Centralized versus Decentralized Decision Making with Regard to the Corporate Tax Rate

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Abstract

This paper analyzes who should set the corporate tax rate by using a model that includes a spillover effect, a tax export effect, and asymmetric information on residents' preference for the public good. We conclude that when both regions' tax export effects are small (except for cases in which the difference in the public good preference is strong), the centralized (decentralized) system is socially preferred for a larger (smaller) spillover effect. When the tax export effect of one region is small and that of the other is medium-sized, the decentralized system is socially preferred for its larger spillover effect.

1. Introduction

Japan's centralized system of government is beset with many problems. For instance, the government seems increasingly unable to provide services to fit the particular needs of various regions of the country. Recently, it has been argued that in order to solve such problems, the central government should delegate its authority pertaining to the provision of political services to local governments; that is, it should decentralize (e.g., Kaizuka (2008), pp. 118–119). We believe that the decisions made by local

governments are based on more accurate assessments of regional needs.

Decentralization concerns (1) the delegation of taxing autonomy and (2) the overhaul of the subsidization system. In order to examine the delegation of taxing autonomy, the influence of spillover effects on the supply of public goods must be considered, as benefits from the public good accrue not only to the region in question but also to other regions.

Earlier studies dealing with spillover effects have demonstrated that the tax rate chosen under decentralization is typically lower than the socially optimal rate. Oates (1972) presented analyses of the transfer of income tax under a spillover effect and the endogenous residents' income and demonstrated that an inadequate income tax rate was implemented.[1] Zodrow and Mieszkowski (1986) analyzed a case in which the local government was granted autonomy with respect to capital tax and showed that intense tax competition occurred and that an inadequate capital tax rate was implemented.

While earlier studies related to the transfer of taxing autonomy discussed income taxation and capital taxation, they seldom addressed corporate tax. However, as presented in Figure 1, both income tax and corporate tax are major contributors to tax income in Japan. Therefore, in order to discuss the transfer of taxing autonomy, we must also consider the corporate tax rate.

Figure 1 A Detailed Account of Tax Income in Japan (2009)

While considering the corporate tax rate for an immobile firm, we should remember that residents typically hold stocks in various firms. If a resident of one region holds the stock of a firm belonging to its own region as well as that belonging to a firm in another region, it is possible that an inefficient policy decision may result from decentralization. That is, because each local government determines the corporate tax rate without considering other regions, its tax rate becomes higher than the socially preferable one. This inefficiency is called the "tax export effect" (McLure, 1969).[2]

In addition to the tax export effect, under decentralization, the decision by a local government yields another conflicting inefficiency: the free-rider problem caused by the spillover effect (e.g., Oates (1972)). It is well documented that the spillover effect leads to an adequate tax rate. Therefore, when considering the corporate tax rate, we should include both the traditional spillover effect and the tax export effect. Furthermore, when considering the characteristics of the spillover effect and the export effect simultaneously, we cannot intuitively conclude whether a tax rate is excessive or inadequate. In other words, before tax rate autonomy is transferred to the local

government, it is crucial to determine whether an excess tax rate or an inadequate tax rate would be realized.

Because the central government cannot ascertain residents' actual preference related to the public good under a centralized system, it cannot determine the socially optimal tax rate (e.g., Besley and Coate (2003)). Therefore, the question arises as to whether it is socially preferred for the local government or the central government to decide the corporate tax rate. We cannot readily determine the solution to this important issue.

Recent studies of political economics have investigated the comparison of financial systems (centralized vs. decentralized) in situations in which there is asymmetric information between residents and the government. For example, Besley and Coate (2003) argued that the centralized system cannot always achieve the first-best solution because of tacit information asymmetry between residents and the central government.[3] However, when the spillover effect is large, the centralized system is socially preferred even though the first-best situation is not realized. Lockwood (2002) analyzed a problem similar to that described by Besley and Coate (2003) and showed that when the spillover effect is small, decentralization is socially preferred.[4]

It is noteworthy that the result concerning the preference for a centralized system when the spillover effect is large holds for income taxation when no tax export effect

exists (e.g., Besley and Coate (2003)).[5] However, we cannot intuitively determine whether the result described above also holds for corporate taxation when the tax export effect exists.

Given these facts, this paper presents an analysis of the corporate tax rate under circumstances where the supply of a public good accompanies the spillover effect. Using a basic idea presented by Krelove (1992) for our analysis,[6] we assume that the shares of a firm's stock differ among regions. Thus, we can analyze the financial system for a situation of asymmetric regions. First, we analyze a centralized system in which the central government cannot realize the representative resident's actual preference for the public good. Following this, we analyze the decentralized system. Finally, we compare the centralized and decentralized systems and present a conclusion as to which financial system is socially preferred.

The analyses described in this paper point to the following conclusions. First, under the centralized system, if the actual preference for the public good is strong (weak), then the central government determines a tax rate that is lower (higher) than the socially optimal one. This result might be readily apparent.

Under the decentralized system in which each local government determines the corporate tax rate, if the representative resident in one region has many shares of stock

of firms in its region, the tax rate becomes lower than the socially optimal rate. Otherwise, the tax rate becomes excessively high. In addition, when the spillover effect is small, the range within which an inadequate tax rate (excessive tax rate) is realized becomes large (small) as the spillover effect increases. On the other hand, with a large spillover effect, the range within which an inadequate tax rate (excessive tax rate) is realized becomes small (large) as the spillover effect increases.

We analyze which system is socially preferred: centralized or decentralized. The results show that when the tax export effect in both regions is small, if the spillover effect is small, the decentralized system is socially preferred. If the spillover effect is large, the centralized system is socially preferred. When the tax export effect of one region is small and that of the other is medium-sized, if the spillover effect is small, the centralized system is socially preferred; if it is large or medium-sized, the decentralized system is socially preferred. When at least one region's tax export effect is large, the centralized system is socially preferred for any degree of spillover effect.

When the difference in the public goods preference is large, if the tax export effect in both regions is medium-sized and the spillover effect is large (small), then the decentralized system (centralized system) is socially preferred. When at least one region's tax export effect is large (small), the centralized system (decentralized system)

is socially preferred for any degree of spillover effect.

This paper is organized as follows. Section 2 establishes the model used for these analyses. In Section 3, we analyze the labor market and derive the equilibrium wage, the private firm's profit, and the tax revenues. Using these results, Section 4 formulates the first-best solutions. In Section 5, we analyze the situation in which the central government, which is unable to ascertain the representative resident's actual preference for the public good, determines the corporate tax rate. Conversely, in Section 6, we examine the situation in which the local government determines the corporate tax rate. In Section 7, based on the results from Sections 5 and 6 and comparing the social welfare in the two cases, we examine the question of who should determine the corporate tax rate. In Section 8, we conclude and propose directions for future research.

2. Model

We consider a country with two regions: region 1 and region 2. Each region has one representative resident and one private firm. No inter-regional migration exists because of high traveling costs.

Each resident has one unit of labor and supplies it to the private firm in the resident's own region. As compensation, each resident earns a wage. Each private firm demands labor and produces a private good. Each resident obtains an income—the wage from its

firm and the dividend from both firms—and consumes the private good using this income. Under a centralized system, the central government imposes a corporate tax on each firm's profit and obtains tax revenue. Using this tax revenue, the central government supplies a local public good to each region. Under a decentralized system, each local government imposes a corporate tax on the firm and gains tax revenue. Using the tax revenue, each local government supplies a local public good. We assume that the local public good to be supplied has a positive spillover effect. Hereafter, for the sake of simplicity, we refer to the local public good as the "public good."

2.1 Resident in Region i

The resident in region i gains a benefit from the consumption of the private good and the public good. Here, it is noteworthy that because the public good has a spillover effect, the benefit from the public good depends on both region i's and region j's public goods. Therefore, the utility function is assumed as follows.

$$u_i = x_i + \theta(q_i + \lambda q_j)^{\frac{1}{2}}. \tag{1}$$

The term x_i denotes consumption of the private good. The term q_i (q_j) refers to the supply of the public good in region i (j). The parameter θ signifies the preference for the public good, which is either strong ($\overline{\theta}$) or weak ($\underline{\theta}$). Here, we assume that the

preference is equal in the two regions.[7] Parameter λ is the degree of the spillover effect. It is assumed that $0 \leq \lambda \leq 1$.

When the resident supplies one unit of labor to the private firm in its region, the resident gains wage income w_i. Additionally, we assume that the resident has s_i stock of the firm in the region where the resident lives[8] and $(1 - s_j)$ stock of the firm in the other region.[9] On account of this stock portfolio, the resident receives dividends from each firm. Using the income thus gained, each resident consumes the private good. Therefore, the budget constraint of a resident in region i is

$$x_i = w_i + s_i\pi_i + (1 - s_j)\pi_j. \quad (2)$$

In Equation (2), the terms π_i and π_j signify the profit of each private firm after taxation.

2.2 Private Firm in Region $\boldsymbol{i}$

Each private firm demands labor from its region and produces a private good. This paper omits an investigation of the market for the private good and assumes that the good is a numeraire. For example, if excess demand exists, the good is imported from foreign countries, while if excess supply exists, the private good is exported to foreign countries. Therefore, the price of the private good can be kept constant. In addition, for these analyses, we assume that the private good is used for consumption by the resident

and for the production of the public good.[10]

We denote the supply of private goods in region i by y_i. Then, the production function is assumed as

$$y_i = L_i^{\frac{1}{2}}. \tag{3}$$

Here, the term L_i denotes the supply of labor in region i.

The before-tax profit of the private firm in region i is denoted by Π_i.

$$\Pi_i = L_i^{\frac{1}{2}} - w_i L_i. \tag{4}$$

The local government (central government) imposes a corporate tax at rate t_i. Therefore, the after-tax profit is

$$\pi_i = (1 - t_i)\left(L_i^{\frac{1}{2}} - w_i L_i\right). \tag{5}$$

2.3 Local Government in Region $\boldsymbol{i}$

The local government imposes a tax at rate t_i on the private firm in region i and gains revenue. Using this tax revenue, it supplies the public good. This paper assumes that the marginal cost to supply the public good equals c. Consequently, the budget constraint of the local government is

$$cq_i = t_i \Pi_i. \tag{6}$$

The local government ascertains the resident's actual preference for the public good

in region i and determines the corporate tax rate to maximize the resident's utility—the social welfare in region i—subject to the budget constraint.

2.4 Central Government

The central government imposes a common corporate tax on each private firm and thereby gains tax revenue. Using this revenue, it supplies the public good to each region. Therefore, the budget constraint for the central government is

$$c(q_1 + q_2) = t \sum_{t=1}^{2} \Pi_i. \tag{7}$$

The central government is unable to discern the representative resident's actual preference for public goods. However, the central government knows that the probabilities of the representative resident having a weak preference (that is, $\underline{\theta}$) or a strong preference (that is, $\overline{\theta}$) are p and $1-p$, respectively.[11] Consequently, the central government determines the corporate tax rate for each private firm to maximize the expected social welfare subject to the budget constraint.

We explain the timeline of the game below. Under centralization, the central government chooses the corporate tax rate t. Thereafter, the wage is determined in the labor market. Then, the private firm produces the private good and the government gains tax revenue. Using the revenue, the government provides the public good. The

resident gains utility by consuming these goods.

The timeline remains the same under decentralization except that the local government determines the corporate tax rate t_i.

3. Analysis of the Labor Market, Equilibrium Wage, and Profit of the Private Firms

This section presents the analysis of the labor market and derives the equilibrium wage and profit of each private firm. After deriving these outcomes, we specifically examine the budget constraints of the resident and the local and central governments.

Each private firm determines its labor demand to maximize its after-tax profit. The representative resident supplies one unit of labor to the private firm. Thus, in the labor market, the equilibrium wage is $w_i^* = \frac{1}{2}$.

Consequently, the local government (central government) imposes a corporate tax t_i on the profit and gains tax revenue T_i, which is given as[12]

$$T_i = \frac{t_i}{2}. \tag{8}$$

The net profit (namely, the after-tax profit) of each private firm is

$$\pi_i = \frac{1 - t_i}{2}. \tag{9}$$

Here, the residents share the net profit. Consequently, the total income of each

resident is the sum of the wage income and the shared income. Income, I_i, is derived as

$$I_i = \frac{1 + s_i(1 - t_i) + (1 - s_j)(1 - t_j)}{2}. \tag{10}$$

Considering that this income is spent to consume the private good, the demand for the private good is given as

$$x_i = \frac{1 + s_i(1 - t_i) + (1 - s_j)(1 - t_j)}{2}. \tag{11}$$

As a result, social welfare in each region is derived by substituting the demand for the private good into the resident's utility function. We denote region i's social welfare by W_i and derive it as

$$W_i = \theta(q_i + \lambda q_j)^{\frac{1}{2}} + \frac{1 + s_i(1 - t_i) + (1 - s_j)(1 - t_j)}{2}. \tag{12}$$

In the following analysis, Equation (12) is used to derive the corporate tax rate.

4. The First-best Solution

In this section, we assume that the central government ascertains the representative resident's actual preference for the public good and analyzes the optimal corporate tax rate. The central government determines the corporate tax rate to maximize the sum of each region's social welfare subject to the budget constraint. Here, the sum of each region's social welfare is given as

$$SW = \theta(q_1 + \lambda q_2)^{\frac{1}{2}} + \theta(q_2 + \lambda q_1)^{\frac{1}{2}} + \frac{4 - t_1 - t_2}{2}. \tag{13}$$

In addition, the budget constraint for the central government is

$$q_1 + q_2 = \frac{t_1 + t_2}{2c}. \tag{14}$$

Here, we focus on the symmetric outcomes ($t_1 = t_2$) because we consider two symmetric regions. Considering the symmetric outcomes, we can derive the first-order condition to maximize social welfare as

$$\frac{\theta(1+\lambda)}{4c}\left(\frac{(1+\lambda)t}{2c}\right)^{-\frac{1}{2}} = \frac{1}{2}. \tag{15}$$

The left-hand side of Equation (15) shows the sum of each region's marginal benefit from the public good. The right-hand side gives the marginal cost as the reduction in the consumption of the private good. In other words, Equation (15) implies that the Samuelson condition holds.

Solving the first-order condition above, we obtain the following optimal corporate tax rate as

$$t^{FB} = \frac{(1+\lambda)\theta^2}{2c}. \tag{16}$$

Here, we assume that $c > \frac{(1+\lambda)\theta^2}{2}$ holds so that the tax rate is less than 1.[13] When the spillover effect increases, the optimal tax rate also increases, the reasoning being that when the degree of the spillover effect increases, the marginal benefit from the public good also increases. The higher the marginal benefit is, the higher the corporate tax rate set by the central government becomes.

5. Analysis of a Centralized System

This section derives the logic for the determination of the corporate tax rate when the central government is unable to discern the representative resident's actual preference for the public good. The probability that this preference is weak is assumed to be p. In the centralized system, the central government is assumed to set a common tax rate t for both regions. Therefore, the expected social welfare function is

$$EW = p\left\{\underline{\theta}(q_1 + \lambda q_2)^{\frac{1}{2}} + \underline{\theta}(q_2 + \lambda q_1)^{\frac{1}{2}}\right\} + (1-p)\left\{\overline{\theta}(q_1 + \lambda q_2)^{\frac{1}{2}} + \overline{\theta}(q_2 + \lambda q_1)^{\frac{1}{2}}\right\} + \frac{4 - t_1 - t_2}{2}. \quad (17)$$

The budget constraint for the central government is $q_1 + q_2 = \frac{t}{c}$. The central government determines the tax rate to maximize the expected social welfare subject to the budget constraint. Although the system to determine the tax rate is simple, this setup maintains generality because the first-best solutions are not always realized because of incomplete information.

The first-order condition to maximize the expected social welfare is

$$\frac{(p\underline{\theta} + (1-p)\overline{\theta})(1+\lambda)}{4c}\left(\frac{(1+\lambda)t}{2c}\right)^{-\frac{1}{2}} = \frac{1}{2}. \quad (18)$$

The left-hand side of Equation (18) refers to the sum of the expected marginal benefits from the public good. Its right-hand side gives the marginal cost as a reduction in the demand for the private good. From the calculation presented above, we can obtain

the tax rate chosen by the central government as

$$t^{CG} = \frac{1}{2c}(1+\lambda)(\overline{\theta}(1-p) + p\underline{\theta})^2. \quad (19)$$

When the spillover effect increases, the tax rate also increases, the reasoning being that when the spillover effect becomes large, the expected marginal benefit from the public good also increases. The greater the marginal benefit is, the higher the tax rate can be set.

Next, comparing the centralized case with the first-best case, we obtain Proposition 1.

Proposition 1

When the public good's actual related preference is $\theta = \overline{\theta}$ ($\underline{\theta}$), *the central government sets a tax rate that is lower (higher) than the socially optimal tax rate.*

Proof

Consider the case in which the actual preference is $\theta = \overline{\theta}$. Then, the difference between t^{FB} and t^{CG} is given as

$$t^{FB} - t^{CG} = \frac{1}{2c}(1+\lambda)p(\overline{\theta} - \underline{\theta})(2\overline{\theta} + p(\underline{\theta} - \overline{\theta})) > 0. \quad (20)$$

Consequently, the central government determines a tax rate that is lower than the socially optimal rate.

Next, consider the case in which the actual preference is $\theta = \underline{\theta}$. Then, we can derive the difference between t^{FB} and t^{CG} as

$$t^{FB} - t^{CG} = \frac{1}{2c}(1+\lambda)(1-p)(\underline{\theta} - \overline{\theta})(\overline{\theta}(1-p) + \underline{\theta}(1 + p)) < 0. \tag{21}$$

Therefore, the central government sets a tax rate that is higher than the socially optimal one.

This proposition might be readily apparent. Even when the actual preference is $\overline{\theta}$, for the central government, the probability that the preference is $\underline{\theta}$ remains p. The result is a marginal benefit from the public good that is less than what is socially optimal. Consequently, the central government sets a corporate tax rate that is lower than the socially optimal tax rate.

Similarly, even when the actual preference is $\underline{\theta}$, for the central government, the probability that the actual preference is $\overline{\theta}$ remains $1-p$. This yields an overvaluation of the public good's marginal benefit. Therefore, the central government sets a corporate tax rate that is higher than what is socially optimal.

6. Analysis of a Decentralized System

This section analyzes the situation in which each local government determines its corporate tax rate to maximize social welfare. Here, social welfare in region i is given

as Equation (12). In addition, the budget constraint may be written as

$$q_i = \frac{t_i}{2c}. \tag{22}$$

Solving the social welfare maximization problem, the following first-order condition is obtained:

$$\frac{\theta}{4c}\left(\frac{t_i}{2c} + \lambda\frac{t_j}{2c}\right)^{-\frac{1}{2}} = \frac{s_i}{2}. \tag{23}$$

The left-hand side of Equation (23) refers to the resident's marginal benefit from the public good in region i. The right-hand side gives the marginal cost arising from the reduced consumption of the private good.

When each local government determines the corporate tax rate to maximize its social welfare, the rate is derived as

$$t_i^{LG} = \frac{\theta^2}{2c(1-\lambda^2)}\left(\frac{1}{s_i^2} - \lambda\frac{1}{s_j^2}\right). \tag{24}$$

Here, to guarantee that t_i^{LG} is non-negative, $\lambda \leq \frac{s_j^2}{s_i^2}$ is assumed. Using comparative static analysis, we obtain the following lemma related to the characteristic of t_i^{LG}.

Lemma 1

Assume that $s_j > s_i$. Then, the following relationship holds.

$$\frac{\partial t_i^{LG}}{\partial \lambda} \geq 0 \Leftrightarrow \lambda \geq \frac{s_j^2 - \sqrt{s_j^4 - s_i^4}}{s_i^2}$$

According to previous research, when the spillover effect (λ) increases, the tax rate imposed by the local government decreases because of free-rider problems (e.g., Oates (1972)). However, Lemma 1 shows that this standard result does not always hold. The reason is as follows. Region i has an incentive to establish a high tax rate because of a tax export effect. However, because region i also has an incentive to free-ride, its tax rate might decrease. We compare the former incentive with the latter. When λ is small, because the incentive for free-riding by region j is small, the former incentive becomes extremely small. Therefore, the incentive of region i to free-ride becomes large. Therefore, as λ increases, the tax rate decreases. Conversely, when λ is large, the former incentive is large. Consequently, region i must increase its tax rate because of a strategic substitution relation. In other words, the tax rate increases with λ.

Comparing the corporate tax rate with the socially optimal one, we obtain Proposition 2.

Proposition 2

When each local government determines its corporate tax rate to maximize its social welfare,

(1) if $\frac{s_i}{s_j} > \{s_j^2(1+\lambda)^2(1-\lambda)+\lambda\}^{-\frac{1}{2}}$, *then* $t^{FB} > t_i^{LG}$ *holds;*

(2) if $\frac{s_i}{s_j} = \{s_j^2(1+\lambda)^2(1-\lambda)+\lambda\}^{-\frac{1}{2}}$*, then* $t^{FB} = t_i^{LG}$ *holds; and*

(3) if $\frac{s_i}{s_j} < \{s_j^2(1+\lambda)^2(1-\lambda)+\lambda\}^{-\frac{1}{2}}$*, then* $t^{FB} < t_i^{LG}$ *holds.*

Proof

The difference between t^{FB} and t_i^{LG} is given as

$$t^{FB} - t_i^{LG} = \frac{\theta^2}{2c}\left\{1+\lambda-\frac{1}{1-\lambda^2}\left(\frac{1}{s_i^2}-\lambda\frac{1}{s_j^2}\right)\right\}. \tag{25}$$

Consequently, if $1+\lambda-\frac{1}{1-\lambda^2}\left(\frac{1}{s_i^2}-\lambda\frac{1}{s_j^2}\right) \geq (<)0$, then $t^{FB} \geq (<)t^{LG}$ holds.

Usually, we tend to believe that when a spillover effect exists, the local government sets a tax rate that is lower than the socially optimal rate because of the incentive to free-ride. In this paper, this phenomenon is apparent when $\frac{s_i}{s_j} > \{s_j^2(1+\lambda)^2(1-\lambda)+\lambda\}^{-\frac{1}{2}}$. However, when $\frac{s_i}{s_j} < \{s_j^2(1+\lambda)^2(1-\lambda)+\lambda\}^{-\frac{1}{2}}$, a contrasting phenomenon is observed.

Here, we must compare the incentive to set a higher tax rate (caused by a tax export effect) with the incentive to set a lower tax rate (caused by a free-ride incentive). First, given s_j, we consider the extreme case in which $s_i = 1$. When $s_i = 1$, the marginal cost from reduced consumption of the private good is the same for both the first-best and decentralized cases. Consequently, because the local government in region i only has an incentive to free-ride under a decentralized system, the tax rate is lower than the

socially optimal rate.

When parameter s_i decreases (that is, when the tax export effect in region i increases), the difference in the marginal cost between the first-best and decentralized systems increases. This difference yields an incentive to set a corporate tax rate that is higher than the socially optimal rate because the local government does not consider the influence on the non-resident's income when deciding the tax rate. This results in the local government's undervaluation of the cost, which engenders a higher tax rate.

7. Who Should Determine the Corporate Tax Rate?

Based on the conclusions from Sections 5 and 6, we present an analysis of who should determine the corporate tax rate: the central government, which cannot ascertain the representative resident's actual preference for the public good, or the local government, which can make a more accurate assessment of regional needs.

The *ex-ante* expected social welfare is defined as

$$ESW = pW(\underline{\theta}) + (1-p)W(\overline{\theta}), \tag{26}$$

where $W(\cdot)$ signifies the social welfare when the actual preference for the public good is $\underline{\theta}$ ($\overline{\theta}$). Using the equilibrium corporate tax rate as derived in Sections 5 and 6, we derive ESW^{CG} (ESW^{LG}) as the expected social welfare in the centralized

(decentralized) system.

$$ESW^{CG} = \frac{1}{2}\left(4 + \frac{((1-p)\overline{\theta} + p\underline{\theta})^2(1+\lambda)}{c}\right) \tag{27}$$

$$\begin{aligned} ESW^{LG} = \{&8c(1+\lambda)s_1^2 s_2^2 + \overline{\theta}^2(1-p)(-s_2^2 + 2(1 \\ &+ \lambda)s_1 s_2^2 + s_1^2(-1 + 2(1+\lambda)s_2)) \\ &+ \underline{\theta}^2 p(-s_2^2 + 2(1+\lambda)s_1 s_2^2 + s_1^2(-1 + 2(1 \\ &+ \lambda)s_2))\}/(4c(1+\lambda)s_1^2 s_2^2) \end{aligned} \tag{28}$$

The calculation associated with the comparison of the two social welfare levels is extremely difficult. Therefore, we use a simulation analysis in which we assume that $\underline{\theta} = 1$, $\overline{\theta} = 2$, and $p = \frac{1}{2}$. Here, the value of c does not influence the results that follow. Therefore, we consider the value of c to satisfy the condition that the tax rate is below one. Additionally, we derive outcomes for four cases depending on s_2.

Figure 2 Comparison of the Expected Social Welfare Levels ($p = 1/2$ and $\overline{\theta} = 2$)

In Figure 2, the bold lines indicate the critical lines of $\lambda = \frac{s_j^2}{s_i^2}$ $(i, j = 1, 2,\ i \neq j)$. Therefore, the range below these lines is valid for this analysis. This argument holds in the figures that follow. From Figure 2, we can summarize the results (as shown in Table 1 and), and we obtain Proposition 3.

Table 1 here.

Proposition 3

When either s_1 or s_2 is small, the centralized system is always socially preferable. When s_2 is medium-sized and s_1 is large, decentralization (centralization) is socially preferable for a large (small) spillover effect. When both s_1 and s_2 are large, a centralized (decentralized) system is socially preferable for a large (small) spillover effect. On the other hand, if s_2 is large and s_1 is medium-sized, a decentralized (centralized) system is socially preferable for a large (small) spillover effect.

In decentralization, our model has two opposite effects: the tax export effect and the spillover effect. Because each local government does not consider how many shares of the non-resident firm its resident has, each local government sets a higher cooperate tax rate than the socially optimal one, which is the tax export effect. On the other hand, because the benefit from local public goods is obtained not only by the resident it provides the goods to but to the other resident as well, each local government has a free-ride incentive, which is the spillover effect. In the following, we discuss how s_1, s_2, and λ influence the results obtained in Proposition 3.

Consider the case where s_2 is sufficiently large (e.g., $s_2 = 0.9$). The tax export

effects in regions 1 and 2 become small when s_1 is large. Consequently, the inefficiency from the effect is small. Then, as demonstrated in various previous studies (e.g., Besley and Coate (2003)), it is apparent that when the spillover effect is large (small), the centralized (decentralized) system is socially preferred.

As s_1 becomes small, the inefficiency from the tax export effect in region 1 becomes large. However, it is noteworthy that this inefficiency is offset by the spillover effect. If the spillover effect is large, the decentralized system is socially preferred because the inefficiency from the tax export effect is sufficiently offset by the spillover effect. If the spillover effect is small, the centralized system is socially preferred for the opposite reason. When s_1 is extremely small, the inefficiency from the tax export effect is very large under the decentralized system. Consequently, the centralized system is socially preferred.

Let us now consider the case where s_2 is medium-sized (e.g., $s_2 = 0.6$). Then, the tax export effect in region 2 becomes large. Therefore, the higher tax export effect offsets the larger inefficiencies from the spillover effect. Our results show that even if the tax export effect in region 1 is small, when the spillover effect is large (small), a decentralized (centralized) system is socially preferred.

Finally, we consider the case where s_2 is small (e.g., $s_2 = 0.35$ or below). In this

case, the tax export effect in region 2 is extremely large. The larger tax export effect exerts a higher tax rate, which reduces social welfare under decentralization. Therefore, for any sizes of the spillover effect and tax export effect in region 1, the centralized system is socially preferred.

We now discuss the degree to which the probability p and the difference of preference for a public good influences the result. First, we change the assumption that $p = \frac{1}{2}$ to $\frac{9}{10}$ to examine the influence of the probability. Figure 3 presents the result.

Figure 3 Comparison of Expected Social Welfare Levels ($p = 9/10$ and $\overline{\theta} = 2$)

When the probability p increases from $\frac{1}{2}$, the probability of being $\underline{\theta}$ becomes high, and the central government recognizes this fact. Therefore, the inefficiency from the asymmetric information between the central government and residents becomes small. In other words, the expected social welfare under the centralized system increases. As depicted in Figure 3, the range within which the decentralized system is socially preferred consequently becomes narrow.

We also show the simulation result obtained when the difference in preference for the public good becomes large (e.g., $\underline{\theta} = 1$ and $\overline{\theta} = 10$). Figure 4 shows the result.

Figure 4 Comparison of Expected Social Welfare Levels ($p = 1/2$ and $\overline{\theta} = 10$)

For larger differences in preference for public goods, the inefficiency under the centralized system becomes large. That is, the expected social welfare under the centralized system decreases. Consequently, the range within which the decentralized system is socially preferred widens, as shown in Figure 4.

8. Concluding Remarks

This paper presented a discussion of which government should determine the corporate tax rate when the local public good has a spillover effect, the central government or the local government. It is assumed that the central government is unable to determine a representative resident's actual preference related to the public good. Given this situation, this paper arrived at the following conclusions. First, when the central government determines the corporate tax rate, the tax rate is determined to be excessive if the actual preference for the public good is small. Conversely, the tax rate is determined to be inadequate if the actual preference is large. This result might be readily apparent because the central government is unable to determine the representative resident's actual preference and evaluates the expected marginal benefit

when deciding the tax rate. Consequently, when the actual preference is strong (weak), the probability that the preference is weak (strong) nevertheless exists. This phenomenon leads to an efficient tax rate.

Next, if the tax export effect in one region is small, the tax rate becomes lower than the socially optimal tax rate because of the spillover effect being higher than the tax export effect. Otherwise, the tax rate becomes excessive because the tax export effect exceeds the spillover effect. In addition, when the spillover effect is small, the range within which an inadequate tax rate (excessive tax rate) is realized becomes large (small) as the spillover effect increases. When it is large, the range within which the inadequate tax rate (excessive tax rate) is realized becomes small (large) as it increases.

Finally, this paper presented an analysis of which government should determine the corporate tax rate. Given a small difference in the preference for the public good, when the tax export effect in both regions is sufficiently small, if the spillover effect is small (large), the decentralized (centralized) system is socially preferred. When at least one region's tax export effect is large or that of both regions is medium-sized, the centralized system is socially preferred for any size of spillover effect. When the tax export effect of one region is small and that of the other region is medium-sized, if the spillover effect is small, the centralized system is socially preferred; if it is large, the

decentralized system is socially preferred.

Given a large difference in the preference for the public good, the decentralized system (centralized system) is socially preferred if the tax export effect in both regions is medium-sized and the spillover effect is large (small). When at least one region's tax export effect is large (small), the centralized system (decentralized system) is socially preferred for any degree of spillover effect.

It is important to point out certain limitations of this study. In conducting these analyses, we assumed that both regions have identical preferences related to public goods. Although this assumption is apparently strong, we can show that the main results obtained in this study almost hold even if the assumption is relaxed. However, deriving this proof (i.e., a detailed analysis of the influence of the asymmetry) did not fall within the scope of this paper. Consequently, more detailed analyses must be conducted using a model that includes asymmetric preferences for public goods.

Moreover, this paper did not address markets for private goods, although the corporate tax might influence the private good market. For that reason, we must analyze who should determine the tax rate using a model that includes a market for the private good. In addition, we assumed that each resident has only one unit of labor; this assumption is also restrictive. Therefore, in future research, the quantity of labor

supplied by one resident should be endogenous.

Finally, this paper did not consider the number of firms in each city, which may be an interesting avenue for exploration. That is, one city may have more firms than another. Under this situation, who should decide the corporate tax rate? We hope to focus on these issues and provide satisfactory answers to them in future research.

Endnotes

1. Williams (1966) presented a result similar to that reported by Oates (1972) using a more intuitive discussion.

2. McLure (1969) conducted pioneering work on the tax export effect. He demonstrated that with regard to the consumption tax, the local government has an incentive to set an excessive tax rate because it can burden residents in its region as well as those in other regions. Krelove (1972), Sandler and Shelton (1972), Arnott and Grieson (1981), Wildasin (1986; 1987a; 1987b), and Wellisch (1993) also discuss the tax export effect.

3. Strictly, the central government provides equal quantities of a public good in two regions with mutually differing preferences related to public goods. We believe that this is because the central government cannot ascertain the exact preferences of residents in different regions. Therefore, our paper interprets this as asymmetric information.

4. Other papers that present discussions of the comparison of financial systems include Williams (1966), Qian and Roland (1998), Laffont and Zantman (2002), Redoano and Scharf (2004), Alesino et al. (2005), Lorz and Willmann (2005), Tomasi and Weinschelbaum (2007), Cheikbossian (2008), Cheikbossian (2008), and Terai (2009).

5. Readers are referred to Angus and Yang (2012) or further details on capital taxation. They proved that the centralized system is socially preferable in the case of perfect mobility of capital

between regions. On the other hand, in the case of imperfect mobility of capital between regions, the decentralized system can be socially preferable.

6. He does not introduce a spillover effect.

7. As described in note 10, this assumption is unlikely to influence the main results of this study.

8. Here, the parameter s_i refers to the possession rate.

9. The portfolio problem is beyond the scope of this paper. However, in future research, we plan to derive these shares endogenously.

10. These assumptions obviate the need to analyze the private good market. Boadway and Keen (1996) adopted this assumption.

11. However, we assume that this probability is common to both regions. Although this assumption is apparently strong, the main results obtained in this study do not change if the difference in the probability between regions is small. If the difference is large, our results may change somewhat. In future research, we plan to relax this assumption and analyze this point in detail.

12. When the central government levies the tax, the revenue is $T_1 + T_2$.

13. This assumption is also used in the following analysis.

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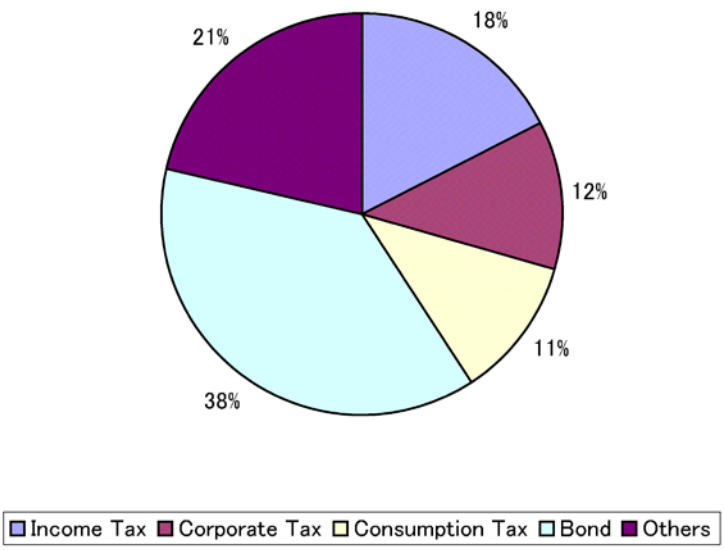
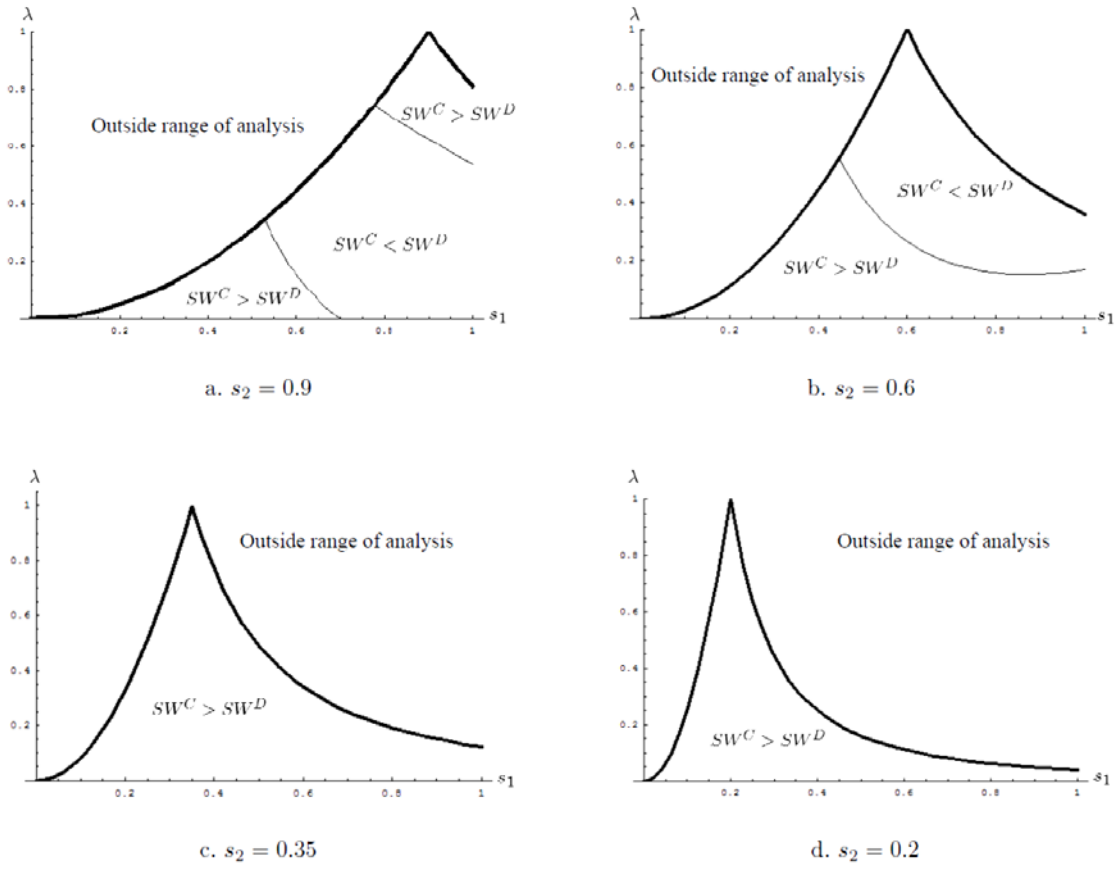
Figure 1 Detailed Account of Tax Income in Japan, 2009



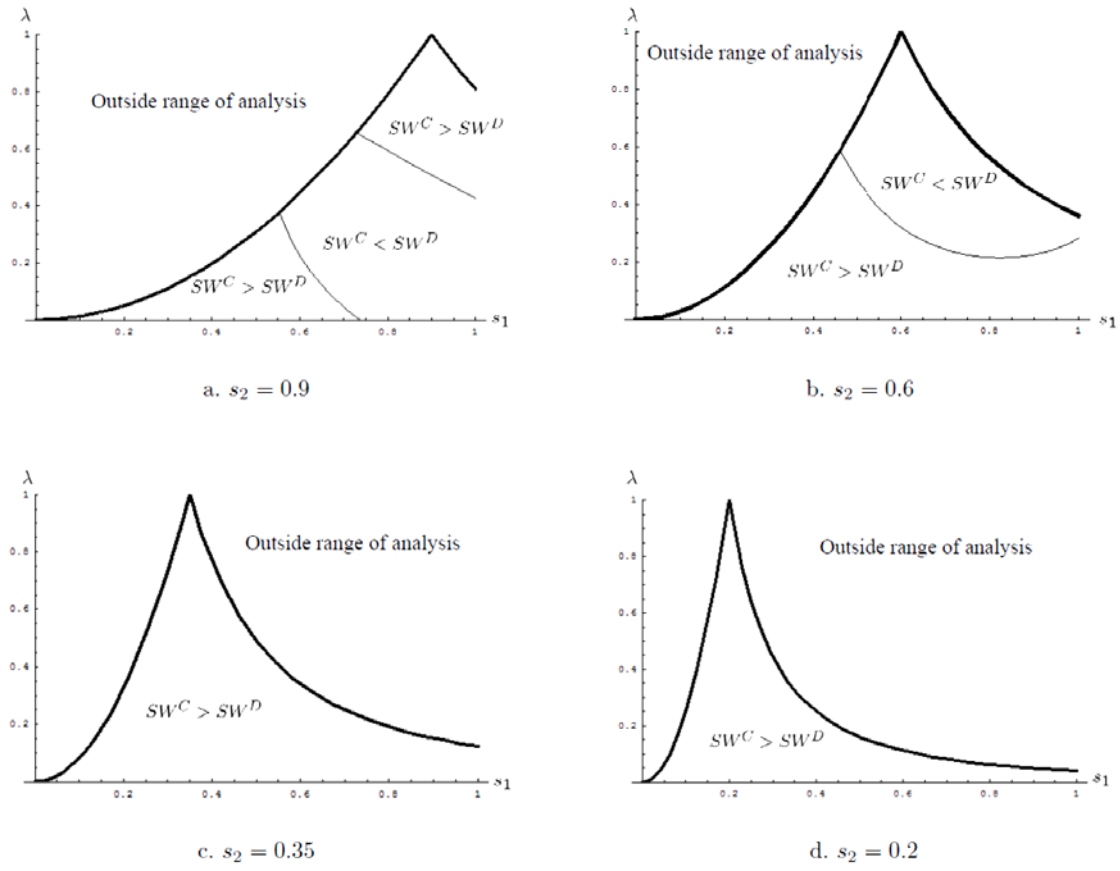
Source: Fukuda (2009)

Figure 2 Comparison of Expected Social Welfare Levels ($p = 1/2$ and $\overline{\theta} = 2$)



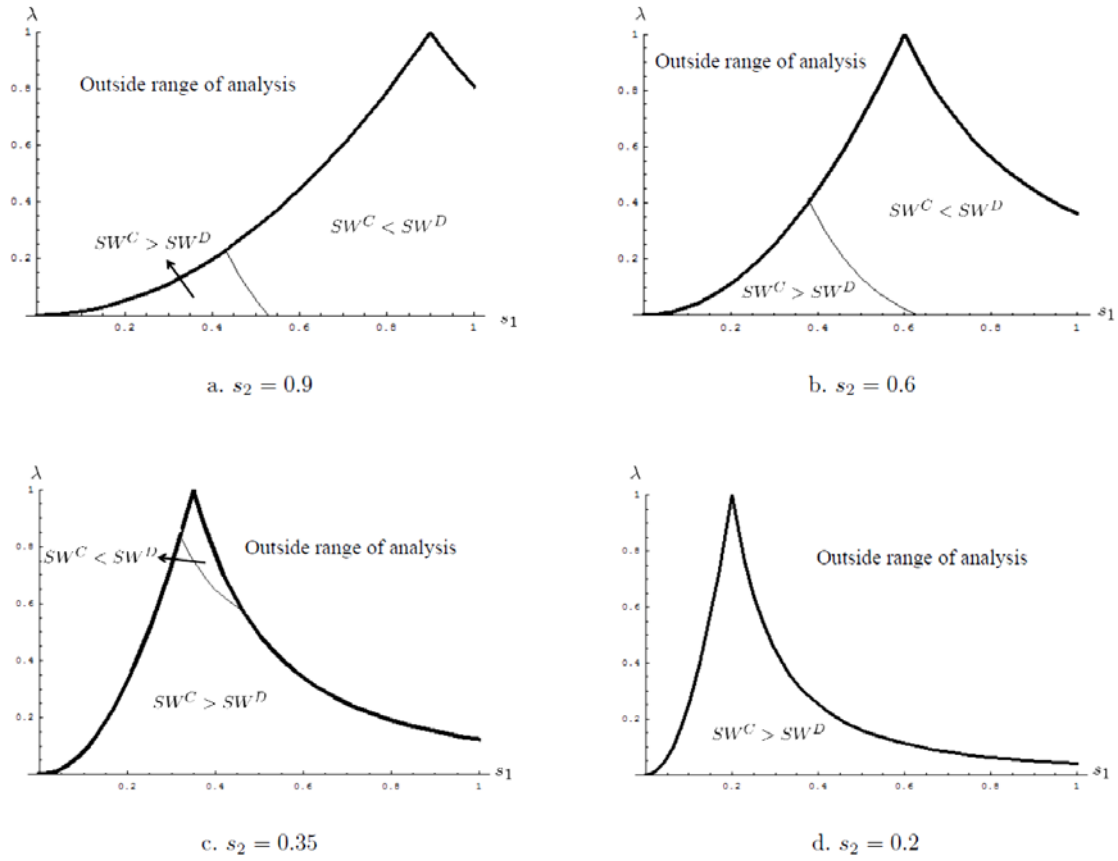
Note: SW^C and SW^D stand for social welfare in a centralised and decentralised system, respectively.

Figure 3 Comparison of Expected Social Welfare Levels ($p = 9/10$ and $\overline{\theta} = 2$)



Note: SW^C and SW^D stand for social welfare in a centralised and decentralised system, respectively.

Figure 4 Comparison of Expected Social Welfare Levels ($p = 1/2$ and $\overline{\theta} = 10$)



Note: SW^C and SW^D stand for social welfare in a centralised and decentralised system, respectively.

Table 1 The summery of outcome

		$s_2 = 0.9$		$s_2 = 0.6$		$s_2 = 0.35$ and 0.2	
		s_1		s_1		s_1	
		large	small	large	small	large	small
λ	large	$SW^C > SW^D$	$SW^C < SW^D$	$SW^C < SW^D$	$SW^C < SW^D$	$SW^C > SW^D$	$SW^C > SW^D$
	small	$SW^C < SW^D$	$SW^C > SW^D$	$SW^C > SW^D$	$SW^C > SW^D$	$SW^C > SW^D$	$SW^C > SW^D$