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Elections accelerate inefficiencies in local public good provision with decentralized leadership

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【Abstract】This paper introduces the election process to the traditional decentralized leadership model, where the central government does not have a pre-commitment ability, and interregional transfer is optimally designed ex post. In the traditional decentralized leadership model, it has been shown that local public good provision is distorted by ex post transfer. The purpose of this paper is to examine how the introduction of the election process affects inefficiencies in the decentralized leadership situation. Our results show that the direction of this distortion depends on the commitment environment, and the degree of this distortion depends on the degree of spillover.

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1 Introduction

In January 2015, the radical left-wing party, led by Alexis Tsipras, won the election in Greece with a promise of anti-austerity. Why was anti-austerity supported by the people even when the European Union (EU) called for austerity in Greece as a condition of additional fiscal support?

The reason why the Greek people took this extreme position may be related to the rescue ex post by the EU. Even if Greece did not impose severe austerity, the EU may have been expected to support Greece ex post by increasing transfers. A very radical ex ante position might have been important to Greece in order to induce transfers from the EU. Given this expectation, the policy leader in Greece is likely to be strategically selected in an election.

The effect of the ex post interregional transfer by the central government has been analyzed theoretically in the context of the lack of commitment. When the central government cannot commit to the policy, it faces a chance to redesign its policy ex post after observing the result in the economy or society. This situation can be modeled for local governments as Stackelberg leaders and for the central government as a Stackelberg follower. Such a model structure is often called "decentralized leadership." Under decentralized leadership, it is shown that local public goods may be either under or overprovided, depending on local governments' ex ante policy. However, some studies show that resource allocation is socially efficient when local governments commit to the provision of pure public goods ex ante (e.g., Caplan et al. 2000; Koethenbuerger 2004, 2008; Akai and Sato 2008; Caplan and Silva 2011; Silva 2014, 2015; Akai and Watanabe 2020). In particular, in previous literature, the importance of the type of local governments' commitment in terms of social welfare has been focused on the decentralized leadership model (e.g., Akai and Watanabe 2020).

In previous models, the election stage where the representative who promises the policy is elected is not considered. It is interesting to incorporate the election stage into the decentralized leadership model from the perspective of reality and analyze how the introduction of the election process affects inefficiencies previously presented in the decentralized leadership model.

In the absence of ex post interregional transfers, there exists some previous literature that considers the election process in the model with interregional competitive interactions among local governments. The policy maker is strategically elected by voters, taking their effect on the election in other regions into account, the behavior of which is often called "strategic delegation." Several studies derive the effects on the local tax or expenditure policies, the degree of strategic delegation, and resource allocation in Nash equilibrium. However, in these previous studies, no ex post interregional transfer is considered. [1]

This paper analyzes how the consideration of the election process improves or exacerbates the resource allocation in decentralized leadership where the central government cannot commit to its policy ex ante and can design interregional transfer ex post.

The main results are as follows. In the neutral situation where the median voter is elected in the absence of ex post transfer, ex post transfer affects the political outcome, and the policy maker who prefers different policies from the median voter is elected. As a result, the resource allocation of local public good provision under the presence of the election process is further distorted, in addition to the original distortion by the ex post transfer in the model without the election process.

The direction of its distortion depends on whether the policy maker's ex ante policy is committed to local public good provision or the local tax rate. When the policy maker in each region commits to local public good provision ex ante, the policy maker with the stronger preference for local public goods would be elected, the degree of which depends on the degree of the spillover effect of local public goods. Resource allocation is more distorted by the higher level of local public good provision, except for the case of perfect spillover. The increase of the degree of the spillover mitigates the inefficiency of the resource allocation, and this distortion can be fully canceled out in the case of perfect spillover.

By contrast, when the policy maker in each region commits to its local tax rate, the policy maker with the weaker preference for local public goods is elected, and resource allocation is more distorted with the lower level of the local public good provision. In this case, this distortion cannot be canceled out even in the case of perfect spillover, while the efficiency of resource allocation is improved as the degree of the spillover increases.

This paper is structured as follows. The basic model is explained in Section 2. Then, we analyze two scenarios. In Section 3, we analyze the scenario where the policy maker commits to local public

[1]One exception is Susa (2019), who analyzes electoral outcomes with equalization transfer in a tax competition framework. The equalization is based on the difference at the capital level, the total of which is constant. The incentive is not biased in Nash equilibrium. By contrast, we analyze the transfer on the levels of private consumption or local public goods, the total of which is not constant in the model.

good provision. In Section 4, we analyze another scenario where the policy maker commits to the local tax rate. In Section 5, we compare the effect of ex post interregional transfer on the elected policy maker between scenarios. Section 6 concludes the paper.

2 The model

Consider an economy with two regions, $i = A, B$. [2] There are two local governments and one central government. The population size of each region is normalized to one. Each region provides a local public good g_i, which is measured in per capita terms and may generate interregional spillovers. All individuals j in region i enjoy private consumption c_{ij}.

Individuals have different local public goods preference. We denote the local public goods preference of individual j in each region by θ_j. This preference in each region is identically and symmetrically distributed over the interval $[\underline{\theta}, \overline{\theta}]$, so the median is equivalent to the mean. The larger an individual's θ_j is, the stronger his/her preference for local public goods is.

Each individual j in both regions is characterized by the local public goods preference parameter θ_j. The preference of a type θ_j citizen in each region is:

$$
\begin{aligned}
& u(c_{ij}) + \theta_j v(g_i, g_{-,i}; \lambda) \\
& = \log c_i + \theta_j [\log g_i + \lambda \log g_{-i}], \ i = A, B, \ \forall j, \ i \neq -i
\end{aligned} \tag{1}
$$

We assume the additively separable utility function, which is a functional form adopted in Besley and Coate (2003), to clearly define the effect of ex post interregional transfer on the election of the policy maker. [3] λ represents the degree of spillover of local public goods. If $\lambda = 0$, spillover effects are absent: individuals in region i do not care about local public good provision in region $-i$. The larger the value of λ, the larger the degree of spillover. If $\lambda = 1$, individuals care about the local public good provided in the other region as well as the local public good produced in their own region. We

[2] For simplicity, we analyze two regions. Our results would not change even if N regions were considered.

[3] Under the additively separable utility function, the distortion does not occur in the model without ex post transfers. Therefore, it is possible to derive the effect of the introduction of ex post transfers clearly. By contrast, Kemp and Rota-Graziosi (2019) assume a utility function that satisfies $\partial^2 v(g_i, g_{-,i}; \lambda)/\partial g_i \partial g_{-i} \neq 0$. In their paper, strategic delegation takes place even without ex post transfers. See Rota-Graziosi (2019) for detailed explanations.

assume:

Assumption 1

$$0 < \lambda \leq 1 \tag{2}$$

We assume that $0 < \lambda$ is the necessary condition for $c_{ij} > 0$ and $g_i > 0,\ i = A, B,\ \forall j$ in the subgame-perfect equilibrium. We also assume:

Assumption 2

$$\frac{1}{1-\lambda} > \theta_M > \frac{1}{1+\lambda} \tag{3}$$

Assumption 2 also ensures an interior solution in the subgame-perfect equilibrium.

Local government i levies a lump sum tax t_i on all residents who live in the region i, and the tax revenue is used for the local public good provision g_i, which is measured in per capita terms. Suppose that y_i is the exogenous per capita income of individuals in region i, then private consumption of individuals in region i is given as follows.

$$c_{ij} = y_i - t_i = c_i,\ i = A, B,\ \forall j \tag{4}$$

Note that the decision t_i directly links to the level of private consumption, given the exogenous income. Now the budget constraint of local government i can be written as:

$$g_i = t_i + s_i, \quad i = A, B \tag{5}$$

where s_i denotes the per capita transfer from the central government to the region. Turning to the budget constraint of the central government, the expression becomes:

$$s_A + s_B = 0 \tag{6}$$

s_i can be either positive or negative.[4] The central government can control the transfer to pursue its own objectives, but cannot commit to the transfer policy; therefore, the transfer is optimized ex post. Given the central and local budget constraints, we can describe the overall resource constraint as follows.

$$c_A + c_B + g_A + g_B = y_A + y_B \tag{7}$$

2.1 Benchmark

We first derive the socially optimal amount of local public goods. The social optimum serves as a benchmark in order to evaluate the outcomes of political decision making under ex post interregional transfers. We define the social optimum as the outcome that maximizes the sum of utilities of all individuals in both regions. Because individuals in each region are symmetrically distributed over the interval $[\underline{\theta}, \overline{\theta}]$, and with population size normalized to one, social welfare is equal to the sum of utilities of median voters in both regions. We denote the position of the median in both regions by θ_M. Hence,

$$\begin{aligned} \max_{\{c_i, g_i\}_{i=A,B}} \quad & S = \log c_A + \theta_M[\log g_A + \lambda \log g_B] \\ & \quad + \log c_B + \theta_M[\log g_B + \lambda \log g_A] \\ \text{s.t.} \quad & c_A + c_B + g_A + g_B = y_A + y_B \end{aligned}$$

First-order conditions become:

$$\frac{1}{c_A} - \alpha = 0 \tag{8}$$

$$\frac{1}{c_B} - \alpha = 0 \tag{9}$$

$$\theta_M \frac{1}{g_A} + \theta_M \frac{\lambda}{g_A} - \alpha = 0 \tag{10}$$

$$\theta_M \frac{1}{g_B} + \theta_M \frac{\lambda}{g_B} - \alpha = 0 \tag{11}$$

[4] In our model, negative transfer implies ex post taxation of the local government by the central government.

where α is a Lagrangian multiplier associated with the constraint of the abovementioned optimization problem. We can rewrite first-order conditions as follows.

$$c_A^{**} = c_B^{**} = c^{**} \tag{12}$$

$$\theta_M \frac{1}{g_A^{**}} + \theta_M \frac{\lambda}{g_A^{**}} = \frac{1}{c^{**}} \tag{13}$$

$$\theta_M \frac{1}{g_B^{**}} + \theta_M \frac{\lambda}{g_B^{**}} = \frac{1}{c^{**}} \tag{14}$$

By substituting condition (12) into equation (7), we obtain:

$$c^{**} = \frac{y_A + y_B - g_A^{**} - g_B^{**}}{2} \tag{15}$$

From conditions (13) and (14), we obtain:

$$g_A^{**} = g_B^{**} = g^{**} \tag{16}$$

Combining equations (15) and ((16) with (13) (or (14)) yields:

$$g^{**} = \frac{(1+\lambda)\theta_M(y_A + y_B)}{2[(1+\lambda)\theta_M + 1]} \tag{17}$$

2.2 Timeline

The timeline of our model is defined as follows.

1. In each region, the policy maker is simultaneously elected from among the individuals through majority voting. The authority to determine the local policy within a region is delegated to the individual selected in this election.

2. Given the environment related to the committed policy variables, the local policy is determined by the policy maker selected through the election in Stage 1.

3. Having observed local policies within both regions committed in Stage 2, the central government designs the transfer s_i. Finally, given all policies of governments, each individual consumes and

gains utility.

Regarding ex ante commitment of the policy maker in each region, we consider following two scenarios. In Scenario I, the policy maker commits to the level of the local public provision g_i ex ante with the local tax rate t_i remaining as residual ex post. By contrast, the local tax rate is pre-committed in Scenario II, and g_i is determined ex post, after the central transfer is designed. In either scenario, the central government is the Stackelberg follower. Because the concept of a subgame-perfect equilibrium is applied, we solve each scenario backwardly.

3 Scenario I: g_i is committed ex ante

3.1 Stage 3: Ex post policy making of the central government

Given that g_i is already committed ex ante, t_i is adjusted ex post so as to balance the local budget $t_i = g_i - s_i$, with s_i transferred from the central government. [5] Then the central government chooses s_i to maximize the sum of utilities of median voters in both regions. [6] The optimization problem solved by the central government in the third stage is given as follows.

$$\begin{aligned}
&\max_{s_A, s_B} U_{AM} + U_{BM} \\
&\qquad = \log(y_A - g_A + s_A) + \theta_M[\log g_A + \lambda \log g_B] \\
&\qquad\quad + \log(y_B - g_B + s_B) + \theta_M[\log g_B + \lambda \log g_A] \\
&\text{s.t. } s_A + s_B = 0
\end{aligned}$$

The first-order condition is:

$$\frac{1}{c_A} - \frac{1}{c_B} = 0 \tag{18}$$

[5] Then private consumption is adjusted by the transfer through the change of t_i.

[6] Here, we simply consider the case of a benevolent central government in order to focus on the distortion of the regional election under a benevolent central government.

Condition (18) states that the ex post interregional transfer s_i is chosen to equalize the marginal utilities of private consumption across regions. This condition implies:

$$c_A = c_B = c \tag{19}$$

Therefore, we obtain:

$$c = \frac{y_A + y_B - g_A - g_B}{2} \tag{20}$$

Substituting equation (20) into $c_i = y_i - g_i + s_i$, we obtain the following.

$$\frac{\partial s_i}{\partial g_i} = \frac{1}{2} > 0, \;\; i = A, B \tag{21}$$

$$\frac{\partial s_{-i}}{\partial g_i} = -\frac{1}{2} < 0, \;\; i = A, B, \;\; i \neq -i \tag{22}$$

The denominator is 2 in equations (21) and (22) because we assume two regions.

3.2 Stage 2: The policy maker's ex ante policy

Let the utility level of the policy maker in region i be denoted by U_{iP}, and the policy maker's local public goods preference denoted by θ_{iP}. Taking the local public good provision in the other region g_{-i} as given, the policy maker determines g_i in his/her region to maximize his/her utility. Therefore, the optimization problem solved by the policy maker in each region is given as follows. [7]

$$\max_{g_i} U_{iP} = \log c + \theta_{iP}[\log g_i + \lambda \log g_{-i}]$$
$$\text{s.t. } c = \frac{y_A + y_B - g_A - g_B}{2}$$

The first-order condition is:

$$\frac{1}{c} \times \left(-\frac{1}{2}\right) + \theta_{iP}\frac{1}{g_i} = 0, \;\; i = A, B \tag{23}$$

[7] In this stage, the policy maker is able to commit to the policy he/she decides, and individuals know it in the first stage election.

From condition (23) and equation (20), we obtain the reaction function of region i as follows.

$$g_i(g_{-i}) = -\frac{\theta_{iP}}{1+\theta_{iP}} g_{-i} + \frac{\theta_{iP}(y_A + y_B)}{1+\theta_{iP}}, \; i = A, B, \; i \neq -i \tag{24}$$

Solving equation (24) for $i = A, B$, we obtain:

$$g_i(\theta_{AP}, \theta_{BP}) = \frac{\theta_{iP}(y_A + y_B)}{1+\theta_{AP}+\theta_{BP}}, \; i = A, B \tag{25}$$

Combining equation (20) with (25) yields:

$$c(\theta_{AP}, \theta_{BP}) = \frac{y_A + y_B}{2(1+\theta_{AP}+\theta_{BP})} \tag{26}$$

3.3 Stage 1: Election of the policy maker

In the first stage, the policy maker is elected by majority voting in each region. Individuals in each region vote for a candidate based on their local public goods preference. Because of the median voter theorem, the individual located at the median of the distribution of the preference is the decisive voter in his/her region. Taking the result of the second stage into account and the choice of the other region as given, the median voter in each region decides to whom the authority to decide the level of the local public good provision is delegated. Hence, the optimization problem considered by the median voter in region i is given as follows.

$$\begin{aligned} \max_{\theta_{iP}} U_{iM} &= \log c(\theta_{AP}, \theta_{BP}) + \theta_M [\log g_i(\theta_{AP}, \theta_{BP}) + \lambda \log g_{-i}(\theta_{AP}, \theta_{BP})] \\ \text{s.t. } c(\theta_{AP}, \theta_{BP}) &= \frac{y_A + y_B}{2(1+\theta_{AP}+\theta_{BP})} \\ g_i(\theta_{AP}, \theta_{BP}) &= \frac{\theta_{iP}(y_A + y_B)}{1+\theta_{AP}+\theta_{BP}}, \; i = A, B, \; i \neq -i \end{aligned}$$

The first-order condition is:

$$\frac{1}{c}\frac{\partial c}{\partial \theta_{iP}} + \theta_M \left[\frac{1}{g_i}\frac{\partial g_i}{\partial \theta_{iP}} + \lambda \frac{1}{g_{-i}}\frac{\partial g_{-i}}{\partial \theta_{iP}} \right] = 0, \; i = A, B, i \neq -i \tag{27}$$

This condition can be rewritten as follows.

$$-\frac{1}{1+\theta_{AP}+\theta_{BP}}+\theta_M\left[\frac{1+\theta_{-iP}}{\theta_{iP}(1+\theta_{AP}+\theta_{BP})}-\frac{\lambda}{1+\theta_{AP}+\theta_{BP}}\right]=0,\ i=A,B,i\neq -i \tag{28}$$

Therefore, we obtain the reaction function of region i as follows.

$$\theta_{iP}(\theta_{-iP})=\frac{\theta_M}{1+\lambda\theta_M}\theta_{-iP}+\frac{\theta_M}{1+\lambda\theta_M},\ i=A,B,i\neq -i \tag{29}$$

Solving equation (29) for $i = A, B$, we obtain:

$$\theta_{AP}^{\mathrm{I}*}=\theta_{BP}^{\mathrm{I}*}=\theta_{P}^{\mathrm{I}*}=\frac{\theta_M}{1-(1-\lambda)\theta_M} \tag{30}$$

Substituting equation (30) into (25) and (26), the equilibrium levels of the local public good and private consumption in each region are derived as follows.

$$g_A^{\mathrm{I}*}=g_B^{\mathrm{I}*}=g^{\mathrm{I}*}=\frac{\theta_M(y_A+y_B)}{(1+\lambda)\theta_M+1} \tag{31}$$

$$c^{\mathrm{I}*}=\frac{[1-(1-\lambda)\theta_M](y_A+y_B)}{2[(1+\lambda)\theta_M+1]} \tag{32}$$

First, we examine the direction of strategic delegation. Comparing the policy maker in the equilibrium with the median voter, we have:

$$\theta_P^{\mathrm{I}*}>\theta_M \quad \text{if} \quad 0<\lambda<1 \tag{33}$$

$$\theta_P^{\mathrm{I}*}=\theta_M \quad \text{if} \quad \lambda=1 \tag{34}$$

Thus, when the degree of spillover of local public goods is less than one, the median voter in each region delegates authority to the individual with stronger local public goods preference to decide the local public good provision. By contrast, when the degree of spillover is equal to one, the median voter in each region is elected as the policy maker.

Next, we examine local public good provision in equilibrium. Remembering that the socially optimal level of local public good provision is $g^{**} = (1+\lambda)\theta_M(y_A+y_B)/\{2[1+(1+\lambda)\theta_M]\}$, we have:

$$g^{\mathrm{I}*} > g^{**} \quad \text{if} \quad 0 < \lambda < 1 \tag{35}$$

$$g^{\mathrm{I}*} = g^{**} \quad \text{if} \quad \lambda = 1 \tag{36}$$

Thus, when the degree of spillover of local public goods is less than one, local public good provision in equilibrium is overprovided relative to the social optimum. By contrast, when the degree of spillover is equal to one, local public good provision in equilibrium coincides with the social optimum.

We can also derive local public good provision in the absence of election of the policy maker. In this case, the local public good provision is determined directly by the median voter. We refer to this case as the "no election case." This level of provision is derived by substituting $\theta_{AP} = \theta_{BP} = \theta_M$ into equation (25). Let $g^{\mathrm{I}*}|_{\theta_P^*=\theta_M}$ represent the local public good provision in the no election case, then we obtain the following.

$$g^{\mathrm{I}*}|_{\theta_P^*=\theta_M} = \frac{\theta_M(y_A+y_B)}{1+2\theta_M} \tag{37}$$

Comparing the case with and without election of the policy maker, we have: [8] :

$$g^{\mathrm{I}*} > g^{\mathrm{I}*}|_{\theta_P^*=\theta_M} > g^{**} \quad \text{if} \quad 0 < \lambda < 1 \tag{38}$$

$$g^{\mathrm{I}*} = g^{\mathrm{I}*}|_{\theta_P^*=\theta_M} = g^{**} \quad \text{if} \quad \lambda = 1 \tag{39}$$

When the degree of spillover of local public goods is less than one, the local public good provision in the presence of election is not coincident with the social optimum and is excessively provided relative to that in the absence of election. By contrast, when the degree of spillover is equal to one, local public good provision even in the presence of election coincides with the socially optimal level.

The results of Scenario I are summarized as follows.

Proposition 1

[8] Comparing the no election outcome with the social optimum, we obtain the following inequality.

$$g^{\mathrm{I}*}|_{\theta_P^*=\theta_M} \geq g^{**} \Leftrightarrow 1 \geq \lambda$$

Therefore, equations (38) and (39) hold.

(a) Assume $\lambda = 1$. *Then, local public good provision in the subgame-perfect equilibrium coincides with the social optimum, i.e.,* $g^{I*} = g^{**}$. *The median voter is elected as the policy maker, i.e.,* $\theta_P^{I*} = \theta_M$.

(b) Assume $\lambda \in (0, 1)$. *Then:*

(b-1) The median voter delegates the authority to the individual with stronger local public goods preference to decide the policy, i.e., $\theta_P^{I*} > \theta_M$.

(b-2) Local public goods are overprovided relative to the social optimum, i.e., $g^{I*} > g^{**}$.

(b-3) Compared with the no election case, local public good provision in the subgame-perfect equilibrium is greater, i.e., $g^{I*} > g^{I*}|_{\theta_P^{I*}=\theta_M} > g^{**}$.

The intuition of Proposition 1 is given as follows. First, as shown in (a), the degree of spillover has the crucial role of achieving the socially optimal allocation. This result can be interpreted as the combination of the results from both the decentralized leadership model and the strategic delegation model. In the decentralized leadership model, it has been shown that the incentive effect of ex post interregional transfer is fully canceled out by the incentive effect of the perfect spillover. In articles on strategic delegation, it has been shown that the strategically elected policy maker coincides with the median voter under the separable utility function. The special situation with both the separable utility function and perfect spillover makes resource allocation optimal.

By contrast, for (b) with imperfect spillover, the result dramatically changes. In addition to the fact that resource allocation is biased under imperfect spillover, because of the incentive effect of the interregional transfer, the strategically elected policy maker does not coincide with the median voter even under the separable utility function. In particular, the individual with stronger preference for local public goods is elected as the policy maker, because the higher level of local public good provision is desirable in order to induce the higher level of transfer ex post (see equation (21)). As a result, the level of the local public good provision is accelerated by the presence of the policy maker election stage. [9]

[9]The results of Proposition 1 seem to be similar to Besley and Coate (2003) and Dur and Roelfsema (2005). in both papers, the reason for obtaining these results is due to the integration of regional budgets by *centralized (cooperative)* decision making, which is different from our results arising from cost sharing by ex post transfers under *decentralized* decision making.

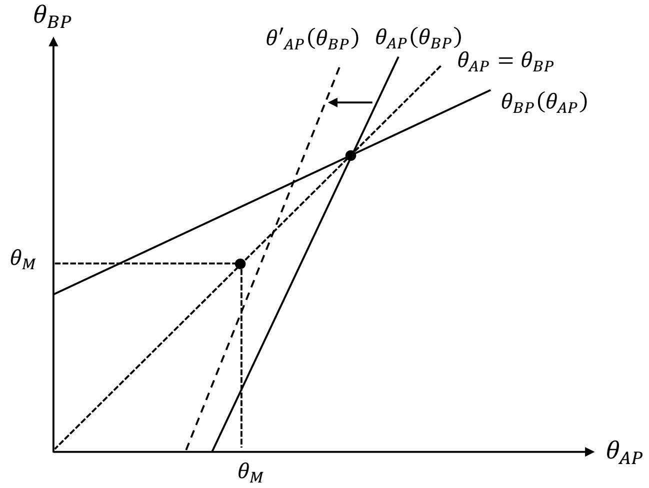

Figure 1: Best responses at the electoral stage in Scenario I.

Figure 1 illustrates changes in electoral outcomes depending on the degree of spillover in Scenario I. For the slope and intercept of the best response function in Stage 1 represented by equation (29), we obtain:

$$\frac{\partial}{\partial \lambda} \frac{\theta_M}{1 + \lambda \theta_M} = -\frac{\theta_M^2}{(1 + \lambda \theta_M)^2} < 0 \tag{40}$$

Therefore, the degree of spillover shifts the best response function of region A downward. This is represented by the shift from $\theta_{AP}(\theta_{BP})$ to $\theta'_{AP}(\theta_{BP})$ in Figure 1. Of course, the best response function of region B also shifts downward, so that the intersection of best response functions of both regions shifts to the southwest on the 45-degree line. As a result, the local public goods' preference of the policy maker elected in each region approaches the median voter's preference. This means that the local public good provision in the equilibrium decreases. That is, we have:

$$\frac{\partial g^{\mathrm{I}*}}{\partial \lambda} = -\frac{\theta_M^2 (y_A + y_B)}{[(1 + \lambda)\theta_M + 1]^2} < 0 \tag{41}$$

The reason for the relationship between the degree of spillover and the electoral outcome is that the higher spillover effect decreases the incentive to induce the transfer to its own region (in other words, the incentive for strategic delegation) due to the increased benefit from the local public good provision in the other region. Under perfect spillover (i.e., $\lambda = 1$), the incentive for strategic delegation disappears, so the elected policy maker is consistent with the median voter. As it approaches the median voter, the local public good provision in equilibrium also decreases, while the socially optimum level increases with the increase of the degree of the spillover. Finally, the local public good provision coincides with the social optimum.

4 Scenario II: t_i is committed ex ante

4.1 Stage 3: Ex post policy making of the central government

In this section, we consider another scenario in which the policy maker in each region commits to the local tax rate ex ante. Because t_i is already committed ex ante, in contrast to Scenario I, g_i is adjusted ex post such as to balance the local budget $g_i = t_i + s_i$. Therefore, the optimization problem solved by the central government in the third stage is given as follows.

$$\begin{aligned}
\max_{s_A, s_B} \; & U_{AM} + U_{BM} \\
& = \log c_A + \theta_M[\log(t_A + s_A) + \lambda \log(t_B + s_B)] \\
& \quad + \log c_B + \theta_M[\log(t_B + s_B) + \lambda \log(t_A + s_A)] \\
\text{s.t. } & s_A + s_B = 0
\end{aligned}$$

The first-order condition is:

$$(1+\lambda)\theta_M \frac{1}{g_A} - (1+\lambda)\theta_M \frac{1}{g_B} = 0 \tag{42}$$

Condition (42) states that the central transfer s_i is chosen to equalize the marginal utilities of local public goods across regions. This condition implies:

$$g_A = g_B = g \tag{43}$$

Therefore, we obtain:

$$g = \frac{t_A + t_B}{2} \tag{44}$$

Substituting equation (44) into $g_i = t_i + s_i$, we obtain the following conditions.

$$\frac{\partial s_i}{\partial t_i} = -\frac{1}{2} < 0, \ i = A, B \tag{45}$$

$$\frac{\partial s_{-i}}{\partial t_i} = \frac{1}{2} > 0, \ i = A, B, \ i \neq -i \tag{46}$$

4.2 Stage 2: The policy maker's ex ante policy making

In the second stage, the policy maker determines t_i in his/her region to maximize his/her utility, taking the local tax rate in the other region t_{-i} as given. Therefore, the optimization problem solved by the policy maker in each region is given as follows.

$$\begin{aligned} &\max_{t_i} U_{iP} = \log c_i + \theta_{iP}[\log g + \lambda \log g] \\ &\text{s.t. } c_i = y_i - t_i, \ i = A, B \\ &\quad g = \frac{t_A + t_B}{2} \end{aligned}$$

The first-order condition is:

$$-\frac{1}{y_i - t_i} + \theta_{iP}\left[\frac{1}{g} \times \frac{1}{2} + \lambda \frac{1}{g} \times \frac{1}{2}\right] = 0, \ i = A, B \tag{47}$$

From condition (47) and equation (44), we obtain the reaction function of region i as follows.

$$t_i(t_{-i}) = -\frac{1}{(1+\lambda)\theta_{iP} + 1} t_{-i} + \frac{(1+\lambda)\theta_{iP} y_i}{(1+\lambda)\theta_{iP} + 1}, \ i = A, B, i \neq -i \tag{48}$$

Solving equation (48) for $i = A, B$, we obtain:

$$t_i(\theta_{AP}, \theta_{BP}) = \frac{\theta_{iP} y_i[(1+\lambda)\theta_{-iP} + 1] - \theta_{-iP} y_{-i}}{(1+\lambda)\theta_{AP}\theta_{BP} + \theta_{AP} + \theta_{BP}}, \ i = A, B, i \neq -i \tag{49}$$

Substituting equation (49) into $c_i = y_i - t_i$ and equation (44) yields:

$$c_i(\theta_{AP}, \theta_{BP}) = \frac{\theta_{-iP}(y_A + y_B)}{(1+\lambda)\theta_{AP}\theta_{BP} + \theta_{AP} + \theta_{BP}},\ i = A, B, i \neq -i \tag{50}$$

$$g(\theta_{AP}, \theta_{BP}) = \frac{1}{2} \times \frac{(1+\lambda)\theta_{AP}\theta_{BP}(y_A + y_B)}{(1+\lambda)\theta_{AP}\theta_{BP} + \theta_{AP} + \theta_{BP}} \tag{51}$$

4.3 Stage 1: Election of the policy maker

As presented in Section 3.3, the optimization problem considered by the median voter in region i is given as follows.

$$\begin{aligned}
&\max_{\theta_{iP}} U_{iM} = \log c_i(\theta_{AP}, \theta_{BP}) + \theta_M[\log g(\theta_{AP}, \theta_{BP}) + \lambda \log g(\theta_{AP}, \theta_{BP})] \\
&\text{s.t. } c_i(\theta_{AP}, \theta_{BP}) = \frac{\theta_{-iP}(y_A + y_B)}{(1+\lambda)\theta_{AP}\theta_{BP} + \theta_{AP} + \theta_{BP}},\ i = A, B,\ i \neq -i \\
&\qquad g(\theta_{AP}, \theta_{BP}) = \frac{1}{2} \times \frac{(1+\lambda)\theta_{AP}\theta_{BP}(y_A + y_B)}{(1+\lambda)\theta_{AP}\theta_{BP} + \theta_{AP} + \theta_{BP}}
\end{aligned}$$

The first-order condition is:

$$\frac{1}{c_i}\frac{\partial c_i}{\partial \theta_{iP}} + \theta_M \left[\frac{1}{g}\frac{\partial g}{\partial \theta_{iP}} + \lambda \frac{1}{g}\frac{\partial g}{\partial \theta_{iP}}\right] = 0,\ i = A, B \tag{52}$$

This condition can be rewritten as follows.

$$\begin{aligned}
&-\frac{[(1+\lambda)\theta_{-iP} + 1]}{(1+\lambda)\theta_{AP}\theta_{BP} + \theta_{AP} + \theta_{BP}} \\
&\quad + \theta_M \left[\frac{(1+\lambda)\theta_{-iP}}{\theta_{iP}[(1+\lambda)\theta_{AP}\theta_{BP} + \theta_{AP} + \theta_{BP}]}\right] = 0,\ i = A, B, i \neq -i
\end{aligned} \tag{53}$$

Therefore, we obtain the reaction function of region i as follows.

$$\theta_{iP}(\theta_{-iP}) = \frac{(1+\lambda)\theta_M}{(1+\lambda)\theta_{-iP} + 1}\theta_{-iP},\ i = A, B, i \neq -i \tag{54}$$

Solving equation (54) for $i = A, B$, we obtain:

$$\theta_{AP}^{\mathrm{II}*} = \theta_{BP}^{\mathrm{II}*} = \theta_P^{\mathrm{II}*} = \frac{(1+\lambda)\theta_M - 1}{1+\lambda} \tag{55}$$

Substituting equation (55) into (50) and (51), the equilibrium levels of private consumption and local public goods in each region are derived as follows.

$$c_A^{\mathrm{II}*} = c_B^{\mathrm{II}*} = c^{\mathrm{II}*} = \frac{y_A + y_B}{(1+\lambda)\theta_M + 1} \tag{56}$$

$$g^{\mathrm{II}*} = \frac{[(1+\lambda)\theta_M - 1](y_A + y_B)}{2[(1+\lambda)\theta_M + 1]} \tag{57}$$

As in Scenario I, we examine the direction of strategic delegation. Comparing the policy maker in equilibrium with the median voter, we obtain the following.

$$\theta_P^{\mathrm{II}*} - \theta_M = -\frac{1}{1+\lambda} \tag{58}$$

Because $\lambda \in (0, 1]$, we have:

$$\theta_P^{\mathrm{II}*} < \theta_M \tag{59}$$

Thus, regardless of the degree of spillover, the median voter in each region delegates authority to the individual with weaker local public goods preference to determine the local tax rate.

Next, we compare local public good provision in equilibrium with the social optimum. Then, we obtain the following inequality.

$$g^{\mathrm{II}*} - g^{**} = -\frac{y_A + y_B}{2[(1+\lambda)\theta_M + 1]} \tag{60}$$

Because $\lambda \in (0, 1]$, we have:

$$g^{\mathrm{II}*} < g^{**} \tag{61}$$

Thus, regardless of the degree of spillover, local public goods in equilibrium are underprovided relative to the social optimum. Unlike Scenario I, the socially optimal provision of the local public good is never achieved in equilibrium. Now, we also derive local public good provision in the no election case.

This is derived by substituting $\theta_{AP} = \theta_{BP} = \theta_M$ into equation (51). Then, we obtain:

$$g^{\mathrm{II}*}|_{\theta_P^* = \theta_M} = \frac{(1+\lambda)\theta_M(y_A + y_B)}{2[(1+\lambda)\theta_M + 2]} \tag{62}$$

Clearly, we obtain:

$$g^{\mathrm{II}*}|_{\theta_P^* = \theta_M} < g^{**} \tag{63}$$

Comparing the case with and without the election of the policy maker, we obtain the following inequality.

$$g^{\mathrm{II}*} - g^{\mathrm{II}*}|_{\theta_P^* = \theta_M} = -\frac{y_A + y_B}{[(1+\lambda)\theta_M + 1][(1+\lambda)\theta_M + 2]} \tag{64}$$

Therefore, we obtain:

$$g^{\mathrm{II}*} < g^{\mathrm{II}*}|_{\theta_P^* = \theta_M} < g^{**} \tag{65}$$

Thus, regardless of the degree of spillover, there are more local public goods provided in the absence of election than in the presence of election, but neither coincide with the social optimum.

The results of Scenario II are summarized as follows.

Proposition 2

(a) Local public good provision in the subgame-perfect equilibrium never coincides with the social optimum, irrespective of the degree of spillover effect λ.

(b) For any λ:

(b-1) The median voter delegates authority to the individual with weaker local public goods preference to decide the policy, i.e., $\theta_P^{II*} < \theta_M$.

(b-2) Local public goods are underprovided relative to the social optimum, i.e., $g^{II*} < g^{**}$.

(b-3) Compared with the no election case, local public goods in the subgame-perfect equilibrium are less provided, i.e., $g^{II*} < g^{II*}|_{\theta_P^* = \theta_M} < g^{**}$.

The intuition of Proposition 2 is given as follows. In this scenario, interregional transfer tends to depress local public good provision, and the election accelerates this downward incentive because the policy maker with weaker preference for local public goods who prefers a lower level of the local tax rate will induce a higher level of transfer ex post.

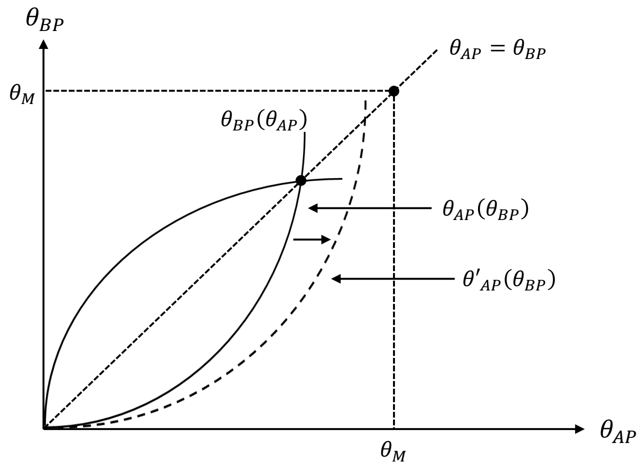

Figure 2: Best responses at the electoral stage in Scenario II.

Figure 2 illustrates changes in electoral outcomes depending on the degree of spillover in Scenario II. For the best response function in Stage 2, represented by equation (54), we obtain:

$$\frac{\partial \theta_{iP}(\theta_{-iP})}{\partial \lambda} = \frac{\theta_M \theta_{-iP}}{[(1+\lambda)\theta_{-iP}+1]^2} > 0, \;\; i = A, B, i \neq -i \tag{66}$$

Therefore, with the increase of the degree of spillover, the best response function of region A shifts upward. This is depicted by the shift from $\theta_{AP}(\theta_{BP})$ to $\theta'_{AP}(\theta_{BP})$ in Figure 2. Of course, the best response function of region B also shifts upward, so that the intersection of best response functions of both regions shifts to the northeast on the 45-degree line. In the equilibrium, the local public goods preference of the policy maker elected in each region approaches the median voter's preference. This shows that local public good provision also increases in equilibrium. That is, we have:

$$\frac{\partial g^{\mathrm{II}*}}{\partial \lambda} = \frac{\theta_M (y_A + y_B)}{[(1+\lambda)\theta_M + 1]^2} > 0 \tag{67}$$

Therefore, increasing the degree of spillover decreases the incentive for strategic delegation, namely the increase of $\theta_P^{\mathrm{II}*}$, and increases local public good provision with the reduction of private consumption in equilibrium. This change might be desirable in the sense that the local public good gap between equilibrium and the social optimum becomes small as the degree of spillover increases. (We can derive this by differentiating the right-hand side of equation (60) with respect to λ.)

Compared with Scenario I, even in the case of perfect spillover, local public good provision in equilibrium does not coincide with the social optimum as shown in (a) in Scenario II. In Scenario I, the enhanced marginal incentive for providing local public good by ex post interregional transfer is perfectly compatible with the socially desirable incentive level under perfect spillover. By contrast, in Scenario II, the reduced marginal incentive for providing the local public good by ex post interregional transfer cannot be compatible with the socially desirable incentive level, which requires enhancing the provision of public goods. Therefore, each region in Scenario II has an incentive to keep private consumption at some level while the incentive for strategic delegation toward the higher level of consumption is not completely eliminated, even if the degree of spillover is perfect. As a result, the elected policy maker still has a smaller incentive for raising the local tax rate (or providing the local public good) compared with the median voter, and local public good provision in equilibrium is still less than the socially optimal level, even if the degree of spillover is perfect.

5 Opposite effects of interregional transfer on electoral outcomes

Table 1 summarizes the effect of interregional transfer on the elected policy maker, θ_P^*, compared with the case without election, θ_M. Under the setting adopted in this paper, the election is not distorted in the case without transfer, $\theta_P^* = \theta_M$. [10] Starting from this point, introducing the transfer affects the elected policy maker, except for the case with commitment to local public good provision with perfect spillover. This exception is caused by the fact that the distortion from the interregional transfer is fully canceled out by the perfect spillover. Generally, effects from the two types of commitments considered in this paper are in the opposite direction to the electoral outcome. In the case with commitment to local public good provision, the policy maker with stronger preference for local public goods is elected.

[10] The case without transfer corresponds to the decentralized outcome in Besley and Coate (2003) and Dur and Roelfsema (2005).

<table>
<tr><th rowspan="3"></th><th colspan="3">Transfer</th></tr>
<tr><th colspan="2">○</th><th>×</th></tr>
<tr><th>$0 < \lambda < 1$</th><th>$\lambda = 1$</th><th>$0 < \lambda \leq 1$</th></tr>
<tr><td>Scenario I
g-commitment</td><td>$\theta_P^{\mathrm{I}*} > \theta_M$</td><td>$\theta_P^{\mathrm{I}*} = \theta_M$</td><td rowspan="2">$\theta_P^{*} = \theta_M$</td></tr>
<tr><td>Scenario II
t-commitment</td><td colspan="2">$\theta_P^{\mathrm{II}*} < \theta_M$</td></tr>
</table>

Table 1: Effect of interregional transfer on electoral outcomes in each scenario.

By contrast, in the case of commitment to the tax rate, namely the level of private consumption, the policy maker with weaker preference for local public goods is elected. These perfectly opposite directions of effect are caused by the opposite direction of incentives due to different commitments.

6 Conclusion

We show that, in the neutral situation where the median voter is elected without transfer, the representative who differs from the median voter is elected, and resource allocation is distorted more after the election process. The direction of this difference in the preference of the elected policy maker depends on whether ex ante policy can be committed to the local public good provision or to the local tax rate by the policy maker.

When the policy maker in each region commits to local public good provision ex ante, then the policy maker with stronger preference for local public goods is elected, and resource allocation is more distorted with the higher level of the local public good provision, except for the case of perfect spillover. In addition, the spillover mitigates the inefficiency of resource allocation, and this distortion can be fully canceled out in the case of perfect spillover.

By contrast, when the policy maker in each region commits to the local tax rate ex ante, then the policy maker with weaker preference for local public goods is elected, and resource allocation is more distorted with a lower level of local public good provision. In this case, this distortion cannot be canceled out even in the case of perfect spillover.

This result may lead to the following policy implications. In the situation where there exists ex post transfer due to the lack of central government's commitment ability, the election accelerates the inefficiency of local public good provision. The direction of this distortion depends on the commitment environment. Moreover, the degree of this distortion depends on the degree of spillover. Therefore, it might be desirable for the central government to regulate the policy of the policy maker elected, depending on the commitment environment and the degree of spillover.

Finally, this paper has some limitations. We assume a logarithmic form of utility function for simplicity of analysis. We assume interregional symmetric distribution of the preference for local public goods and intraregional symmetric income distribution. Extensions to the model with a general type of utility function and these asymmetries may give new insights to our research in the future.

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