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Relation	

The Private Capital Tax Rates for Large Heterogeneous Jurisdictions in a Two-Period Economy with Spillover Effects [1]

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Abstract

This study introduces the spillover effect of public goods and the heterogeneity of jurisdictions to the capital tax competition literature using a two-period economy. A clear result is that the private capital tax rate used by the hyperopic jurisdictional government in the first period significantly depends on the relative size of the income and spill-in effects in the second period. The relative size of the two effects, which work in opposite directions, is determined by the tastes and endowments of the jurisdictions, the form of their production functions and the degree of spillovers, among other factors. This research verifies that the jurisdiction with the less efficient production technology may choose to tax private capital in the first period, assuming that a lump-sum tax is available to it, and receive substantial spillover benefits from the other jurisdiction with more efficient production technology in the second period when the jurisdiction is hyperopic and benevolent, which is quite different from the literature.

Keywords: Tax competition; Benefit spillovers; Heterogeneous Jurisdictions
JEL classification: H2, H4, J6

1. Introduction

This study reconsiders the capital tax rate used by a jurisdictional government in a two-period economy with spillover effects when the jurisdictional government is assumed to be hyperopic or farsighted. In the literature, Ogawa (2000) confirms that the jurisdictional government may subsidise private capital in the first period to increase capital stock in the second period when a lump-sum tax is available to a hyperopic jurisdictional government. However, the spillover effects and the heterogeneity of jurisdictions are ignored in the analysis. Therefore, this study introduces the spillover effect of public goods and the heterogeneity of jurisdictions to the capital tax competition literature using a two-period economy.

The literature analysing capital tax competition is relevant to this study (see, for example, Zodrow and Mieszkowski 1986; DePater and Myers 1994). The basic idea of Zodrow and Mieszkowski (1986) is that perfect mobility of private capital among small homogeneous jurisdictions results in under-provision of a local public good, which is financed by a distortionary property tax because a lump-sum tax is unavailable. However, DePater and Myers (1994) demonstrate that the pecuniary externality among large heterogeneous jurisdictions derived from a change in the capital price, which is affected by distortionary

[1] I would like to thank professor Hikaru Ogawa at Japan Institute of Public Finance 2020 at Tohoku University, where this paper was presented under the title “A Corrective Device for Large Heterogeneous Jurisdictions in a Two-Period Economy with Spillover Effects”.

capital taxes, should be moderately internalised by a corrective device. In the traditional small-jurisdiction tax competition model, the after-tax return to capital is a parameter for each jurisdiction. In this paper, there are only two jurisdictions, so the after-tax return to capital is endogenous, which, unsurprisingly, leads to tax exporting. There are large-jurisdiction models in the literature, including Hauer and Wooton (1999), Kanbur and Keen (1993) and many others. This study is based on a large-jurisdiction model that is similar to those in the literature above.

On the other hand, the costs of moving faced by private capital, which are also referred to as transaction costs (see, for example, Lee 1997), should not be ignored in a tax competition model. When the private capital investor has decided to locate in one jurisdiction and invest in some projects, these projects will usually last for a long period of time. Once the private capital is invested, it is usually quite difficult to abandon the projects and leave the jurisdiction because of the large moving costs. Even if the private capital can move freely among the jurisdictions in the initial stage, imperfect mobility is inevitable in the later stages. Therefore, we must consider both transaction costs and inter-temporal effects in a tax competition model. There are several relevant studies that consider such issues. For example, Lee (1997) considers the imperfect mobility of private capital arising from transaction costs in a two-period tax competition model. He shows that a jurisdictional government will over-provide local public goods in the second period because of transaction costs and that the jurisdictions may choose a lower capital tax rate than that chosen in a one-period tax competition model to increase capital stock in the first period. Furthermore, by introducing a head tax into the model, Ogawa (2000) confirms that the jurisdictional government may subsidise private capital in the first period to increase capital stock in the second period when the private capital cannot mobile in the second period. This result is compatible with that of the repeated game explained by Coates (1993). There are also some two-period-model constructions that are relevant to our study (for example, King, McAfee and Welling 1993). However, most of the relevant literature analysing the transaction costs and dynamic effects does not clarify the important roles played by the spillover effects of public goods and the heterogeneity of jurisdictions in a repeated-game model. Hence, the focus of this study is to examine these roles.

In the discussion on the spillover effects of local public goods among different jurisdictions, the prevailing view is that such spillover effects will aggravate the under-provision of local public goods (see, for example, Boadway, Pestieau and Wildasin 1989). However, another quite different view is that the spillover effects of local public goods may alleviate the under-provision of local public goods in some situations. In a repeated-game model with large homogeneous jurisdictions, Kawachi and Ogawa (2006) find that the jurisdictional governments are more inclined to provide an efficient level of local public goods when the degree of the spillover effects is sufficient. Furthermore, Ogawa (2007) confirms that, in a tax competition model with large heterogeneous jurisdictions, the jurisdiction with less efficient production technology is likely to increase its capital tax rate to drive out private capital and obtain substantial spill-in effects from the other jurisdiction with more efficient production technology. This means that a distortional capital tax may lead to a more efficient level of local public goods funding. This finding is a key motivation and implication for the current study. Recognizing these effects and the heterogeneity of jurisdictions, Yang (2020) noted that "the revision of a corrective device used by the central government in the first period to ensure an optimal level of a local public good which is provided by a hyperopic jurisdictional government, significantly depends on the relative size of the income and spill-in effects in the second period" . However, the jurisdictional governments consider the corrective device only in the first period when making the capital tax rate decision because they do not believe in the central government's commitment to the corrective device in the second period. In addition, it is also difficult to know how to determine the corrective device according to the discount factor and whether the local public goods are over-provided or under-provided. Therefore, it is not realistic to analyse the corrective device based on a simple two-period economy. Instead, the capital tax rate may be suitable to be analysed as a baseline in the literature.

By introducing spillover effects into our analysis, this study verify that the jurisdiction with the less efficient production technology may choose to tax private capital in the first period, assuming that a lump-sum tax is available to it, and receive substantial spillover benefits from the other jurisdiction with more efficient production technology in the second period when the jurisdiction is hyperopic and benevolent, which is quite different from Ogawa (2000). In other words, these constructions are put together to model an interesting phenomenon and not simply to arrive at predetermined results.

The remainder of the paper is organised as follows. The basic model is set out in section 2, in which we introduce the spillover effects of public goods and the heterogeneity of jurisdictions into a two-period economy. In section 3, we show the Nash equilibria by employing backward induction to obtain the capital tax rate used by the jurisdictional government in the two periods. In section 4, we discuss our findings based on the derived capital tax rate. Section 5 draws conclusions.

2. The Model

The model that we use is similar to that used in Ogawa (2000). There are two heterogeneous jurisdictions in a two-period game[2] and, in each jurisdiction i ($i=1, 2$)[3] , the immobile resident is normalised to unity, with preferences defined by a strictly quasi-concave utility function[4] U_p^i (x_p^i, G_p^i), where x_p^i is the consumption of a private numeraire good in period p ($p=1, 2$) and G_p^i is the consumption of a local public good in period p. The local public good G_p^i is defined by:

$$G_p^i = g_p^i + \beta_{ji} g_p^j, \tag{1}$$

where g_p^i is the provision of the local public good by jurisdictional government i and β_{ji} ($0 \leqq \beta_{ji} \leqq 1$) is a parameter indicating the degree of spillover benefits from jurisdiction j to jurisdiction i.

We assume that the well-behaved aggregate production function in jurisdiction i is f_i (k_p^i), and that $\frac{df_i(k_p^i)}{dk_p^i}$ and $\frac{d^2 f_i(k_p^i)}{d(k_p^i)^2}$ can be rewritten as f_{kp}^i (k_p^i) and f_{kkp}^i (k_p^i), respectively, where k_p^i is the private capital

2 The model can be written in a simpler way using only one period (see, for example, Ogawa 2007). However, as this paper focuses on how the degree of governmental hyperopia and asymmetry in capital ownership affect the optimal redistribution mechanism, the dynamic effects must be considered.

3 For simplicity, we assume that there are only two jurisdictions in the model. It can be confirmed that most of the results in this paper will not change qualitatively even if there are more than two jurisdictions.

4 The properties of the utility functions are similar to those in the extant literature (for example, Ogawa 2000).

employed by jurisdiction i in period p. The production function can be assumed to take the quadratic form, for example, $f^i(k_p^i) = a_i k_i - 0.5 b_i k_i^2$, which is also used by Wildasin (1991) and Ogawa (2007) in their numerical analyses, because the marginal productivity of private capital can take a linear and concise form, that is, $f_{kp}^i(k_p^i) = a_i - b_i k_i$. The production technology in the jurisdiction depends on the parameters a_i and b_i. The private capital is perfectly mobile in the first period and perfectly immobile in the second period. We assume that the private capital is myopic, following Ogawa (2000). The reason behind this is that the jurisdictional governments cannot commit to second-period taxes given the immobility of private capital in the second period. Even if the private tax rate was 100% in the second period, the private capital could not move to another jurisdiction. Thus, the private capital providers consider the tax rate only in the first period when making the location decision because they do not believe in the jurisdictional government's commitment to the tax rate in the second period. In other words, the capital owners do not take into account second-period taxation in their location decision.

The total supply of private capital in the country is fixed at $\bar{k}$ such that:

$$\bar{k} = k_p^i + k_p^j. \tag{2}$$

In equilibrium, therefore, the after-tax return to capital in the first period is equalised across jurisdictions as follows:

$$f_{k1}^i(k_1^i) - t_1^i = f_{k1}^j(k_1^j) - t_1^j = r_1, \qquad (j \neq i) \tag{3}$$

where t_1^i is the tax rate per unit of capital employed by jurisdiction i and r is the after-tax return to private capital in the country in the first period. Based on the established conventions, for example, see Bucovetsky (1991) and Ogawa (2007), we obtain the effect of changes in the first-period tax rate on the after-tax return to private capital and the location of private capital by taking total derivatives of (2) and (3), as follows:

$$\frac{\partial k_1^i}{\partial t_1^i} = \frac{1}{f_{kk1}^i + f_{kk1}^j} < 0 \tag{4}$$

$$\frac{\partial k_1^j}{\partial t_1^i} = -\frac{1}{f_{kk1}^i + f_{kk1}^j} > 0 \tag{5}$$

$$\frac{\partial r_1}{\partial t_1^i} = -\frac{f_{kk1}^j}{f_{kk1}^i + f_{kk1}^j} < 0 \tag{6}$$

The budget constraint of the resident in the first period requires that:

$$x_1^i = f_i(k_1^i) - f_{k1}^i(k_1^i) k_1^i + r_1 \overline{k_1^i}. \tag{7}$$

where $\overline{k_1^i}$ is the initial endowment of private capital in jurisdiction i with $\overline{k_1^i} = \alpha^i \bar{k}$. Following Ogawa (2000), we postulate that α^i is a fraction of the capital stock owned by the resident in jurisdiction i and that it does not change with time, where $\alpha^i + \alpha^j = 1$.

Substituting (3) into (7), (7) can be rewritten as:

$$x_1^i = f_i(k_1^i) - t_1^i k_1^i + r_1(\overline{k_1^i} - k_1^i). \tag{7'}$$

During the second period, the after-tax return to capital may differ between the two jurisdictions because of the immobility of private capital. Therefore, the budget constraint of the resident in the second period requires that:

$$x_2^i = f_i(k_2^i) - f_{k2}^i(k_2^i)k_2^i + \alpha^i\{[f_{k2}^i(k_2^i) - t_2^i]k_2^i + [f_{k2}^j(k_2^j) - t_2^j]k_2^j\}. \tag{8}$$

Owing to the immobility of private capital in the second period, the amount of private capital located in jurisdiction i in the second period is equal to the amount in the first period, that is, $k_1^i = k_2^i$. The jurisdictional government budget constraint is given by:

$$g_p^i = t_p^i k_p^i. \tag{9}$$

3. The Nash Equilibria

As this two-period game is a subgame perfect equilibrium, we employ backward induction to solve the problem for each jurisdictional government.

3.1 The second period

In the second period, the jurisdictional government i maximises the utility of the residents by choosing t_2^i and g_2^i, given t_2^j and g_2^j. Although the jurisdictional governments cannot commit to second-period taxes, some facts (for example, the laws and policies in the jurisdictions) stop the capital-importing country from taxing away all capital and redistributing it to its citizens. Therefore, the capital owners would foresee this in their location decision. Following Ogawa (2000), the optimisation problem for jurisdictional government i can be written as:

$$\max_{t_2^i, g_2^i} \quad U_i(x_2^i, G_2^i)$$
$$\text{s.t.} \quad x_2^i = f_i(k_2^i) - f_{k2}^i(k_2^i)k_2^i + \alpha^i\{[f_{k2}^i(k_2^i) - t_2^i]k_2^i + [f_{k2}^j(k_2^j) - t_2^j]k_2^j\}$$
$$G_2^i = g_2^i + \beta_{ji} g_2^j$$
$$g_2^i = t_2^i k_2^i$$

The first-order condition for jurisdictional government i is given by:

$$\frac{\partial u_2^i}{\partial t_2^i} = U_{G2}^i(k_2^i) + U_{x2}^i(-\alpha^i k_2^i) = 0, \tag{10}$$

where the jurisdictional government i takes k_2^i as k_1^i in the first period. It can be derived that the second-order condition is satisfied under some realistic functional assumptions and the properties of the equilibria are fully determined (see Ogawa 2007). Rearranging (10), we have:

$$\frac{U_{G2}^{i}}{U_{x2}^{i}} = \alpha^{i}. \quad (11)$$

The Pareto-optimal condition is derived by[5]:

$$\max_{x_2^i, g_2^i} U_2^i\left(x_2^i, G_2^i\right) + U_2^j\left(x_2^j, G_2^j\right)$$

$$\text{s.t. } x_2^i + x_2^j + g_2^i + g_2^j = f_i\left(k_2^i\right) + f_j\left(k_2^j\right).$$

Let λ denotes the Lagrange multiplier of the constraint above. Then, the Lagrange function is given by:

$$L\left(x_2^i, g_2^i\right) = U_2^i + U_2^j + \lambda\left[x_2^i + x_2^j + g_2^i + g_2^j - f_i\left(k_2^i\right) - f_j\left(k_2^j\right)\right].$$

Differentiating $L(x_2^i, g_2^i)$ with respect to x_2^i, g_2^i ,and λ, yields:

$$\frac{\partial L}{\partial g_2^i} = U_{G2}^i + \beta_{ij} U_{G2}^j + \lambda = 0,$$

$$\frac{\partial L}{\partial x_2^i} = U_{x2}^i + \lambda = 0,$$

$$\frac{\partial L}{\partial \lambda} = x_2^i + x_2^j + g_2^i + g_2^j - f_i\left(k_2^i\right) - f_j\left(k_2^j\right) = 0,$$

which can be rewritten as:

$$U_{G2}^i + \beta_{ij} U_{G2}^j = U_{x2}^i. \quad (12)$$

Rearranging (12), we have:

$$\frac{U_{G2}^i}{U_{x2}^i} = 1 - \beta_{ij} \frac{U_{G2}^j}{U_{x2}^i}. \quad (13)$$

This finding corresponds with the conclusions from the existing literature (for example, see Bjorvatn and Schjelderup 2002). Notably, this result is an extension of Ogawa (2000) with reference to a particular case.

Considering (13), the inefficiency here arises first from the under-provision of local public goods resulting from the spillover effects. This is determined by the degree of spillovers. The larger are the degree of spillovers, the larger is the positive externality. In addition, considering (11), inefficiency arises from the over-provision of local public goods resulting from tax exporting[6]. This effect is determined by

[5] For the sake of simplicity, the central government is not introduced into the model, which is different from Yang (2020). Of course, the inefficiency on local provision of public goods is inevitable from the viewpoint of central government.

the proportion of the capital stock owned by the jurisdiction's residents. The larger this proportion is, the larger is the negative fiscal externality ignored by the jurisdictional government. If the former positive externality is larger than the latter negative fiscal externality, the net effect is that local public goods are under-provided by the jurisdictional government in the second period. Conversely, if the former positive externality is smaller than the latter negative fiscal externality, the net effect is that local public goods are over-provided by the jurisdictional government in the second period. This finding may be summarised in the following proposition.

Proposition 1: If the spillover effect is larger than the tax-exporting effect in the second period, the local public good is under-provided. On the contrary, if the spillover effect is smaller than the tax-exporting effect in the second period, the local public good is over-provided.

This proposition mainly restates what the prior literature has found in similar contexts (see, for example, Bjorvatn and Schjelderup 2002).

3.2 The first period

The capital tax rate in the second period depends on the amount of private capital located in jurisdiction *i* in the second period. Owing to the immobility of private capital in the second period, the amount of private capital located in jurisdiction *i* in the second period is equal to the amount in the first period, that is, $k_1^i = k_2^i$. At the same time, the amount of private capital located in jurisdiction *i* in the first period depends on the capital tax rate, which is chosen by the jurisdictional government in the first period. Therefore, following Ogawa (2000), we assume that $t_2^i = q(t_1^i)$, where t_2^i is expressed as a function of t_1^i. This means that how the jurisdictional government *i* chooses the optimal capital tax rate in the second period is significantly determined by the capital tax rate that it chose in the first period. Note that this does not mean that t_2^i is predetermined. The jurisdictional government chooses t_1^i to maximise the discounted sum of the utilities in the two periods, given the variables for jurisdictional government *j*. If the jurisdictional government is hyperopic, the maximisation problem for jurisdictional government *i* in the first period can be written as:

$$\max_{t_1^i, g_1^i} u_1^i = U_i(x_1^i, G_1^i) + \delta^i U_i(x_2^i, G_2^i)$$

$$\text{s.t.} \quad x_1^i = f_i(k_1^i) - f_{k1}^i(k_1^i)k_1^i + r_1\overline{k_1^i}$$

$$x_2^i = f_i(k_2^i) - f_{k2}^i(k_2^i)k_2^i + \alpha^i\{[f_{k2}^i(k_2^i) - t_2^i]k_2^i + [f_{k2}^j(k_2^j) - t_2^j]k_2^j\}$$

$$G_1^i = g_1^i + \beta_{ji}g_1^j$$

$$G_2^i = g_2^i + \beta_{ji}g_2^j$$

$$g_1^i = t_1^i k_1^i$$

$$g_2^i = t_2^i k_2^i$$

$$k_1^i = k_2^i$$

$$t_2^i = q(t_1^i)$$

[6] See Noiset (2003).

by assuming that the discount factor for the jurisdictional government is $\delta^i \geq 0$. To derive the first-order condition, we use the substitution method and differentiate u_1^i with respect to t_1^i. Substituting (1), (3), (7), (8), (9) into the objective function, we obtain:

$$\frac{\partial u_1^i}{\partial t_1^i} = U_{G1}^i \left[\left(k_1^i + t_1^i \frac{\partial k_1^i}{\partial t_1^i} \right) + \beta_{ji} t_1^j \frac{\partial k_1^j}{\partial t_1^i} \right] + U_{x1}^i \left[\left(\overline{k_1^i} - k_1^i \right) \frac{\partial r_1}{\partial t_1^i} - k_1^i \right]$$
$$+ \delta^i U_{x2}^i \left\{ \left[\alpha^i \left(f_{k2}^i - t_2^i \right) - \left(1 - \alpha^i \right) k_2^i f_{kk2}^i \right] \frac{\partial k_2^i}{\partial t_1^i} - \alpha^i k_2^i \frac{\partial t_2^i}{\partial t_1^i} \right\}$$
$$+ \delta^i U_{G2}^i \left[\left(t_1^i \frac{\partial k_2^i}{\partial t_1^i} + k_2^i \frac{\partial t_2^i}{\partial t_1^i} \right) + \beta_{ji} t_2^j \frac{\partial k_2^j}{\partial t_1^i} \right]. \quad (14)$$

Substituting (11) into (14), (14) can be rewritten as:

$$\frac{\partial u_1^i}{\partial t_1^i} = U_{G1}^i \left[\left(k_1^i + t_1^i \frac{\partial k_1^i}{\partial t_1^i} \right) + \left(\beta_{ji} t_1^j \frac{\partial k_1^j}{\partial t_1^i} \right) \right] + U_{x1}^i \left[\left(\overline{k_1^i} - k_1^i \right) \frac{\partial r_1}{\partial t_1^i} - k_1^i \right]$$
$$+ \delta^i U_{G2}^i \left\{ \left[\left(f_{k2}^i - t_2^i \right) - \frac{1 - \alpha^i}{\alpha^i} k_2^i f_{kk2}^i \right] \frac{\partial k_2^i}{\partial t_1^i} - k_2^i \frac{\partial t_2^i}{\partial t_1^i} \right\}$$
$$+ \delta^i U_{G2}^i \left[\left(t_1^i \frac{\partial k_2^i}{\partial t_1^i} + k_2^i \frac{\partial t_2^i}{\partial t_1^i} \right) + \beta_{ji} t_2^j \frac{\partial k_2^j}{\partial t_1^i} \right]. \quad (15)$$

Rearranging (15) with cancellation, we have:

$$\frac{\partial u_1^i}{\partial t_1^i} = U_{G1}^i \left[\left(k_1^i + t_1^i \frac{\partial k_1^i}{\partial t_1^i} \right) + \left(\beta_{ji} t_1^j \frac{\partial k_1^j}{\partial t_1^i} \right) \right] + U_{x1}^i \left[\left(\overline{k_1^i} - k_1^i \right) \frac{\partial r_1}{\partial t_1^i} - k_1^i \right]$$
$$+ \delta^i U_{G2}^i \left[\left(f_{k2}^i - \frac{1-\alpha^i}{\alpha^i} k_2^i f_{kk2}^i \right) \frac{\partial k_2^i}{\partial t_1^i} + \beta_{ji} t_2^j \frac{\partial k_2^j}{\partial t_1^i} \right]. \quad (16)$$

Using (2) and the assumption that $k_1^i = k_2^i$, the first-order condition can be written as:

$$\frac{\partial u_1^i}{\partial t_1^i} = U_{G1}^i \left[\left(k_1^i + t_1^i \frac{\partial k_1^i}{\partial t_1^i} \right) - \left(\beta_{ji} t_1^j \frac{\partial k_1^i}{\partial t_1^i} \right) \right] + U_{x1}^i \left[\left(\overline{k_1^i} - k_1^i \right) \frac{\partial r_1}{\partial t_1^i} - k_1^i \right]$$
$$+ \delta^i U_{G2}^i \left\{ \left[f_{k2}^i - \frac{1-\alpha^i}{\alpha^i} k_2^i f_{kk2}^i \right] - \beta_{ji} t_2^j \right\} \frac{\partial k_1^i}{\partial t_1^i} = 0. \quad (17)$$

It can be derived that the second-order condition is satisfied under some realistic functional assumptions and the properties of the equilibria are fully determined (see Ogawa 2007).

Notably, this result is an extension of Ogawa (2000) with reference to a particular case.

4. Discussion

We assume that we are on the left-hand side of a Laffer curve, $k_1^i + t_1^i \frac{\partial k_1^i}{\partial t_1^i} > 0$. As $\frac{\partial k_1^i}{\partial t_1^i} < 0$, we know from (17) that how the jurisdictional government changes the private capital tax rate depends only on the curly bracketed term if δ^i increases[7]. On the one hand, the hyperopic jurisdictional government has an incentive to decrease the tax rate in the first period to attract the private capital because the jurisdictional government considers the income in the second period (the income effect). The first term in the curly bracketed term of (17) is positive. However, if the spillover effect in the second period is taken into account by the hyperopic jurisdictional government, the jurisdictional government has an incentive to increase the tax rate in the first period to drive out the private capital and obtain the spillover benefits from the other jurisdiction (the spill-in effect). The second term in the curly bracketed term of (17) is negative. The relationship between the private capital tax rate in the first period and the degree of hyperopia of the jurisdictional government significantly depends on the relative size of the two effects that are working in the opposite direction in the second period, as stated succinctly in the following proposition.

Proposition 2: When the income effect is larger than the spill-in effect in the second period, the private capital tax rate in the first period used by a more hyperopic jurisdictional government is decreased. Conversely, when the spill-in effect is larger than the income effect in the second period, the private capital tax rate in the first period used by a more hyperopic jurisdictional government is increased.

Notice that the external validity of this proposition depends on a political strategy of the politicians. The benefits that the politicians can obtain in one jurisdiction (the re-election rent) equals the marginal increase in the probability of re-election multiplied by the value of being re-elected. Of course, these factors are seen as the exogenous variables in this model. If the politicians would like to stand for election for the next term, the conclusion would be valid and could also be a benchmark for some extensions in the future. However, if the politicians would like to stand down, they would be myopic and their discount factor might be zero in the first period. The result would collapse into the finding in Ogawa (2007).

Now, we state the boundaries of the research and applications of the model. In some suburban areas, for example, less populated areas surrounding a metropolitan area but of lower socioeconomic status, beneficial spillovers of local public goods from the urban core are necessary and essential for the suburban residents. If the politicians in these kinds of jurisdictions place a significant weight on the distant future, the under-provision of local public goods might be eased to some extent. However, in some urban areas, for example, a densely populated urban core in a metropolitan area with high socioeconomic status, benefit spillovers of local public goods from the surrounding territories are unnecessary and negligible for these urban residents. If the politicians in these kinds of jurisdictions place a significant weight on the distant future, the under-provision of local public goods might be aggravated to some extent.

[7] Of course, it does not mean that the corrective device from the central government can be determined easily according to the change of capital tax rate as the literature (see, for example, Yang 2020). There are many other endogenous determinants of the corrective device for Large Heterogeneous Jurisdictions (for example, the stock of capital in the jurisdictions). Thus, only the capital tax rate can be determined according to the discount factor.

This result is quite different from Ogawa (2000). One jurisdictional government might tax private capital in the first period to receive more benefit spillovers from other jurisdictions in the second period even if a lump-sum tax is available for the benevolent and hyperopic jurisdictional government. Of course, the robustness and external validity of this research requires further analysis and the incorporation of other key assumptions such as, for example, political re-election motivations.

5. Conclusions

This paper has focused on the private capital tax rate in a two-period model in which spillover effects are considered. We have obtained the following results.

(1) If the spillover effect is larger than the tax-exporting effect in the second period, the local public good is under-provided. Conversely, if the spillover effect is smaller than the tax-exporting effect in the second period, the local public good is over-provided.

(2) When the income effect is larger than the spill-in effect in the second period, for example, if the production technology in the jurisdiction is significantly higher than in other jurisdictions and the spillover benefits received by the jurisdiction are not very large, the private capital tax rate used by a more hyperopic jurisdictional government is decreased in the first period. Conversely, when the spill-in effect is larger than the income effect in the second period, for example, the production technology in the jurisdiction is significantly lower than in other jurisdictions and the spillover benefits received by the jurisdiction are relatively large, the private capital tax rate used by a more hyperopic jurisdictional government is increased in the first period.

For simplicity, it has been assumed that capital is perfectly immobile in the second period. If we introduce transactions costs into the model in the second period, our results may be adjusted quantitatively. However, our findings about the private capital tax rate will not be changed qualitatively even if capital is imperfectly mobile in the second period.

There is no inter-temporal redistribution via public debt or public investment as would usually be relevant when determining public finances across time (for example, Barro 1979; Jensen and Toma 1991). In a dynamic model, the timing of and commitment to policies (for example, see Wildasin 2003) matter. However, for simplicity's sake, these issues are not addressed in the present research. This topic is left for future research.

It is worth noting that the degree of hyperopia of jurisdictional government is determined by the probability of re-election and the rent from being re-elected for the politicians. If the politicians in the jurisdiction can obtain high rent from being re-elected or if the probability that the politicians will be re-elected in the next term is very high, the jurisdictional government may possess greater foresight in this term, and vice versa. Although these factors are seen as the exogenous variables in this study, the finding could provide a benchmark for some extensions in the future. Therefore, in future work, it would be interesting to take into account these issues concerning the incumbents and the anti-incumbency factors.

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