Fiscal Competition among Regional Governments^{**} —Tax Competition, Expenditure Competition and Externalities—

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Abstract

This paper reviews a number of topics that have been analyzed in the field of fiscal competition. A representative fiscal competition analysis is found in the theory of capital tax competition, in which the regional governments compete for mobile capital, using capital tax/subsidy as a policy variable. However, making capital tax/subsidy a policy instrument is a merely a presumption that has been given exogenously. If it were more advantageous for governments to use other policy variables, such as the level of public infrastructure investment, competition would take the form of expenditure competition rather than tax competition. In the first half of this paper, fiscal competition studies on strategic choice of policy instruments are examined. We find here that policy instruments selected in equilibrium are, at least, influenced by the following two factors. Firstly, whether public spending contributes to the region as public goods that directly enhance the resident's welfare, or whether it works as public inputs that enhance regional productivity. Secondly, it may be influenced by the presence of benefit spillovers.

The second half of this paper provides further details on the effects of the above two factors (public input vs. public good and spillovers) on the fiscal competition equilibrium. Specifically, a reexamination of the efficiency properties of public goods provision with spillover externalities is provided in the framework of fiscal competition. Traditional studies, analyzed in the absence of fiscal competition, suggest that the benefit spillover of local public goods is a source that distorts resource allocation. However, in the fiscal competition model, we identify another role of spillovers that works in the opposite direction, to argue that an increase in spillovers actually reduces the distortion due to externalities caused by fiscal competition, so that the existence of spillover might enhance full efficiency.

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I. Introduction

If more than one regional (*or* local) government to which policymaking powers are delegated exists, fiscal competition will occur among these regions to attract inter-regional mobile resources such as skilled labor and capital. Such fiscal competition appears in the form of policy competition among countries or regional governments for attracting enterprises and factories. Wallace Oates, who is a prominent scholar in the field of local public finance, states in his book "Fiscal Federalism" that "The result of tax competition may well be a tendency toward less than efficient levels of output of local public services. In an attempt to keep tax rates low to attract business investment, local officials may hold spending below those levels for which marginal benefits equal marginal costs, particularly for those programs that do not offer direct benefits to local business (p. 143)."

Since the 1980s, 10 years after Oates's suggestion, and inspired by the studies by Zodrow and Mieszkowski (1986) and Wilson (1986), various studies on tax competition have been actively carried out. The starting point of these initial studies has been the fact that various state governments in the USA have been facing wasteful tax competition, and as Oates suggests, these state governments seem to have become the victims of such excessive competition. In addition, if we translate Oates' view in a slightly broader sense, there was widespread recognition that competition on environmental standard which regional governments face (to ease such standard to attract enterprises), and competition on welfare policy (to reduce welfare allowances to drive impoverished people out of these regions) can be interpreted as fiscal competition like tax competition.

Analyses of fiscal competition triggered in the USA also spilt over into Europe. Preparation for the integration of labor/capital markets in Europe was in good progress at that time, and this was strongly supported there by the view that it is desirable for all countries to compete with one another in one unified market. However, looking at the view derived from the fiscal competition analysis, it became necessary to urgently discuss to what extent each national government should be given power and what the central government's role should be in making policies within the unified European region.

While Matsumoto's paper in this special edition mainly reviews a series of studies on tax competition, this paper examines discussions focusing on strategic choice of policy variables. If we define fiscal competition in the most limited sense, by following Wildasin and Wilson (2004, p.1066-67), "it is a form of non-cooperative tax setting by independent governments, in which each government's tax policy influences the allocation of tax revenue across government treasuries". If a "policy" as used in this sentence means a "capital tax/public expenditure/environmental standard", then jurisdictional competition is called "capital tax/expenditure/environmental standard" competition¹. This paper firstly introduces analytical studies on policy choice problem: among tax, expenditure, and environmental criteria etc., what variables do governments choose to control as policy instruments? This analysis will reveal which policy instrument can favor regional

¹⁾ See Wilson (1999), Zodrow (2003), Wildasin and Wilson (2004), and Wildasin (2006) for surveys on capital tax competition. In addition to Matsumoto's paper in this special edition paper, another paper written in Japanese is by Horiba (Chapter 10, 1999). Wilson (1996) reviews on environmental standard competition. Sinn (2003) discusses fiscal competition by regarding the present inter-regional competition as "system competition" which instrumentalizes social systems in a broader sense and placing fiscal competition as part of the system competition.

governments if these governments adopt such instruments to compete with one another. It is found that the results depend on the nature of public spending in each region, in which the nature of public spending is characterized firstly by whether public spending functions as public goods for directly increasing the utility of residents, or it contributes, as public inputs, to the utility of residents indirectly through boosting regional productivity; secondly, it is characterized by whether local public goods (public inputs) provided by regional governments bring benefits only to residents and enterprises within their jurisdiction, or bring benefits to residents and enterprises in other jurisdictions, that is, whether or not such public goods entail spatial externalities (spillover effects). In the first part of the analysis, we review the studies on the endogenous choice of policy instruments in the framework of tax competition. In addition, studies on spatial externalities are also examined referring to research on environmental spillovers and private provision of public goods. Based on this review, the second half of this paper introduces studies that find out a new role for spatial spillovers in the framework of fiscal competition.

This paper consists of the following sections. Section II examines the issue of the choice of policy variables, based on Wildasin (1988, 1991), which prove tax and expenditure competition do not always correspond with each other, so that the regional government has an incentive to select a policy variable when it faces a tax competition situation among governments. In addition, this section introduces studies that explicitly distinguish between public goods and public inputs. Tax competition with benefit spillovers of public goods is also mentioned. These clarifications are important since the nature of these aspects have influence on the results of Wildasin. Since expenditure for reducing environmental pollution is considered to be a typical example of public spending entailing spatial externalities, it can be seen that a situation where public goods are accompanied by externalities is closely related to analyses of environmental pollution. Section 3 discusses optimal subsidy rules to correct externalities that are especially important to vertical intergovernmental fiscal relations, referring to models for voluntary provision of public goods. Section 4 introduces the optimal subsidy rules in tax competition analysis with spatial externality, by comparing those obtained in traditional studies. We present a new role for spillover effects in this section. Section 5 concludes this paper.

II. Fiscal Competition: Tax Competition or Expenditure Competition?

II.1. Choice of Policy Variables

As Matsumoto's paper in this special edition introduces in detail, the studies that attract the most attention among the various studies on fiscal competition are the ones related to capital tax competition, inspired by the studies of Zodrow and Mieszkowski (1986) and Wilson (1986). In such studies, competition has been based on the condition that there are a sufficient number of local governments that use tax on mobile capital. The concept of the Nash equilibrium is used when such competition is analyzed. In a situation where tax competition on capital is carried out among many regions, regional governments determine the fiscal policies, taking those in other governments as given. In traditional analyses, when a regional government chooses "tax rates", they take other regions' tax rates as given. On the other hand, if we look at the situation actually observed from the viewpoint of tax competition, it will be undesirable to confine analyses to competition where only tax rates are policy instruments. As introduced in Wildasin (1991), Kolstad and Wolak (1983) point out that a model based on quantity competition can explain actual tax rates on coal in Wyoming and Montana better than a model based on tax rate competition can explain. Therefore, in the traditional tax competition model, two assumptions -- that a regional government defines its tax rates as an instrumental variable and that the tax rates of other regional governments are given – are certainly exogenously given assumptions, and thus the question of whether these assumptions are appropriate is yet to be answered. That is, based on the tax competition model suggested by Zodrow and Mieszkowski (1986), Wilson (1986), and so on, the following questions must be answered:

- (1) Does the regional government work with "tax rate" as a policy variable? It is suspected that the public spending for infrastructure investment will be chosen as a policy variable and accordingly tax rates will be determined (ex post). Is there any reasonable reason to take tax rates as an instrumental variable?
- (2) If the regional government works with tax rates as a policy variable, is there no chance of defining not the "tax rates" but the "public expenditures" of another regional government as given?

It is Wildasin (1991) who addressed the resolution of these problems. Simply speaking, as long as the economy is on the left side of the Laffer curve, there is a corresponding relationship between taxes and spending; if taxes are raised, public spending also rises, and vise versa. Therefore, it seems that in both cases where tax rates are taken as a policy variable and where spending is taken as a policy variable, the same result can be derived. However, as it is justifiable to ask the question "price vs. quantity" competition in the oligopoly theory, so equilibrium values differ in cases where regional governments take capital tax rates as a policy variable and cases where they take public expenditure as a policy variable. Based on this argument, the endogenous choice of policy variables in the fiscal competition model is first examined by Wildasin (1991).

We here briefly introduce the model setting and the results of Wildasin (1988, 1991). The economy consists of n (i=1, 2, ..., n) homogeneous regions, and the population of each region is normalized as 1. The utility of the residents in the region is represented by $u(x_i, g_i)$, where x_i and g_i represent the consumption of private goods and the level of local public goods, respectively. The production function of the region i is represented by $f(k_i)$, where labor is omitted as it is standardized with 1. The amount of capital used for production in the region i is represented by k_i . The capital of k exists in the whole economy, and it moves freely among regions. Then, each regional government finances local public goods by imposing taxes on regional capital, and tax rates on capital shall be represented by t_i , where capital tax is imposed in the form of unit tax. In this case, the capital in the equilibrium will be allocated among regions so that the following equations are satisfied:

$$f_k(k_i) - t_i = r, \qquad (1)$$

$$k = \sum_{i=1}^{n} k_i , \qquad (2)$$

where *r* is the net return on capital. The residents in region *i* will gain the labor income, $f(k_i) - f_k(k_i)k_i$ and the capital income, $r k_i$, where k_i is the initial endowment of capital in the region *i*. If these incomes are used for consuming private goods, the budget constraint of residents in region *i* will be given by $x_i = f(k_i) - f_k(k_i)k_i + r k_i$. If local public goods are financed by taxes on capital, the budget constraint for a regional government can be given by:

$$t_i k_i = g_i . (3)$$

It is assumed that the regional government maximizes the utility of the residents in the region, subject to (1)-(3). Wildasin (1988) defines an equilibrium in fiscal competition in each case where regional governments take tax rates or public expenditures as a policy variable, and then shows that tax rates and public expenditures when regional governments are engaged in "tax" competition, in which they use tax rates as a policy variable, are greater than those when they are engaged in "expenditure" competition, in which they use public expenditures as a policy variable. The reason is explained as follows.

Consider a case where region *i* chooses its tax rate t_i while taking the tax rate t_j in region *j* as given. The raising of t_i will result in the outflow of capital from the region *i* to the region *j*. Now, the regional government *i*, which sees the tax rate t_j of the region *j* as given, has simply recognized that due to the increase of k_j arising from the rising of t_i , the government *j* would raise the level of public goods, g_j , to satisfy its budget constraint.

Next, consider a case where region *i* chooses its expenditure g_i given the expenditure of region *j*, g_j . The increase of g_i will involve not only the rising of the tax rate t_i but also the decline of the tax rate t_j of the region *j*. This is because an increase in t_i entailing an increase in g_i results in the outflow of capital from the region *i* to the region *j*. Since region *i* sees g_j as given, region *i* understands that government *j* reduces t_j so as to maintain its budget constraints. That is, when the expenditure is taken as a policy variable, the increase of t_i to increase g_i entails the decline of t_j . In other words, if the tax rate t_i is raised when a tax rate is taken as a policy variable, such policy change in the region does not entail any responses related to the tax rates of the other region; if g_i is increased when the public spending is taken as a policy variable, regional government *i* has envisaged that region *j* would aggressively respond to such policy change by reducing the tax rate t_j . Consequently, in the case of expenditure competition, a gap from the optimal tax rate will be wider because public spending taken as a policy variable will involve additional strategic response among regional governments.

If the choice of policy instruments changes tax rates and public expenditures in the equilibrium, there emerges the question of what variable should be taken as a policy instrument in fiscal competition. Wildasin (1991) examines what policy instrument a regional government should endogenously employ as a strategic variable, by applying the model of variables choice problem in oligopoly markets presented by Singh and Vives (1984). He develops the following two stage game:

- Stage 1: Each regional government chooses one of the two policy variables (i) tax rate and (ii) level of public expenditures.
- Stage 2: Given the decision made in Stage 1, each government determines the level of tax rate or expenditures.

To solve this problem, Wildasin (1991) specifies a utility and a production function, and gains the response curves shown in Figure 1. In Figure 1, $t_i(t_j)$ and $t_j(t_i)$ represent response curves in the case that both regional governments take tax rates as a policy variable. $\tau_i(\tau_j)$ is the response curve of tax rates which are set (ex post) in the case that the regional government *i* takes expenditures as a policy variable. In Figure 1, the point T (*or* G) is a Nash equilibrium in the case that both regional governments take tax rates (*or* expenditures) as a policy variable, and the point A (*or* B) is a Nash equilibrium in the case that the regional government 2 (*or* 1) takes tax rates as a policy variable. From this figure, it is clear that an equilibrium tax rate in the case that both regional governments take tax rates as a policy variable is higher than that in the case that they take expenditures as a policy variable. Furthermore, it shows that a government which employs tax rate as a policy variable chooses a higher tax rate than that chosen by another government which chooses the level of public expenditure as the policy variable.

Figure 1. Response Curves of Regional Governments



Table 1. Choice of Policy Variables

| | | Regional government 2 | | |
|-----------------------|------------------|-----------------------|-----------------------|--|
| | | Tax rate (t_2) | Expenditure (g_2) | |
| Regional government 1 | Tax rate (t_l) | 1,1 | 2,4 | |
| | Expenditure (g1) | 4,2 | 3,3 | |

Note. Numbers are arranged in a prioritized order.

Table 1 is a payoff matrix based on the residents' utility in both regions. It shows that the regional government i (i = 1, 2) has two choices, that is, the tax rate t_i and the expenditure g_i , but that "tax rates" are the dominant strategy, so that each regional government carries on fiscal competition by using tax rates as a policy instrument. This result means that the implicit assumption on choice variables made by Zodrow and Mieszkowski (1986) and Wilson (1986) is supported by solving the problem of endogenous variable choice.

Should tax rates on capital be endogenously chosen as a policy variable, the next problem is about the way of imposing tax. The traditional tax competition model assumes that capital taxes should be taken as a policy variable, and at the same time taxes should be imposed in the unit tax form. Although it is possible to adopt other taxation systems such as the ad valorem tax form, is the unit tax justified? Lockwood (2004) develops a model in which, in Stage 1, a regional government chooses either the unit tax or the ad valorem tax method to impose capital taxes, and in Stage 2, it chooses tax rates based on the tax system chosen in Stage 1. In his model, it is shown that the utility level of residents is higher in the case that all governments choose the unit tax method than in the case that they choose the ad valorem tax method, and that the unit tax method assumed by many studies is reasonable. Lockwood (2004), however, does not solve the two-stage game in a stricter sense, but only compares the following two cases: two regions choose the ad valorem tax method as a taxation system; and two regions choose the unit tax method as a taxation system. He, from this position, argues not only that the unit tax method which in theory produces higher utility as a taxation system should be chosen, but also that theory and reality should be at variance with each other because what is actually observed as a taxation system is the ad valorem tax method. He attributes such variance to the fact that the unit tax expressed in the theory model is inapplicable in that machinery and others are not homogeneous, and for other reasons. But if the two-stage game is properly solved, there may remain a possibility that both regional governments are in a prisoner's dilemma where they will choose the ad valorem tax method as a taxation system. However, this problem has not been verified yet.

II.2. Public Goods and Public Inputs

Oates (1972) points out that there is a possibility that in a fiscal competition among regional governments, each government will be forced to make an inefficient policy decision. He, however, assumes that before discussing such a possibility, public expenditure financed by capital taxes will directly raise the utility of residents in a manner that it is included in the utility function of residents. His assumption is verified by the model analyses

performed at least by Zodrow and Mieszkowski (1986), and Wilson (1986). In addition to a situation where the utility of residents will be directly raised by public expenditure in a manner so that it becomes a component of the resident utility function (this situation is known as a public goods model), there may be a situation where the regional productivity raised by public spending will indirectly affect the utility of residents (this situation is known as a public input model). This section discusses the issue of the choice of policy variables based on the public input model.

In their early work, Zodrow and Mieszkowski (1986) have analyzed the public input model in which public spending contributes to the raising of the regional productivity, by modifying the production function to $f(k_i, g_i)$, and conclude that underprovision results apply as much to the public input model as to the public goods model. The legitimacy of this argument, however, has been questioned even within the framework of their model. The difference between public goods and public inputs is that while the former do not directly affect the capital demand, the latter do so. The capital demand in each region is determined by a condition such that the net capital returns can be equalized ($f_k(k_i, g_i) - t_i = r$). The increase of public inputs accompanied by the tax increase results in the increase in marginal productivity of capital, and thereby the inflow of capital. While the raising of capital tax rates directly causes capital outflow, the increase of public inputs causes capital inflow, and therefore, it is not at all clear whether the increase of public inputs due to the raising of tax rates will result in an increased tax base.

It was Noiset (1995) who pointed out this fact for the first time and criticized Zodrow and Mieszkowski (1986). In the public input model, if a region *i* raises tax rates, it will be accompanied by the first effect, that is, a decrease in the capital invested in the region. Meanwhile, the raising of tax rates will be accompanied by an increase in public expenditures. If public inputs and private capital complement each other in production, and if the increase of public inputs contributes to the increase of productivity f_{k} , $(f_{kg}^i > 0)$, the second effect, that is, the inflow of capital to the region i will be created. What the study by Noiset (1995) argues is that if the first effect dominates the second effect, the raising of capital taxes will lead to an increase of the tax base k_i , and create positive externality, but if, on the other hand, the second effect dominates the first effect, conversely, the rise of t_i will leads to a decrease of k_i , and create negative external effects. The essence of the criticism by Noiset (1995) is that Zodrow and Mieszkowski (1986), in their analysis, hypothesize that as a result of imposing certain restraints on the production function, the outflow effect of capital due to raised tax rates will always dominate the inflow effect of capital due to the increase of public inputs. The restraint on this production function are known as the "Zodrow-Mieszkowski condition" in the relevant literature, but Noiset (1995) figure outs that in this condition there is no economic rationality. In addition, Noiset (1995) argues that if a Zodrow-Mieszkowski condition does not hold, then in the theoretical framework of Zodrow and Mieszkowski (1986), a possibility of the overprovision of public inputs cannot be denied.

Bayindir-Upmann (1998) tries analyzing the Wildasin type of instrument choice problem to examine whether regional governments should use tax rates or expenditures by using the public input model. As stated before, in the traditional fiscal competition model indicating that only capital can move, it is not made clear whether dependence on capital taxes causes either the overprovision or underprovision of public inputs. With the model having this nature, Bayindir-Upmann (1998) shows the following: the result obtained by Wildasin (1988), that is, the result that tax rates and public expenditures in the case where governments use the tax rate as policy variable,

are higher than those in the case where they use public expenditures as a policy variable, cannot be always justified. But contrary to Wildasin's result, within a range of parameters that can be realistically accepted, tax rates and public expenditures in the case where they use tax rates as a policy variable, are lower than those in the case where they use public expenditures as a policy variable.

What is interesting in the study by Bayindir-Upmann (1998) is that he considers the possibility of excessive public expenditures (tax rates). In the case of the public goods model discussed by Wildasin (1988, 1991), tax rates (expenditures) in equilibrium are smaller than the optimal level in two cases of tax rates and expenditures taken as a policy variables. From this perspective, it will be more desirable that tax rates are taken as a policy variable, even though the first best cannot be achieved, than that expenditures are taken as a policy variable, because tax rates (expenditures) in the former case are higher than in the latter case. According to Bayindir-Upmann (1998), on the other hand, in the public input model, because there are also some cases where established tax rates (expenditures) are higher than the optimal level, choosing the level of public expenditure as a policy instrument will be more desirable. In order to show this, Bayindir-Upmann (1998) conducts a numerical examination by specifying the production function as $f(k, g) = [1 + exp(-kg^a)]^{-1} - 0.5$, where a is a parameter representing the productivity of public inputs. Although simulations analysis has limitations in terms of generality, it gives some indication that the productivity of public inputs affects the results of the issue on policy variables choice. What is concluded here may require the modification of the results made for the endogenous choice of policy variables indicated by Wildasin (1991). In other words, if public spending contributes to regions in a manner in which such spending as a public input raises the regional productivity, regional governments may conduct fiscal competition by using the level of public expenditures as a variable.

What is important here is the Zodrow–Mieszkowski condition which conditions the possibility of excessive capital tax rates (public expenditures). However, there is some confusion among researchers of tax competition theory. Despite the criticism from Noiset (1995), on one hand, there are some papers which argue, following this condition, the possibility of the underprovision of public inputs (e.g., Keen and Marchand (1997), Wrede (1997), and Gugl (2003)). Like Noiset (1995), on the other hand, there are some papers which emphasize the possibility of overprovision (e.g., Noiset and Oakland (1995), Fuest (1995), and Wooders et al. (2004)). Matsumoto (1998), contrary to such papers, reexamines how tax competition affects the provision of public inputs, by clarifying the degree of constant returns to scale, which need not rely on the Zodrow–Mieszkowski condition. Matsumoto (1998) considers (a) the case of constant returns to scale regarding all inputs (public inputs included)²⁾. The difference between (a) and (b) is that in the former case, the income from production is all reduced to the income generated by private inputs because the production function is linear homogeneous only for private inputs, while in the latter case, there exist firms' profits arising from public inputs. If the condition (a) is imposed on the Zodrow–Mieszkowski model, the underprovision of public inputs is derived. If a region increases public inputs by raising capital tax rates, then it means a decrease of the capital in the region, and thus the regional government

²⁾ The method of classifying public inputs depending on the level of constant returns (or the level of the linear homogeneity of the production function) has been widely used in fields related to optimal provision of public inputs. See Feehan (1989, 1998).

chooses smaller tax rates (public expenditure). In case (b), although there remains a possibility of overprovision in the Zodrow–Mieszkowski model that expects only capital mobility, underprovision may occur in an uncoordinated equilibrium, if the inter-regional mobility of firms, in addition to capital movement, are taken into consideration. The analysis by Matsumoto (1998) reveals that the degree of inefficiency of the provision of public inputs due to tax competition depends on production factors and the degree of the firm's mobility. As seen in this discussion, the possibility of overprovision that Noiset (1995) points out applies to a case where firms have profits, but this occurs because only capital mobility is taken into account. In the light of the fact that the mobility of both capital and firms are actually a widespread phenomenon, it can be argued that overprovision is rather unlikely to occur³. Given the accumulation of these studies, it must be kept in mind that the result obtained by Bayindir–Upmann (1998) is based on the assumption that the firm's mobility is not allowed.

II.3. Allocation of Public Spending

Section II.2 considers the choice of policy variables for the public goods model in which regional public spending directly raises the utility of residents and for the public input model in which the rise of productivity indirectly affects the utility of residents. In the real world, it is rare for regional governments to carry out public spending only focusing on either public goods or public inputs, and rather such governments will realistically divide the composition of public expenditures into public goods and public inputs in a certain proportion. Fuest (1995) and Keen and Marchand (1997) consider public goods and public inputs in their models at the same time, and try analyzing fiscal competition by choosing allocation ratios between public goods and public inputs as policy variables. Let us briefly introduce the model of Keen and Marchand (1997). They take the allocation rate b $\in (0, 1)$ between g_p and g_u (the ratio of public inputs to public expenditures) as a policy variable $[b = g_p / (g_p +$ g_{u}]. If public inputs and public capital complement each other in production, the marginal increase of allocation rate to public inputs, b, induces the capital inflow to the region because of the rise of the productivity of private capital. However, the increased capital means a decreased tax base in other regions since governments do not consider this negative effect. On the other hand, the raising in b which means the decrease of public goods will directly lead to the decreased utility of regional residents. This, however, does not generate any external effects. Therefore, in the case of competition where an allocation ratio is taken as a policy variable, because there occur only negative external effects, the allocation rate b is set higher compared with the optimal level, and the public inputs will be relatively overprovided.

An interesting counterargument to the study of Keen and Marchand (1997) is made by Matsumoto (2000b) which insists that the Keen and Marchand's result is based on the assumption that there is no inter-regional household migration, and thus, if it is taken into consideration, the opposite result may be found. The essence of his study is as follows. Consider a rise in the allocation rate to public inputs, *b*. If we consider costs arising from such raising, the utility of residents will decline as Keen and Marchand (1997) show. This means involving the

³⁾ Related to the case (b), Richter (1994), and Richter and Wellisch (1996) establish a model with the congestion externalities involving the use of public inputs, and examine how the firm's mobility affects the provision of public inputs. Matsumoto's model (2000a) is established by adding mobile capital and capital taxes to their analyses.

decrease of the population of the region *i* if inter-regional household migration is possible. If capital and labor are complement in production, the decrease of the population will involve a decline in the capital productivity. This leads to a decline of capital in region *i*, and the increase of capital (tax base) in other regions. This, in turn, means the increase of the allocation rate to public inputs will result in a positive externality. After all, the study of Keen and Marchand (1997), which does not consider this kind of positive externality, draws their result simply because they do not account for household migration. If it is considered in the model, their result will not hold. According to Matsumoto (2000b), the degree of complementarity between capital and labor must be sufficiently higher to make the allocation rate to public inputs smaller, and at the same time, the competition with the choice of allocation ratios as a policy variable will lead to the socially optimal situation if a CES type production function is assumed⁴.

II.4. Public Inputs Provision and the Participation in Fiscal Competition

In the fiscal competition model with public inputs, in recent years, there have emerged interesting studies which depart from the traditional approach of Zodrow and Mieszkowski (1986). These fascinating studies deliver an attack on the assumption made in the traditional literature that all regions in question participate in inter-regional fiscal competition. Contrary to this, Justman et al. (2001) and Bucovetsky (2005) present models in which a regional government chooses whether or not it should participate in fiscal competition through the provision of public inputs⁵⁾. According to their analyses, when the number of regions which participate in competition is endogenously determined, an inefficiently larger number of regions participate in competition, intending to attract inter-regional mobile production factors and firms. As long as public inputs are used as instruments to attract capital and firms, a situation where excessive participation occurs means that excessive resources are used for public inputs⁶. The model of Justman et al. (2001) assumes there are different types of public inputs as well as of non-homogeneous firms which prefer specific types of such inputs. Each regional government (in the case of participating in inter-regional competition) supplies specific types of such inputs. The more the number of participating regions increases, the more similar types of public inputs are supplied and the fiercer fiscal competition becomes by carrying out measures for supporting mobile production factors and firms, such as the reduction of tax rates and the provision of subsidies. Since regional governments do not consider how much such intensification of competition affects the whole economy when deciding whether or not to participate

⁴⁾ This means the allocation ratio is optimal. However, the size of public spending is still inefficient. Although the efficiency of the allocation ratio between public goods and public inputs is discussed here, Matsumoto (2005), by considering two types of public inputs divided by a regional government (public inputs that complement labor in production and public inputs that complement inter-regional mobile capital), discusses the efficiency of the allocation ratio between two types of public input.

⁵⁾ Bucovetsky (2005) and Justman et al. (2001) look on lump-sum taxes (not taxes on mobile inputs and firms) to finance public inputs and for subsidies to firms. This also applies to Justman et al. (2002) mentioned later. In this sense, their study focuses only on inter-regional expenditure competition, and has a nature different from those of various studies derived from Zodrow and Miszkowski (1986). In a model of Justman et al. (2001), public inputs are not taken as independent variables of the production function, but as variables affecting fixed costs.

⁶⁾ As a mechanism of excessive participation, Bucovetsky (2005) suggests that there is agglomeration economy attributed to externalities among firms within each region.

in such competition, an excessive number of regions will, as a result, provide public inputs in equilibrium.

In addition, one of the studies related to recent regional public inputs which are beyond the framework of Zodrow and Mieszkowski (1986) is a study by Justman et al. (2002), which focuses not on the level of provision, but on its "quality". Although Justman et al. (2001), as already stated above, analyze inter-regional competition by endogenously determining the number of regions which participate in such competition, they also mention the case that a certain proportional number of regions provide public inputs. If a certain proportional number of regions can freely choose types of public inputs to be supplied by themselves, they tend to differentiate each other with regard to such types in order to avoid competition done through taxation and subsidies. This differentiation will go too far, and public inputs which only some firms prefer will be supplied. As a result, the types of public inputs chosen by regional governments will be inefficient in equilibrium⁷.

In the context of traditional fiscal competition, issues related to the underprovision of public goods (inputs) resulting from fiscal competition often focus on the premise that all regions participate in fiscal competition. The arguments made by Bucovetsky (2005) and Justman et al. (2001, 2002) are completely different from the previous arguments concerning fiscal competition, because they indicate, by considering a participation problem, there is a possibility that public goods will be oversupplied as a result of excessive participation. Their studies may reserve appreciation as they find a new approach to the fiscal competition study. In addition, considering such matters as the applicability of the case of public goods to their models, the frameworks shown by them may apply to a wider range of analyses, despite the fact that in their models, analysis is limited to the case of public inputs. Needless to say, however, judging from the previous process of developing fiscal competition theories, the robustness of the results brought about by their arguments need to be verified through the consideration of various factors such as the mobility of population and firms.

II.5. External Effects

Wildasin (1991) extends the model to include the case that regional public goods may involve what is called spatial externalities (spillover effects). Spillover effects of regional public goods are a phenomenon that the benefits of public services which a certain regional government has provided, affect not only residents in its jurisdiction but also residents living in other jurisdictions in some way or another. There is no guarantee that the benefits of public services financed by capital taxes can remain within its jurisdiction superficially separated from other jurisdictions. Rather, it is more natural to think that many regional public services provide some benefits for residents and enterprises in other areas, and that spillover effects beyond a jurisdiction cannot be ignored. In addition, it is, even without referring to national security and environment issues, apparent that the benefits of policies conducted by a country affect other countries. The spillover effects of national policies to other countries are further enhanced, along with the development of regional integration including European integration. In the

⁷⁾ Justman et al. (2002) also reviews, in more detail, the relationships between the quality of the public inputs chosen in an uncoordinated equilibrium, and the level of taxes on and subsidies to firms. In recent years, there have been studies focusing on the non-homogeneities of economic factors such as the preferential heterogeneity regarding public goods (Hsu (2005)), and the heterogeneity of the labor force (Sato and Thisse (2005)).

field of local public finance, issues related to spillover effects on equilibrium cannot be ignored, and such issues have drawn the attention of many scholars and researchers for a long time, at least going back to Williams $(1966)^{8}$.

Because of the presence of spillover effects, a spatial area where economic effects are generated by regional public goods does not always coincide with an administrative area superficially arranged in accordance with criteria which differ from economic ones. Therefore, this mismatching of the spatial areas between these economic and political criteria will distort resource allocation, and cause detriment to the economic welfare of the entire society. As Cornes and Sandler (1996, p. 33) point out, even today, arguments about the spillover effects of public goods draw a great attention, especially amid calls for policy coordination across countries in the world with regard to environment and national security, which bring about global spillover effects.

There are several simple empirical studies on beneficial spillover of regional public goods. Murdoch et al. (1983) examines whether or not spillover effects of recreation services exist, and Olson and Zeckhauser (1966) and Dudley and Montmarquette (1981) deal with military services. Deller (1990) also points out that spillover of regional public services exists in the USA. Empirical studies based on the public input model, in which regional public goods contribute to increasing the regional productivity, have also been actively carried out after the study of Aschauer (1989) on productivity effects of public capital. Munnell (1992), who reexamines early studies concerning productivity effects of public capital, points out that the elasticity of public capital to the gross production shown in a series of studies using state-level data is, on the whole, lower than the elasticity in studies using aggregated data. As its cause, she indicates the possibility that if state-level data is used there will be factors in public capital, such as spillover effects, which cannot be considered to contribute to production. Since then, based on her indication, Holtz–Eakin (1994), Holtz–Eakin and Schwartz (1995), Pereira and Roca–Sagales (2003), and others have tried to directly or indirectly examine whether regional public capital has spillover effects⁹.

Wildasin (1991) analyzes the issue of the choice of policy variables when such spillover effects are explicitly included in a model. In his analysis, the benefits G_i from public goods that the region *i* can enjoy are defined as $G_i = a_{ii} g_i + a_{ij} g_j (a_{ii} \ge a_{ij})$, where g_i is the regional public spending by the regional government *i*, and a_{ij} is a parameter representing the degree of spillover from the region *j* to *i*. G_i is supposed to be an indicator representing the level of environment, safety, fire risk, and road congestion, where $a_{ij} > 0$ means that the residents living in the region *i* receive certain benefits from the regional public spending supplied by the regional government *j*. Based on these, Wildasin (1991) analyzes the situation where the regional government *i* determines its own expenditure g_i with

⁸⁾ In addition to Williams (1966), Buchanan and Kafoglis (1963), Holtmann (1966), Brainard and Dolbear (1967), and others analyze the optimality of regional public goods with spillover effects, and Pauly (1970), by dividing "publicness" into several categories, tries integrating these studies.

⁹⁾ It is difficult to say whether the existence of spillover effects of "pubic inputs" is empirically verified. While Holtz–Eakin and Schwartz (1995), by using the data from 1969 to 1986, consider the freeways as public capital for state government and arrive at the negative conclusion that spillover effects cannot be obtained, some researchers believe in the presence of spillover effects. Pereira and Roca–Sagales (2003), for instance, using the data of 17 regions in Spain for the period from 1970 to 1995, indicate that the public capital of a certain region can significantly and positively affect the production of another region to almost the same scale as it contributes to the production of the said region. Like them, Solé–Ollé (2006) also verifies the presence of spillover effects in Spain by using data of 2,500 cities.

the public goods level G_j of another region as given, and the situation where *i* determines the public goods level G_i (g_i for achieving it) of its own region with the public goods level G_j of another region as given. The latter situation applies to the following issues: to what degree should the regional government maintain the environmental level given the environmental level of another region, in order to maximize the utility of its own residents? And to do so, to what degree should investment in the improvement of the environment be made? And by solving a two-stage game similar to the one mentioned in the previous section, Wildasin shows that it will be a dominant strategy for the regional government to choose the public spending g_i as a policy variable.

The formulation of externalities by Wildasin (1991), though an older but similar formulation can be seen in the study of Oates (1972), is made use of in many studies, especially those regarding policies that contribute to the reduction of cross-border pollution. Wellisch (1995a) and Silva (1997), for instance, discuss the efficiency of policy-making for the environment of a region where factors are mobile. Wellisch (1993, 1994), using the incentive equivalence model by Myers (1990), shows that the efficient allocation of resources will be achieved in the decentralized economy, even if regional public spending generates spillover effects because of inter-regional population mobility and inter-regional voluntary income transfers¹⁰. Considering that this regional public spending contributes to the reduction of environmental pollution in the world, it can be said that Wellisch's model (1993, 1994) and a series of studies by Silva and others are in the same framework, and even though public spending that leads to the reduction of the amount of pollution may involve externality matters, fiscal competition will achieve an efficient equilibrium in a situation where inter-regional population migration is allowed¹¹.

II.6. Environment Externality and Fiscal Competition

Environment issues, as the representative phenomena of spatial externality, are analyzed in the framework of fiscal competition. Based on the assumption that firms produce pollutants in the production process, which in turn deteriorates the regional environment, Oates and Schwab (1988), Wellisch (1995b), Kim and Wilson (1997), Glazer (1999), Kunce and Shogren (2002), Cremer and Gahvari (2004) analyze the outcomes of inter-regional competition by determining environmental taxes or environmental standards as policy instruments. Traditionally, as mentioned by Cumberland (1981), if regional governments which try to attract firms and capital, compete on the basis of determining environmental standards as policy instruments, there is concern that environmental standards may be too relaxed, which in turn leads to a terrible environment. This view is confirmed by Kim and Wilson (1997) which shows that the environment is excessively consumed in equilibrium.

However, it can be said that the analyses of Kim and Wilson (1997), which are based only on capital mobility, are similar to that of Keen and Marchand (1997) described in Section II.3. If there is population mobility as well

¹⁰⁾ Not only Wellisch's paper (2000) but also many Japanese-written papers describe the incentive equivalence model build by Myers (1990), based on the analysis by Boadway (1982). Refer to Sakashita (1994), Itaba (1995, Chapter 11), Doi (2002, Chapter 10), and others.

¹¹⁾ The research objective of Silva (1997) is to pursue a desirable combination of policy instruments by using models containing several policy instruments, and thus, the purposes of his study and the study of Wellisch (1993, 1994) are not altogether the same.

as environment externality in the economy, such environmental standards will not always generate an inefficient condition. Also, unlike the indication of Cumberland (1981), Wellisch (1995b) and Glazer (1999), who consider firm mobility, show the possibility that fiscal competition based on environmental standards will lead to the establishment of excessively strict levels. The reason for the establishment of excessively strict standards can be explained as follows. Under efficient environmental standards, the level of marginal benefits (an improved environment level, etc.) and the level of marginal costs (a reduced amount of production, etc.), arising from such standards, must coincide with each other. However, if the emissions produced by firms are directly controlled in accordance with environmental standards, firms need not bear any external costs arising from such pollution. To put it the other way around, the rent obtained by emitting pollutants should be paid back to victims from pollution under normal circumstances, but since polluting firms are not liable for such pollution, the rent concerning environmental pollution can be internally reserved as a production factor by firms. If a regional government raises environmental standards in a situation where there is a remaining rent concerning pollution in the profits of an firm, which should be paid back to regional residents, there is concern that the firm may move to another region while retaining the internal reserves which should be normally paid back to the present region. The regional government, which cannot prevent the internal reserves for pollution from moving out to another region, is highly likely to establish excessively strict standards, compared with the optimal level. This indicates that when a regional government introduces environmental taxes paid for pollution as a policy instrument, an optimal regulation level may be attained even if there is firm mobility. By contrast, when a regional government has any other policy instruments for firms to pay their rent for pollution emissions back to the region, the establishment of excessively strict environmental standards may be prevented¹²).

With regard to the effects of the inter-regional mobility of the tax base upon environmental policies, there are also studies focusing not on competition for attracting capital and enterprises, but rather on NIMBY (not-in-my-backyard) competition¹³⁾. Markusen et al. (1993, 1995), for instance, create a model in which (single) firms causing the deterioration of the regional environment choose a place of production. The economy is comprised of two regions, and the governments of the two regions impose taxes on production, which work as environmental taxes. Since there are transportation costs for products, each regional government, when production activities are performed in its region, is faced with a trade-off between profits from the falling prices and the environmental damage arising from the saving of transportation costs. In this framework, competition for attracting firms by reducing tax rates will occur if environmental damage is small, and NIMBY competition by increasing tax rates will occur if such damage is large. Markusen et al. show that in the latter case, especially, there is a possibility that even if either of the two regions is a desirable place for a firm, the firm may choose to

¹²⁾ Although Oates and Schwab (1988) provide models in which the environmental standards regionally established and the optimal levels coincide with each other, their conclusions greatly depend on the situation which is created for firms not to make profits by two suppositions: the CRS production function and a particular kind of environmental standard. Kunce and Shogren (2002) make a model of a situation in which environmental standards are more relaxed than the optimal level by extending from the small-open region model of Wellisch (1995b) to a model for regions large enough to affect market values as a result of policy changes.

¹³⁾ It is Levinson (1997) who describes the differences between the model of Oates and Schwab (1988) and the model of Markusen et al. (1993, 1997) in details, by comparing both studies.

start production in another region.

In the context of fiscal competition with environmental issues, examination of the choice of policy instrument has not progressed so far. For instance, Wellisch (1995b) reveals that indirect regulations (pollution tax setting) are more desirable than direct regulations (standard setting). But this does not mean that all regional governments choose indirect regulations as a policy variable. The issue of the instrument choice problem in the fiscal competition model with environmental spillover is yet to be sorted out.

III. Spillover effects and Central Government Intervention

Regional public goods with spatial externality (spillovers) dealt with in Section II-5, have been a subject for study in the field of local public finance for a long time, and these studies are associated with the theory of voluntary provision of public goods. Warr's paper published in 1983 has attracted the attention of many scholars for a long time. Warr comes to the conclusion that if each individual voluntarily contributes to public goods, an income redistribution policy by the government does not at all affect the total amount of public goods. This conclusion has a policy implication that the intervention of the government through income redistribution does not affect the volume of provided public goods, and later, it has been known as the Shibata-Warr Neutrality Theorem for public goods named after Shibata (1971). Traditional studies concerning voluntary provisions, starting from Warr (1983), analyze equilibrium characteristics in the economy where public goods are voluntarily provided by individuals based on altruistic externalities, and conclude, on the whole, that the volume of public goods voluntarily provided is smaller than the optimal level. Since Warr's paper (1983) has an extremely strong policy implication that an income redistribution policy by the government is denied as a policy option for bringing the volume of underprovided public goods closer to the optimal level, it has influenced its subsequent studies and its theory has been enhanced and developed in various directions.

III.1. Inter-regional Income Transfers: Neutrality Theorem

The theory of voluntary provision of public goods can apply to the public good model with spatial externality by looking not at individuals but at regional governments and/or national governments as economic agents (Kemp (1984), Boadway et al. (1989a), Ihori (1992, 1994a, 1994b, 1996), Ley (1998), Boadway and Hayashi (1999), Lim (2003), and others)). Especially, as far as international public goods (regional public goods with extremely large spillover effects), including the international burden of each national government on environment improvement policies and defense costs, are concerned, nations are the economic agents. Therefore, whether to provide such public goods is up to each national government's voluntary will, and this was one of the earliest fields to make use of the theory of voluntary provision of public goods.

As verified by Williams (1966) and others, in a situation where a regional government provides regional public goods with spillover externality, the equilibrium public goods level will be smaller than the optimal level. The Shibata–Warr Theorem has a strong policy implication on this point: if the spillover of public goods is extremely large, and the central government tries to improve the inefficient outcome through inter-regional

income transfers, such intervention can affect nothing at all. For this reason, analyses of the theory of voluntary provision of public goods have led to many arguments, and economists trying to verify the robustness of the results of these analyses. With the help of the results obtained from such studies, we can understand that the study of Bergstrom et al. (1986) indicates that inter-regional income transfers have substantial effects if there are regional governments which provide no regional public goods. From the analyses of Boadway et al. (1989a), we can point out that if we can not use lump-sum taxes so that taxes affect the relative prices of goods, the neutrality theorem for public goods will not be held. Furthermore, it is indicated that if the prices of regional public goods that reflect regional productivity differ among regions, the neutrality theorem will not be sustained (Ihori (1996), Ley (1998), Akai (2003)), and that regions with low productivity have an incentive to voluntarily transfer incomes to regions with high productivity (Buchholz and Konrad (1995)). On the other hand, there are some studies that indicate that not all of, but part of the benefits of regional public goods spillover to other regions, and it is known that in such cases, the neutrality theorem does not hold. The most interesting finding is, as Ihori (1992) shows, a phenomenon called the transfer paradox (while the utility of the region from which incomes are transferred improves, that of the region to which the incomes are transferred deteriorates) which will occur under an inter-regional income transfer policy. Since studies have been developed by using a variety of realistic factors, policy implications indicated by such studies cover a wide range, and the importance of studies by using models containing modifications/enhancements will further increase.

III.2. Matching Grant: Optimal Subsidy Rule

In studies on the neutrality theorem by Warr and others, inter-regional lump-sum income transfers have been envisioned as policy instruments of central governments. On the other hand, many scholars consider the method of improving the underprovision of public goods with spillover effects by the central government providing matching grant for regional governments. An optimal subsidy rule for resolving the inefficient allocation of resources involved in spillover effects is formulated by Oates (1972), but since then, there have been some studies which have sought to find what an optimal subsidy rule should be by using findings from studies based on the theory of the voluntary provision of public goods. In order to clarify the distinction between the above rule and the optimal subsidy rule introduced in the next and subsequent chapters, this section introduces the essence of the optimal subsidy rule developed by Oates (1972), Boadway et al. (1989b), Roberts (1992), Lee (1995), and Akai and Ihori (2002).

The economy considered here shall be comprised of *n* homogeneous regions ¹⁴⁾. In region *i*, there is a single resident who is supposed to stick to the region. The residents shall obtain utility from private goods x_i and public goods G_i , and the utility function is represented by $u_i = u(x_i, G_i)$, where G_i is given as follows.

$$G_i = g_i + \beta \sum_{j \neq i} g_j \tag{4}$$

¹⁴) By hypothesizing the homogeneous regions, we can eliminate debates over the inter-regional equity.

In (4), g_i is the level of regional public goods provided in the region *i*. β is the parameter representing the degree of spillover. While $\beta = 0$ means that the regional public goods do not have spillover effects, $\beta = 1$ means that the benefits of the regional public goods fully spillover into other regions.

Incomes in the region shall be exogenously given by y_i . The regional government collects the regional (lump-sum) taxes z_i for providing regional public goods. In addition, the central government collects the national (lump-sum) taxes h_i for financing subsidy. Now, the budget constraints for the regional residents are as follows.

$$x_i = y_i - z_i - h_i \tag{5}$$

The regional government provides regional public goods which are financed by the regional taxes z_i and the subsidies s_i from the central government. The budget constraints of the regional government are:

$$z_i + s_i = g_i \tag{6}$$

Under the matching grant system, the subsidies that the regional government receives are represented by:

$$s_i = m_i g_i, \tag{7}$$

where m_i is a matching grant rate. h_i in (5) is determined so that the budget constraint for the central government can be fulfilled.

Supposing the regional government maximizes the utility of the residents, the optimization problem for the regional government can be formulated as a problem to maximize $u_i = u(x_i, G_i)$, subject to (4) to (7). The first order condition can be obtained as $u_g^i = u_x^i (1 - m_i)$ by maximizing the tax rates z_i , given the tax rates z_j of other region *j*. On the other hand, since the Pareto optimal condition is represented by $u_g^i + \beta \sum_{j \neq i} u_g^j = u_x^i$, the optimal subsidy rate can be obtained as follows:

$$m = \frac{\beta(n-1)}{1+\beta(n-1)} \tag{8}$$

From (8), the following can be obtained as characteristics of the traditional subsidy rule.

Characteristics of the optimal subsidy rule

- (1) $\partial m/\partial \beta > 0$: As the degree of spillover increases, the optimal subsidy rate increases.
- (2) $\partial m/\partial n > 0$: As the number of regions increases, the optimal subsidy rate increases.

The subsidy rule obtained here has, at least, two policy implications. The first characteristic will give validity to the idea that the subsidy rate differs by public service project (e.g., education, welfare, and roads) from an economic perspective. That is to say, because the degree of the benefit spillover of a certain public good differs from other public goods, the central government will subsidize each public service project based on a different matching grant rate. The second characteristic is used as a theoretical basis for considering the relationship between municipal mergers causing the internalization of spillover effects and the reduction of subsidies.

IV. Roles of Spillover in the Fiscal Competition Model

Traditional arguments regarding regional public goods, made by Williams (1966) and Oates (1972), are associated with the voluntary provision of public goods when public goods providers are changed from individuals to regional governments. In the analysis in the previous section, which simply utilizes the theory of voluntary provision of public goods, however, several regions are linked with one another only when the benefits of public goods regionally provided spill over. Therefore, it is difficult to say that factors peculiar to regional analyses (e.g., the choice of regions by residents or firms, and capital mobility) are fully reflected in the analysis. Considering the emergence and development of the fiscal competition model during and after the 1980s, we should consider the new relationships that have emerged among public goods providers which were previously linked with one another by the spatial external effects of public goods. Bjorvatn and Schjelderup (2002) point out that capital mobility, in addition to spillover effects, becomes a factor for creating mutual relationships among economic agents, and unified fiscal competition model and the model of voluntary provision of public goods.

This chapter introduces studies that reexamine the relationships between spillover effects and the optimal subsidy rule within the framework of the fiscal competition model based on the traditional models mentioned in the previous chapter¹⁵.

IV.1. Optimal Subsidy Rule

The basic model is the same as the ones mentioned in Sections II.1 and III.2. The economy consists of n homogeneous regions, and the population of each region shall be 1. Unlike the model in Section III-2, this section explicitly considers the production sector. The production function of region i is represented by $f(k_i, l_i)$, where k_i represents the amount of capital in region i. The capital of k exists in the whole economy, and that capital freely moves among regions to seek higher profits. Then, each regional government finances local public goods with taxes on the capital that exists in its region, and the tax rates on the capital shall be represented by t_i . In this case, the capital in equilibrium will be allocated among regions so that (1) and (2) can be satisfied. The budget

constraints for the residents in region *i* shall be represented by $x_i = f(k_i) - f_k(k_i) k_i + r k_i - h_i$, where h_i is the lump-sum taxes collected by the central government to finance matching grants. The budget constraints for the regional government will be $t_i k_i + s_i = g_i$, where the subsidies s_i is represented by (7).

¹⁵⁾ The analysis in this section relies on Bjorvatn and Schjelderup (2002), and Ogawa (2005). In this section, the situation where public spending provides other regions with external benefits is the subject of analysis. In contrast, Olsen and Osmundsen (2003) examine the situation where direct investment from overseas affects external benefits by raising the productivity of domestic capital.

The maximization problem of the regional government can be formulated as follows:

$$\operatorname{Max}_{t_{i}} u_{i} = u \left[f(k_{i}) - f_{k}(k_{i})k_{i} + r\overline{k_{i}} - h_{i}, \frac{t_{i}k_{i}}{1 - m} + \beta \sum_{j \neq i} \frac{t_{j}k_{j}}{1 - m} \right]$$
(9)

Using (9), the optimal subsidy rate in the fiscal competition model can be obtained as follows (see Appendix).

$$m = \frac{\phi(n-1) + \varepsilon(1-\beta)}{1+\beta(n-1)},$$
(10)

where $\varepsilon \equiv -(\partial k_i/\partial t_i)(t_i/k_i)$ is the tax elasticity of capital demand, and represent to what degree capital demand is sensitive to the tax rate. As can be easily understood, supposing that capital does not move among the regions ($\varepsilon = 0$), (8) and (10) will agree with each other. However, in the case of $\varepsilon > 0$, the following interesting characteristic will be obtained as an optimal subsidy rule.

Characteristic of the optimal subsidy rule (fiscal competition model)

 $\partial m/\partial \beta > 0$: the relationships between the degree of spillover and the optimal subsidy rate are ambiguous¹⁶.

The above characteristic is obvious when we see the polar cases; $\beta = 0$ and $\beta = 1$. To satisfy $m|_{\beta=1} > m|_{\beta=0}$, as considered in the traditional models, $\varepsilon < (n - 1)/n$ must hold. Conversely, when (11) holds, in which the inter-regional capital mobility is sufficiently high, the degree of spillover will have a negative relationship with the optimal subsidy rate.

$$\varepsilon > (n-1)/n \tag{1}$$

Figure 2 shows the area where (11) holds. For instance, in the case of n = 2, in which a subject of analysis is taken as fiscal competition between Europe and the USA, when $\varepsilon > 0.5$, the degree of spillover will have a negative relationship with the optimal subsidy rate¹⁷⁾.

¹⁶⁾ Although there is no generality, given $\partial \varepsilon /\partial \beta = 0$, the sign condition of $\partial m /\partial \beta$ will be determined by ε and the size of (n - 1)/n. Also, given $\partial \varepsilon /\partial \beta = 0$, $\partial m /\partial n > 0$ will be obtained. The results of the comparative statics analysis regarding the number of regions have also obtained by Hoyt (1991), Sato (2003) and others. According to their studies, if the number of regional governments decreases, the distortion of resource allocation with fiscal externality will become smaller, and thus, their studies will give us an interesting perspective when considering issues related to municipal mergers here in Japan.

¹⁷⁾ Parry (2003, p. 46–47) states that it will be most suitable that the value of ε is between 0.1 and 0.8.

IV.2. Fiscal Externality and Spatial Externality

0.5

In the model shown in the previous section, there is a possibility that when the degree of spillover effects becomes larger, the optimal subsidy rate will become smaller. This result can be understood as follows. Two reasons exist why the allocation of resources is distorted in this economy. One reason is that regional public goods involve spillover effects, and the other is that the setting of tax rates involves fiscal externality. As Wildasin (1989) points out, fiscal externality will appear when a regional government changes tax rates, and such decision is considered not to fiscally affect other regions. For instance, when a region *i* changes the tax rates t_i , the tax revenues of regions other than *i* must change by $\sum_{j \neq i} t_j (\partial k_j / \partial t_i)$. However, the region *i* does not consider these external effects at the time of the change in its tax rates t_i .



2

Figure 2. The Area Where the Degree of Spillover Has a Negative Relationship with Subsidy Rates

Actually, it is no surprise that a distortion of resource allocation may occur, caused by some externalities in decentralized decision-making systems. Therefore, if such externalities are discussed in a way in which subsidy policies are analyzed in this paper, the issue is the degree of welfare loss caused by such externalities. Wildasin (1989), by using the concept of the dead-weight loss, measures the loss arising from tax competition, based on the numeric data of the USA. According to his analysis, the loss is equivalent to 8.2% of the public spending, and supposing that the public spending accounts for 30 to 40% of GDP, the loss of resources caused by fiscal externality is equivalent to 2.46 to 3.28% of GDP. According to the study of Parry (2003), who improves the measuring technique of Wildasin (1989) by using more flexible assumptions, the loss arising from resource allocation accounts for a little less than 5% of the public expenditure. A loss accounting for 2 to 3% of GDP cannot be ignored, and thus, prescriptions for correcting the fiscal externalities arising from decentralized

 $\varepsilon = (n-1)/n$

п

policy-decisions have been required to be included in subsidy policies¹⁸).

In addition to the presence of fiscal externality, regional public goods have spillover effects in this economy. Because of the presence of spillover effects, a region *i* considers effects on the tax revenues of other regions when establishing its tax rates. Let's consider the case of $\beta = 1$, for instance. Now, as evidenced from the right-hand side of the formula (A1) in the Appendix, the region *i* definitely considers the effects on the tax revenues of other regions $[\sum_{j\neq i} t_j (\partial k_j / \partial t_i)]$ when determining tax rates t_i . From this point of view, not only does β represent the degree of spillover effect, but it is also an indicator for considering the degree of effect on other regions when a certain regional government establishes tax rates. Large β means that spillover effects are large, and it will become a factor for distorting the allocation of resources. However, since it also means that the degree of redressing the distortion of the resource allocation associated with fiscal externality is large, it cannot be definitely determined whether the optimal subsidy rates from the central government become larger or smaller.

Traditionally, it has been thought that the distortion of resource allocation arising from spillover effects, which are unavoidable in a decentralized finance system, is a source of headache, but actually, there is a possibility that spillover effects will be a blessing in the sense that the presence of such effects contribute to the improved efficiency of resource allocation in hindsight, because a regional government negates fiscal externality by establishing uncoordinated tax rates. In an inter-regional fiscal competition for capital, the traditional meaning of spillover effects of public goods may change greatly. With the globalization of economy and society, the fact that capital easily moves beyond jurisdictions and inter-regional fiscal competition is under way, requires us to reconsider the effects of spatial externalities or fiscal externalities.

IV.3. Choice of Policy Variables: Reconsideration

The discussion about fiscal competition with spillover effects described in the previous section, is based on the "tax competition" in which tax rates on capital are taken as a policy variable according to Zodrow and Mieszkowski (1986), and others. In their discussion, it is assumed that there are a sufficient number of regions, and that these are all homogeneous. In this model, the equilibrium depends on whether the governments choose tax rates or public expenditures as a policy variable. The issue of the choice of policy variables is reconsidered in this part.

As in the previous section, suppose the preference of the residents of the region *i* is represented by $u(x_i, g_i + \beta g_j)$, and the budget constraints by $t_i k_i = g_i$. Let us consider a situation where the regional government takes the tax rate t_i as a policy variable and raises such rates. Now, since the regional government *i*, following the normal Nash conjecture, takes the tax rate t_j of the region *j* as given, the raising of tax rates will lead to an increase in the amount of public goods g_j of the other region, and the spill-in of the benefits of public goods from *j* to *i* is expected to become larger. This occurs because the regional government *i* knows that the raising of the tax rates t_i , will lead capital to flow out of its region and go to other regions. Since the tax rate t_i is defined as given, an

¹⁸⁾ DePater and Myers (1994), Bucovetsky et al. (1998), and others, in addition to Wildasin (1989), propose subsidy systems desirable for the central government.

increase of k_j will lead to an increase of g_j in hindsight.

In the meantime, let us consider a situation where the regional government chooses the expenditures as a policy variable, and increases them. Now, since the regional government *i* chooses the expenditure g_j of the region *j* as given, and the raising of the public expenditure g_i causes the rise of the tax rate t_i , capital outflow from the region *i* to the region *j* occurs. Now, as the region *j* receives the external benefits-- the amount of capital k_j increases-- the region *i* will predict that the increase of g_i will lead to the decrease of t_j in hindsight because region *i* acts given the expenditure g_j of the other region.

As just described, if a region chooses tax rates as a policy variable, it takes the tax rates of the other region as given. Therefore, when the region changes its tax rates, the other region is considered not to aggressively respond to such change by changing its tax rates as well. And then, with the raising of tax rates, the public goods in the other region increases, which in turn positively affect what should be called spill-in effects. On the other hand, if a regional government chooses expenditures as a policy variable, the other region aggressively responds to such decision in hindsight by changing its tax rates. Furthermore, even if the region changes its policies, this change does not affect the public goods of the other region, and thus, such secondary spill-in effects are considered not to occur. Judging from the above, if spillover effects are perceived as described in the previous section, it is to be expected that the equilibrium differs between tax competition and expenditure competition, and that when compared with a situation where there are no spillover effects, the latter competition will generate a more inefficient situation than the former.

V. Conclusion

This paper has analyzed fiscal competition generated in an economy where the tax base moves among regions, and reviewed the focal points of several topics for analysis. The first half of this paper considered the issue of the endogenous choice of policy variables, which is raised by Wildasin (1991). In the first half, the following points were clarified: the policy instrument endogenously chosen by a regional government depends on the characteristics of regional public spending - that is, whether such spending directly provides benefits to the residents, or whether it indirectly affects the utility of the residents by raising the regional productivity as a public input - and whether public spending is fraught with spillover externality. By explicitly addressing these two factors in the fiscal policy analysis, analytical study concerning fiscal competition has greatly expanded. As for the former factor (public input vs. public good), this study has subsequently succeeded in checking the robustness of the conventional results. Furthermore, this study also contributes to the establishment of the new issue of whether to participate in fiscal competition. Also, it is now possible to merge fiscal competition theories, environmental economic theories, and the theory of voluntary provision of public goods altogether, as the spillovers are now explicitly considered in fiscal competition models.

The second half of this paper, based on fiscal competition models with spatial externalities, reviewed the spillover effects of public goods. Traditionally, if the spillover effects of regional public services became larger, regional public services were underprovided compared with the optimal level. So, it was thought that in order to remedy such underprovision, it was necessary to implement policies through subsidies. By using the model of

matching grant policy, this paper has introduced studies which find out that spillover effects have a new role apart from the factors that have previously been thought to distort the allocation of resources. Specifically, we find that an increase in spillovers may contribute to remedy distortions due to fiscal externality.

Inter-regional tax base mobility has been affecting Japan more and more strongly, not to mention European integration. In addition, issues of the spillover effects of regional public goods not only occur among regional governments within a country, but also issues related to policy benefits arising from such effects occur between countries. New findings on the role of spillovers in the tax competition model appear to offer an important perspective on the role of policy intervention by the central government.

Appendix

Supposing that the regional government *i* decides its tax rate t_i given the tax rate t_j of another region, the first order condition for the optimization problem represented by (9) can be obtained as follows.

$$\frac{u_g^i}{u_x^i} = \frac{(1-m)[k_i - (\bar{k}_i - k_i)(\partial r / \partial t_i)]}{k_i[1 + (\partial k_i / \partial t_i)(t_i / k_i)] + \beta \sum_{j \neq i} t_j(\partial k_j / \partial t_i)}$$
(A1)

Now, the comparative statics results show that $\partial k_i / \partial t_i < 0$, $\partial k_j / \partial t_i > 0$, and $\partial r / \partial t_i < 0$. By using these relationships, (A1) can be rewritten as follows.

$$\frac{u_g^i}{u_x^i} = \frac{(1-m)}{1-\varepsilon(1-\beta)}.$$
 (A2)

By comparing (A2) with the Pareto optimal condition, we obtain (10).

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