Transaction Costs in a Tiebout Setup

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ABSTRACT. – The paper addresses three issues related to Tiebout-type equilibrium: (a) Is the property tax a second-best instrument? (b) Given the feasible instrument menu, is a Tiebout-type allocation with profit-maximizing suppliers of the LPG constrained efficient? (c) Given the ranking of instruments, are profit maximizing developers better equipped with instruments conductive to efficiency than local jurisdictions? It is shown that the property tax is not necessarily a second-best instrument, that Tiebout-type equilibrium is constrained efficient, and that developers in the strict sense lack the second-best instruments available to local governments.

Le coût d'une transaction dans un contexte Tiebout

RÉSUMÉ. – Ce papier considère trois problèmes reliés à l'équilibre de type-Tiebout: (a) La taxe sur la propriété, est-elle un instrument de second rang? (b) Étant donné le menu d'instruments utilisables, une allocation de type-Tiebout avec des fournisseurs de LPG maximisant le profit est-elle efficace? (c) Étant donné la classification des instruments, les entrepreneurs maximisant le profit sont-ils mieux équipés avec des instruments contribuant à l'efficacité que la juridiction locale? Il est démontré que la taxe sur la propriété n'est pas nécessairement un instrument de second-rang, que l'équilibre de type Tiebout est forcément sujet aux contraintes relevantes, et que les entrepreneurs n'ont pas les instruments de second-rang, disponibles aux gouvernements locaux.

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1 Introduction

Following club theory, local public good (LPG) models emphasize the role of the user charge, supplemented by a 100-percent tax on rent as the main, and frequently the only taxes, appropriate for financing the LPG. A variety of models were used to demonstrate that these taxes are required for efficient resource allocations (see, for example, ARNOTT and STIGLITZ [1979], BERGLAS and PINES [1981], and WILDASIN [1986]). In reality, however, user charges are rarely used, and it seems that the main reason for this are the transaction costs associated with monitoring consumption and collecting charges. This explanation certainly applies to streets, sidewalks, parks and, in some cases, garbage collection, and fire and police protection. In the case of other services, such as education, cultural activities, and health, user charges are rejected because of merit good considerations.

The present paper is concerned with the efficiency of Tiebout-type allocations with profit-maximizing suppliers of a LPG when monitoring congested LPG consumption is either infeasible or, more generally, too expensive. Specifically, it addresses three distinct questions:

(a) Casting the problem in the optimal taxation framework, is, indeed, the property tax a second-best instrument?

(b) Given the set of feasible instrument menu (provision of the LPG and taxes), is a Tiebout-type allocation with profit-maximizing suppliers of the LPG constrained-efficient?

(c) Given the ranking of instruments according to (a), are profit-maximizing developers better equipped with instruments conducive to (constrained) efficiency than land rent-maximizing local jurisdictions or vice-versa?

Existing local public good theory is mainly concerned with the second question; the first and the third questions are almost entirely ignored. Regarding the first question, the literature refers to financing the LPG by property taxes as a second-best regime while almost totally overlooking alternative instruments (see HENDERSON [1985] and WILDASIN [1986]). Regarding the third question, in discussing profit-maximizing behavior, no distinction is made between provision of the LPG by local governments and profit-maximizing developers.

Before discussing the treatment of the second question in the literature and the contribution of this paper to its answer, we need to digress and to define precisely what we mean by "Tiebout-type allocations", or "Tiebout version of the LPG theory". On a formal level, we interpret Tiebout's assumption regarding a "large number of communities" as meaning that there is no shortage of sites available for establishing new communities (identical to the existing ones), an assumption referred to hereinafter as "perfect replicability". On a more substantive level, we badly need this assumption for circumventing some fundamental difficulties involved when there is a shortage of communities. As shown recently, when such a shortage prevails, we need quite strong assumptions for guaranteeing the

very existence of a price-taking (utility taking) equilibrium. For, if no equilibrium exists, our discussion regarding efficiency becomes vacuous.

Once we adopt the perfect replicability assumption, the distinction between clubs and LPG models almost vanishes. The only difference is that communities can be conceived as multi-activity clubs which apply cross-subsidization among the activities, better known in the literature as the Henry George rule (see BERGLAS and PINES [1981]). An example of this rule is illustrated in STIGLITZ [1977], where the surplus from production activity (equivalent to land rent) is used to finance the deficit from the provision of the pure LPG activity. Another example is the case of a club engaged in supplying more than one LPG, that is, a multi-product club (see BERGLAS [1984]) [1].

It follows that the conclusion regarding the optimality of market provision of club goods, discussed in the literature since BUCHANAN [1965] and later proved by SCOTCHMER and WOODERS [1987], directly applies to our notion of Tiebout-type allocation as well. In fact, this application of the first welfare theorem also applies to the case of imperfect replicability, provided that an equilibrium with profit-maximizing suppliers of the LPG exists (see PINES [1991], SCOTCHMER [1985, 1994], and WILDASIN [1986]).

The aforementioned literature, however, is confined to first-best regimes where both the social planner and the profit-maximizing suppliers of the LPG are equipped with a complete instrument menu. Another strand of the literature is concerned with the case where both the planner and the profit-maximizing suppliers of the LPG are constrained to use a property tax for affecting the utilization of the LPG and financing its provision. In this case, however, the reported results are more controversial than those of SCOTCHMER and WOODERS regarding the case of a complete instrument menu. HENDERSON [1985], on the one hand, reports that equilibrium with property-tax financing of the LPG is constrained-efficient. HOYT [1991] and KRELOVE [1993], on the other hand, challenge this result. However, none of these authors are concerned with the more general issue presented in (b), that is, given any instrument menu available to the decision makers, is the Tiebout-type equilibrium constrained-efficient? [2]

The choice of the instruments set is also studied in a positive context. HENDERSON [1994] explores what are the most preferable instruments chosen under two decision-making regimes, differing from one another by who owns the land and who controls the decision-making in the community ("profit-maximizing model" and "median voter model"). Our analysis, however, differs from Henderson's in several respects. First, we concentrate mainly

1. Observe that our distinction between the club and the LPG theories differs from that of Scotchmer [1994]. First, Scotchmer reserves the perfect replicability assumption to clubs but not communities and, second, she assumes (in the introduction) that the LPG, in contrast to the club good, is provided without a user charge. In her formal analysis, however, she confines herself to a pure LPG, and, thus, circumvents the second-best issue implied by the absence of a user charge.

2. However, we do not endeavor to analyze the more fundamental issue of instrument menu determination when the use of each instrument is possible but expensive (see HELSLEY and STRANGE [1991]).

on the normative issue of the socially efficient tax mix, rather than the chosen tax mix in alternative decision-making regimes. Second, while the menu available to the decision-maker is complete in Henserson, our analysis refers to the optimal tax mix within an incomplete menu. Third, in Tiebout's spirit and in contrast to Henderson's framework, our analysis allows a full replication of communities.

Following this introduction, in Section 2 we introduce a LPG model which, in some sense, is a union of the models frequently discussed in the literature. Then, in Section 3, we use the model for characterizing the first-, second-, and less-best. We use these results to evaluate the use of property tax. In Section 4 we examine whether, given any tool menu, the Tiebout-type allocation with profit-maximizing suppliers of LPG is constrained-efficient. In Section 5 we discuss the relationship between the institutional framework of the LPG provision, the corresponding instrument sets, and the associated "rank of achievable best". Concluding remarks are provided in Section 6.

2 The Basic Setup

We introduce here a simple LPG models with a congestable public good and housing, which allows elaboration on the effect of transaction costs and optimal tax structure. Formally, consider N individuals with identical preferences, distributed on M identical islands according to $\{n_i;\ i \in M\}$, where n_i is the number of individuals on island i. Each individual derives utility, according to a well-behaved utility function, $u(X, H, V, G)$, from a composite good, X, housing, H, visits to public facility, V, and the attributes of the facility, G, referred to as the "quality" of the LPG hereinafter.

Housing is produced by land and by a composite good according to a linear homogeneous production function. By choosing the appropriate land unit, therefore, the housing production function can be represented by $f(K)$, where K is the composite good input per land unit when the land supply on any given island is 1. We assume $f'(\cdot) > 0$ and $f''(\cdot) < 0$.

The material balance of housing on island i is given by:

$$n_i H_i - f(K_i) = 0; \qquad i \in M \tag{1}$$

The provision of the facility and its use on island i requires $c(n_i V_i, G_i)$ units of the composite good. We assume that

$\partial^2 c(\cdot)/\partial(nV)\,\partial G \leq 0$, that is, the marginal contribution of G in reducing the LPG cost does not fall with nV.

The material balance of the composite good is

$$\sum_{i \in M} [n_i X_i + c(n_i V_i, G_i) + K_i - n_i I] = 0 \tag{2}$$

where I is the composite-good initial endowment of each individual.

In this section, we always assume that all individuals are equally treated, that is, for all $n_i > 0$ we have

$$u(X_i, H_i, V_i, G_i) - U = 0. \tag{3}$$

Now, define

$$v(n_i) \equiv \underset{X_i, H_i, V_i, G_i}{\text{Max}} \; u(X_i, H_i, V_i, G_i)$$
$$\text{subject to} \quad (1)$$

and

$$n_i X_i + c(n_i V_i, G_i) + K_i - n_i I = 0. \tag{4}$$

To guarantee a $\cap$ shape of $v(n_i)$, we assume that, at least for sufficiently small community size, the provision of the LPG is characterized by increasing returns to scale (in the global aspect defined in BERGLAS and PINES [1981]). Furthermore, we assume that, for sufficiently small community size, these increasing returns dominate the decreasing returns associated with housing while, for sufficiently large community size, the decreasing returns associated with housing (and, perhaps, the provision of the LPG) determine the global effect of n_i on utility. Consequently, $v(n_i)$ assumes a $\cap$ shape, with a unique finite maximand, say n^* [3].

We then interpret Tiebout's concept of "large number of communities" as

$$M > N/n^* = \text{large integer number}, \tag{5}$$

and, in the following, refer to (5) by the term "perfect replicability."

3 First-, Second-, Third-, and "Less"-Best Allocations

3.1. First-Best Allocation

Since the islands are identical, we can hereinafter delete the index i which indicates the specific island. Accordingly, a first-best allocation is a

3. The $\cap$ shape and, therefore, the existence of a finite optimal community size resulting from our formulation is also consistent with a specification of a publicly provided private good. This is the case when we delete G from the utility function and let c/nV, as a function of nV, have a U shape. In contrast to our specification, HENDERSON [1985], HOYT [1991], and KRELOVE [1993] adopt a more restrictive case, according to which the publicly provided private good is produced under constant returns-to-scale, while housing is produced under decreasing returns-to-scale. This specification results in a globally decreasing utility as a function of community size, *i.e.* the optimal community size is zero.

set $\{n, X, H, V, G$, and K, which maximizes $v(n)$. With (5), the first-best allocation is obtained when, n^* individuals live on each of the N/n^* populated islands, achieving there a utility $v(n^*)$. $M - n/n^*$ of the islands remain unpopulated.

Maximizing $v(n)$ yields the following first-order conditions [4].

$$u_2/u_1 = 1/f'(K), \tag{6}$$

$$u_3/u_1 = c_1, \tag{7}$$

$$nu_4/u_1 = c_2, \tag{8}$$

$$[(u_2/u_1) f(K) - K] + (u_3/u_1) n V = c(\cdot), \tag{9}$$

where here and hereinafter, a subscript denotes the partial derivative such that, for any function of $z_1, z_2, z_3, ..., z_n$, $F(z_1, z_2, z_3, ..., z_n)$, $F_i \equiv \partial F/\partial z_i$.

Equations (1), (4), and (6)-(9) solve for the optimal values of n, X, H, V, G, K, and U. Equation (1) and (4) guarantee feasibility; (6)-(8) equate the MRS to the MRT of H, V, and G, respectively, in terms of the composite good. Equation (9) is the HENRY GEORGE rule, that is, the user charge and a 100-percent land-rent tax are just sufficient to finance the LPG provision.

In the above formulation, the set of policy instruments used by the social planner is very wide and includes n, K, X, H, V, and G. In fact, throughout the subsequent discussion, it is more convenient to present the social planner problem as a choice of a smaller set of policy instruments which includes the quality of the facility, G; a congestion charge for facility utilization, t; a property tax, τ; a net land rent tax; and a poll tax, letting the markets for land, housing, and the composite good be cleared competitively. In this more compact specification, the social planner solves

$$\underset{\tau, t, G, P, n}{\text{Max}} \; U$$

subject to:

$$nh(P + \tau, t, G, U) - f(k(P)) = 0 \tag{10}$$

and

$$nx(P+\tau, t, G, U) + c(nv(P+\tau, t, G, U), G) + k(P) - nI = 0, \tag{11}$$

4. In the following analysis we could add a congestion variable such that $U = u(X, H, V, G, nV)$. In this case, the right-hand side of equation (7) would include an additional term, $-nu_5/u_1$. However. all the qualitative results of the following analysis would not be affected

where $x(\cdot)$, $h(\cdot)$, and $v(\cdot)$ are the compensated demands for X, H, and V, respectively, and $k(P)$ is the maximand of

$$\text{(12)} \qquad \underset{K}{\text{Max}}\ f(K)P - K.$$

In this formulation, the land-rent tax revenue is

$$\min\left[c(\cdot) - f(\cdot)\tau - nv(\cdot)t,\ f(\cdot)P - k(P)\right]$$

and the poll tax revenue is

$$\max\left\{0,\ c(\cdot) - \left[f(\cdot)(P+\tau) - k(\cdot)\right] - nv(\cdot)t\right\}^{5}.$$

It can be shown that the solution to this problem yields the first-best allocation, where

$$\begin{aligned}\min\left[c(\cdot) - f(\cdot)\tau - nv(\cdot)t,\ f(\cdot)P - k(\cdot)\right]\\ = c(\cdot) - nv(\cdot)t = f(\cdot)P - k(\cdot)\end{aligned}$$

and

$$\max\left\{0,\ c(\cdot) - \left[f(\cdot)(P+\tau) - k(\cdot)\right] - nv(\cdot)t\right\} = 0.$$

Thus, once again, when collecting the user charge is costless, 100-percent tax on land rent and the warranted toll revenue are the only sources for financing the provision of the LPG. This is not the case when monitoring of visits to the facility is prohibitively high, such that collection of t is infeasible. This is the subject of the next subsection.

3.2. Second-Best Allocation

Suppose that monitoring the consumption of V is prohibitive or very expensive. We redefine the planner problem and characterize the resulting allocation. The planner problem is the maximization of U subject to (10), (11) and, contrary to the preceding case,

$$\text{(13)} \qquad t = 0.$$

Assuming that (13) is binding, the first-order conditions become [6]:

$$\text{(14)} \qquad \begin{bmatrix} h_1 & v_1 \\ h_2 & v_2 \end{bmatrix} \begin{bmatrix} -\tau \\ c_1 \end{bmatrix} = \begin{bmatrix} 0 \\ \mu \end{bmatrix},$$

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5. A poll tax referred to in the text is one which is imposed directly on household when the revenue from all other taxes, including land rent tax, is not sufficient to cover the provision cost of the LPG.

6. We exclude the possibility that under "less bests", the allocation is distorted such that the shadow prices of any of the constraints is not binding. Thus, in the subsequent analysis, the shadow prices of (1) and (2) are positive. In particular, this means that the maximized utility is still an increasing function of the available resources, I, that is, $dU/dI > 0$.

where μ is the Lagrange multiplier of (13),

$$c_2 = -n\,(x_3 + Ph_3 + c_1\,v_3), \tag{15}$$

and

$$c(\cdot) = [Pf(K) - K] + nv(\cdot)\,c_1, \tag{16}$$

where, in the derivatives of $x(\cdot)$ and $h(\cdot)$, $t = 0$.

Since the congestion effect is positive, we first infer from (16) that ALR (Aggregate Land Rent) is smaller than the cost of the LPG. Therefore, an additional revenue source is always necessary to finance the provision of the LPG. Apparently, it follows from (16) that, if $c(\cdot)$ exhibits homogeneity of one degree in nv, that is, $nvc_1 = c(\cdot)$, as assumed in the literature on property tax cited above, then the rent must vanish and the only source for financing the LPG remains the property tax. However, this conclusion is misleading. Given that housing production is characterized by decreasing returns due to land scarcity, if, in addition, $nvc_1 = c(\cdot)$, then the utility is a globally decreasing function of population size and, consequently, the left-hand side of (16) must be negative, thus violating the equation (optimal population size vanishes). For the existence of a positive optimal community size, which is inherent in (16), $c(\cdot)$ must exhibit (in the margin) homogeneity of less than one degree, that is, $nvc_1 < c(\cdot)$. Thus, if communities are replicable, then the assumption of land scarcity in any given community, on the one hand, and a privately provided public good produced under constant returns-to-scale, on the other, leads to a meaningless solution [7].

Observe, first, that (16) does not imply that 100-percent tax is always imposed on land rent. It is shown below that if H and V are complements with an own-price elasticity of housing smaller than the cross price elasticity, the optimal tax mix is composed of a property tax and a less than 100-percent land rent tax.

Second, it follows from (14) that

$$\tau = c_1\,v_1/h_1 \geq (<)\,0 \quad \text{as } v_1 \leq (>)0, \tag{17}$$

where v_1 is the net substitution effect between housing and the intensity of using the public facility, V.

Thus, housing is taxed (subsidized) whenever it is a net complement (substitute) to facility-utilization. This is, of course, a standard pricing principle under second-best allocation (see CORLETT and HAGUE [1953]). The intuition for this result is straightforward: if H and V are net complements, then increasing the housing price helps in reducing the

7. Once again, note that it is not the assumption that the LPG is a publicly provided private good that causes the problem but, rather, its conjunction with constant returns-to-scale technology. See Footnote 3.

excessive unpriced utilization of the public-facility. If they are net substitutes, the opposite is true, housing should be subsidized to discourage the intensity of the public facility use. It turns out, therefore, that with an appropriate specification of the second-best issue, a property tax is not necessarily used to finance provision of the public facility. Sometimes, *housing deserves subsidy* rather than being subjected to a tax. In this case, the property subsidy, together with the LPG, should be financed by other revenue sources.

What, then, is the (constrained) optimal mix of taxes when land taxes, property taxes, and head taxes are included in the instrument menu? To answer this question, we now use (16) and (17) to obtain

$$(18) \qquad \begin{cases} c = [Pf(\cdot) - K] + (\eta_H/\eta_V) f(\cdot)\tau \\ \quad = \text{ALR} + (\eta_H/\eta_V) \text{ property tax}, \end{cases}$$

where ALR is Aggregate Land Rent and η_H and η_V are the price elasticities of $h(\cdot)$ and $v(\cdot)$, respectively.

We can thus use (16), (17), and (18) to characterize several cases:

(a) H and V are neither substitutes nor complements, *i.e.*, $v_1 = 0$: The optimal taxation is comprised of 100-percent land rent tax and a poll tax. Neither a property taxes nor aproperty subsidy is included in the optimal tax mix.

(b) H and V are substitutes, *i.e.*, $v_1 > 0$: In this case, (17) implies that the optimal tax/subsidy mix must include a *property subsidy*. Therefore, 100-percent land rent tax and poll tax are used to finance the provision of the LPG and the property subsidy.

(c) H and V are complements, *i.e.*, $v_1 < 0$, with an own-price elasticity, $|\eta_H|$, larger than the cross-price elasticity, η_V: In this case, 100-percent land rent tax and a property tax are supplemented by a poll tax for financing the LPG.

(d) H and V are complements, *i.e.* $v_1 < 0$, with an own-price elasticity, $|\eta_H|$, smaller than the cross-price elasticity, η_V: In this case, the optimal tax mix is composed of property tax and less than 100-percent land rent tax.

3.3. Third- and Fourth-Best Allocations

We have just realized that, with the exception of case (d), a second-best menu must include a poll tax. Such a tax is missing in the menu discussed by HENDERSON [1985], HOYT [1991], and KRELOVE [1993]. Therefore, their allocations must be referred to as a third-best. To highlight the specific implications of not allowing the collection of a poll tax, the planner's problem can be represented by choosing P, τ, and G, to maximize U subject to (10), (11), (13), and

$$(19) \qquad c(\cdot) \leq [f(\cdot)P - K(\cdot)] + f(\cdot)\tau = f(\cdot)(P + \tau) - k(\cdot).$$

Equation (19) states that only taxes on land and housing property can be used to finance the provision of the LPG.

Since in this case, too, (16) applies, implying that a 100-percent tax on land rent is not sufficient for financing the LPG, and since a poll tax is not allowable, the third-best allocation requires a positive property tax (the property tax revenue amounts to nvc_1).

We can, of course, also define a fourth-best case where, instead of (19), we have

$$c(\cdot) = f(\cdot)\tau, \tag{20}$$

implying the use of a property tax only.

Summing up, it is inappropriate to refer to the property tax as a second-best instrument. Furthermore, under second-best, and even under third-best allocations, only in special cases is a property tax used as the single instrument. Now we turn to the second question raised in the introduction and show that these conclsuions apply equally to Tiebout-type allocations with profit-maximizing suppliers of LPG.

4 Tiebout-Type Allocation with Profit-Maximizing Suppliers of the LPG

One of the main issues elaborated in club and LPG theories is whether efficient resource allocation can be achieved in equilibrium with utility-taking profit-maximizing suppliers of the LPG. The suppliers can be developers or local governments which use the profit-maximization criterion. These two distinct agents are inappropriately referred to interchangeably in the literature. In this section, however, we only inquire whether, given a policy tools menu, the profit-maximizing criterion for providing the LPG is consistent with efficient resource allocation. The distinction between the two agents is deferred to the next section.

Regarding the first-best allocation, "the case is closed" in the sense that it no longer raises controversy. As long as equilibrium exists, it is efficient (see, for example, PINES [1991], SCOTCHMER [1985 and 1990], SCOTCHMER and WOODERS [1987], and WILDASIN [1986]). The controversy refers to the second-, third- and, perhaps, "less"-best cases. We will show here that, with the same tool menu, a decentralized Tiebout-type allocation is efficient as long as our interpretation of Tiebout's "large number of communities" is adopted, that is, communities are perfectly replicable.

To see this we first define equilibra corresponding to the optima discussed in the preceding section.

(a) **First-Best Tiebout-Type Equilibrium (FBTE):** equilibrium with utility-taking profit-maximizing suppliers of the LPG who control all the

potential instruments (G, t, τ, land rent, and poll taxes). Accordingly, **FBTE** is a set $\{P, \tau, t, G, n, U\}$ satisfying

$$\begin{aligned}(21)\qquad \pi &\equiv \{\underset{P,G,\tau,n,t,U}{\text{Max}}\, n[I - x(\cdot) - h(\cdot)(P+\tau) - v(\cdot)t]\} \\ &\quad + [f(\cdot)P - k(P)] + [f(\cdot)\tau + nv(\cdot)t - c(\cdot)] \\ &= \{\underset{P,G,\tau,t,U}{\text{Max}}\, s(P, G, \tau, t, U; I)\} \\ &= 0\end{aligned}$$

where

$$(22)\qquad s(P, G, \tau, t, U; I) \equiv f(\cdot)[I - x(\cdot)]/h(\cdot) - c(\cdot) - k(P).$$

(b) **Second-Best Tiebout-Type Equilibrium (SBTE):** equilibrium with utility-taking profit-maximizing suppliers of the LPG who cannot impose a user charge. Accordingly, **SBTE** is a set $\{P, \tau, t, G, U\}$ satisfying

$$(23)\qquad \pi' = \{\underset{P,G,\tau,t,U}{\text{Max}}\, s(P, G, \tau, t, U; I) \text{ subject to } t = 0\} = 0.$$

(c) **Third-Best Tiebout-Type Equilibrium (TBTE):** equilibrium with utility-taking profit-maximizing suppliers of the LPG who can impose neither a user charge nor a poll tax. Accordingly, **TBTE** is a set $\{P, \tau, t, G, U\}$ satisfying

$$(24)\qquad \begin{cases} \pi'' = \{\underset{P,G,\tau,t,U}{\text{Max}}\, s(P, G, \tau, t, U; I)\} \text{ subject to } t = 0, \\ \qquad \text{and} \quad c(\cdot) \le f(\cdot)(P+\tau) - k(P), \end{cases}$$

We claim:

PROPOSITION 1 : The allocations under **FBTE, SBTE** or **TBTE** are, respectively, a first-, second-, or third-best allocation.

Proof: Suppose not, that is, if U^c is the utility under **FBTE**, **SBTE**, or **TBTE**, and U^0 is, respectively, the first-, second-, or third-best allocation, then $U^c < U^0$. Since (11) is satisfied with U^0 and I, and since the quantity of resouces is an unbounded, monotone-increasing function of U, there must exist some level of per-capita resources, say $I_1 < I$, such that (11) is satisfied for I_1 and U^c under the respective first-, second-, or third-best allocation [8]. In this case, however, (11) can also be written as

(i) $s(P^0, G^0, \tau^0, t^0, U^c; I_1) = 0.$

But then, since $s(\cdot)$ is certainly increasing in I, it follows from (23) and (24) that

(ii) $s(P^0, G^0, \tau^0, t^0, U^c; I) > 0 = s(P^c, G^c, \tau^c, t^c, U^c; I),$

which implies that, in contrast to (23) and (24), the set $\{P^c, G^c, \tau^c, t^c, U^c; I\}$ does not maximize $s(\cdot)$. A contradiction. □

8. See Footnote 6.

We can now use Proposition 1 and the results derived in the preceding section to make some observations.

(a) Prohibitive monitoring costs is not a sufficient explanation for the prevalence of property taxation. We have already seen that as long as V and H are substitutes and a poll tax is available, property may be subsidized, rather than being taxed, to achieve a social optimum. Proposition 1 tells us that, under **SBTE**, such subsidization is also profit-maximizing.

(b) A property tax is, indeed, used when poll taxation is infeasible, but never as a single source. It is always supplemented by 100-percent land tax.

The failure of both HOYT [1991] and KRELOVE [1993] derive (b) is that their models treat a case of publicly provided private good characterized by constant return-to-scale production technology. Given that housing production exhibits decreasing returns, the optimal community size vanishes and, accordingly, profit-maximizing community size is zero. Inappropriately imposing conditions for an internal solution necessarily yields their result that only property tax is used (see WILDASIN and WILSON [1991]).

We now turn to the third issue raised in the introduction.

5 Local Governments vs. Developers

In discussing profit-maximizing suppliers of the LPG, no distinction is made between developers who are directly engaged in business, on the one hand, and local governments which are political entities, on the other HENDERSON [1985] and WILDASIN [1986], for example, discuss developers, while HOYT [1991], KRELOVE [1993], and SCOTCHMER [1985, 1994] refer to local governments. Such a distinciton is, indeed, redundant if the suppliers of the LPG under both economic regims are equipped with identical instruments. But they are not; hence, it is inappropriate to refer to them interchangeably.

In general, by developers, we mean entrepreneurs who realize profit by supplying developed land for residential and other uses. We assume that this function includes the determination of K. They supply the LPG for raising the market value of the property or service they sell. Thus, all the rent accrues to them and all the cost of supplying the LPG is borne by them. In case of costless monitoring, of course, they are supposed to charge the users of the facility as to suppliers of club goods.

Furthermore, the developers can always use a nonlinear price which incorporates a fixed sum–playing the role of a head tax–and a proportional part–playing the role of conventional price. In fact, houses are seldom sold at a fixed average price per square feet. Rather, developers often offer buyers extra square feet at a price lower than the average. Thus, nonlinear average pricing which incorporates a head tax is quite a common practice.

The developers can also tax or subsidize a commodity produced by them. This is done by employing K at a level which differs from the one which equates K's value of marginal product to its price, 1. However, in general,

developers cannot impose taxes on or grant subsidies to commodities in whose production they are not engaged.

Local governments are defined as political entities which are engaged in the supply of the LPG and its financing through taxation. By assumption, they are not involved in direct production, including land development.

In the simple case presented above, where, beside the LPG, there are only two commodities, composite good, X, and housing, H, the two institutions are almost isomorphic. One can, perhaps, argue that a developer may have an advantage over a local government because the latter has to rely on taxation, especially on the problematic 100-percent tax on rent (see ATKINSON and SLIGLITZ [1980]). However, this advantage does not directly follow from our analysis.

This conclusion may change when we extend our model by introducing more than one commodity, whether private or public, whose pricing is costless. In this case, the second-best optimization requires a complete system of taxes and subsidies according to the substitutability and complementarity of each good with the unpriced publicly provided good (see ATKINSON and STIGLITZ [1980]). In other words, we have to extend (14)-(16) to account for each commodity. In this more general case, a property tax is one out of a whole set of taxes on each of the nontradeables. More importantly, increasing the set of feasible taxes improves the resource allocation. Local governments, thus, appear to have an advantage over private developers. Indeed, one can argue that developers, too, can effectively impose taxes and grant subsidies by appropriately using inputs in the goods they produce. However, this requires complete horizontal integration of local supplies, which is certainly problematic [9].

The alleged advantage attributed to local governments by their ability to tax commodities is subject to some qualifications, however. A local government can be constrained in its ability to use a commodity tax since its residents are then motivated to cross the border and to purchase in a neighboring community. Thus, the set of taxable commodities may be effectively restricted only to local services, of which housing is important. This also raises the question of the level of government involved, as the taxation power increases with each level.

6 Concluding Remarks

This paper is concerned with three issues associated with Tiebout-type allocation with profit-maximizing suppliers of LPG when monitoring the use of public facilities is prohibitively costly:

(a) Is, indeed, the property tax a second-best instrument?

9. This can provide an incentive to the developer to own the local general store in a small, remote community.

(b) Given the set of feasible instrument menu (provision of the LPG and taxes), is a Tiebout-type allocation with profit-maximizing suppliers of the LPG constrained-efficient?

(c) Given the ranking of instruments, are profit-maximizing developers better equipped with instruments conducive to (constrained) efficiency than land-rent maximizing local jurisdictions or vice-versa?

Regarding the first question, the concept of second-and less-best is systematically spelled out in the context of optimal taxation. It turns out that, in contrast to the literature on the subject, a property tax is not necessarily a second-best instrument. Rather, according to optimal taxation approach, a property subsidy may be appropriate. Even when a property tax is necessary, it should never be used as the single tax instrument but, rather, be supplemented by tax on land rent.

Regarding the second question, we find that given the tax instrument menu, a Tiebout-type equilibrium is constraint-efficient. Thus, SCOTCHMER's and WOODERS' [1987] result regarding the first-best optimality of market provision of club goods carries over to Tiebout-type allocations under second-and less-best allocations as well.

Since a second-best allocation requires a variety of taxes and since developers are constrained in their taxation capabilities, local governments are better equipped to handle a second-best situation that is, when a user charge is infeasible). However, this result is qualified by the cost of taxation, which was overlooked in our analysis.

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