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SWIMMING POOL VERSUS ART MUSEUM: EFFICIENCY IN THE PROVISION OF LOCAL PUBLIC FACILITIES WITH HETEROGENEITY

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This paper follows an approach adopted by Cremer, Marchand and Pestieau (1997) to analyze efficiency in the provision of heterogeneous local public facilities. Even when spillovers exist, under certain conditions the local government could still reach the optimum provision of the local public good, otherwise there is under-provision. Secondly, relaxing the non-excludability assumption, provision efficiency could be achieved if the local governments collect the service fees based on the neighboring community user's net marginal willingness to pay. If not, the service fee mechanism would not always be able to eliminate the preexisting allocation inefficiency and could sometimes lead to increased inefficiency due to overprovision of the public good.

JEL classification codes: H41, H7, R5
Key words: local public good, public facility, spillovers

I. Introduction

Except for a few discussions on the public provision of private goods,[1] the contemporary literature on local public services mainly focuses on the inefficiency caused by the non-excludability and non-rivalry characteristics of local public goods. The typical results of those studies claim that spillover effects might lead

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[1] See Epple and Romano (1996), Gouveia (1997), Akutagawaa and Mun (2005).

to either an undersupply or oversupply of public goods.[2] In order to eliminate the inefficiency, discussions are extended to decentralization and local competition.[3]

While talking about services or facilities provided by the local government, the relevant studies typically use local public goods as a general term. However, the reality is that the local governments will provide a variety of services. For instance, providing an art museum is fundamentally different from providing an Olympic-size swimming pool in terms of the characteristics of the goods and the related efficiency analysis.

In a departure from many other studies on the efficiency analysis of local public facilities, Cremer, Marchand and Pestieau (1997) have analyzed the provision efficiency in relation to standard-sized sports facilities (i.e., Olympic-size swimming pools) provided by the local government. The model was created based on the assumption of indivisibility, which restricts the choice of each community to an all-or-nothing decision and examines the provision of local public goods in two-jurisdictions (where decisions are made on the basis of the provision and travel costs). One jurisdiction may choose to supply local public goods, while the other may choose not to supply them and have their residents travel to the other jurisdiction to consume them. Based on a large number of cases, the results showed that either social optimality is achieved in a Nash equilibrium setting without government intervention or it can be implemented through matching grants. On a similar topic related to the spillover effect of public facilities, Bloch and Zenginobuz (2006) used the model with symmetric spillovers to analyze mobility across jurisdictions and characterize Tiebout equilibria as a function of the spillovers across jurisdictions. Bloch and Zenginobuz (2007) revealed the complexity of interactions that plagued the design of institutions for multijurisdictional local public good economies with spillovers. Braid (2010) extended Cremer, Marchand and Pestieau (1997) basic model to more than two adjacent jurisdictions. Besides the under-provision of the public goods, he found under certain circumstances that the number of towns, where public goods are provided, can be higher than the optimal level.

[2] See Brainard and Dolbear (1967) and Williams (1966).

[3] Epple and Zelenitz (1981) investigate whether compensation among local jurisdictions is sufficient to ensure the efficient provision of local public goods. Oates and Schwab(1988) explored the conditions under which horizontal competition among governments is efficiency-enhancing. Besley and Coate (2003) argue that the sharing of the costs of local public spending in a centralized system will create conflicts of interest between citizens in different jurisdictions. Takahashi (2004) studied the competition among the governments that make decisions regarding investments in their excludable public facilities with nonrivalry.

Based on the observations of the model constructed by Cremer, Marchand and Pestieau (1997), the distribution of some local public services across communities, such as sports facilities, is often very uneven. These standardized facilities like tennis courts or public swimming pools have a high degree of homogeneity. In other words, residents will not consider traveling to the same type of facility located in other jurisdictions after consuming the public facility in their own community. The residents that do not have these types of public facilities will factor in the transportation cost to determine if it is worth traveling to another jurisdiction to consume the facility.

In real life, heterogeneity sometimes exists between the public facilities or services provided by different communities. For instance, in the case of an art museum, even though the exhibition format and/or architecture might share some similar characteristics based on current regulatory requirements, from the consumer's point of view, different types of art work bring different levels of satisfaction.

Using the sports facilities and art museum as examples, we intend to discuss the impact on consumer behavior due to the heterogeneous nature of public facilities. In the case of two towns, where only one town has a facility (a sports facility or an art museum), the residents of both towns will make one trip (per unit of time) to the facility. In the case of two facilities, where there is a sports facility in each town, the consumers in each town will only use the sports facility in their own town, and will never travel to the other town as pointed out by Cremer, Marchand and Pestieau (1997). However, if both towns have art museums, which presumably have different paintings, then it can be assumed that the residents of each town will make one trip to each art museum. This heterogeneous characteristic leads to a different conclusion regarding the provision efficiency analyses and is rarely discussed in studies on public goods. This paper tries to demonstrate how a difference in consumption behavior changes the results of efficiency analyses.

To illustrate the impact of the heterogeneous nature of public facilities on consumer behavior, this paper assumes that the local public goods are not necessarily standardized public facilities. The residents might travel to another town to consume the public facility even though the residents' current community already provides the same type of facility.

The remainder of this paper is organized into five sections. Section II focuses on the building of a basic framework. Section III presents the solution to derive the social optimum of a decision problem regarding a national government. Through the comparison of Nash equilibria patterns and optimal patterns by the local government in Section IV, this study discusses the provision efficiency in relation to public facilities. Section V further relaxes the assumption of non-excludability, and analyzes the impact of imposing a fee-collecting mechanism. Lastly, Section VI concludes the study.

II. The model

Based on Cremer, Marchand and Pestieau (1997), the model used in this study focuses on just two identical communities with the same number of homogeneous individuals. It is assumed that there are two goods, a private composite good, x, taken as the numeraire, and an indivisible local public good that is non-excludable and brings the same gross benefits to the inhabitants of both communities regardless of its location. The public good supplied by community i is denoted by g_i, where either the public good is provided ($g_i = 1$) or it is not provided ($g_i = 0$). Let $g = g_1 + g_2$ be the total number of units of a public good available to the two communities. It can take values of 0, 1 or 2. Being independent of the number of users, the community provides the public good at a per resident cost of p. As the provision cost is independent of number of users, the congestion occurring if two communities share a public good is entirely captured by the utility function. An individual who uses the public facility of the neighboring community will incur a transportation cost of $t < p$.

When deciding whether to build a public facility, local governments try to maximize the utility of a representative individual in their community: $u_i(g, x_i)$, $i = 1,2$, which is strictly increasing in g and x and strictly concave in x. There is no residential mobility between the two communities. Let R be each community's initial endowment per capita in regard to the numeraire good. We also define r' and r'' such that:

$$u_i(0, R) = u_i(1, R - r') = u_i(2, R - r''). \tag{1}$$

So r' is an individual's willingness to pay for a move from $g_i = 0$ to $g_i = 1$, while r'' is his/her willingness to pay for having $g_i = 2$ instead of $g_i = 0$. For any level of R, it seems reasonable to assume that $r'' - r' < r'$ (the marginal willingness to pay for a second art museum) is less than the marginal willingness to pay for the first art museum, implying that $r'' < 2r'$. To ensure that the residents of a community without a public facility will use a neighboring facility, we also assume that $t < r'$.

III. Optimal solution and pattern

Let us start by characterizing the first-best optimum as a benchmark for the efficiency analysis. As we are interested in policy issues, we consider a concept of social welfare which implies a complete ordering, and use a utilitarian welfare function $W(u_1, u_2) = u_1 + u_2$ for simplicity. The first-best optimal allocation $(x_1^*, x_2^*, g_1^*, g_2^*)$ is defined in the traditional way as a feasible allocation yielding the highest value of social welfare. Formally, it is the solution to the following problem:

$$\underset{x_1, x_2, g_1, g_2}{\text{Max}} \; W(u_1, u_2) = u_1(g_1 + g_2, x_1) + u_2(g_1 + g_2, x_2),$$

subject to $x_1 + x_2 + (p+t)(g_1 + g_2) = 2R.$ (2)

Equation (2) is the feasibility condition. The term $(p+t)(g_1 + g_2)$ presents the total cost of the society in the different levels of local public facility. Depending on the assumption of indivisibility which restricts the choice of each community to an all or nothing decision, there will be three cases. First, when $g_1 = g_2 = 0$, no local government provides the local facility. Since $(p+t)(g_1 + g_2) = 0$, there are no provision and transportation costs. Secondly, if only one community provides an art museum, for example, $g_1 = 1,\ g_2 = 0$, then the members of one community pay the provision costs and those of the other pay the transportation costs. So the total cost of the society is $p+t$. Finally, if both towns provide an art museum, $g_1 = g_2 = 1$ the residents of each town would incur production and transportation costs from their visits to these two museums. The total cost of the society is $2(p+t)$. The concavity of u_i and the symmetry of the problem implies that $u_1^* = u_2^*$ and hence, $x_1^* = x_2^*$ must hold at the optimum. This result implies that if the provision pattern is (1, 0) or (0, 1), transfers must thus be used to equalize utilities in a decentralized setting.

The welfare of a society for different levels of public facilities should be

$$W_{00} = u_1(0, R) + u_2(0, R) = 2u(0, R),$$
$$W_{10} = W_{01} = 2u(1, R - \frac{p+t}{2}),$$
$$W_{10} = W_{01} = 2u(1, R - \frac{p+t}{2}),$$

Notice that when the residents of both communities consume two units of public goods, the provision of these goods costs them $p+t$ (the costs charged by the community to which they belong and the neighboring community to which they traveled).

By comparing pair wise the three levels of social welfare, we have:

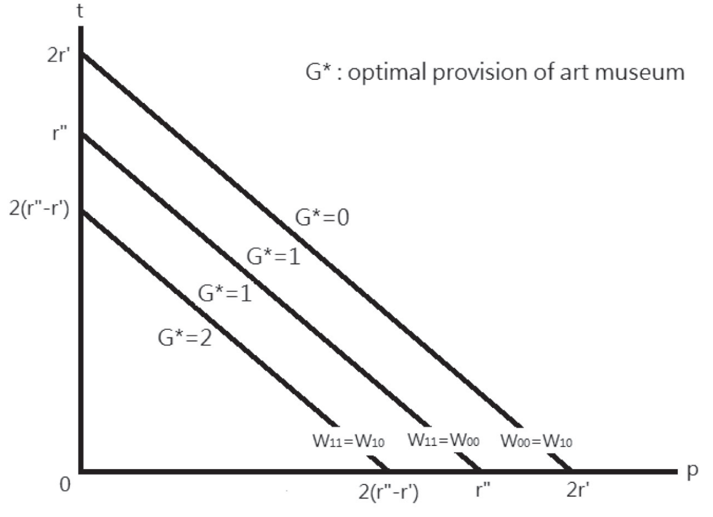
$$W_{11} > (<) W_{00} \text{ iff } u(2, R-p-t) > (<) u(0,R) \text{, or } r'' > (<) p+t, \tag{3}$$

$$W_{10} > (<) W_{00} \text{ iff } u(1, R-\frac{p+t}{2}) > (<) u(0,R) \text{, or } r' > (<) \frac{p+t}{2}, \tag{4}$$

$$W_{11} > (<) W_{10} \text{ iff } u(2, R-p-t) > (<) u(1, R-\frac{p+t}{2}) \text{, or } r''-r' > (<) \frac{p+t}{2}. \tag{5}$$

Which one dominates depends on the values of p and t, and the plane (p,t) can then be partitioned into four areas, each defined by the pattern which prevails above. The three inequality conditions in equations (3), (4) and (5) are drawn in Figure 1. In the social optimum, the outer area of the diagram corresponds to 0 art museums, the inner area corresponds to 2 art museums, and the two middle areas correspond to 1 art museum.[4]

Figure 1. Frontier of optimal patterns



[4] The middle line $W_1 = W_0$ in Figure 1 is always between the two lines and is left out in the later figures.

IV. The efficiency of the Nash equilibrium

In this non-cooperative game, communities decide on their provision of a public good in a decentralized way and choose their strategies $g_i \in \{0,1\}$ simultaneously. Let $h_i(g_j) \in \{0,1\}$ be the best reply function of community i 's government with the following properties:

$$h_i(0) = 1 \text{ iff } u_i(1, R-p) > u_i(0, R) \text{ or } r' > p \tag{6}$$

$$h_i(1) = 1 \text{ iff } u_i(2, R-p-t) > u_i(1, R-t) \text{ or } r''-r' > p \tag{7}$$

Equations (6) and (7) show whether the nearby community government provides public facilities, and travel costs do not impact the provision decision of the community government. First, if the nearby community does not provide public facilities, the individual residents will have no reason to travel to the nearby community. Secondly, if the nearby community does provide public facilities, given that $t < p$, the residents will first consume the public facility provided by the nearby community and determine if the marginal willingness to pay is higher than the provision cost to decide whether to build their own public facility, to be interpreted as an art museum, is necessary.

As for the analysis of standardized public facilities conducted by Cremer, Marchand and Pestieau (1997), their study shows that when only one community has public facilities, given that $t < p$, the community that does not have public facilities will first consider consuming the facilities of the nearby community rather than building its own facilities. Under the situation where both communities provide the facilities, residents will no longer travel to their nearby community to consume the facilities. Under the setting of this study, the residents would still be attracted by the exhibition taking place in the nearby community art museum, even after visiting the museum in their own community, and consuming the facilities in the nearby community as well. This demonstrates that heterogeneity and its relationship with travel cost has a totally different meaning compared to its role in the Cremer, Marchand and Pestieau (1997) model.

By leveraging off the results from Section III and Figure 1, we now shift gears to examine the Nash equilibrium allocations based on equations (6) and (7). The provision efficiency in relation to each equilibrium is examined. Due to the differences in the relative conditions of optimal patterns and the reply function of a community, we elaborate on the results under two cases — $r''-r' > r'/2$ and $r''-r' < r'/2$.

Case 1. $r''-r'>r'/2$

Under this condition, we show the optimality and Nash equilibrium in Figure 2. The frontiers associated with equations (6) and (7) are given by the vertical line $p=r'$ and $p=r''-r'$. Both conditions are satisfied to the left of $p=r''-r'$, so two facilities are provided. Neither condition is satisfied to the right of $p=r'$, so no facilities are provided. Between these two vertical lines, only one town provides a facility.

Notice that only the areas to the right and below the 45 degree line are relevant, since it has been assumed that $t<p$. Optimal patterns and the reply function separate the plane (p,t) into 6 subareas. In areas 1, 2 and 3, the Nash equilibrium provision is socially optimal (these areas are green in Figure 2 and yellow in Table 1), whereas in areas 4, 5 and 6, there is an under-provision. Here we can see that Figure 2 is significantly different from Figure 1 in Cremer, Marchand and Pestieau (1997), due to their considering swimming pools, while this paper considers art museums.

Figure 2. Optimality and Nash equilibrium in the case of $r''-r'>r'/2$

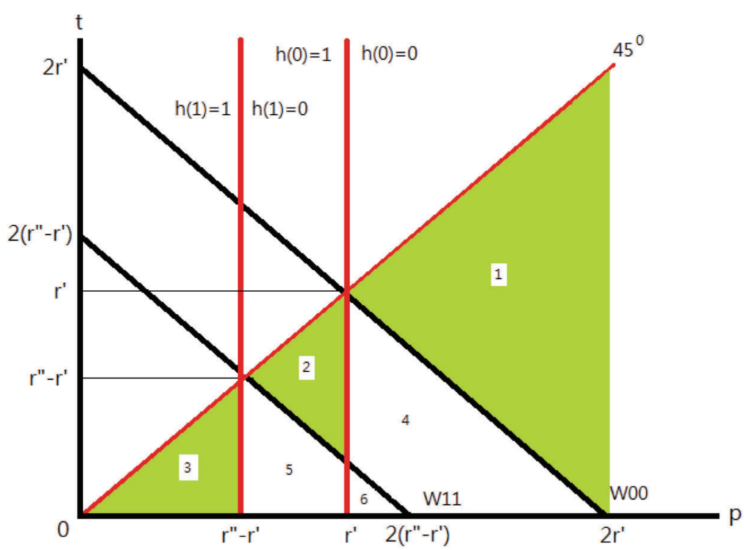


Table 1 summarizes the results so far. It gives the Nash equilibria and optimal patterns corresponding to the various areas that appear in Figure 2. The Nash equilibria where only a single public facility is provided are optimal in area 2. Because the communities do not take into account the spillover effect created by their investment, cases where Nash equilibria are not in line with optimality and undersupply public facilities are areas 4, 5, and 6.

Table 1. Nash equilibria and optimal patterns if $r''-r' > r'/2$

Area	Strategy	Nash equilibrium pattern	Welfare Ranking
1	h(0)=0,h(1)=0	(0,0)	$W_{00}>W_{10}>W_{11}$
2	h(0)=1,h(1)=0	(1,0)	$W_{10}>W_{00}>W_{11}$ or $W_{10}>W_{11}>W_{00}$
3	h(0)=1,h(1)=1	(1,1)	$W_{11}>W_{10}>W_{00}$
4	h(0)=0,h(1)=0	(0,0)	$W_{10}>W_{00}>W_{11}$ or $W_{10}>W_{11}>W_{00}$
5	h(0)=1,h(1)=0	(1,0)	$W_{11}>W_{10}>W_{00}$
6	h(0)=0,h(1)=0	(0,0)	$W_{11}>W_{10}>W_{00}$

Now let us focus on the areas where a single public facility follows a Nash equilibrium pattern. These areas are located in $r''-r' < p < r'$. It follows the set of values (p,t), where the pattern (1, 0) is both optimal and a Nash equilibrium is given by area 2. In the model of Cremer, Marchand and Pestieau (1997), such an equilibrium occurs since transportation costs are low, which makes it more attractive for residents to use their neighboring community's public facilities. However, in our model with the art museum, transportation cost plays no role in the decision-making process. On the other hand, the optimal patterns show the trade-off relationship between the transportation cost and provision cost. It means that if the transportation cost is low, such as area 5, the local governments that do not take into account the externality created by their investment will undersupply the public facility. In area 2, a Nash equilibrium where a single public facility is provided could be optimal because the transportation cost is high enough to offset the spillover effect.

Case 2. $r''-r'<r'/2$

In this case, the optimal pattern and Nash equilibrium is similar to the case mentioned above. Table 2 shows that the public facility is underprovided, except for areas 1, 2 and 3. It is worth noticing that in this case the consumer is willing to pay less than half of the marginal willingness it took to pay for the first unit of the public facility to consume the second unit of the public facility.

When $t=0$, the bottom boundary of area 5 in Figure 2, a Nash equilibrium based on providing a single public facility would not be optimal in case 1. Meanwhile, in case 2, if $2(r''-r')<p<r'$, it is optimal when only one community provides the public facility (this is the bottom boundary of area 2, where $t=0$, in Figure 3). The reason is that first $p<r'<2r'$, which means that the local government will provide a public facility if the nearby community does not provide one. Second, $r''-r'<2(r''-r')<p$, which means that the cost of providing a second unit of the public facility is too high regardless of what the local government's or central government's opinions are. Therefore, the best way for the communities to reach the optimal pattern is through the existence of a spillover.

Figure 3. Optimality and Nash equilibrium in the case where $r''-r'<r'/2$

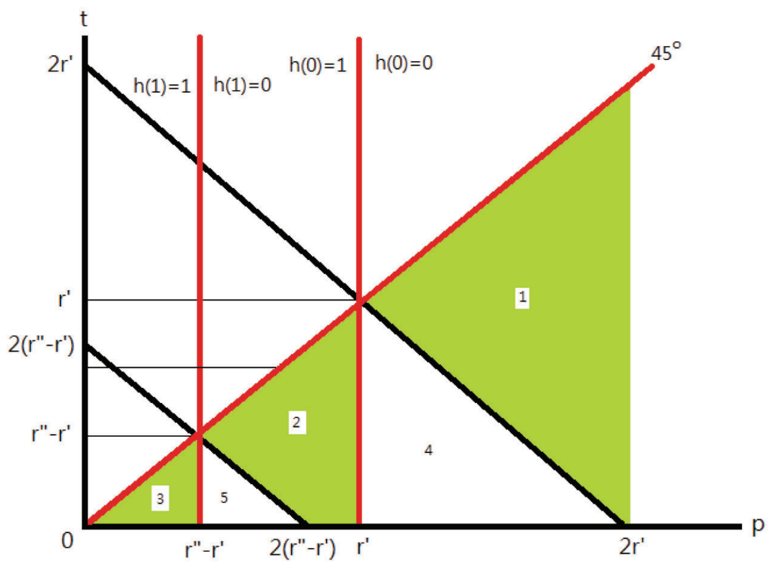


Table 2. Nash equilibria and optimal patterns if $r''-r'<r'/2$

Area	Strategy	Nash equilibrium pattern	Welfare Ranking
1	h(0)=0,h(1)=0	(0,0)	$W_{00}>W_{10}>W_{11}$
2	h(0)=1,h(1)=0	(1,0)	$W_{10}>W_{00}>W_{11}$ or $W_{10}>W_{11}>W_{00}$
3	h(0)=1,h(1)=1	(1,1)	$W_{11}>W_{10}>W_{00}$
4	h(0)=0,h(1)=0	(0,0)	$W_{10}>W_{00}>W_{11}$ or $W_{10}>W_{11}>W_{00}$
5	h(0)=1,h(1)=0	(1,0)	$W_{11}>W_{10}>W_{00}$

Thus, building on the relationship between the Nash equilibria and the optimal pattern of local public facility provision, we can derive the following proposition:

Proposition 1. (***Nash equilibrium and efficient provision of local public facility***) *Under the assumptions in the basic model, for any given providing cost* p *and transportation cost* t*, the conditions under which the local public facility provision is both optimal and at the Nash equilibrium are given by*

$$G^* = \begin{cases} 0 & if \quad p+t>2r', \\ 1 & if \quad p<r' \quad and \quad p+t>2(r''-r'), \\ 2 & if \quad p<r''-r'. \end{cases}$$

Proof. Given $G^*=0$, the optimal patterns of $(g_1,g_2)=(0,0)$ are $W_{00}>W_{11}$ and $W_{00}>W_{10}$; thus, we have $p+t>2r'$. Furthermore, $(g_1,g_2)=(0,0)$ is the Nash equilibrium if the reply functions h(0) = 0 and h(1) = 0 are satisfied (i.e., $p>r'$). The value of (p,t) at the same time in line with $p+t>2r'$ and $p>r'$ is $p+t>2r'$. The other two cases $G^*=1$, $G^*=2$, can be proved similarly. Q.E.D.

V. Application to excludable goods

In many real life examples of public facilities, the local government has the ability to distinguish to which community the consumer belongs and to charge the neighboring residents a user fee based on predetermined criteria. For example, museums can ask for a visitor's ID to determine the state of residence and exercise price discrimination based on residency. In fact, this is pretty common in real life. In this section we will relax the non-excludability hypothesis and consider what the equilibria pattern and optimal patterns would be if the local governments were to collect revenue from visitors from the neighboring community. We will further discuss the impact on the provision efficiency.

For individual communities, the mechanism could be treated as an increase in the benefit from provision or a decrease in the cost of provision, which further impacts the decision as to whether the communities should provide public facilities. This implies that the best response function of community i's government would have the following properties:

$$h_i(0; f_1) = 1 \text{ iff } u_i(1, R - p + f_1) > u_i(0, R) \text{, or } r' > p - f_1, \tag{6'}$$

$$h_i(1; f_2) = 1 \text{ iff } u_i(2, R - p - t + f_2) > u_i(1, R - t) \text{, or } r'' - r' > p - f_2, \tag{7'}$$

where f_i , $i = 1,2$ is the user fee charged by the public facility provider, regardless of whether the neighboring community provides its own public facility or not.

If the local government can exercise price discrimination with regard to the nearby community residents based on residency and the level of consumption, under the assumption of maximizing utility, the local government will be able to collect revenue up to the net marginal willingness to pay of the neighboring user. Then, f_i will be: $f_1 = r' - t$; $f_2 = r'' - r' - t$, and (6') and (7') could be rewritten as:

$$h_i(0; f_1) = 1 \text{ iff } 2r' > p + t, \tag{6''}$$

$$h_i(1; f_2) = 1 \text{ iff } 2(r'' - r') > p + t, \tag{7''}$$

Equations (6'') and (7'') show that a local public facility would be provided if the sum of the community residents' marginal willingness to pay and the user fee from the neighboring residents exceed the cost of providing the public facility. In other words, the local government can afford a higher cost of providing a public facility under the exclusive mechanism.

Comparing equations (6”) and (7”) helps determine if the local governments should provide public facilities given the socially optimal provision level, and from equations (3) and (4), we can see that they are identical. The results are not as surprising as they might appear because the simplified model factors in the local government’s provision decision to collect a service fee based on the nearby community user’s net marginal willingness to pay. This mechanism operates in the same way as a monopoly firm that treats the consumer’s surplus as part of its economic profit through price discrimination.

However, to effectively execute such a service fee mechanism, the local government needs to obtain information regarding the nearby community users’ net marginal willingness to pay. In real life, it would be extremely challenging to obtain such information and to apply it to the mechanism. In addition, collecting a service fee will involve other issues such as the legality and practicality of the pricing mechanism. Therefore, visitors are charged per head by most of the museums. In order to elaborate on the impact of collecting service fees, assume that the local governments pass a regulation to collect a fixed fee based on exogenous expectations from the nearby community users, given by $f_1 = f_2 = R$. Since we introduce incomplete information, the solution concept is Bayes Nash equilibrium. The priors that the members of the nearby community are willing to pay the fee might not be verified.

We take case 1 ($r''-r' > r'/2$) as an example (similar results are observed if $r''-r' < r'/2$). In Figure 4, it is clear that the best reply functions of community i’s government under this condition shift to the right in parallel lines. By comparing Figure 4 with Figure 2, the areas with Nash equilibria $(g_1, g_2) = (0,0)$ shrink, and the areas with Nash equilibria $(g_1, g_2) =$ (1,1) expand. This result is consistent with our intuition. Moreover, the Nash equilibria $(g_1, g_2) =$ (1,0) or (0,1) change subtly. As shown in Figure 4, the areas where only one local government provides a public facility change from areas 1, 2, 3 and 4 to areas 3, 4, 5, 6 and 7. In view of the provision efficiency, areas 1 and 5 became worse, whereas areas 2, 6 and 7 get better. Under the premise of optimality, the areas where only one local government provides a public facility are areas 3 and 6. It is worth noting that in Figure 4, areas 1 and 5, the transport costs are so high that nobody from the nearby community will actually use that facility. It means regions of overprovision could happen when authorities have a prior about the users’ type that is not verified, where ex-post nobody will pay that fee so the providing community will sustain a loss. The Bayes Nash equilibria and their impacts on the efficiency are summarized in Table 3.

Figure 4. Effect of user fee collection in the case of $r''-r'>r'/2$

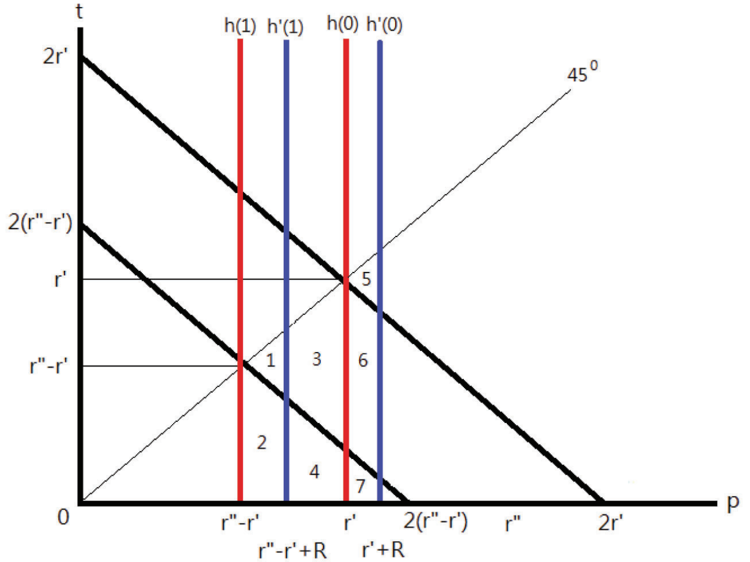


Table 3. Exogenous priors: efficiency status of user fee collection in the case of $r''-r'>r'/2$

Area	Nash equilibrium pattern before pricing	Bayes Nash equilibrium pattern after pricing	Optimal provision	Better or worse?	Efficiency status
1	(1,0)	(1,1)	(1,0)	W	overprovision
2	(1,0)	(1,1)	(1,1)	B	optimal provision
3	(1,0)	(1,0)	(1,0)	-	optimal provision
4	(1,0)	(1,0)	(1,1)	-	underprovision
5	(0,0)	(1,0)	(0,0)	W	overprovision
6	(0,0)	(1,0)	(1,0)	B	optimal provision
7	(0,0)	(1,0)	(1,1)	B	underprovision

As shown in Table 3, the expectation that the collection of a fixed service fee per head is feasible may change the local government's provision decision. The impacts of these changes on efficiency are summarized as follows. First, the efficiency status may remain unchanged, for instance area 3. Second, the service fee may reduce inefficiency, turning under-provision into an optimal provision, as in area 6. Finally, the service fee may create overprovision if the government acts on erroneous expectations, as in area 1.

We summarize the properties of the results in the following proposition.

Proposition 2. (User fee and the improvement of welfare) *If the local government can distinguish to which community the consumer belongs to and to which neighboring residents a user fee should be charged on the basis of predetermined criteria, then the user fee could improve the total welfare only in two cases:*

1. $r' < p < r' + \overline{f}$ *and* $2(r'' - r') < p + t < 2r'$,
2. $r'' - r' < p < r'' - r' + \overline{f}$ *and* $p + t < 2(r'' - r')$.

Proof. For the first case, within the areas surrounded by $p > r'$ and $2(r'' - r') < p + t < 2r'$, the Nash equilibrium of local public facility ($G = 0$) is less than the optimal provision ($G^* = 1$). By contrast, if the local government can charge the neighboring residents a user fee, then the reply function shifts to the right, and the Nash equilibrium local public facility would become $G = 1$ for $r' < p < r' + \overline{f}$, which is the optimal provision in the same time. The second case can be proved similarly. Q.E.D.

In brief, the service fee mechanism could improve the inefficiency caused by the spillover under certain conditions. Nevertheless, in the third scenario, some areas (p, t) that were originally at the optimal provision level are distorted by the service fee collection mechanism. This shows that the service fee mechanism is not the universal remedy for inefficiency unless the local government is able to actually collect the fee, something that depends on the nearby community user's marginal willingness to pay. Otherwise, in some scenarios, this could even distort the original Nash equilibria that were at the optimal provision level.

VI. Concluding remarks

The paper by Cremer, Marchand and Pestieau (1997) presented a model of two towns that were some distance apart from each other, where each town has the option to either provide or not provide an indivisible (and congestible and non-excludable) public facility such as a swimming pool. There are two basic parameters, the cost of the swimming pool per capita and the travel costs between the towns per capita. If neither town provides a pool, nobody swims. If both towns provide a pool, everyone swims in their own town's pool. If town 1 provides it and town 2 does not, everyone swims in town 1, the residents of town 1 pay for the pool, the residents of town 2 pay the travel costs, and the pool is more crowded than if both towns had a pool.

The case in this paper supposes however that the facilities are art museums. The main difference comes when both towns have an art museum, in which case the residents of each town visit the art museum in both towns. Owing to the heterogeneous nature of public facilities, this affects not only the social optimal provision of public facilities, but also the Nash equilibrium provision. As shown in Sections III and IV, this causes the analysis and the results to be very different than the analysis and results of Cremer, Marchand and Pestieau (1997). That is the first basic contribution of this paper.

The second basic contribution is that this paper allows admissions fees to be charged by towns with art museums. Section V shows that the possibility of charging users from the neighboring community a fee enhances the willingness and ability of the local government to provide local public facilities and mitigate the undersupply of local public facilities. If the local government sets the fee in line with the neighboring user's net marginal willingness to pay, this restores efficiency. However, if the local government does not set the fee in line with the neighboring user's net marginal willingness to pay, it can improve, leave unchanged or even harm efficiency.

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