \tau K + T. \end{aligned} \tag{36}$$

The first-order condition for the maximizing problem (36) is given by

$$F_g = \frac{1}{1 - \tau\phi / K} > 1. \tag{37}$$

This condition is the second best rule for public input provision. The equilibrium values of K, g, and τ are determined by (33), (34), and (37). Owing to the head tax, in the best case scenario, the public input would be provided such that the marginal product of the public input is equal to its marginal cost ($F_g = 1$). As is well known, distortional capital tax causes the under-provision of public good at the margin.

3.2 Yardstick competition in a small jurisdiction model

In this subsection, we consider a tax model with yardstick competition. First, we assume that each jurisdiction is small relative to the national economy. Thus, the local government in each jurisdiction acts, recognizing that all other jurisdictions do not respond to changes in its capital tax rate, and that its actions cannot affect the national net return to capital, ρ. In addition, the local government recognizes that its action does not affect utility levels in other jurisdiction. Therefore, the incumbent in jurisdiction i is re-elected if $u(x_i)+\varepsilon_i > u_0$, where u_0, a constant denotes the average value of utility levels in other jurisdiction. The local government's maximization problem is given by

$$\max_{\tau_i, H, g_i} E[v(g_i)+R] = v(g_i) + R \int_{-\infty}^{u_i(x_i)+\varepsilon-u_0} f(\varepsilon_i) d\varepsilon_i,$$

$$s.t.\ x_i = F(K_i, g_i) - (\rho_i + \tau_i)K_i - \rho_i \overline{K}/N - T,. \quad g_i = \tau_i K_i + T.$$

From the first-order conditions for this maximization problem, we obtain the following condition:

$$F_g = \frac{1}{1-\tau\phi/K} - \frac{v'(g)}{Ru'(x)f(\varepsilon)}. \tag{38}$$

The first term on the right-hand side in (38) corresponds to the standard condition (37) derived in Zodrow and Mieszkowski (1989). This term represents the tax competition effect. In contrast, the second term appears under the yardstick competition with a positive sign. This effect is the marginal disutility (cost) of raising the capital tax, which is perceived by the local government (politician). In the presence of yardstick competition, the local government increase its under-provision of the public goods because F_g is always larger than $1/[1-\tau\phi/K] > 1$.

3.3 The two-jurisdiction model

In this subsection, we consider a national economy consisting of two jurisdictions. In this situation, the local government in each jurisdiction recognizes that the other jurisdiction responds to changes in its capital tax rate, and that its action affects the national net return to capital and the utility level in the other jurisdiction. Under two jurisdictions, the incumbent in jurisdiction i is re-elected if $u_i + \varepsilon_i \geq u_j + \varepsilon_j$.

The local government's maximization problem is given by

$$\max_{\tau_i, H_i, g_i} E[v(g_i) + R] = v(g_i) + R \int_{-\infty}^{u_i(x_i) - u_j(x_j)} f(\xi) d\xi,$$
$$s.t.\ \ x_i = F(K_i, g_i) - (\rho_i + \tau_i) K_i - \rho \overline{K} / N - T_i,. \qquad g_i = \tau_i K_i + T.$$

Solving this problem and using the conditions of the symmetric equilibrium, with some manipulation, we obtain the following necessary conditions:

$$F_{g_i} = 1 - \frac{v_i'(g_i)}{Ru_i(x_i) f(0)} \left(1 - \frac{\tau \phi}{K_i} \right) \tag{39}$$

Comparing (38) to (39), it appears that the RHS of (39) is identical to result of multiplying the RHS of (38) by $0 < 1 - \tau\phi / K_i < 1$. Therefore, if each jurisdiction is large relative to the national economy, the local government in a yardstick competition alleviates the under-provision of the local public goods. As long as the incumbent obtains disutility from the local public goods provision, the first-best optimum cannot be attained.

4. Conclusion

This study investigated tax in a yardstick competition model by introducing the production of private and public goods using the inter-regionally mobile factor of capital stock. The effects of a capital tax increase and efficiency of public goods provision were investigated in a multiple jurisdiction and symmetrical two-jurisdiction yardstick competition models. In addition to the usual consumptive public goods, this study focused on productive public services.

The harmful effects of the under-provision of public goods caused by tax and political competition were synthesized in the yardstick equilibrium. Furthermore, it was shown that the externality caused by the loss in capital stock is internalized through the informational externality of the yardstick comparison.

The main results we obtain are as follows. The yardstick competition in the small jurisdictions' model generates additional cost of financing public goods and increases the seriousness of the under-provision of public goods caused by the tax competition. On the other hand, the Nash equilibrium in the two-jurisdiction model shows that a change in the neighboring jurisdictions' utility is reflected in the decisions of the governor through the yardstick evaluations of voters. Hence, the positive production effects of capital inflow in the neighboring jurisdiction may reflect in the provision of public goods.

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