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Who should decide the corporation tax rate?*

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Abstract

This paper analyzes who should decide the corporation tax rate under the situation in which a local public good has a spillover effect and the central government cannot realize residents' actual preference of the public good.

This paper makes the following conclusions. When a local government decides the tax rate, it has an incentive to not only decide an inadequate tax rate because of the incentive to free-ride but also an incentive to decide an excessive tax rate because of the tax export effect. As such, because the incentive to decide an excessive tax rate is dominant, the local government decides a tax rate higher than the socially optimal one.

With regard to the problem of who should decide the tax rate, this paper demonstrates the following: when the spillover effect is large (small), the local (central) government should decide the corporation tax rate. This result is unlike those in previous studies.

Keywords: Corporation tax, Decentralization, Spillover effect, Tax export effect.

JEL: H21, H70, H72, H77.

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1 Introduction

In Japan, there are various income resources that are subject to taxation, for example, labor income, capital income, corporate income, and consumption. The government imposes taxes on these resources and collects revenues to provide public services. Figure 1 draws a detailed account of the tax income in 2009.

Figure 1: Detailed account of the tax income in 2009

As is shown by Fig. 1, both income tax and corporation tax (excluding bonds) are major contributors to the tax income in Japan. Consequently, corporation income is one of the important resources for tax income. Previous studies have paid attention to the tax on labor income and capital, and have not discussed corporation tax sufficiently. This paper seeks to redress this ¹.

In Japan, corporation tax refers to the tax on corporation income collected by the central government. However, recently, there has been a trend toward decentralization and often the problem of autonomy in taxation is discussed. Here, we discuss the transfer of income tax, capital tax, and corporation tax autonomy. When we examine the transfer of autonomy, the spillover effect for the public good must also be considered. This is because not only the residents in one region but also the residents in other regions may enjoy the benefit from one region's public good (or service). For example, Oates (1972) analyzes the transfer of income tax under a spillover effect and exogenous residents' income. He demonstrates that an inadequate income tax rate is realized because each local government decides its policy considering that it also gains from the other regions' public good.

Zodrow and Mieskovsky (1986) analyze the case in which the local government is granted an autonomy with regard to the capital tax. Their findings are as follows: each local government has an incentive to decide a low tax rate, since it wants to the investors to invest the maximum possible capital in its own region. As a result, tax competition occurs and an inadequate capital tax rate is realized.

¹Recently, Eichner and Runkel (2009) studied the problem of corporation tax. Using the two-countries model with involuntary unemployment, they compared separate accounting and formula apportionment.

With regard to the transfer of corporation tax for the immobile firm, we realize that when the firm subject to the tax is possessed by a non-resident, tax export occurs and the transfer of taxation is not preferable. Here, the term “tax export” implies that when each local government imposes a tax on the immobile firms in its region that are possessed by non-residents, an excessive tax rate is decided². The underlying mechanism is as follows. Each local government imposes a tax to not only on its residents but also its non-residents. However, the local government does not realize that it is also imposing a tax on the non-residents. Consequently, each local government has an incentive to decide an excessive corporation tax rate. The pioneer work in tax export is Mclure (1969).

Now, if the local government decides the corporation tax rate under the condition in which the local public good has a spillover effect, though it has an incentive to decide an excessive tax rate because of the tax export effect, it also has another incentive to decide an inadequate tax rate because of the incentive to free-ride. As a result, we are unable to ascertain the inefficiency when the local government decides the corporation tax rate.

We sometimes consider that centralization, that is the central government deciding the tax rate, is socially preferable. However, as many papers argue, centralization also has some problems. One of the problems is that the central government is unable to realize the residents’ actual preference of the public good³. Consequently, the probability that an inefficient tax rate will be set exists.

Recently, this problem has been studied in political economics, particularly, by the works on information asymmetry between the resident and the central government. Baseley and Coate (2003) is one such study. According to them, the residents control the action of the central government by means of elections in which each resident can select a deputy who has nearly the same preference as him/her⁴.

However, many research works including Baseley and Coate (2003) argue that centralization does not always achieve the first-best situation because of information asymmetry between the resident and the central government. Therefore, when we assume that the central government is unable to realize the residents’ actual preference of the local public good, it is not obvious whether the central or the local

²This term is defined in Wildasin (1986) and Wildashin (1987a).

³Some also argue that centralization is unable to match the needs of each region.

⁴Baseley and Coate (2003) make the following conclusions. First, under centralization, the first-best situation is not observed, except in the full spillover case. As such, when the spillover effect is large, centralization is socially preferable.

government should decide the corporation tax rate.

Lockwood (2002) analyzes the same problem as Basely and Coate (2003) under the following situation: there are multiple regions populated by homogeneous residents; in these regions, the central or local government supplies a non-division local public good with the spillover effect. Lockwood (2002) demonstrates that when the spillover effect is small, it is socially efficient for the local government to decide its policy (that is, decentralization)⁵.

In addition, Cheikbossian (2008) also compares the systems of policy decision, namely, centralization and decentralization, assuming the existence of a local public good with spillover. According to him, under centralization, the local governments share the costs of the public good supply. Therefore, a conflict of interest between the heterogeneous local governments arises. Consequently, even if the spillover effect exists, the policy decision under centralization is not socially preferable⁶.

In this paper, the influence of tax export is important. The tax export problem has been studied by Mclure (1969), Sandler and Shelton (1972), Arnott and Grieson (1981), Wildashin (1987), Krellove (1972), and Welisch (1993).

Focussing on the indirect tax under the partial equilibrium analysis, Mclure (1969) analyzes the influence of tax export. He finds that the influence of the consumption tax on the demand (supply) function in one region extends to other regions through the influence on the aggregate demand (supply) function in the overall good market. As a result, the increase in tax is also experienced by the non-residents and tax export does occur.

Sandler and Shelton (1972) discuss the tax export problem considering the situation in which the local public good has a spillover effect. According to them, under both tax export and spillover effect, even when the local government in one region that indirectly imposes a tax on other regions increases the supply of the local public good, the residents in the regions experiencing the indirect increase in tax because of the tax export effect can also benefit from the spillover effect.

⁵Note that his paper does not discuss the first-best situation.

⁶Other papers on the policy decision under centralization are Lorz and Willmann (2005), Redoano and Scharf (2004), and Alesina et al. (2005).

These two studies use the partial equilibrium analysis. On the other hand, Arnott and Grieson (1981) adopt the framework of general equilibrium analysis and analyze the tax export problem. Arnott and Grieson (1981) derive a condition for the optimal transfer of autonomy, and demonstrate that when each local government imposes a tax on its private good, an excessive tax rate is decided. This is so because while the residents in each region increase the tax by consuming the private good that incurs other regions' tax, no local government considers this increase in tax.

Wildasin (1987b) analyzes the influence of tax export on the marginal cost of public expenditure, considering the situation in which the local government imposes the tax on its labor and the private good, which is exchanged between regions. He finds that when the local government increases the tax on the private good or labor, the tax revenues in the region increase. In addition, even when the tax export effect is observed because the tax on the private good is restricted, the restriction does not influence the marginal cost of public expenditure, and the supply of the public good does not change.

Krelove (1992) analyzes the tax export problem in the long-run considering the residents' migration between regions. When a local government imposes a corporation tax in its region, it creates an incentive to decide a higher corporation tax rate than the socially optimal one, since the tax is also imposed on the non-residents in its region. However, considering the possibility of migration, the increase in the tax rate decreases both wage and rent from the private firm, which gives each resident an incentive to move to other regions. Therefore, according to Krelove (1992), the following is observed. The local government decides the corporation tax rate considering that the change in the tax rate influences the wage and rent from the private firm, and the migration that may occur. Therefore, though the local government evaluates the marginal cost from tax as less because of the tax export effect, it also considers the marginal cost from tax because of migration. As a result, efficient local public provision is realized.

In addition, Wellisch (1993) also analyzes the tax problem of the gain from the region's capital in the long-run. Wellisch (1993) demonstrates that even when the local public good has a spillover effect, the first-best situation is realized if the movement between the regions is free and each local government imposes the tax for capital gain in its region.

This paper does not consider the long-run situation, and pays attention to the short-run situation in which no resident migrates between regions because of the high movement cost. We analyze the problem of corporation tax rate under the situation in which there exists a spillover effect. Even in the short-run in which migration does not occur, when the spillover effect exists, there is an incentive to not only decide an excessive tax rate because of the tax export effect but also an inadequate tax rate because of the incentive to free-ride. Consequently, the supply of the public good by the local government is not always inefficient.

Therefore, as in Krelove (1992), this paper assumes that the local public good has a spillover effect, and analyzes the problem of the tax export effect. However, though Krelove (1992) considers migration when analyzing the corporation tax problem under decentralization, our paper analyzes the corporation tax problem under decentralization with the spillover effect. In addition, we analyze the same problem under centralization. Under centralization, the central government that is unable to realize the residents' actual preference of the public good decides the corporation tax rate. Finally, we compare the two financial set ups and decide who should decide the corporation tax rate.

This paper makes the following conclusions. When the local government decides the corporation tax rate, it decides a tax rate higher than the socially optimal one. However, if the full spillover effect is observed, the local government's decision corresponds with the first-best. The reasoning behind this is as follows. Because of the spillover effect, the local government evaluates the marginal benefit from the local public good as low. On the other hand, when the tax rate in one region increases, the cost, which is the reduction in the residents' income in the other regions, also increases. Note that the first region does not consider this cost. Here, we note that the cost is evaluated as half of the first-best's cost, and that the marginal benefit is evaluated as larger than the half of the first-best's marginal benefit. As a result, the inadequate evaluation of cost (namely, the tax export effect) is dominant along with the inadequate evaluation of marginal benefit (namely, the spillover effect). This yields an excessive corporation tax rate.

Next, we show that when the central government that cannot realize the residents' actual preference of the public good decides the tax rate, an inadequate (excessive) tax rate is decided when the actual preference is large (small). This result is obvious. The central government considers the residents' costs

in both regions. However, it is unaware of the actual preference of the public good. Therefore, the central government uses the expected marginal benefit from the public good. This expected marginal benefit is lesser (higher) than the actual marginal benefit when the actual preference is large (small). The lesser (higher) marginal benefit results in an inadequate (excess) tax rate.

Finally, we analyze who should decide the corporation tax rate. We find that if the actual preference of the public good is large, when the degree of spillover effect is large (small), the local (central) government should decide the corporation tax rate. Further, if the actual preference of the public good is small and the probability of a central government realizing the actual preference is large, we can conclude the same. However, if the probability is small, it is always preferable that the local government decides the tax rate.

The result that when the spillover effect is small (large), the central (local) government should decide the corporation tax rate has surprised us. Previous studies have found that when the spillover effect is large, it is socially preferable for the central government to decide the tax rate, because a larger spillover effect brings the local government a larger incentive to free-ride and an inadequate tax rate is decided. However, this paper demonstrates that the incentive to free-ride (namely, the spillover effect) offsets the incentive to decide an excessive tax rate. Consequently, a larger spillover effect mostly offsets the incentive to decide an excessive tax rate. Further, when the complete spillover effect is observed, the first-best situation is realized. As a result, we can conclude that when the spillover effect is large, the local government should decide the corporation tax rate.

This paper is organized as follows. Section 2 sets up the model for this paper. In section 3, the labor market is analyzed, and the equilibrium wage, private firm's profit, and tax revenues are derived. Using these results, section 4 derives the first-best solutions. In section 5, we analyze the situation in which the central government that is unable to realize the residents' actual preference of the public good decides the corporation tax rate. Section 6 analyzes the situation in which the local government decides the corporation tax rate. In section 7, based on the results of sections 5 and 6, we analyze who should decide the corporation tax rate by comparing the social welfare in the two cases. Section 8 concludes this paper's result and proposes some future problems.

2 Model

Let us consider a country with two homogeneous regions—region 1 and region 2. In each region, there are N homogeneous residents and one private firm. Further, there is no inter-region migration because of a high traveling cost.

Each resident has one unit of labor and supplies it to the private firm in his/her region. Then, 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 centralization, the central government imposes a corporation tax on each firm's profit and gains tax revenue. Using this tax revenue, the central government supplies a local public good to each region. Under decentralization, each local government imposes a corporation tax on the firm and gains tax revenue. Using the tax revenue, each local government supplies a local public good. Here, the local public good to be supplied has a positive spillover effect. In what follows, we refer to the local public good as public good for simplicity.

The residents and the private firm in each region are explained below. Following this, we explain the central government and the local government.

Residents in region i The residents in region i gain a benefit from the consumption of private good and public good. Here, note 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 good. Therefore, the utility function is assumed as follows:

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

Here, the term x_i denotes the consumption of the private good. The term q_i (q_j) refers to the supply of public good in region i (j). The parameter θ gives the preference of the public good, which is either large or small. When the preference is large, we refer to it as $\theta = \bar{\theta}$; when the preference is small, we refer to it as $\theta = \underline{\theta}$. Here, we assume that the preference is identical in both regions because this paper considers homogeneous regions. The parameter λ is the degree of the spillover effect and assumes that $0 \leq \lambda \leq 1$.

When the residents supply one unit of labor (each) to the private firm in their region, they gain wage

income w_i (each). In addition, they gain a share of the profit from both private firms. Using this income, each resident consumes the private good. Therefore, the budget constraint of a resident in region i is

$$x_i = w_i + \frac{\sum_{i=1}^2 \pi_i}{2N}. \quad (2)$$

In eq. (2), the term π_i is the profit of the private firm after taxation.

Private firm in region i Each private firm demands labor from its region and produces a private good. This paper omits the market of the private good and assumes that the good is numeraire. For example, if there is excess demand, it is imported from foreign countries; if there is excess supply, it is exported to foreign countries. Therefore, the price of the private good can be kept constant. In addition, this paper assumes that the private good is used for consumption by the resident and for the production of public good⁷.

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

$$y_i = L_i^{\frac{1}{2}}. \quad (3)$$

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

Before imposing the tax, the profit of the private firm in region i is denoted by Π_i . Then, the profit is

$$\Pi_i = L_i^{\frac{1}{2}} - w_i L_i. \quad (4)$$

The local government (central government) imposes a corporation tax at the rate t_i . Therefore, the profit after taxation is as follows:

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

Local government in region i The local government imposes a tax at the rate t_i on the private firm in region i and gains revenue. Using the tax revenue, it supplies the public good. This paper assumes

⁷These assumptions remove the necessity of analyzing the private good market. For example, Boadway and Keen (1996) adopt this assumption.

that the marginal cost to supply the public good equals c . Consequently, the budget constraint of the local government is

$$cg_i = t_i \Pi_i. \quad (6)$$

In eq. (6), the left-hand side term refers to the cost of supplying the public good and the right-hand side term denotes the revenue from corporation tax.

The local government realizes the residents' actual preference of the public good in region i . Consequently, it decides the corporation tax rate to maximize the sum of the residents' utility, that is, the social welfare in region i (W_i), subject to the budget constraint.

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

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

Here, the left-hand side of eq. (7) denotes the cost of supplying the public good, and the right-hand side, the revenue from the corporation tax.

The central government is unable to realize the residents' actual preference of the public good. However, the central government knows that the probability of the residents having a small preference (that is, $\underline{\theta}$) is p , and of having a large preference (that is, $\bar{\theta}$) is $1 - p$. Consequently, the central government decides the corporation 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 decides the corporation tax rate t_i . Following this, the wage is decided 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 residents gain a utility by consuming these goods.

Under decentralization, the timeline remains the same except for that the local government decides the corporation tax rate. Fig. 2 shows the two timelines.

Figure 2: Timeline

We now analyze the labor market, and derive the corporation tax rate under centralization and decentralization. Later, we compare these outcomes and conclude whether the local government or the central government should decide the corporation tax rate.

3 Labor Market

This section analyzes the labor market and derives the equilibrium wage and profit of each private firm. After deriving these outcomes, we focus on the budget constraint of the residents and the government.

First, we derive the labor demand function. Each private firm decides its labor demand to maximize the following (after taxation) profit:

$$\pi_i = (1 - t_i) \left(L^{\frac{1}{2}} - w_i L_i \right). \quad (8)$$

Solving the profit maximization problem by L_i , we obtain the labor demand function for each region:

$$L_i = \left(\frac{1}{2w_i} \right)^2. \quad (9)$$

Each resident supplies one unit of labor to the private firm. Therefore, the total supply of labor equals N . In the labor market, the wage is decided to clear the market. Consequently, the equilibrium wage w_i^* is

$$w_i^* = \frac{1}{2N^{\frac{1}{2}}}. \quad (10)$$

As such, the equilibrium labor demand equals N . Consequently, the profit before taxation of the private firm in region i is

$$\Pi_i = \frac{1}{2} N^{\frac{1}{2}}. \quad (11)$$

The local government (central government) imposes a corporation tax t_i on the profit and gains tax

revenue T_i given by⁸

$$T_i = \frac{t_i}{2} N^{\frac{1}{2}}. \quad (12)$$

In addition, the net profit (namely, the profit after taxation) of each private firm is

$$\pi_i = \frac{1 - t_i}{2} N^{\frac{1}{2}}. \quad (13)$$

Here, the net profit is shared among all residents. Consequently, the total income of each resident is given by his/her wage and shared income. The income, I_i , is derived as follows:

$$I_i = \frac{4 - t_i - t_j}{4N^{\frac{1}{2}}}. \quad (14)$$

Considering that this income is spend to consume the private good, the demand of the private good is given by

$$x_i = \frac{4 - t_i - t_j}{4N^{\frac{1}{2}}}. \quad (15)$$

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

$$W_i = N \left\{ \theta(q_i + \lambda q_j)^{\frac{1}{2}} + \frac{4 - t_i - t_j}{4N^{\frac{1}{2}}} \right\}. \quad (16)$$

In the following analysis, eq. (16) is used to derive the corporation tax rate.

4 First-Best

This section assumes that the central government realizes the residents' actual preference of the public good, and analyzes the optimal corporation tax rate under this condition. The central government decides the corporation tax rate to maximize the sum of each region's social welfare, subject to the

⁸Note that when the central government levies the tax, the revenue is $T_1 + T_2$.

budget constraint. Here, the sum of each region's social welfare is given as follows.

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

In addition, the budget constraint for the central government is

$$q_1 + q_2 = \left(\frac{t_1 + t_2}{2c} \right) N^{\frac{1}{2}}. \quad (18)$$

Considering that both the regions are symmetric, the tax rate to maximize the social welfare is the same for both regions. In other words, $t_1 = t_2$. Considering this outcome, we can derive the first-order condition to maximize the social welfare as follows:

$$\theta \left(\frac{1 + \lambda}{2c} \right)^{\frac{1}{2}} t^{-\frac{1}{2}} N^{\frac{1}{4}} = \frac{1}{N^{\frac{1}{2}}}. \quad (19)$$

The left-hand side of eq. (19) is 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, eq. (19) implies that the Samuelson condition holds.

Solving the above first-order condition, we obtain the following optimal corporation tax rate:

$$t^{FB} = \frac{(1 + \lambda)\theta^2}{2c} N^{\frac{3}{2}}. \quad (20)$$

Here, we assume that the tax rate is less than 1 because of a higher marginal cost c^9 . When the degree of the spillover effect increases, the optimal tax rate also increases. The reasoning is as follows: when the degree of the spillover effect increases, the marginal benefit from the public good also increases. The higher the marginal benefit, the higher the corporation tax rate that the central government can set.

⁹This assumption is used in the analysis that follows.

5 Centralization

This section analyzes how the corporation tax rate is decided when the central government is unable to realize the residents' actual preference of the public good. The probability that this preference is small is assumed to be p . Therefore, the expected social welfare function is as follows:

$$EW = N \left[p \left\{ \underline{\theta}(q_1 + \lambda q_2)^{\frac{1}{2}} + \underline{\theta}(q_2 + \lambda q_1)^{\frac{1}{2}} \right\} + (1-p) \left\{ \bar{\theta}(q_1 + \lambda q_2)^{\frac{1}{2}} + \bar{\theta}(q_2 + \lambda q_1)^{\frac{1}{2}} \right\} + \frac{4 - t_1 - t_2}{2N^{\frac{1}{2}}} \right]. \quad (21)$$

The budget constraint for the central government is $q_1 + q_2 = \frac{t_1 + t_2}{2c} N^{\frac{1}{2}}$. The central government decides the tax rate to maximize the expected social welfare subject to the budget constraint. Though the system to decide the tax rate is very simple, this setup is without the loss of generality because the first-best solutions are not always realized under incomplete information.

Here, because this paper presumes symmetry, the optimal tax rate to maximize the expected social welfare can be the same in both regions, that is, $t_1 = t_2$. Consequently, the first-order condition to maximize the expected social welfare is

$$\left(\frac{1 + \lambda}{2c} \right)^{\frac{1}{2}} t^{-\frac{1}{2}} (p\underline{\theta} + (1-p)\bar{\theta}) N^{\frac{1}{4}} = \frac{1}{N^{\frac{1}{2}}}. \quad (22)$$

The left-hand side of eq. (22) refers to the sum of the expected marginal benefit from the public good; the right-hand side gives the marginal cost as the reduction in the private good demand. From the above calculation, we can obtain the tax rate decided by the central government:

$$t^{CG} = \frac{N^{\frac{3}{2}}}{2c} (1 + \lambda) (\bar{\theta}(1-p) + p\underline{\theta})^2. \quad (23)$$

When the degree of the spillover effect becomes large, the tax rate also increases. The reasoning is as follows: when the degree of the spillover effect becomes large, the expected marginal benefit from the public good also increases. The larger marginal benefit makes it possible to set a higher tax rate.

Next, comparing the centralization case with the first-best, we obtain proposition 1.

Proposition 1 *When the actual public good's preference is $\theta = \bar{\theta}(\underline{\theta})$, the central government sets a tax rate lower (higher) than the socially optimal tax rate.*

Proof Consider the case where the actual preference is $\theta = \bar{\theta}$. Then, the difference between t^{FB} and t^{CG} is given by

$$t^{FB} - t^{CG} = \frac{N^{\frac{3}{2}}}{2c}(1 + \lambda)p(\bar{\theta} - \underline{\theta})(2\bar{\theta} + p(\underline{\theta} - \bar{\theta})) > 0. \quad (24)$$

Consequently, the central government decides a lower rate than socially optimal rate.

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

$$t^{FB} - t^{CG} = \frac{N^{\frac{3}{2}}}{2c}(1 + \lambda)(1 - p)(\underline{\theta} - \bar{\theta})(\bar{\theta}(1 - p) + \underline{\theta}(1 + p)) < 0. \quad (25)$$

As a result, the central government sets a tax rate higher than the socially optimal one. \square

This proposition is obvious. Even when the actual preference is $\bar{\theta}$, for the the central government, the probability that the preference is $\underline{\theta}$ remains p . This yields a marginal benefit from the public good that is smaller than the socially optimal one. As a result, the central government sets a corporation tax rate smaller 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 $\bar{\theta}$ remains $1 - p$. This yields an over-evaluation of the public good's marginal benefit. As a result, the central government sets a corporation tax rate higher than the socially optimal one.

6 Decentralization

This section analyzes the situation where each local government decides its corporation tax rate to maximize its social welfare. Here, the social welfare in region i is given by

$$W_i = N \left\{ \theta(q_i + \lambda q_j)^{\frac{1}{2}} + \frac{4 - t_i - t_j}{4N^{\frac{1}{2}}} \right\}. \quad (26)$$

In addition, the budget constraint is as follows:

$$q_i = \frac{t_i}{2c} N^{\frac{1}{2}} \quad (27)$$

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

$$\frac{\theta}{4c} \left(\frac{t_i}{2c} + \lambda \frac{t_j}{2c} \right)^{-\frac{1}{2}} N^{\frac{1}{4}} = \frac{1}{4N^{\frac{1}{2}}}. \quad (28)$$

The left-hand side of eq. (28) refers to the residents' marginal benefit from the public good in region i ; the right-hand side gives the marginal cost arising from the reduction in the consumption of private good.

Because this paper considers two symmetric regions, the symmetric equilibria hold. Therefore, when each local government decides the corporation tax rate to maximize its social welfare, the rate is derived as follows:

$$t^{LG} = \frac{2\theta^2}{c(1+\lambda)} N^{\frac{3}{2}} \quad (29)$$

When the degree of the spillover effect increases, the rate set by each local government becomes small. This is because when the degree of the spillover effect increases, each local government strengthens the incentive to free-ride.

Upon comparing the above corporation tax rate and the socially optimal one, we obtain proposition 2.

Proposition 2 *When each local government decides its corporation tax rate to maximize its social welfare, the decided rate is higher than the socially optimal one.*

Proof The difference between t^{FB} and t^{LG} is given by

$$t^{FB} - t^{LG} = \frac{\theta^2}{c} \left(\frac{(1+\lambda)^2 - 4}{2(1+\lambda)} \right) N^{\frac{3}{2}}. \quad (30)$$

Considering that the parameter λ is the degree of the spillover effect and $0 \leq \lambda \leq 1$, the sign of eq. (30) is minus. \square

It is noteworthy that the result of proposition 2 depends on the assumption that one private firm's profit is shared equally among all residents. If we assume that the resident in one region gains more dividend from its region's private firm than the resident in the other region, an inadequate tax rate is realized.

Now, usually, we tend to believe that when the spillover effect exists, the local government sets a tax rate lower than the socially optimal one because of the incentive to free-ride. However, this paper obtains a contradictory result. The following analysis considers in detail as to why this contradictory result is obtained.

We compare the first-order condition for the first-best (i.e., eq. (19)) with that for decentralization (i.e., eq. (28)). Comparing the left-hand side of each equation (that is, the marginal benefit from the public good), we realize that the marginal benefit when the local government sets the tax rate is smaller than the social optimum. This property is consistent with most studies. Namely, because of the spillover effect, the local government has an incentive to free-ride. This incentive results in the local government setting a lower corporation tax rate.

On the other hand, comparing the right-hand side of the two first-order conditions—eqs. (19) and (28)—we find that when the local government decides the tax rate, the cost from the reduction in the consumption of private good is also under-evaluated as compared to the social optimum. The reasoning is as follows: the net profit of the private firm in each region influences not only its residents' income but also the income of other residents. However, the local government does not pay attention to the other region's income when it decides its corporation tax rate. As a result, it has an incentive to set a tax rate higher than the socially optimal one.

Here, we must compare the incentive to set a higher tax rate with that to set a lower tax rate. Then, we consider the extreme case—the perfect spillover case. The marginal benefit from the public good as considered by the local government reduces to half of the socially optimal one. On the other hand, the marginal cost from the reduction in private good consumption also reduces to half of the socially optimal

one. Consequently, offsetting these inefficiencies, the local government’s decision corresponds with the first-best tax rate.

We now consider an imperfect spillover case. Under imperfect spillover, the marginal benefit as considered by the local government is evaluated to be more than the half of the first-best’s marginal benefit. On the other hand, the marginal cost from the reduction in private good consumption is half of the first-best. Therefore, the incentive to set a higher tax rate is greater than that to set a lower rate. As a result, each local government sets a corporation tax rate higher than the first-best.

This result corresponds with some previous studies on the “tax export effect.” The term “tax export” implies as follows: when each local government imposes a tax on an immobile firm and is partially owned by non-residents, the tax rate is excessive. This is because not only the local residents but also the non-residents experience the increase in taxation. This creates an incentive to set a higher corporation tax rate.

7 Who should decide the corporation tax rate?

Based on the conclusions of sections 5 and 6, this section analyzes who should decide the corporation tax rate—the central government who does not realize the residents’ actual preference of the public good, or the local government. We analyze two cases: $\theta = \bar{\theta}$ and $\theta = \underline{\theta}$.

7.1 $\theta = \bar{\theta}$

This subsection analyzes who should decide the corporation tax rate when $\theta = \bar{\theta}$.

When the local government decides the corporation tax rate, the social welfare, SW^{LG} , given as follows:

$$SW^{LG} = \frac{2N^{\frac{1}{2}} \left(c(1 + \lambda) + N^{\frac{3}{2}} \lambda \bar{\theta}^2 \right)}{c(1 + \lambda)}. \quad (31)$$

When the spillover effect increases, the social welfare increases¹⁰. The reasoning is as follows: when it becomes larger, though the supply of the public good decreases because of lower corporation tax, the

¹⁰Of course, this result depends on the assumption of the utility function. If the function has a characteristic that the increase in the benefit from the public good is smaller than the decrease in the benefit from the private good, a higher spillover effect decreases social welfare.

income (the consumption of private good) increases. In addition, some of the influence of the decrease in public good supply is offset by the larger spillover effect. Therefore, the effect increasing social welfare is larger than that decreasing the same.

When the ignorant central government sets the corporation tax rate, social welfare (different from expected social welfare) is expressed as SW^{CG} :

$$SW^{CG} = \frac{N^{\frac{1}{2}}}{2c} \left(4c + N^{\frac{3}{2}}(1 + \lambda)((1 - p)\bar{\theta} + p\underline{\theta})((1 + p)\bar{\theta} - p\underline{\theta}) \right). \quad (32)$$

When the spillover effect increases, social welfare also increases¹¹. This is because, when the spillover effect becomes large, the overall supply of the public good increases, which increases the benefit from the public good. In addition, because of the greater spillover effect, the influence of its increase is very large.

Fig. 3 depicts the social welfare under the two conditions.

Figure 3: Social welfare when $\theta = \bar{\theta}$.

In Fig. 3, the parameter $\bar{\lambda}$ refers to the critical value at which $SW^{CG} = SW^{LG}$. From Fig. 3, we obtain proposition 3.

Proposition 3 *Consider the case in which $\theta = \bar{\theta}$. When the degree of the spillover effect is given by $\lambda \geq \bar{\lambda}$, it is socially preferable for the local government to decide the corporation tax rate. However, when $\lambda < \bar{\lambda}$ holds, the central government should decide the corporation tax rate.*

Proof The difference between eqs. (31) and (32) is given as follows:

$$SW^{CG} - SW^{LG} = \frac{-N^2}{2c(1 + \lambda)} (\bar{\theta}(1 + p - \lambda(1 - p)) - p\underline{\theta}(1 + \lambda))(\bar{\theta}(-1 + p + \lambda(1 + p)) - p\underline{\theta}(1 + \lambda)). \quad (33)$$

¹¹Note that this result also depends on the shape of the utility function. Though we can generalize the utility function, the analysis is very complex. The complex analysis is not always useful for us.

Here, considering that the degree of the spillover effect λ is less than one, we obtain the following relationship:

$$SW^{CG} \geq (<)SW^{LG} \iff \lambda \leq (>) \frac{(1-p)\bar{\theta} + p\theta}{(1+p)\bar{\theta} - p\theta} (\equiv \bar{\lambda}). \quad (34)$$

Equation (34) expresses proposition 3. \square

From propositions 1 and 2, we get that when the central government sets the corporation tax rate, a rate lower than the social optimum is decided; when the local government sets it, a rate higher than the social optimum is decided. In addition, when the central government decides the tax rate, the rate increases with the degree of the spillover effect. This is also true when the local government decides the rate. Therefore, we discuss the two extreme cases.

The first case is the case of no spillover effect. When the local government decides the corporation tax rate, it decides a higher corporation tax rate because it has no incentive to free-ride¹². Then, the excessive tax rate resulting from the under-evaluation of the marginal cost decreases the consumption of the private good. This worsens social welfare considerably, when compared to the first-best.

On the other hand, when the central government decides the corporation tax rate, it considers both regions' marginal cost, but evaluates the marginal benefit from the public good inadequately because it is ignorant¹³. The lower tax rate resulting from the inadequate marginal benefit from the public good decreases the supply of the public good; the decrease in the public good supply worsens residents' benefit from the public good. However, the lower tax rate yields a higher income to the residents, which increases the consumption of the private good and the benefit from the private good. Therefore, as compared to the first-best, although the social welfare worsens, the degree of deterioration is small. Consequently, it is socially optimal for the central government who considers both regions' cost to decide the corporation tax rate¹⁴.

The second case is the case of full spillover effect. This case yields an opposite result. When the local

¹²This mechanism is explained in section 6. In short, this is so because the local government does not consider the income of (consumption of the private good by) the non-residents.

¹³Namely, the central government is unable to realize the residents' actual preference of the public good.

¹⁴This result also depends on the shape of the utility function. Of course, if we use a general utility function, we can address all possible results. However, the analysis is very complex, and our message will be vague. This paper is willing to argue that the previous result does not always hold. Therefore, this paper uses a specific utility function.

government decides the corporation tax rate, the marginal cost is evaluated inadequately. In addition, because of the spillover effect, the marginal benefit from the public good is also evaluated inadequately. As such, this under-evaluation is offset, and the first-best is realized. When the central government decides the corporation tax rate, the central government is unable to achieve the first-best, because it is unable to realize the residents' actual preference of the public good. As a result, in this case, the local government should decide the corporation tax rate.

After discussing these two extreme cases, we get the following. Consider the case where the degree of the spillover effect is small. When the local government decides the corporation tax rate, it evaluates the marginal cost of the resident inadequately but the marginal benefit from the public good approximately precisely. Then, the influence of the under-evaluation of the marginal cost is high. This influence yields an outcome much different from the first-best. On the other hand, when the central government decides tax rate, though it evaluates the marginal benefit inadequately, the influence is small. As a result, it is socially preferable that the central government decides the corporation tax rate.

Consider the case where the degree of the spillover effect is large. When the local government decides the corporation tax rate, the tax rate becomes lower because the local government has a larger incentive to free-ride. Here, note that when there is no spillover effect, the corporation tax rate is considerably large. Then, when the spillover effect becomes large, the considerably high corporation tax rate becomes small and nears the first-best. Actually, in the full spillover case, the decision of the local government corresponds with the first-best solution. Consequently, when the spillover effect becomes large, the local government, and not the central government, should decide the corporation tax rate.

This paper demonstrates the following: when the corporation tax rate is the subject of analysis, if the degree of the spillover effect is large, decentralization is more preferable than centralization; this conclusion is different from those in previous studies. This is because, a higher spillover effect weakens the influence of the tax export effect, which happens in the case of decentralization.

This conclusion also shows that the local government must incur the corporation tax that contains a larger tax export effect in order to weaken its incentive to free-ride when it provides public utilities that have a larger spillover effect under decentralization.

We do a comparative static analysis of $\bar{\lambda}$ by p , and obtain lemma 1.

Lemma 1 *When the central government feels that the probability of $\theta = \underline{\theta}$ is large, the range within which the local government should decide the corporation tax rate widens.*

This lemma is obvious. When the central government thinks that the probability of $\theta = \underline{\theta}$ is large although the actual preference is $\theta = \bar{\theta}$, it decides a very small corporation tax rate. This results in lesser supply of the public good. Consequently, though the tax rate becomes high, the local government who realizes the actual preference should decide the corporation tax rate.

7.2 $\theta = \underline{\theta}$

This subsection analyzes who should decide the corporation tax rate—the central government or the local government—when $\theta = \underline{\theta}$.

When the local government decides the corporation tax rate, the social welfare is given by

$$SW^{LG} = \frac{2N^{\frac{1}{2}} \left(c(1 + \lambda) + N^{\frac{3}{2}} \lambda \underline{\theta}^2 \right)}{c(1 + \lambda)}. \quad (35)$$

Here, we can see that when the degree of the spillover effect increases, the social welfare also increases.

On the other hand, when the central government decides the corporation tax rate, the social welfare is derived as follows:

$$SW^{CG} = \frac{N^{\frac{1}{2}}}{2c} \left(4c - N^{\frac{3}{2}}(1 + \lambda)((1 - p)\bar{\theta} - (2 - p)\underline{\theta})((1 - p)\bar{\theta} + p\underline{\theta}) \right). \quad (36)$$

Here, we obtain the following lemma with regard to the influence of social welfare when the degree of the spillover effect increases.

Lemma 2 *When the probability of $\theta = \underline{\theta}$ is small, the social welfare decreases with λ . When the probability is large, the social welfare increases with λ .*

Proof From the comparative static analysis, we obtain the following equation:

$$\text{sign} \left(\frac{\partial SW^{CG}}{\partial \lambda} \right) = \text{sign} \left(-(1-p)\bar{\theta} - (2-p)\underline{\theta} \right). \quad (37)$$

As a result, we obtain the following relationship:

$$\frac{\partial SW^{CG}}{\partial \lambda} \geq (<)0 \iff p \geq (<) \frac{\bar{\theta} - 2\underline{\theta}}{\bar{\theta} - \underline{\theta}} \quad (38)$$

This relation expresses lemma 2. \square

When the probability of $\theta = \underline{\theta}$ is small, although the actual preference is $\underline{\theta}$, the central government decides a corporation tax rate much higher than the socially optimal one. Then, if the degree of the spillover effect increases, the tax rate becomes higher. The higher tax rate yields an increased supply of the public good, and each resident's benefit from the public good also increases. However, the increase is small because the preference of the public good is small (and hence the marginal benefit decreases). On the other hand, when the corporation tax rate increases, the residents' income decreases; therefore, the consumption of the private good (and the benefit from the consumption) decreases. This is the cost of an increase in the tax rate.

Then, when the spillover effect becomes large and the corporation tax rate increases, the benefit from the public good does not increase sufficiently, but the cost becomes very high. As a result, when the central government thinks that the probability of $\theta = \underline{\theta}$ is low, social welfare decreases with λ .

We now consider the case where the central government thinks that the probability of $\theta = \underline{\theta}$ is high. Then, when the degree of the spillover effect increases, the central government can decide an almost socially optimal tax rate, because it can evaluate the marginal benefit from the public good approximately accurately. It is noteworthy that the accurate tax rate increases the social welfare¹⁵. In other words, the cost of decreasing the consumption of the private good (that is, the income) is smaller than the benefit from the increase in the consumption of the public good. Consequently, when the central government thinks that the probability of $\theta = \underline{\theta}$ is high, the social welfare increases with λ .

¹⁵This characteristic is taken from the analysis in the previous subsection.

Fig. 4 shows the social welfare under decentralization and centralization.

Figure 4: Social welfare when $\theta = \underline{\theta}$

In Fig. 4, the term $\underline{\lambda}$ is the boundary at which SW^{LG} is equal to SW^{CG} . From Fig. 4, we obtain proposition 4.

Proposition 4 *Suppose that the actual preference of the public good is $\theta = \underline{\theta}$.*

- (1) *If $p \leq \frac{\bar{\theta}-2\underline{\theta}}{\bar{\theta}-\underline{\theta}}$, it is socially preferable for the local government to decide the corporation tax rate.*
- (2) *Otherwise, when $\lambda \leq (>)\underline{\lambda}$, the central government (local government) should decide it.*

Proof The difference between eqs. (35) and (36) yields the following equation:

$$SW^{CG} - SW^{LG} = \frac{-N^2}{2c(1+\lambda)} (-\bar{\theta}(-1+p)(1+\lambda) + (-2+p(1+\lambda))\underline{\theta}) (-\bar{\theta}(-1+p)(1+\lambda) + (-2\lambda+p(1+\lambda))\underline{\theta}). \quad (39)$$

Then, considering that the degree of the spillover effect is smaller than one, we obtain the following relationship:

$$SW^{CG} \geq (<)SW^{LG} \iff \lambda \leq (>) \frac{(2-p)\underline{\theta} - (1-p)\bar{\theta}}{(1-p)\bar{\theta} + p\underline{\theta}} (\equiv \underline{\lambda}). \quad (40)$$

Here, we note that when $p \leq \frac{\bar{\theta}-2\underline{\theta}}{\bar{\theta}-\underline{\theta}}$, the numerator of $\underline{\lambda}$ is negative. As such, the parameter $\underline{\lambda}$ does not exist between zero and one. In this case, $SW^{LG} \geq SW^{CG}$ always holds. \square

When the difference between the actual preference and the central government's expectation is large, the corporation tax rate that is decided by the central government is larger than the rate decided by the local government. The reasoning is as follows: the local government sets a high tax rate because it under-evaluates the residents' cost. On the other hand, the central government over-evaluates the benefit from the public good. Here, note that the over-evaluation of the marginal benefit from the public good yields a higher tax rate, which increases the supply of the public good. However, the increase in the supply does not give sufficient benefit to the residents because the actual preference is small. Consequently, though

both the factors yield a higher tax rate, the influence of the under-evaluation of the resident's cost is smaller. This indicates that the local government should always decide the corporation tax rate.

When the difference between the actual preference and the central government's expectation is small, the result depends on the degree of the spillover effect. This is similar to Proposition 3. Namely, when the public good has a full spillover effect, the local government can set the first-best because the inefficiency from the tax export effect is offset by the incentive to free-ride. On the other hand, because the central government is unable to realize the actual preference of the public good, the first-best solution is not realized. As a result, it is socially preferable that the local government decides the corporation tax rate.

When there is no spillover effect, the local government sets a very high corporation tax rate because it under-evaluates the residents' cost. On the other hand, though the central government is unable to realize the actual preference, it can set a nearly optimal tax rate because it accurately evaluates the cost and nearly accurately evaluates the marginal benefit. Consequently, in this case, the central government should decide the corporation tax rate.

Considering two extreme cases, we can make the following observation. When the degree of the spillover effect is small, the central government should decide the tax rate because the central government decides an almost suitable rate, while the local government decides a higher rate. When the degree of the spillover effect becomes large, it is preferable that the local government decide the tax rate. This is because the incentive to free-ride decreases the rate decided by the local government, and the rate is close to the optimal one.

From the above discussions, we demonstrate the following important implications with regard to the transfer of tax revenue sources. With regard to the corporation tax, it is preferable to transfer the tax revenue sources if the degree of the spillover effect is large; this result is contradictory to those in the previous studies. For example, if a facility (e.g., the road network) that considerably influences the other region is improved using the corporation tax revenue, the local government should decide the corporation tax rate.

On the other hand, if a facility that has a small spillover effect is the subject, the probability that

the central government will decide the tax rate is high¹⁶. Consequently, we are unable to clearly decide who should decide the corporation tax rate. However, at least we demonstrate that the local government should impose the corporation tax if it requires the tax revenue to improve the facilities with a large spillover effect. In other words, decentralization is preferable to centralization.

In addition, we can also interpret this paper's result as follows. Under decentralization, the local government should decide the corporation tax rate to become higher tax export effect when the local public good has a large spillover effect.

8 Concluding Remarks

This paper discusses who should decide the corporation tax rate—the central government or the local government—when the local public good has a spillover effect. In addition, the central government is unable to realize the residents' actual preference of the public good. Consequently, this paper makes the following conclusions. First, when the central government decides the corporation tax rate, an excessive tax rate is decided if the actual preference is small; if the actual preference is large, an inadequate tax rate is decided. This result is obvious, because the central government is unable to realize the residents' actual preference, and evaluates the expected marginal benefit when deciding the tax rate. Consequently, though the actual preference is large (small), the probability that the preference can be small (large) exists. It is this probability that results in inefficiency.

Next, when the local government decides the corporation tax rate, we find that it has two incentives: an incentive to free-ride and an incentive to under-evaluate residents' cost. As a result, because the incentive to under-evaluate the residents' cost is larger than the incentive to free-ride, the local government decides a tax rate higher than the socially optimal one. A similar result is obtained with the tax export problem. However, this paper demonstrates that the spillover effect weakens the tax export effect.

Finally, this paper analyzes who should decide the corporation tax rate. We find that when the spillover effect is small, it is preferable that the central government decides the corporation tax rate

¹⁶Here, the reason for the vagueness is as follows: though the actual preference of the public good is θ , when the central government thinks that the probability of $\theta = \bar{\theta}$ is large, the local government should impose the tax.

(except for when the central government considers the higher probability to imply a large preference). Conversely, when the spillover effect is high, the local government should decide the tax rate. According to the traditional thought process, when the spillover effect is high, it is preferable that the central government decides the tax rate because the local government has an incentive to free-ride and an inadequate tax rate is decided. However, this paper demonstrates the reverse. This point is new insight to the literatures. As mentioned above, the spillover effect weakens the tax export effect, which results in a higher tax rate. Therefore, the higher the spillover effect, the larger the inefficiency from the tax export effect that is offsetted. If the local public good has a full spillover effect, the local government's decision corresponds with the first-best. Consequently, we can conclude that decentralization is preferable if the local public good has a large spillover effect.

Note that because we use a very simple set up, this paper has some problems. First, this paper ignores the market of the private good, even though the corporation tax may have an influence on the private good market. Therefore, we analyze who should decide the tax rate using the model that includes the private good market. In addition, this paper assumes that each resident has only one unit of labor. This assumption is also restrictive. Therefore, the quantity of labor supplied by one resident must be endogenous.

Next, this paper pays attention to only corporation tax. However, in the real world, governments impose both income tax and corporation tax. Generally, we believe that when the income tax is imposed, if the local government decides it, an inadequate tax rate is decided. As such, if both income tax and corporation tax are imposed simultaneously, the possibility that an efficient tax rate may yield exists. Consequently, in the future, we must analyze the tax rate problem using the model in which two types of tax income resources—income tax and corporation tax—are included.

Finally, the results in this paper depend on the specification of the utility function. Therefore, future research must use a general type utility function. In addition, this paper ignores the migration of residents. However, some researches argue that the first-best solutions are realized when migration between regions is considered. Consequently, we need to include migration into our model, and analyze who should decide the corporation tax rate.

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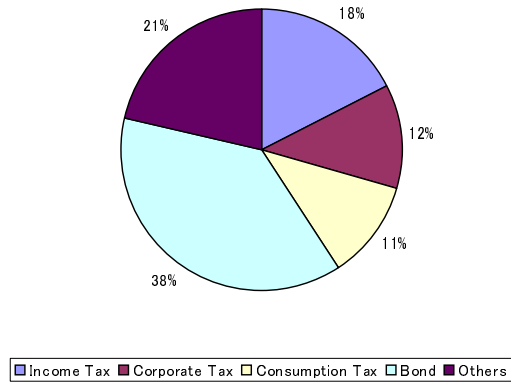


Figure 1: Detailed account of the tax income in 2009 (Source: Fukuda (2009))

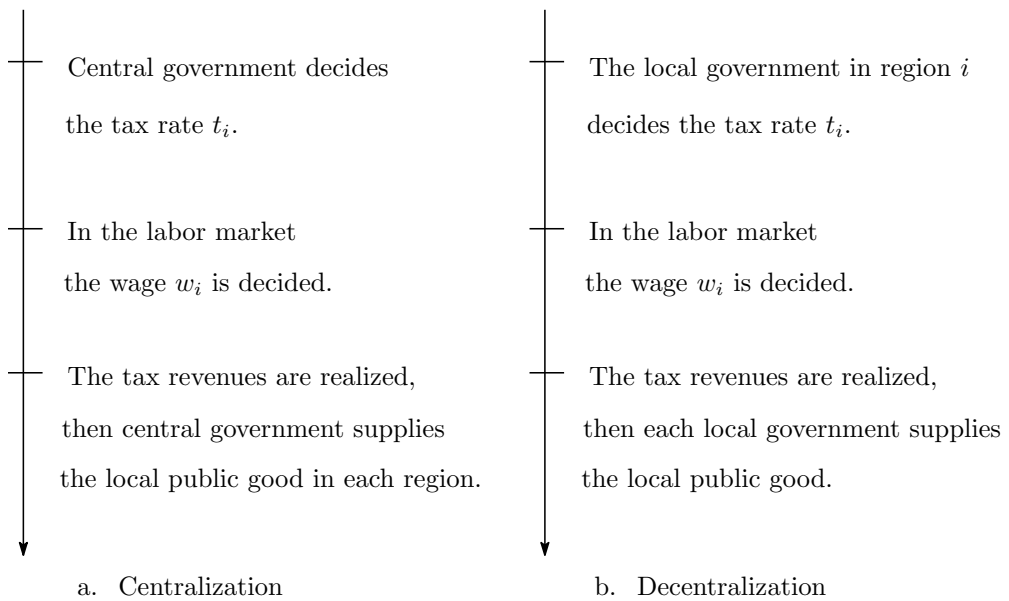


Figure 2: Timeline

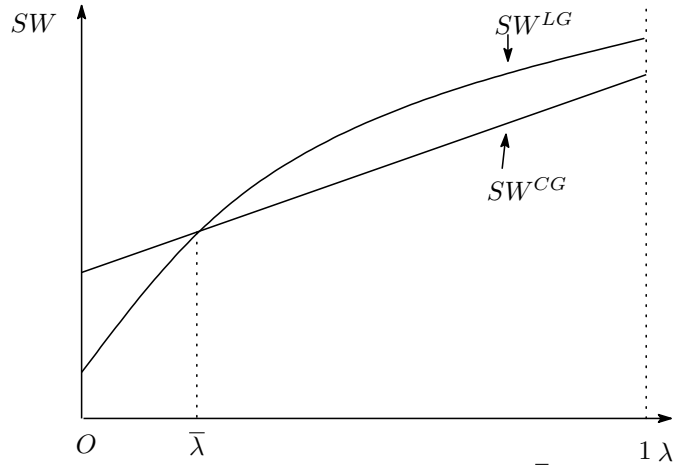
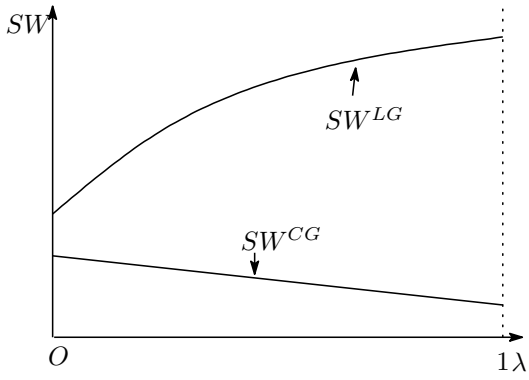
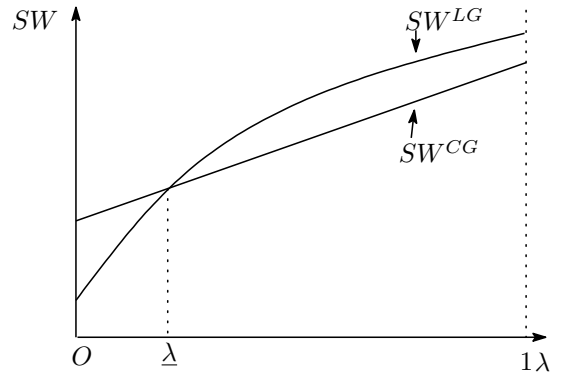


Figure 3: Social welfare when $\theta = \bar{\theta}$



a. $p \leq \frac{\bar{\theta} - 2\theta}{\bar{\theta} - \theta}$



b. $p > \frac{\bar{\theta} - 2\theta}{\bar{\theta} - \theta}$

Figure 4: Social welfare when $\theta = \underline{\theta}$