Chapter 11

THE ECONOMICS OF THE LOCAL PUBLIC SECTOR

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1. Introduction

One of the dominant areas of study in public finance during the past several decades has been the provision of public goods. Public finance economists spend a good deal of time and effort attempting to determine what individuals' preferences for public goods are, to decide what the "efficient" level of provision of goods is, and to analyze the actual production process that provides these goods. While the provision of public goods may occur at any of several levels of government, local aspects of public economics have only recently come to be an area of substantial academic interest. What distinguishes the study of the local public sector from the general theory of public goods is the possibility of migration between local jurisdictions. My analysis begins and ends with a focus on the "Tiebout (1956)" model. Tiebout suggested that it might be useful to view the provision of local public goods in a system of numerous jurisdictions as being analogous to a competitive market for private goods. Competition among jurisdictions would allow for a variety of bundles of public goods to be produced, and individuals would reveal their preferences for those public goods by moving ("voting with your feet"). Tiebout also argued that such a process, at least in the abstract, would lead to an efficient outcome in the sense that no one would be able to make themselves better off without making someone else worse off.

The Tiebout view provides an extreme view of the world, but it does allow us to concentrate on what makes the local public sector of unusual interest. Of course, the Tiebout view of the world is a narrow one. However, at present there really is no fully satisfactory model of the local public sector, so that the

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appropriate question is whether and under what assumptions the Tiebout model (or an alternative model with fixed population which focuses on the choice of public goods within a jurisdiction) provides a good "approximation" to the local public economy. I will begin with a simple and hopefully intelligible form of the model and then add sequentially a number of complicated, but relevant assumptions which can be crucial in understanding both normative and positive aspects of local public service provision.

One of the concerns raised by Tiebout (often confused in the literature) is the determination of optimal public service provision. Optimality or efficiency (used interchangeably) in local public economics has two distinct meanings, which I will have occasion to discuss throughout the chapter. The more common use of the term applies to the provision of public services within a single jurisdiction. An optimal provision, which leads to *intra*jurisdictional efficiency, is one which maximizes the sum over all individuals within the jurisdiction of the net-of-costs willingness to pay for the public good, where the set of individuals within the jurisdiction is taken to be fixed. Optimality within a *system* of jurisdictions, i.e. *inter*jurisdictional efficiency, applies to the provision of public services among jurisdictions when migration is possible. Efficiency is achieved when the existing number of jurisdictions results in the provision of a level of public goods which is sufficient to satisfy individuals' demands, and is produced at minimum cost. The notion of interjurisdictional efficiency, while clearly unimportant to the discussion of public goods at the federal level, is central to local public economics and will serve as a focal point of this chapter.

As a first step in discussing the question of jurisdictional optimality one might ask whether a given jurisdiction ought to be increased in size or decreased in size. In other words, is it efficient to have a small number of large jurisdictions or a large number of small jurisdictions? One immediate thought is that a small jurisdiction has an advantage from a political perspective. The smaller and more homogeneous is each of the communities in a system of local governments, the more likely it is that services provided will be consistent with desires of each and every member of the population. Thus, a small jurisdiction is likely to minimize the "political externalities" that individuals create when selecting a level of public goods provision that does not satisfy everyone's tastes.

On the other hand, local redistributive goals that society might have are likely to be thwarted if communities are small and homogeneous. In addition, most public goods involve benefits that extend beyond jurisdictional boundaries. The obvious way to solve this externality problem is to internalize it by expanding the jurisdictional scope. Finally, jurisdictional scale may also be affected by the supply side of the local public sector. If there are economies of scale in the provision of local public services, it makes sense to have larger jurisdictions, for production purposes at least. The problem of balancing these objectives is a complex problem which will appear and reappear throughout the discussion.

The chapter is primarily a methodological one. I sketch examples of some of the kinds of models that local public finance economists have used, illustrating some of their advantages and difficulties, but without attempting to achieve complete coverage. A general discussion of public goods provision has been omitted here since it is treated in the opening chapter of this Handbook, while the discussion of public choice and political economy appears in a later chapter. Relatively few references are given in the text, but the reader is urged to read the footnotes and suggested references there when further detail is desired.

Section 2 begins the discussion of optimality among jurisdictions with an analysis of the club model of local public provision of public services. This model allows one to see in a very simple way the conditions under which the competitive nature of the provision of local public goods is similar to the competitive market. It illustrates the trade-off between scale economies in the provision of public goods and the externality created when communities become congested or crowded. Section 3 continues with a detailed description of the Tiebout model. It expands the earlier discussion to look at the allocation of individuals among communities when individuals have different incomes, and when a property tax is used to finance public goods. The primary concern is whether an equilibrium exists and if so whether it will be efficient.

Local public economics is concerned with the fact that both public spending and taxes can have a direct impact on land and property values. This additional consideration is added to the Tiebout framework in Section 3. The possibility that public sector variables can affect land values alters the analysis of the efficiency of the Tiebout mechanism. How one might test the Tiebout model in such a framework is sketched out at the end of the section.

With the broad normative analysis in the background, the review switches briefly to a more technical positive analysis of the local public sector. I ask whether information about individual demand functions for public goods can be obtained within a world of numerous jurisdictions, and if so how one might estimate those demand functions. To some extent the issues are similar to those in the general public finance literature, but information about interjurisdictional variation in the provision of public services adds greatly to the set of possible techniques for estimating demand functions. However, the possibility of migration in response to fiscal variables in a Tiebout-type world adds substantially to the difficulty of obtaining consistent demand parameter estimators. Section 4 illustrates several traditional approaches which can yield demand functions. Section 5 focuses on demand functions also, but looks at some non-traditional methods for estimating demand functions. The first involves analysis of the use of survey data, and the second an examination of differentials in property values, the so-called "hedonic" approach. The discussion then continues to ask: If one knows about demand functions, is it possible to test whether the provision of local public services within jurisdictions is efficient? Finally, Section 6 presents a

broader overview of the question of the allocation of responsibilities among levels of jurisdictions. The so-called "fiscal federalism" question asks whether the local government ought to be balancing its budget, what local public goods should be provided locally, and whether and how the revenues ought to be shared between levels of government.

2. Community formation and group choice

The large number of jurisdictions providing public goods distinguishes local public economics from the rest of public economics. Because individuals are mobile and vary in tastes, the determination of the optimal level of provision of public goods among a series of jurisdictions is complex, as is the meaning of "optimality" itself.

Tiebout provided a start by describing a model in which there is a mobile population and a sufficient set of either potential or existing communities offering varying bundles of public goods so that, with costless mobility, individuals can choose the community with the best package of public goods and taxes and in the process reveal their true preferences for public goods. There is no private sector production in the Tiebout model. Individuals simply allocate some portion of their income (obtained outside the model as "dividend income") towards the consumption of the public good and consume the rest. The result is an equilibrium with individuals distributed among communities on the basis of public service demands, with each individual obtaining his own desired public service–tax bundle.

The Tiebout model is a demand side model, within which individuals choose locations on the basis of their preferences for public goods. Tiebout's paper says little if anything about the supply side and, in particular, nothing about the technology of production of public goods or the underlying political mechanism by which levels of public goods might be chosen. Average cost curves for public services are U-shaped as a function of population size, and all jurisdictions are assumed to provide services at the point of minimum average cost.

As a consequence of all of these assumptions, Tiebout suggests that the outcome of a process by which individuals select jurisdictions will be optimal or Pareto efficient in the sense that no one can be made better off without making someone worse off. Efficiency arises both because public goods are provided at minimum average cost and because each individual resides in a jurisdiction in which his demand is exactly satisfied. By revealed preference individuals who could have moved chose not to, and thus cannot make themselves better off.

The Tiebout model has appealed to a large number of writers in public finance, in part because of its analytical convenience, and in part because of the analogy

are so familiar. The number of variables ...

as in previous analyses, I focus on the analogy between the many jurisdictions and the competitive market. The fundamental question to be answered is whether a competitive analog in the form of an equilibrium distribution of households among jurisdictions exists, and if so whether that equilibrium is efficient. In the simple version of the Tiebout model that arises out of the theory of "clubs",[1] the Tiebout equilibrium exists and yields an efficient outcome. As the model is generalized to incorporate more realistic assumptions, however, an existence problem arises. Perhaps more disturbing is the fact that when an equilibrium does exist, it may not be efficient.

Since my objective is to progress from the simple Tiebout model towards more complex and realistic models of the local public sector, a brief summary of the assumptions of the Tiebout model will serve as a good starting point. The reader should refer to this list in the following sections as many of the assumptions are relaxed. The Tiebout assumptions are:

(1) Individuals have perfect information.

(2) Mobility is costless and is responsive only to fiscal conditions.

(3) Public goods are provided at minimum average cost within each jurisdiction. Each new migrant to a community pays an access cost equal to the cost of providing public services to that migrant.

(4) There are no interjurisdictional externalities.

(5) There are a sufficient number of jurisdictions and a sufficient number of households of each type (in terms of tastes and incomes) so that each jurisdiction can contain identical individuals. Thus, new communities can be developed costlessly.

(6) There is no public choice mechanism other than the utility-maximizing decision of an identical set of individuals.

(7) All income is dividend income, not generated by private production. There is no labor market.

(8) Public goods are financed by lump sum taxes.

(9) There is no land, no housing, and therefore no capitalization.

Clearly, these restrictions are extremely strong. The hard question is whether the Tiebout model is sufficiently like the local public economy so as to make it useful for both normative and positive purposes. This is a question for which there is not an easy answer, but which motivates a good deal of the methodological discussion which follows.[2]

[1] See, for example, Buchanan (1965), See, also, Sandler and Tschirhart (1980), Berglas (1982), Berglas and Pines (1984), and Scotchmer (1985a).

[2] Of course, this is in part an empirical question, as is discussed in Oates (1981).

Assume initially that all individuals are identical in tastes and in incomes. In such a world the level of public services provided will be the utility-maximizing level selected by any individual within the community. This most elementary "public choice" mechanism will be relaxed later in the chapter, in which case the competitive analogy is substantially weakened. Assume also that a pure public good is provided to all identical residents of a community or region which is isolated from other communities.[3] The "pure" public good has the property that its consumption is unaffected by the number of people in the community. To produce the public good, the production of the private good, and thus private consumption, must be forgone. As a result, a trade-off exists, in both production and consumption, between public and private goods.

Following Stiglitz (1977), let G represent the level of provision of the public good, X private consumption per capita, W total income available to all members of the community, and N the number of individuals. Private and public goods are assumed to be measured in identical units and produced by a single production process. The single production function, f, for both public and private goods, is given in equation (1):

$$W = f(N), \quad f' \text{ positive}, f'' \text{ negative}. \tag{1}$$

With this functional form there are first increasing and then decreasing returns to scale (in population). Total income W is measured in units of output, produced within the jurisdiction. The constraint

$$W = XN + G \tag{2}$$

reflects the fact that W must be fully allocated among the purely private good and the purely public good. As a result of these assumptions, the Stiglitz model is quite restrictive. It requires, in effect, that individuals work where they live and consume public goods on islands.

If N is fixed, and all individuals in a given jurisdiction have identical tastes and income, then each resident's problem is to choose X and G to maximize his utility function, $U(X, G)$. The Lagrangian is (λ is a Lagrange multiplier):

$$\text{maximize } U(X, G) - \lambda(XN + G - f(N)), \tag{3}$$

and the first-order conditions are

$$\partial U/\partial X - \lambda N = 0 \tag{4}$$

[3] This model is a good starting point, but is somewhat limited in its application to the local public sector, since it assumes an isolated island economy. The assumption that all income is generated from local production is a very restrictive one.

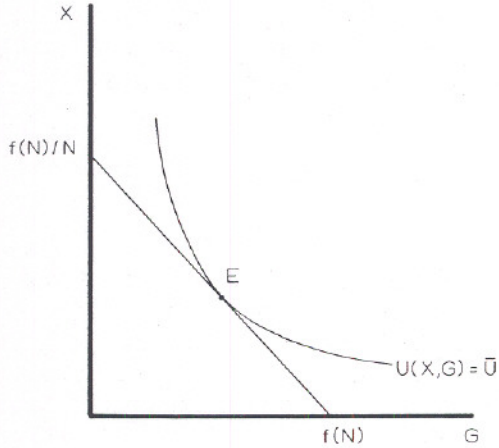

Figure 2.1

and

$$\partial U/\partial G - \lambda = 0. \tag{5}$$

Solving equations (4) and (5) yields:

$$N\left[(\partial U/\partial G)/(\partial U/\partial X)\right] = 1. \tag{6}$$

Equation (6) is the Samuelson condition for efficient provision of the public good. The expression in brackets is the marginal rate of substitution of public for private goods, and N is the population. The left-hand side of the equation is the sum of the individual marginal rates of substitution between public and private goods. The right-hand side is the marginal rate of transformation, i.e. the marginal cost in terms of forgone units of X of producing an additional unit of output G (since inputs and outputs are all measured in equivalent units).

In Figure 2.1, $f(N)$ represents maximal public good provision, while $f(N)/N$ is the maximum possible per capita consumption of the private good. Since the technology is assumed to be linear, the production possibility frontier is linear and an interior optimum is attained at point E. Thus, for a given population, the optimum provision of the public good is easily determined, since complications associated with the public choice process in a world of heterogeneous individuals are not present here.

Now consider the problem of allocating population among jurisdictions. If the level of public goods, G, is fixed in each community, how many people should reside in each? The "club" analogy applies here, since this is the kind of decision that would face an entrepreneur attempting to decide how many individuals to let into an exclusive private club. The entrepreneur's objective is to obtain the

... to maximize private good consumption *given a fixed G*.

From (1) and (2) private good consumption is given by

$$X = (f(N) - G)/N. \tag{7}$$

Maximizing X with respect to N yields:

$$X = f'(N). \tag{8}$$

This condition states that population is added to the point at which the added income is equal to the per capita consumption of the private good. If the additional income were lower than X, for example, the newest member of the club would not have sufficient private income to assure that the current standard of living (private consumption) would be maintained.

With the level of G as well as N allowed to vary, the full club model can be analyzed. As population increases, aggregate income and thus the maximum level of public good obtainable increases, given that there is a positive marginal product of labor. However, the maximal level of private consumption decreases, since the marginal productivity of labor diminishes. In other words, as N increases, $f(N)$ rises, but $f(N)/N$ falls. An example of how the "opportunity sets" vary with N is given in Figure 2.2. Clearly, a high population allows for increased public good consumption, but at the cost of having less of the private good available (and greater congestion and other externalities in a more realistic model).

In terms of the entrepreneur's decision to set the size of the club optimally, the locus of all possible opportunities is relevant, since any allocation of resources

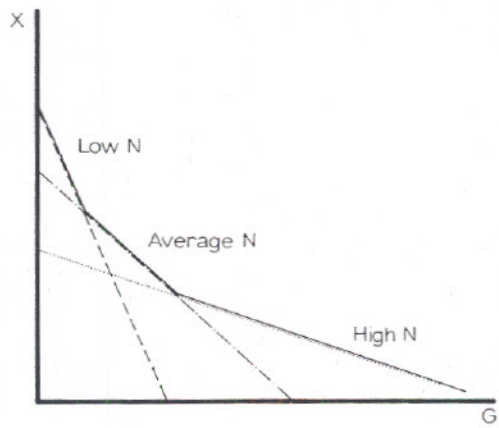

Figure 2.2

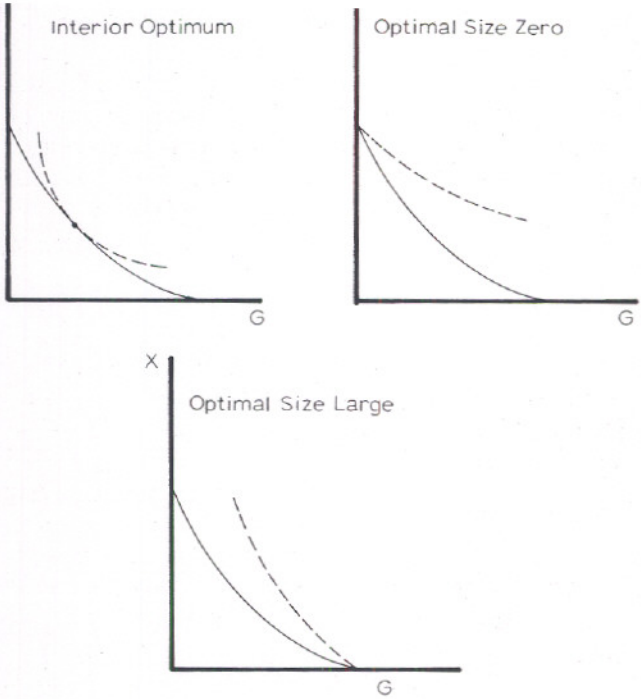

Figure 2.3

not on the locus cannot be utility maximizing. Figure 2.2 illustrates the situation in which there are only three sizes of jurisdictions, but the general point should be clear. Although the production possibilities set within each community is convex for a given N, the opportunity set may well be non-convex. As a consequence, a number of possibilities can arise, three of which are illustrated in Figure 2.3.[4]

Figure 2.3 shows that the optimal size of the community may be either zero, the entire population, or somewhere in between, depending upon the shape of the opportunity locus and the shape of the indifference curves of the identical individuals. The model is an extremely simple one, but the theoretical possibility of "corner solutions" because of supply or demand conditions holds quite generally.[5] The corner-solution possibility should not be particularly troubling to students concerned with policy, because the Tiebout model assumes away a

[4]See Stiglitz (1977) for additional details. See, also Wooders (1980).
[5]Multiple equilibria are also possible, but not illustrated in the figure.

"interior" equilibria may occur in local public economics. If interior optima are to be studied (using the calculus) some further assumptions about the nature of utility and production functions or about institutions such as land-use controls, must be made.[6] To avoid this problem I assume in the next section that any solution to the optimization problem does not involve a corner solution.

2.2. *Optimum club size with congestion*

The club model becomes more interesting and more realistic if one allows for congestion in the consumption of the public good. There are a number of ways in which congestion might be modeled, but one simple alternative is to account for congestion in the cost of providing the public good. To do so, I borrow from Henderson (1979) and denote the cost of providing a unit of output of the public good (e.g. a year of public education) by $C(N)$. If the public good is a pure public good, then $C'(N)=0$. If the public good has either private good characteristics or can have congestion in consumption, then $C'(N)$ is positive.

I assume that consumers are able to purchase units of housing, H, at an exogenous price, p, and for pedagogic reasons that they are identical in both taste and income, but will relax this assumption in a moment. The individuals solve the following optimization problem, where Y represents *individual* exogenous income and the price of X is one:

$$\text{maximize } U(X, H, G) \tag{9}$$

$$\text{subject to } X = Y - pH - [C(N)/N]G. \tag{10}$$

The first-order conditions are similar to those in (4) and (5) yielding:

$$N[(\partial U/\partial G)/(\partial U/\partial X)] = C(N) \tag{11a}$$

and

$$[(\partial U/\partial H)/(\partial U/\partial X)] = p. \tag{11b}$$

In (11a) the left-hand side represents the sum of the marginal rates of substitution of individuals' preference for public versus private goods, while the right-hand side represents the marginal rate of transformation or the cost of producing an additional unit of the public good when population is fixed. Equation (11b) represents the equivalent condition for the MRS between housing and the private good.

[6] Courant and Rubinfeld (1981, pp. 297–298) describe a set of conditions sufficient to guarantee an interior optimum.

mizing private consumption with respect to N, with G fixed, yields the necessary condition given in (12):

$$C'(N) = C(N)/N. \tag{12}$$

Equation (12) states that the optimum size of the community[7] is the point at which the average cost of the provision of public services is equal to the marginal cost of adding another individual to the club. For the standard U-shaped cost curve this is the point of minimum average cost. Thus, an entrepreneur wishing to maximize consumer's utility, and implicitly entrepreneurial rents, would choose a community size at which the public good is produced at minimum average cost.

Models of this type as applied to the study of local jurisdictions assume that communities can control the entry of population as well as the provision of public goods, so that by choosing N to minimize the cost of providing public goods, they can maximize the price they can obtain for entry into the jurisdictions.[8] Any entry charge is taken to be the same for everyone. Assuming that the total population to be allocated among jurisdictions is a multiple of the optimum club size, the equilibrium solution would involve a host of identical clubs, all of equivalent optimal size. As shown by Henderson (1979), such an outcome would be efficient and stable. When consumers are identical, if any jurisdiction is above or below the optimum jurisdiction size, then the cost of public good provision in that jurisdiction would be higher than average, and hence, a new club would be formed to provide the same public good bundle at lower cost. If the population were not a multiple of club size the analysis would be greatly complicated because public goods would not be produced at minimum average cost in each community. Pauly (1970) argues that in general an equilibrium will not exist in such a case.

The club model provides a natural introduction to the Tiebout model because it describes optimal public good provision within communities as well as optimal jurisdiction (or club) size. The Tiebout model focuses primarily on interjurisdictional optimality in a world of varying tastes and incomes, and should be viewed simply as an analysis of the optimal provision of public goods in a series of clubs or jurisdictions.

3. The Tiebout model

3.1. Allocating individuals with different incomes

Models of optimal community size are most interesting when the tastes and/or incomes of consumers and their public good demands vary. To get a sense of the

[7]Assuming that the optimum exists and is not a corner solution.
[8]See, for example, McGuire (1974).

out to be slightly easier to analyze than the case of identical incomes and differing tastes which is what the Tiebout model is about. I will also assume that each of these groups is sufficiently large to support jurisdictions of the optimal size and that individuals within jurisdictions pay equal tax shares.

A necessary condition for optimality within each jurisdiction is that the population must be divided into different types of clubs each of which is homogeneous in income and satisfies the Samuelson condition for efficiency in the provision of public goods. A mixed club, on the other hand, would necessarily be inefficient. A typical possibility in a mixed club would be that the actual level of public provision would be an average of the demands of the two types of individuals. Neither the low nor the high income group would then be consuming their most preferred level of public services given the taxes that they pay. In this case both groups could improve their well-being if they moved to homogeneous communities[9].

Heterogeneity is inefficient when all individuals pay equal taxes within a jurisdiction. Of course, heterogeneity may make sense in a model in which individuals of differing skills are complementary factors in production or if individuals simply have a taste for living among others of different tastes and/or incomes. However, within the relatively simple club model we ask a harder question. Does the heterogeneity result change when taxes paid are a function of income or of the benefits received from the consumption of public goods? To answer this question, consider a Lindahl pricing or tax scheme in which the tax paid per unit of public good is equal to the marginal benefit that the individual receives from the consumption of the last unit of the public good provided.[10] By construction, the Lindahl taxation scheme has the property that both high and low income individuals will choose to consume the identical public service bundle given the "price" that they face.

Although appealing in terms of the marginal conditions of utility maximization, this solution is nonetheless inefficient; both groups of individuals can increase their welfare by moving to jurisdictions with equal tax shares. To achieve the income redistribution implicit in the diversity of tax shares it is better to simply redistribute income rather than redistribute through induced overcon-

[9]As Henderson (1979) argues, in a mixed club the Samuelson condition will provide for provision of public goods above that of the low demanders and below that of the high demanders. (There is a positive income elasticity of demand.) Such an arrangement lowers the potential utility obtained by all members in the community. The low demanders are forced to consume on the same production possibilities curve as in a homogeneous community, but at a point that is not a tangency with their indifference curves. The same is true for the high demanders since they underconsume rather than overconsume.

[10]Lindahl prices here are set equal to each individual's marginal benefit from the public good at a given level of provision (not necessarily the efficient level).

sumption of public goods.[11] Thus, heterogeneity is not efficient in this simple Tiebout model.

The argument developed here could be extended to the case in which there are a large number of types of individuals differing both in incomes and in tastes. Clearly, the optimal number of jurisdictions which provide public goods would increase. With costless mobility each individual could move to the community of his or her choice. In such a world the tax system would not be distorting since public goods would be paid for with a head tax. The market analogy suggested by Tiebout would be complete. An equilibrium that existed would be efficient. While Tiebout did not describe how such an equilibrium might arise, one can easily image an entrepreneurial process that would lead to the creation of new communities.

It is at this point that the extreme limitation of the Tiebout model becomes clear. For the Tiebout model to generate an efficient outcome each community would have to produce at minimum average cost, yet there may not be enough people of each type to provide the appropriate scale for production efficiency. In addition, the assumption that new communities can be developed costlessly is crucial for the market analogy to be complete.[12] Without free entry individuals cannot be assured that opportunities will exist to consume the utility-maximizing level of public good in a homogeneous community. Free entry is a very strong assumption, however. In urban areas and in urban models with labor markets and limited accessibility, the number of possible communities is restricted. A new community would either have to evolve at the urban fringe with workers facing high costs of commuting, or new urban areas would have to develop – an unlikely prospect. Finally, the Tiebout competitive model does not allow for the property tax as a means of financing public goods – a complication to which I now turn.

3.2. The property tax

The property tax is the primary source of revenue for local governments in the United States. While its role as a revenue source has diminished substantially since the turn of the twentieth century, it still represents over 50 percent of total local revenues (54.7 percent in 1980). This figure includes only revenues that are raised locally. Intergovernmental aid from both states and from the federal government today represent an additional major revenue source, a subject to which we turn in Section 6 of the chapter.

When the property tax is used to finance the local public good and when tastes for housing are not perfectly correlated with tastes for public goods (i.e. when

[11] See Henderson (1979) as well as Eberts and Gronberg (1981).
[12] This point is developed in Courant and Rubinfeld (1982) and Epple and Zelenitz (1981).

Tiebout model becomes substantially more complex. In this case the entrepreneurs in each community provide combinations of public goods and housing to suit all individuals. As a result, there must be a sufficient number of communities to provide the desired levels of public goods and of housing for all groups of individuals. The necessary number of such communities is likely to be extremely large.

To see exactly how the presence of a property tax alters the efficiency properties of the Tiebout model, I add a property tax on housing (assumed identical to land here to simplify matters) to the previous model. Again, to simplify the discussion I choose the property tax rate, t, to be defined as the rate of taxation on *annual* housing expenditures. This rate is equal to the usual tax rate on property *value* divided by an appropriate discount rate (assuming an infinite stream of housing services). If p is the annual price of producing housing, and t is the tax rate, then $p(1+t)$ is the annual price of housing, gross of taxes, that the consumer faces when making his consumption decision. Utility maximization is now carried out subject to the budget constraint given by

$$X = Y - p(1+t)H, \tag{13}$$

where $ptH = C(N)(G/N)$, the average cost of a unit of public good G.

The first-order condition for optimal public service provision remains as before – the Samuelson condition that the sum of the marginal rates of substitution equals the marginal rate of transformation. However, consider the first-order condition given in (14), which provides the necessary condition for the optimum consumption of housing:

$$(\partial U/\partial H)/(\partial U/\partial X) = p(1+t). \tag{14}$$

If there were no property tax, the efficient housing consumption condition would be given by (11b), reproduced here as (15), rather than (14):

$$(\partial U/\partial H)/(\partial U/\partial X) = p. \tag{15}$$

Clearly, the property tax alters the housing consumption choice, leading to underconsumption of housing (other things equal). This suboptimality in housing consumption will also lead to inefficiency in public good consumption, except when public good and housing choices are independent. In general, I would expect either complementarity or substitutability between housing and public service demand. To the extent that public goods and housing are complements, I would expect the underconsumption of housing caused by the property tax to lead to underconsumption of the public good. On the other hand, if public goods

greater than would be efficient.[13]

The inefficiency of housing consumption is a crucial problem for the Tiebout models that follow. As long as the property tax does distort housing consumption, *any* conclusions about efficiency or inefficiency in the provision of public goods will be *conditional* on current housing consumption. Such analyses might be reasonable in a short-run model where housing consumption is fixed, but can lead to unreasonable results in a long-run model in which housing consumption is allowed to vary.

3.3. Production inefficiencies in the Tiebout model

Inefficiencies can also arise in Tiebout models when there are economies of scale in the provision of public goods and individuals assume that their migration will not alter the provision of public goods or taxes in either of the jurisdictions. Assume that land is a fixed factor in the production of the public good and that individuals cannot contract for public goods outside of their jurisdiction. Migration of a low income individual into the high income community reduces the per capita costs of providing the public good in this high income community, but it increases the per capita costs in the low income community. As a result, it is possible to have an equilibrium in which consumers live in a variety of small jurisdictions, each optimizing by selecting the bundle of housing and public good that maximizes his utility, and each content, believing that there is no move that could make him better off. However, it may be possible to combine communities, taking advantage of the scale economies in the provision of public goods, and make everyone better off.[14]

Bewley (1981) illustrates this production inefficiency in a very special case where individuals have identical tastes for public goods and utility is separable

[13] This is a standard result in the theory of the second best, whereby a failure in one market, the housing market, can create inefficiencies in other markets. For a discussion of the property tax in a general equilibrium setting, see Courant (1977). See, also Dusansky et al. (1981). For additional studies which evaluate the question of efficiency of resource allocation in models with public goods and with various kinds of distortionary taxes, see, for example, Wildasin (1977), Hochman (1981) and Rufolo (1979). The possibility of efficiency of taxation has usually focused on the land tax, or other taxes that serve as head taxes. See, for example, Hochman (1981, 1982) and Bucovetsky (1981). The discussion of land taxation has occasionally focused on the "Henry George Theorem", which states in effect that with an optimal jurisdictional population the aggregate land rents will be identically equal to the optimal spending on the local public good. The obvious appeal of such a proposal is that one need not resort to distortionary taxation to finance the public sector. The result, unfortunately, holds only under rather extreme assumptions, and is therefore more of a curiosity than a fundamental result. For some discussion of the Henry George Theorem, see, for example, Flatters, Henderson and Mieszkowski (1974), Stiglitz (1977, 1983a, 1983b), Arnott (1979), Arnott and Stiglitz (1979), Berglas (1982), Hartwick (1980), Schweizer (1983) and Wildasin (1984).

[14] In the language of game theory the model would involve a game without a core.

equilibrium exists because no one individual will have any motivation to switch communities, the two being identical. However, if the two communities were to combine, the new community could provide twice the level of public goods at no additional per capita cost, making everyone better off. Clearly, it is the inability of individuals to form coalitions and the absence of land developers that allows for an inefficient equilibrium.[15]

[15]A more complex kind of inefficiency can arise when individuals have complementary tastes and are mismatched in their current jurisdictions; as discussed in Bewley (1981). To take a simple arithmetic example, assume that four individuals supply one unit of labor and are each independently able to provide one unit of a public good with that labor. There are four distinct public goods labeled G^A, G^B, G^C, and G^D, and two communities, 1 and 2. Each individual's utility function is given as:

$$U(\mathrm{A}) = 2G^A + G^B,$$

$$U(\mathrm{B}) = G^A + 2G^B,$$

$$U(\mathrm{C}) = 2G^C + G^D,$$

$$U(\mathrm{D}) = G^C + 2G^D,$$

where $G^A + G^B + G^C + G^D = 4$. Thus, individuals vary in the extent to which they care about each of the four public goods that might be provided, and total production of public goods must be limited to the number of individuals living in each community.

Now consider the following equilibria.

In *equilibrium* I, A and C live in community 1, B and D live in community 2.
In 1, $G^A = 1 = G^C$ while in 2, $G^B = 1 = G^D$.
Then, $U(\mathrm{A}) = U(\mathrm{B}) = U(\mathrm{C}) = U(\mathrm{D}) = 2$.

In *equilibrium* II, A and B live in 1, while C and D live in 2.
Then, in 1, $G^A = 1 = G^B$, while in 2, $G^C = 1 = G^D$.
Then, $U(\mathrm{A}) = U(\mathrm{B}) = U(\mathrm{C}) = U(\mathrm{D}) = 3$.

Here, A and C both live in one community, but each is poorly matched, and is able therefore to obtain a level of utility equal to only 2 units. The same is true for individuals B and D in community 2. There are no complementarities in terms of consumption here, but the equilibrium is a stable equilibrium because any attempt by any individual to move to the alternative community will result in a level of utility which falls from 2 to 1. The problem is the strong assumption that individuals do not take into account any shift in the production of public goods which might arise when they enter the community. Were the entrepreneurs running the community to encourage migration, aware of the option to change the level of public service provision, then the equilibrium which is clearly inefficient, would also be stable.

With proper entrepreneurial ability, equilibrium II would arise. Here A and B live together in community 1, taking advantage of their complementarities, as do individuals C and D in community 2. In this case the utility level obtained by all is 3 and the equilibrium is efficient. These examples are simple, but they apply quite broadly. Even if the model allowed for the ability of governments to alter public service provision, the possibility of inefficiency would still exist.

Before proceeding much further it is important to ask whether there is an equilibrium consistent with any version of the Tiebout model. In fact without additional institutional restrictions on mobility, one cannot be assured of this result.[16] The non-existence problem can be most easily seen in a model with two income classes all having identical utility functions.[17] A graphical demonstration is easier if I assume that the utility function is separable between the private good and the combined bundle of housing and the public good as given in equation (16):

$$U(X, H, G) = V(X) + W(H, G). \tag{16}$$

Both low and high income individuals live in homogeneous communities, with no commercial and industrial tax base. Is such an outcome an equilibrium? Under property tax financing of the public good, the "tax-price" that any individual pays for a unit of public good is equal to the cost per unit of producing the public good times the individual's tax share, in this case the ratio of the individual's house value to the total house value (total tax base) in the community. With a head tax everyone's tax-share is $1/N$, the reciprocal of the number of community residents.

If the homogeneous community outcome is to be an equilibrium no individual should have an opportunity to improve his welfare by moving to another jurisdiction. As an example of why this might be a problem [following Henderson (1979)], consider the utility-maximizing calculus of *one* low income household. In both panels (a) and (b) of Figure 3.1 the low income individual is initially at point D, facing budget line AB in the low income community. However, buying a small house in the high (rather than low) income jurisdiction, the low income individual effectively faces a lower tax-price for public goods than do the high income individuals with larger homes. The tax-price in dollars per unit of public good for the low income household can be represented as

$$P_G = (t \cdot p \cdot H_L)/G, \tag{17a}$$

where t = expenditures/tax base = $cG/[p(H_L + N_H H_H)]$ (recall that I am assuming only one low income entrant to the high income community). Here P_G

[16]A complete argument would also discuss stability and would necessitate a description of the process by which public goods provision is determined, as well as a discussion of the adjustment of housing prices to the potential or actual movement of each of the income classes.

[17]For a more complete discussion of this issue, see Buchanan and Goetz (1972) and Henderson (1979) for a theoretical perspective, and Inman and Rubinfeld (1979) for an empirical discussion. More general analyses of equilibria in models with public goods appear in Greenberg (1977, 1983), Richter (1978, 1982), and Foley (1967). See also Ellickson (1973, 1977), and Stahl and Varaiya (1983).

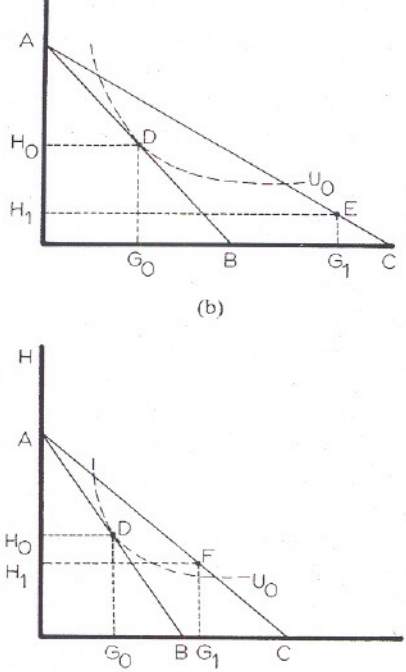

Figure 3.1. (a) Low income household does not migrate; (b) low income household migrates.

represents the tax-price, c the marginal cost of providing public goods (assumed equal to the average cost), and H_L and H_H the housing consumption of the low income and high income individuals (of which there are N_H), respectively.[18] Then, it follows directly that

$$P_G = c[pH_L/p(H_L + N_H H_H)] = c[H_L/(H_L + N_H H_H)]. \tag{17b}$$

Since the tax-price is a function of how much housing the low income person consumes, the budget constraint faced by the low income individual in the high income community varies with the level of housing consumption selected. In the high income community, the budget constraint faced by the low income individ-

[18] The price of housing is assumed to be exogenous and thus, does not affect tax-price.

ual is given by line AC (in both panels), with housing consumption at H_1, and public good provision at G_1. The indifference curve, U_0, in Figure 3.1, panels (a) and (b), shows the maximum level of utility obtainable given the prices that the consumer faces in the *low income community*. An equilibrium arises if the low income household would not find it advantageous to move to the high income community.

In panel (a), the consumer is initially at point D in the low income community, facing budget constraint AB. If the low income individual were to move to the high income community, he would be required to buy the public services, G_1, offered there. G_1 involves a low tax-price per unit of public services, but a high total expenditures on public goods. As a result, if G_1 were purchased the low income individual would have little income to spend on housing and would consume housing H_1 associated with point E on budget line AC. The benefits from the additional public good consumption are outweighed by the lost utility from diminished housing consumption. In this case the outcome is an equilibrium, since low income individuals have no desire to migrate elsewhere. Incidently, it is here that the separability assumption is helpful. With separability the graphical analysis can focus on the trade-off between housing and the public good. Private good expenditures are omitted since they are unaffected by changes in the price of the public good relative to housing.

In panel (b), however, the non-existence problem can arise. Here, the level of public good provided in the low income community is not as high as in the previous case, so that the low income individual faces a lower cost of the public good in terms of housing, even though the tax-price has fallen somewhat less than in the previous case. The move from point D to point F represents an increase in utility for the low income individual choosing to live in the high income community (even though the public good remains at G_1). If the result of calculations of this type is for low income individuals to continually move into high income communities, and for high income individuals to move to avoid the low income individuals, an equilibrium will not exist. Since there is nothing within the Tiebout framework which restricts individual mobility, it is perfectly reasonable, and even likely, to expect a non-existence problem of this kind.

How can existence be assured in such a Tiebout framework? One solution involves the use of various zoning and land use devices to limit the mobility of low income families. For the residents of the high income community, a given spending level per household can be obtained with a lower tax rate than in the low income community, since the high income tax base is larger. Admitting low income individuals, who purchase houses valued below the community average into the community lowers the tax base per family and raises the tax rate. This increased tax rate makes the high income community less attractive to future residents and lowers the value of remaining properties – causing tax rates to increase again. As a result, the incentive of current residents to keep out lower

families than by constructing large homes.[19]

A low income entry barrier can be created if the high income community increases the level of public spending beyond the level preferred by high income individuals. This adds to the cost of entry to low income individuals but also lowers the utility of current residents. A more direct and effective approach is for the high income community to regulate the minimum size for houses. By fixing a minimum consumption level for housing greater than the housing demand of low income individuals, the cost of entry into the high income community is increased. If the minimum is set to be equal to the high income individuals' consumption levels, then the low income migrant will no longer face a lower tax-price for public services.

By forcing equal housing consumption, the exclusionary zoning device changes the property tax to a "head" tax, with everyone in the community paying an equal share of the cost of the public good. Faced with a head tax, the low income individuals are unable to move to the high income community, since they would have to buy the same level of housing and more of the public good.

The argument just made was developed by Hamilton (1975). In an attempt to rescue the Tiebout model, Hamilton shows that with perfectly elastic housing supply and zoning the Tiebout equilibrium will exist and be efficient, despite property tax financing of the public good. If property taxes paid equal benefits received, there is no migration incentive (on that account). If they do not, there is. Of course, this result occurs only because the property tax has been effectively turned into a head tax and because the distortion in housing consumption caused by the property tax has been eliminated. In the usual non-zoning case low income individuals desire to move into the high income community because the benefits from the increased consumption of public services outweigh the costs or taxes paid for those public services. Thus, the purchase of a small house generates a fiscal surplus or residuum for the low income individual. From the perspective of residents in the high income community, a "fiscal externality" has been created, since the new entrant does not fully pay for the additional public service costs. A fiscal externality is created in the low income community as well if the public good is provided originally at minimum average cost; in this case the departure of the resident could force the average cost of provision of public services to be higher for all remaining residents.

Thus, the zoning device can simultaneously improve the welfare of high income households and eliminate the fiscal externality. Hamilton's argument shows that

[19] The arguments concerning the motivation of the various parties to use zoning as a restrictive device are given in White (1975) and Mills (1979). See also Rubinfeld (1979), Eppel et al. (1978), Hamilton (1983a) and Zodrow and Mieszkowski (1983).

to the extent that one can make the property tax a head tax, an efficient outcome can be insured. However, without a head tax (even with Lindahl taxes which equate marginal benefit to marginal cost), migration incentives arise, generating externalities that are likely to lead to an inefficient outcome.[20] And, there is reason to believe that actual zoning policies deviate substantially from the one which transforms a property tax into a head tax.

The analysis suggests that the pure Tiebout equilibrium will exist and be efficient if there are sufficient communities to match the tastes of all individuals for both housing and public service consumption, if the public good is produced at minimum average cost with respect to population, if profit-maximizing entrepreneurs are free to produce new communities to satisfy the demands of residents, and if a host of additional assumptions mentioned previously also hold.[21] Even though the Tiebout model involves a series of strong and unrealistic assumptions, the insights that it gives about the manner in which individuals respond to fiscal variables are relevant for both theory and practice. The Tiebout framework is useful from a normative perspective because it defines a clear set of conditions which are necessary for optimality, while clarifying the intrajurisdictional and interjurisdictional aspects of efficiency. The "competitive" Tiebout world highlights the efficiency gains to be made when individuals are allowed to choose by "voting with their feet". It can and has been useful from a positive perspective because it emphasizes the effect that variation in the supply of public goods can have on locational choice, as opposed to more traditional empirical analyses which do not take migration into account.

However, both normative and positive aspects of the Tiebout model are changed somewhat when the land market is modeled explicitly. This additional complication is the subject of the discussion which follows.

3.5. Capitalization of public spending and taxes in a Tiebout framework

I have assumed that the pre-tax price of housing in any of the communities is fixed. To the extent that housing prices respond to differences in public sector variables, the "capitalization" of public sector variables into housing prices may provide an adjustment mechanism that will improve the efficiency of the Tiebout process. But, even with capitalization, inefficiency, both in terms of the distribu-

[20] The previous results are overstated somewhat since they assume a positive correlation between tastes for public goods and income. If tastes and income are uncorrelated, efficiency and income mixing are not incompatible.

[21] These conditions are sufficient, but not necessary, for an efficient equilibrium and thus appear overly stringent. For example, Mark Pauly points out that one could have an efficient equilibrium at other than minimum average cost if there were economies of scale up to a point, but all communities were at the optimal size. See Pauly (1976), Pestieau (1983) and Zodrow (1983).

work. To begin, one might ask what are the effects of property taxes or public services on the value of land? For this discussion assume that when one purchases a house one buys simply the plot of land with a fixed structure on it so there is no distinction between land and the structures on land. Allowance for the substitution of capital for land in the production of housing changes the quantitative, but not the qualitative nature of the analysis.

The individual's willingness to pay for a plot of land will depend in part upon the bundle of public services that can be consumed once the land has been purchased and residence in the community is determined. However, the market price that is paid for the land will reflect not only the willingness to pay of the individual who eventually purchases the land, but also the willingness to pay of all potential purchasers of the land. If all individuals have identical tastes for public goods – one interesting extreme – then the price of land will be bid up by competition to reflect the value of public goods to all, and complete capitalization will have occurred. However, in the other extreme, if the individual's demand for public good is different from all others, then the price of land will not change and no capitalization will occur. The individual will be fortunate in being able to enjoy the consumer surplus associated with his unique tastes.

Thus, with "sufficient" competition for land among individuals with "similar" tastes, one would expect that higher taxes would lead to lower land values, while greater public services would lead to increased land values. Capitalization is the term which refers to the effect of fiscal variables on the capitalized or present value of the asset land, rather than the annual rental price.

Because competition is a crucial determinant of the presence of capitalization, it is important to distinguish between capitalization in the short run, intermediate run, and in the long run. In the short run with land (housing) in fixed supply, one would expect capitalization to occur with some frequency. In the intermediate run with housing in variable supply, an increased supply of housing could diminish or conceivably eliminate capitalization. Finally, in the long run in which the number of communities, and perhaps the number of metropolitan areas, is in variable supply, capitalization is likely not to occur. The reason is that with an increased demand for public goods individuals would always have the option to

[22] Capitalization has extremely important implications for policy since it can thwart or even counteract attempts to achieve equity through judicial reform. For an extensive discussion of this issue, see Inman and Rubinfeld (1979). Capitalization adds a complication because individuals moving into a community must pay what is in effect a two-part tariff. One part of the price of public services is contained in the portion of the price of housing which is associated with the capitalization of fiscal differences. The second part is the direct payment made in terms of property taxes. Any policy change which increases costs of buying public services in an attempt to obtain equity will simultaneously lower land prices, compensating partially or wholly for the change in property taxes.

and long run are crucial for understanding the more technical analysis which follows.

The Tiebout model can easily be modified to account for capitalization, beginning with the short run. Let H be the units of housing consumed, p the price of a stream of services available from that housing, and i be the discount rate.[23] Then, the value of a house in the community, V, is as follows:

$$V = (pH - tV)/i. \tag{18}$$

Here the property tax rate, t, is defined as a tax on the value of housing. Equation (18) assumes complete or total capitalization of taxes because total tax payments are deducted from the pre-tax value of the house to obtain the final after-tax value. Other things equal, an increased tax rate will lower the value of the house. More explicitly, the house value, V, in terms of the remaining variables is as follows:

$$V = pH/(i + t). \tag{19}$$

Equation (19) shows that higher tax rates lead to lower house values, assuming the level of public services provided is constant. The intermediate story would be similar except for the fact that land price adjustments would differ from housing price adjustments due to the supply response. When there is imperfect capitalization, equation (19) becomes:

$$V = pH/(i + \alpha t), \tag{20}$$

where α is less than one.[24]

Imperfect capitalization can occur in a short-run situation because individuals differ in their tastes and because the fixed number of communities limits the amount of competition for the variety of public services available. Of course, partial capitalization may also arise if there are informational market imperfections as well.

[23] This abstracts from the usual problems with selecting the appropriate discount rate.

[24] There has been a substantial literature of an empirical nature dealing with the extent to which property taxes as well as public sector variables are capitalized. The most widely cited piece is by Oates (1969), but there has been an extended discussion, both empirical and conceptual, about the Oates work. For a review of this entire literature, see Bloom, Ladd and Yinger (forthcoming). See also Church (1973), Cushing (1984), Edelstein (1974), Heinberg and Oates (1970), King (1977), Levin (1982), McDougall (1976), Oates (1972), Polinsky and Rubinfeld (1978), Rosen and Fullerton (1977), Smith (1970), Wales and Weins (1974), Wicks, Little, and Beck (1968), Woodard and Brady (1965), Rosen (1982), Yinger (1982).

example, that public services are provided more efficiently in some communities than in others in the sense that the tax cost of an equivalent bundle of services is lower. Then, we would expect competition to lead some individuals to move into the more efficient producing community, raising the price of land there. Hamilton (1976), on the other hand, has argued that zoning restrictions on low income housing within a mixed community can lead to intrajurisdictional capitalization.[25] In Hamilton's case capitalization occurs because the supply of housing of each type is not perfectly elastic even in the intermediate run.

In the long run, however, the prospect of new communities will be sufficient to eliminate capitalization, subject to the proviso that tastes of individuals are sufficiently similar to allow all surpluses to disappear.[26] To see this, imagine that some capitalization has occurred, i.e. that an additional unit of public service leads to a positive increment in house value, net of tax cost. Then, a new community can be created costlessly that provides the higher level of service without increasing the price of land. The "rents" originally earned by the owner of the land whose value was high due to capitalization, are dissipated when the new community is developed. However, since the assumptions associated with the Tiebout model – long-run assumptions – are not satisfied in the local public sector, the empirical presence of capitalization is not and should not be a surprise to public finance economists.[27]

A complete analysis of how capitalization relates to the Tiebout model requires a framework which models both the decision to move among communities and the effect of the move on the tax base and the demand for public services. In addition, variations in individuals' preferences may influence the decision-making process within communities. Attempts to model such complex behavioral systems

[25] In Hamilton's (1976) discussion of intrajurisdictional capitalization of public services, the possibility of efficiency with mixed communities is considered. Hamilton shows under a set of strong conditions concerning mobility and the use of zoning to regulate housing consumption, that an efficient heterogeneous community can exist. The efficient solution occurs because everyone satisfies their public service demands, since their tastes are assumed to be indistinguished. Housing demands vary, but these demands are also satisfied by a restrictive zoning ordinance. Those individuals with high incomes consume more housing but pay a higher price, while those with low incomes consume less housing and pay a lower price. The net effect of this full capitalization of the benefits and costs of public services is that no individual wishes to move to make himself better off. The efficiency of this solution arises only because we have assumed that everyone has identical public service demands. The main point, however, does hold – that stratification and homogeneity of individuals within jurisdictions is not a necessary condition for efficiency. See Bucovetsky (1981) for a more recent discussion of this and similar issues. See also Starrett (1981) and Scotchmer (1985b).

[26] This is essentially the argument made by Edel and Sclar (1974).

[27] See also Hamilton (1976) Epple, Zelenitz and Visscher (1978) Sonstelie and Portney (1980), Stiglitz (1983b), Topham (1982), and Wildasin (1983), for some methodological discussion. Brueckner's (1979) paper argues for capitalization, but does not consider long-run supply responses.

by a number of authors, yet none is completely satisfactory.[28] Nevertheless, the discussion of capitalization by Yinger (1982) on which the following analysis relies, is illuminating.[29]

Capitalization depends on the willingness of potential or actual movers to pay for housing in a given community. For example, let P represent the amount of money per year per unit of housing services that a household is willing to pay to live in a house in a given community (not necessarily equal to p, the market price of housing), which is a function of the level of public services, G, and the property tax rate, t, in the community. The optimization decision of a household choosing among communities, with public services fixed, is given by

$$\text{maximize } U(X, H, G)$$

$$\text{subject to } Y = X + P(G, t)H + tP(G, t)H/i. \tag{21}$$

The expression tPH/i represents the tax rate times total house value, V. Thus, this model is essentially equivalent to the previous one except that P is now a function of both G and t. Households' bids for housing vary with public service and taxes, as can be seen by differentiating this system not only with respect to X and H, but also with respect to G and t. The complete set of first-order conditions is given below:

$$\begin{aligned}
&\text{(i)} && \partial U/\mathrm{d}X = \lambda, \\
&\text{(ii)} && \partial U/\mathrm{d}H = \lambda P(1 + t/i), \\
&\text{(iii)} && \partial U/\mathrm{d}G = \lambda(\mathrm{d}P/\mathrm{d}G)H(1 + t/i), \\
&\text{(iv)} && (\mathrm{d}P/\mathrm{d}t)(i + t) + P = 0.^{30}
\end{aligned} \tag{22}$$

First, assume that all households have identical tastes and income. In this case competition among households will eliminate all consumer surpluses so that the function $P(G, t)$ represents an *equilibrium* pattern of housing prices. To see whether capitalization occurs, fix G at some arbitrary level, say G^*, and then solve equation (22, iv) for the bid price function P. The solution to this differential equation is

$$P = \lambda(G)/(i + t), \tag{23}$$

where $\lambda(G)$ is a constant of integration whose value varies with G.

[28] See, for example, Rose-Ackerman (1979, 1983), Portney and Sonstelie (1978), as well as Epple, Filamon and Romer (1983, 1984).

[29] Yinger's model is limiting in part because there is no explicit public choice mechanism. Voter models are important in Epple et al (1983, 1984), Martinez-Vasquez (1981), Wildasin (1984), and Rose-Ackerman (1979).

[30] (iv) is obtained by differentiating the constraint with respect to t, and solving.

tax rate is zero, then the constant of integration is equal to the bid that would be made for housing in a no-tax world. Since a change in the level of public services, G^* (through additional federally financed local goods), alters the constant of integration, equation (23) shows that the extent of capitalization depends upon the level of public services.[31]

More generally, the pattern of housing prices will depend upon the choice of housing and the public good, when all four equations in (22) are solved simultaneously for H, G, and X in terms of the remaining variables. Yinger illustrates this solution in the case of a Cobb–Douglas utility function. The utility function is given in (24) and the solution for the bid price function in (25):

$$U(X, H, G) = \ln X + \alpha \ln H + \beta \ln G, \tag{24}$$

$$P(G, t) = (\gamma G^{\beta/\alpha})/(i + t), \tag{25}$$

where γ is a constant of integration.

With identical households there will be no differences in willingness to pay for the same public service bundle, and P will equal the equilibrium price of housing. Within a jurisdiction where G is fixed, any variation in taxes – tax-rates – is capitalized immediately into the price of housing. The dollar amount of capitalization depends upon the function, P, and, implicitly, the tastes of the individuals. For example, the extent of capitalization will vary directly with α, the strength of preference for the public good, and inversely with β, the strength of preference for housing.

Equation (25) also describes the variation in housing prices reflecting different levels of G when t is fixed. Specifically, the change in housing prices is given by

$$\mathrm{d}P/\mathrm{d}G = (\beta/\alpha)P(G, t)/G. \tag{26}$$

Here the percentage change in housing prices is a positive function of the strength of preference of the public good.

Now consider what happens if either the tastes or incomes of individuals differ. Recall that in a model with two income classes, low income and high income households are likely to segregate.[32] In such a case the capitalization question becomes more complicated, since the willingness to pay of a low income household to live (in a given size house) in a high income community depends on the trade-off between the value of additional public services and the cost reflected

[31] And, in general on the level of all commodities.

[32] This segregation is not a necessary condition for Tiebout equilibrium. See Yinger (1982) for a discussion of this issue. See, also Henderson (1985).

there may be two different tax and service bundles in two different communities with the same housing prices. This follows because [as implied by (26)] differences in the dollar expenditure on public services may not be reflected dollar for dollar in differences in house values. How much individuals value public services affects capitalization, not the dollar expenditures. Thus, there may be little capitalization if differences in services are not valued by one of the income groups.[33]

To sum up, the analysis has shown that as a general rule the no capitalization case can arise only in the very long run in which entry of new communities is free, a necessary condition for the Tiebout model to mimic the usual competitive model. However, even in the long run, such a possibility is quite unrealistic, not only because of the cost of such development, but because of the spatial nature of urban areas which depend upon one or more centralized workplaces for employment. Despite some theoretical suggestions to the contrary, capitalization is a phenomenon which is likely to be an important one. Fortunately, this outcome is useful empirically. I will show in a later section, for example, how the presence of capitalization can be used to empirically estimate the demand for local public goods.

3.6. The efficiency of the Tiebout model with capitalization

How is our previous discussion about Tiebout modified in a model in which capitalization may occur? In particular, is the outcome efficient in the intrajurisdictional sense, conditional on the property-tax-distorted housing choice?

Allowing for capitalization complicates the problem. Imagine, for example, two individuals, A and B, both with identical income and tastes. The individuals reside initially in separate jurisdictions providing different public goods, but with

[33] Finally, consider the decision among *residents* of the community to select a public service level. Because changes in the public budget affect the location decision of potential community entrants, the prospect of capital gains and losses associated with capitalization can influence the public sector decision. In the simplest model in which *all* individuals have identical tastes and incomes, the possibility of capital gains does not affect the public service bundle choice. By choosing public services that set marginal benefit equal to marginal cost (implicit in the Samuelson condition), the individual is paying the maximum amount for the house that he would be willing to pay if he moved into the community. Even if non-residents have different tastes, the individual in the community is still maximizing property values. However, if the resident is planning to leave the community a different calculation might occur. As long as the political process is dominated by current residents, an equilibrium with property value maximization in a simple model (and with no business property) yields an efficient outcome. If movers do dominate or have a substantial impact, the analysis becomes more complex. The property value maximization argument has been utilized by a number of public finance researchers to build a simple structure for analyzing the local capitalization question. See, for example, Brueckner (1979). Note that the analysis becomes substantially more complex if we have heterogeneous communities, but we leave this analysis for a later section.

is underconsuming public services and is initially worse off than A. Since an equilibrium in such a model occurs only when utility levels are equal for both individuals, one possible outcome is for capitalization to occur, causing the price of housing in B's jurisdiction to fall. In the resulting equilibrium, B will face a lower price of housing, and will consume more housing and less public services than A. Both, however, will achieve the same level of utility and not be motivated to move. Thus, capitalization can compensate individuals, eliminating their incentive to move. However, this equilibrium will, in general, not be efficient, for the same kinds of reasons that were given previously. For example, it may be efficient from a production point of view to have one, rather than two, communities. However, individuals will not have the appropriate incentive to take advantage of economies of scale. With or without capitalization, the efficiency of the outcome in a Tiebout model depends upon the provision of public services and individual mobility. And, capitalization cannot rule out either production inefficiencies or suboptimality in consumption within communities.[34]

3.7. Testing the Tiebout model

Tests of the Tiebout model can be divided into two distinct types. First are the abstract tests of whether the Tiebout model yields an efficient outcome with each individual obtaining his most preferred level of public services in a homogeneous community. The second type of test attempts to evaluate whether fiscal variables affect migration so that there is at least a partial sorting of individuals in communities based on public sector variables. Some of these tests look at mobility explicitly, while others look indirectly by focusing on the capitalization of public sector variables into land values.

One conceptual test of the Tiebout model follows from our previous discussion about capitalization. In a model in which all residents of the community are homeowners, property value maximization can lead to efficiency in the Tiebout world. The test of Tiebout efficiency is then to see whether aggregate property values are maximized for the current distribution of individuals among jurisdictions. The argument is most fully developed in Brueckner (1979, 1982, 1983), and is illustrated in Figure 3.2. Brueckner suggests that the graph of the relationship between aggregate total property values in a community, APV, and public output, G, is likely to be an inverted U-shape. The most important assumption in his analysis is that the local public choice mechanism is one which selects public

[34] For a model involving strong assumptions in which the efficient outcome will be obtained, see Brueckner (1979). See also Sonstelie and Portney (1980) and Westhoff (1979).

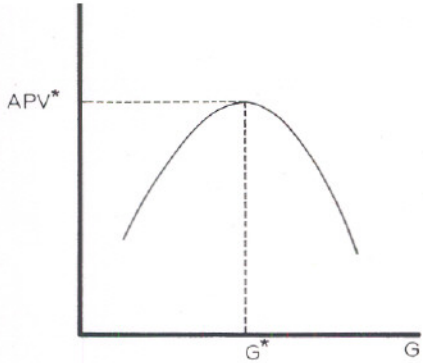

Figure 3.2

goods to maximize property values. In this case, the point G^*, where public service provision is optimal, is the point at which property values are maximized. A test of Tiebout efficiency involves looking across communities to see whether they are near the peak or the maximum of property values.

Such a test can theoretically be made by estimating a multiple regression of the form given in equation (27):

$$APV = \alpha + \beta G + \gamma Z + \varepsilon. \tag{27}$$

Here Z is a vector of variables (other than public sector variables), that determine property values and ε is a random disturbance term. Note that this multiple regression model is similar to what has been called a "hedonic" regression model, where Z includes a list of housing, accessibility, and neighborhood characteristics. The model accounts not only for G, but also other variables that affect property values, and thus is a kind of "reduced form" explanation of why property values vary across communities.

If the model is correct and public goods are efficiently produced, then near the optimum small changes in public spending should have no effect on property values. Whether the coefficient β in equation (27) is significantly different from zero can be tested to evaluate whether property values do respond to changes in public goods provision. Insignificance is at least consistent with property value maximization and efficiency.

The test works because property value maximization implies that public goods will be provided up to the level at which a tax-financed increase in public goods yields a competitive return in terms of increased house value. The tax increase used to finance the public good takes into account the opportunity cost of the

apply in a more general model than the one just described has been suggested by Inman (1978). Inman suggests that we analyze a structural equation such as (27a) in which the tax variable is included:

$$APV = \alpha + \beta G + \gamma Z + ft + \varepsilon. \tag{27a}$$

In this case $\mathrm{d}APV/\mathrm{d}G = \beta + f(\mathrm{d}t/\mathrm{d}G) = R$, where R measures the return on the public investment. If the annual value of this return $R = 1 + i$, where i is the competitive rate of return, then the level of public investment is efficient. Inman's empirical work supports this conclusion for a group of jurisdictions on Long Island, New York.

There are, however, substantial methodological and empirical problems associated with the narrow property value maximization test. First, the specification of the hedonic regression affects the interpretation of the results; in particular the regression is not likely to be linear. Second, it is difficult to measure all the appropriate control variables that ought to appear in the vector Z. Third, β may be insignificant even though there is not Tiebout efficiency. As Brueckner notes, one cannot be assured that some communities do not overprovide public services and others underprovide services so that the net effect appears to be a zero coefficient on the G variable. In addition, any empirical test which relies on an insignificant result is a weak one, since we cannot rule out the possibility that the regression model is improperly specified.[35] Thus, this test of Tiebout efficiency is not likely to be very useful from an empirical perspective.

Do public sector variables affect the decisions of individual households who move between jurisdictions? The best of the relatively scanty evidence, given in Reschovsky (1979), suggests that high income households are influenced by variations in public services, especially education. However, Reschovsky finds no support for this effect among low income movers. His study is particularly appealing because it focuses solely on the behavior of movers, not on all individuals, and is a micro rather than aggregated study.

Most other Tiebout studies focus on the implications that such movement may have on the distribution of spending and on the spending demands within communities, usually as proxied by income. For example, Hamilton, Mills and

[35] Tests of the Tiebout hypothesis using estimating equations like (27) do have some additional deficiencies. As Portney and Sonstelie (1978) point out, a linear form assumes that differences in property tax rates between communities have the same effect on the value of homes independent of the size of those homes. This suggests that it is tax payments rather than tax rates that ought to be capitalized. Sonstelie and Portney suggest an alternative Tiebout test which they claim has the advantage of not depending on the presence of capitalization. There are additional methodological problems with this approach, but it is a conceptually appealing one.

suggests that there is more homogeneity of income and public good provision within suburban jurisdictions than there is within the central city. Given the vast set of choices that exist in suburban areas, one expects such homogeneity in a world in which public sector variables matter. However, we are clearly a long way from having homogeneous suburbs as is illustrated in the empirical analysis by Pack and Pack (1977).

Perhaps the most widely discussed test of the Tiebout hypothesis was one described by Oates (1969). Oates suggested, along the lines of the argument spelled out by Brueckner, that if the Tiebout model was an accurate depiction of the local public sector, the effect (on the margin) of increased public services on property values, holding taxes constant, would be positive. Likewise, the tax variable, holding services constant, would have a negative sign, and the net effect of the two changing jointly would be zero, at least for the median or decisive voter. A good deal of discussion of the theory underlying the Oates paper has led to the view that the empirical work does not provide a direct test of the Tiebout efficiency. This should not come as a surprise since Tiebout equilibrium can occur without capitalization, and capitalization can arise without Tiebout efficiency. The Oates and other follow-up papers do suggest, however, that capitalization of both public spending and taxes is prevalent.

Finally, an alternative test of the Tiebout mechanism uses survey data. Gramlich and Rubinfeld (1982) analyzed responses by a random sample of Michigan voters to questions about the voters desired level of public expenditures. Responses were used to estimate demand functions, which in turn were used to evaluate statistically the variation in public sector demands within various kinds of communities across the state. If the Tiebout model is appropriate, then one would expect greater homogeneity of demands in suburban communities where there is substantial locational and public sector choice. The data do support this view. Within the suburbs of the city of Detroit and several other large metropolitan areas, public service demands are relatively homogeneous, while the demands are less homogeneous in cities with smaller suburbs or rural areas.

4. Empirical determination of the demand for local public goods

4.1. Introduction

Empirical estimation of the demand for public goods is a major focus of public finance. Throughout the 1950s and 1960s many researchers attempted to explain variations in local public expenditures as reflecting socioeconomic characteristics of the population as well as the level of intergovernmental aid. In the past decade

or so, researchers advanced this literature substantially by concentrating on the optimizing behavior of the parties demanding public goods.[36] The natural reaction was to borrow directly from the optimization literature of consumer theory, an approach which has a number of advantages over the previous methods. Specifically, it may be possible to distinguish between demand and supply characteristics, to specify the appropriate price and income variables, and to model the effect of grants-in-aid on local spending. However, a number of difficulties not present in standard consumer theory arise in modeling local public goods. I will treat both empirical and theoretical problems in this section, beginning with a discussion of the conceptual problems which underly demand estimation.

The first conceptual problem involves the aggregation of preferences. Individual demands for the public good are translated into a community demand through some kind of political process. As a result, estimation of the demand for a publicly provided good must either explicitly or implicitly model this process. The usual resolution of this problem involves the use of the median voter model.[37] The median voter model is a demand-side model which takes the community demand for a single-dimensional public good to be the median of the individual demands for the good. Of course, the actual public good provided will depend upon the supply side as well – whether and under what conditions public officials will provide the public good desired by the median voter. More about this later. For the moment, however, I assume that the public provision comes about by a majority rule voting process. Under a set of reasonably strong assumptions (including single-peaked preferences, a single-dimensional public good, and no agenda setting), the median voter's demand will be the public good actually provided. Any alternative proposal can never win a majority of the votes in an election against the level demanded by the median person.

Under some political processes there is no guarantee that the level of community provision of the public good will represent the quantity demanded by any one individual in the community. If this possibility occurs, demand estimation using aggregate data becomes very difficult. The median voter model is appealing among other reasons because it avoids this problem.

The paper by Bergstrom and Goodman (1973) serves a valuable function in that it specifies clearly a sufficient set of very restrictive assumptions that makes use of aggregate data to estimate demand functions possible. Whether and to what extent the model is empirically validated is a subject for further discussion. First, however, it will be useful to discuss some additional conceptual problems

[36] For two examples of this see Borcherding and Deacon (1972) and Deacon (1977).

[37] The median voter model was proposed by Bowen (1943), and extended by Barr and Davis (1966), and Bergstrom and Goodman (1973). See also Mueller (1976), and Martinez-Vasquez (1981).

peculiar to public goods – the measurement of output and the determination of price.

Individual demand functions are derived as follows: each individual is assumed to have a quasi-concave utility function, $U(X, H, G)$. To allow for variation in tastes among individuals with different socioeconomic characteristics, these utility functions are conditioned on a set of characteristics, denoted by Z. The individual's problem is then:

$$\text{maximize } U(X, H, G; Z)$$

$$\text{subject to } Y = X + pH + P_G G. \tag{28}$$

Here the price of the private good has been normalized to be equal to 1, and the price of the public good is denoted by P_G.

The public good need not be a pure public good. In fact, I will allow for "congestion" in the sense that the level of the public good will depend upon population in the jurisdiction. Nevertheless, it will be useful at this point to assume that all individuals within the jurisdiction consume the same level of G, so that G need not be subscripted by individual household.[38]

The Tiebout model has no supply side in which the process by which the public good is produced is clearly specified. One relatively straightforward specification of the supply, given by Inman (1979), is to describe G as representing the flow of public services obtained from a production function whose inputs include the public capital stock and the population of the community. The capital stock itself is obtained from another production process which uses both labor and materials as inputs. This supply-side specification allows for the treatment of a number of interesting local public finance issues which will not be taken up in this chapter. First, it introduces the local public labor market (as well as the private market) explicitly into the model. Second, it raises the question of what the appropriate level of the public capital stock ought to be, as well as questions concerning the rate of investment in the capital stock, and the source of financing. Unfortunately, all of these issues cannot be covered in this chapter and are left for further reading and thought.[39]

Individual demand functions depend not only on individual budget constraints, but also on the budget constraint facing the public sector, which in turn determines the individual tax-price, P_G. To incorporate this into the analysis I let

[38] This could be accounted for by subscripting the public good, allowing the within jurisdiction benefits to vary among individuals.

[39] The estimation of production functions and, more generally, the study of the supply of local public goods has been undertaken in a substantial list of articles. A sample of those would include Carr-Hill and Stern (1973) and Fare et al. (1982). See Inman (1979) for a longer list.

$$cG = T + A, \tag{29}$$

where T is the level of locally raised taxes and A is the total amount of aid given to the municipality by higher levels of government. This aid is assumed to be "non-matching", i.e. independent of the level of local tax effort. If matching aid were also included the budget constraint would then become

$$cG = (1 + m)T + A, \tag{29a}$$

where m is the matching rate as a fraction of local taxes T. If local revenues are raised by a property tax, then the tax-price of a dollar of local public spending to a homeowner is given by

$$P_G = cpH/B, \tag{30}$$

where pH is the value of the individual house, and B is total tax base in the community $(\sum p_i H_i)$.[40]

Here tax-price represents the individual's cost of purchasing an additional *dollar* of local public services, with no commercial and industrial tax base present.[41] Solving the maximization problem given by equation (28) subject to the individual budget constraint and the budget constraint of the local government (29), yields (in general) the individual's demand function for the public good. This demand function is given in its most general form in equation (31) below where a superscript asterisk denotes the *desired* public good:

$$G^* = g(Y, P_G; Z). \tag{31}$$

Following Bergstrom and Goodman (1973), most theories of the demand for public goods assume that individuals demand a flow of services of uniform quality, G_0, from the publicly produced good. Because of "congestion" or crowding in the consumption of that good, G_0 is a function of the population of the community, N. For example, one might postulate that

$$G_0 = G/N^g,$$

[40] This avoids all issues surrounding the distinction between assessed and market values for housing, as well as the questions of rental as opposed to owner-occupied housing, and the shifting of the tax on non-residential property.

[41] A more complex calculation of price would account for the deductibility of local taxes under the federal personal income tax and the possibility of local tax credits associated with the payment of property taxes.

However, when g equals 1, the consumption of the publicly provided good is equal to the individual's per capita share of the public good produced, so that G is a pure private good. Values of g between 0 and 1 allow for the possibility of goods that are mixed or that have partly private and partly public characteristics. If the tax-price associated with G is given by (30), then the tax-price per unit of G_0 is

$$P_G^0 = P_G N^g.$$

Note that when G is a pure public good ($g = 0$), then P_G^0 represents the price of one unit of public good which when consumed is available to all individuals. Thus, with the simplifying assumption that all houses are uniformly valued, the price would equal $1/N$th of the cost of producing a unit of the pure public good. When G is a pure private good P_G^0 represents the cost of producing *one* unit of the public good, which is N times the cost per individual of producing the good.

The most popular approach to estimating demand functions, in part because of its tractability, uses aggregate data on spending at either the jurisdiction, county, or perhaps state level. Were everyone in the community to receive the level of public services that he or she demanded, then the demand function might appear as follows:[42]

$$\log G_0 = \beta_1 + \beta_2 \log Y + \beta_3 \log P_G^0 + \beta_5 \log Z + \varepsilon. \tag{32}$$

However, empirically one explains variation in actual output, G, not variations in G_0. If the following substitutions are made:

$$\log G_0 = \log G - g \log N$$

and

$$\log P_G^0 = \log P_G + g \log N,$$

then the actual output demand equation is

$$\log G = \beta_1 + \beta_2 \log Y + \beta_3 \log P_G + \beta_4 \log N + \beta_5 \log Z + \varepsilon, \tag{33}$$

where $\beta_4 = g(1 + \beta_3)$. The observations for each variable differ by jurisdiction, but the subscript has been suppressed.

[42] The log–log form is chosen for simplicity because parameter estimates are elasticities. However, one should note that the only utility function globally consistent with such a demand function is the Cobb–Douglas with unitary income and price elasticities.

Strong as the median voter assumptions are, they are not sufficient to allow for demand estimation using aggregate data unless we know the characteristics of the median voter. Bergstrom and Goodman (1973) showed that under a certain set of rather strong conditions an observation on expenditures and public goods in the community can be treated *as if* it were the amount demanded by a homeowner with the median income and the median house value of that community. Their rather strong set of conditions shows one possible set of sufficient conditions for demand estimation.

A number of Bergstrom–Goodman assumptions are worthy of particular attention. First, all jurisdictions are assumed to have income distributions that are simple proportional shifts of each other. For example, if the distribution of income in one community is normal with mean \$10 000 and variance \$100 000, a second city with mean income \$20 000 would have a normal income distribution with the *same* \$100 000 variance. Second, each individual's tax-price is a constant elasticity function of individual family income. This is equivalent to assuming that all individuals have identical constant income elasticities of demand for housing.[44] Finally, the income and price elasticities are assumed to be related so that the distribution of desired demands is a monotonic function of income. To see why the monotonicity assumption is crucial, consider the distributions of desired demands given in Figure 4.1. Panel (a) illustrates the monotonic case in which the quantity demanded by the median person is the median quantity demanded. However, if the distribution is as in panel (b), it is clear that the median desired level of spending is no longer the level desired by the median income person. Instead, the individual with the median income demands G_{med}, the highest demand, while individuals with incomes Y_1 and Y_2 demand G^* or the median quantity demanded.

What constraints on the parameters of the model insure that the median voter result works? The answer can be derived by differentiating the demand function with respect to income and realizing that the gross effect on demand of the change in income must be positive (or negative) everywhere so that differentiating

[43] Crowding can occur with respect to dimensions other than population. For example, Gramlich and Rubinfeld (1982) specify crowding in terms of both the income and the property tax bases. This allows for the possibility that the provision of public goods will vary among individuals of different income classes living in different size houses.

[44] In this case $\log H = C_0 + \eta \log Y$.

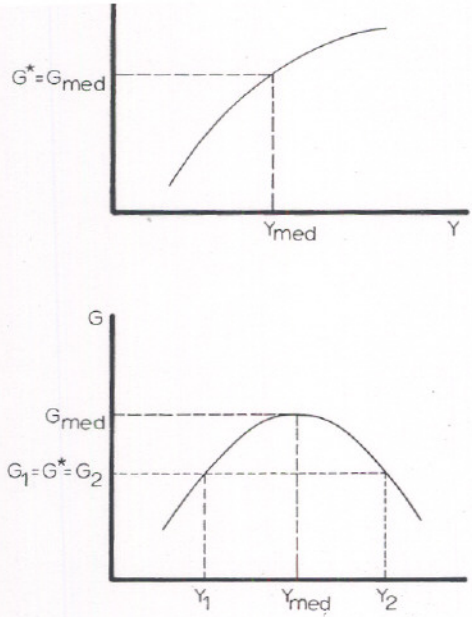

Figure 4.1

(33) with respect to $\log Y$ yields:

$$\mathrm{d}\log G/\mathrm{d}\log Y = \beta_2 + \beta_3 \mathrm{d}\log P_G/\mathrm{d}\log Y. \tag{34}$$

Now assume (as do Bergstrom and Goodman) that the public good is property tax financed and there is a constant income elasticity of demand for housing, η (i.e. $\log H = C_0 + \eta \log Y$). Since $\log P_G = \log(cp/B) + \log(H)$ from (30), it follows that $\log P_G = C_0 + \eta \log Y$. Then, substituting into (34), it follows that

$$\mathrm{d}\log G/\mathrm{d}\log Y = \beta_2 + \beta_3\eta. \tag{35}$$

This suggests one useful empirical test of the median voter model: the income and price elasticity of demand for public goods, β_2 and β_3, as well as the income elasticity of demand for housing, η, must make $\beta_2 + \beta_3\eta$ positive. If this condition does not hold, then all empirical results will be suspect.[45]

[45] To the extent that empirical estimates are available, they do tend to support this necessary condition for the median voter model.

and of expenditure item studied.[46] However, a few general conclusions for education may serve to give the reader a flavor of the results. Income elasticities vary from about 0.4 to 1.3 but most are substantially less than 1. Price elasticity estimates are generally very low in the range of -0.2 to -0.4. While income elasticity estimates are reasonably comparable, price elasticities' estimates are not, since empirical studies differ substantially in their definition of tax price.[47] Still, the estimates of the elasticities are consistent with the use of the median voter model.[48] Additional support comes from the fact that most empirical evidence indicates that β_4 is reasonably close to 1, a result consistent with the fact that education involves congestion (given a low price elasticity of demand).

Nevertheless, the primary criticism of the median voter model is that other political theories are better able to explain public expenditure levels. Since Inman treats these issues in greater detail elsewhere in this volume, only a few issues are mentioned here. In many states a jurisdiction's expenditures are not determined by referenda. As a result, the role of political parties, information and voting become extremely important. Even in the context of referenda-determined expenditures, the median voter model requires strong assumptions. For example, it assumes that all eligible voters vote and that the suppliers of the public services, the boards of education or city councils, play an entirely passive role in determining the referenda agendas.

Both Romer and Rosenthal (1978), and Denzau, Mackay and Weaver (1981) have suggested models in which agendas may not allow voters to choose between the median desired level and other alternatives. Romer and Rosenthal argue that if the alternative to passage of the proposal is a reversion to a substantially lower level of spending, then voters may opt for a higher than median desired level. This reversion agenda setting argument is troublesome, since many communities offer a sequence of elections. In such a case even if one or two referenda fail, a final passage can ensure continued expenditures. In addition, the literature on agenda setting does not fully resolve the question of whether electorates would,

[46] Reviews are given in Inman (1978) and Denzau (1975). See also the review of the literature on demand for education in Bergstrom, Rubinfeld, and Shapiro (1982). While most of the literature deals with demand in the United States, there has been similar evidence outside the United States. See Pommerehne and Frey (1976), Pommerehne (1978), and Pommerehne and Schneider (1978).

[47] A useful summary of these comparative results is given in Bergstrom, Rubinfeld and Shapiro (1982).

[48] Another troublesome problem with the median voter approach is that preferences must not only be single peaked, but also one dimensional. However, recent work suggests that the majority rule outcomes may be unstable in a more general setting. See McKelvey (1976, 1979) for a discussion. Deviations and variations from median voter outcomes which might arise are discussed elsewhere by Comanor (1976) and Hinich (1977). The best review of the median voter model is given by Romer and Rosenthal (1979b). See also Filamon, Romer and Rosenthal (1982), Romer and Rosenthal (1979a), and Ott (1980).

power. Further development of the reasons that limited entry to the political process and/or the high costs of mobility among jurisdictions may result in agenda setting is needed.

Romer and Rosenthal point out a number of empirical problems that suggest that demand function estimates may not provide strong support for the median voter model. One critique, which they call the "multiple fallacy", arises if, for example, all individuals desire twice the actual level of spending provided in the community. Given the model of equation (33), the only change in empirical estimates of demand parameters would be a change in the intercept. Since $\log 2G = \log 2 + \log G$, the intercept in the equation with doubled demands would become $\log 2 + \beta_1$ or $\log(2\,e^{\beta_1})$, but all of the other coefficients would remain unchanged. Why and under what conditions voters may be coerced into proportionally under- or overconsuming public services is an unanswered question, but troubling nonetheless.

A second empirical issue surrounds the use of median income as an explanatory variable. To the extent that income distributions are similar among communities, one cannot be sure that the significance of the median income variable in an estimated demand equation supports the median voter model any more than it would a mean voter model or, for that matter, a model associated with individuals in any "fractile" of the income distribution. Current results are consistent with the use of median income, but no one has provided (to my knowledge) a robust test which distinguishes between the median and mean, for example.

If the distribution of demands (or more correctly marginal rates of substitution) for public goods are nearly symmetric then the mean–median distinction becomes a trivial one. For asymmetric distributions, however, the difference can be important. As I discuss in Section 5.3, the median public good demanded would be the predicted outcome of majority rule voting. However, the mean demand would relate directly to the interjurisdictionally efficient provision of the good. With the mean substantially different from the median, majority rule is a political rule which leads to economically inefficient outcomes.

4.3. Some additional empirical issues

The demand function given in (33) specifies a level of real services provided. However, data on public goods are given usually in terms of dollars of expenditure. In order to account empirically for the difference between expenditures and output, G must be multiplied by an index of the price of public services. With the log–log demand form, this is equivalent to including price as a separate right-hand

because it does not include non-labor inputs to production and because the average wage may not account for the mix of labor quality. Of course, attempts to control for quality are often made. For example, in studies of education, quality can be proxied, although imperfectly, by the number of years of teacher experience or by the educational training of the teacher.

Demand functions should be estimated for renters as well as homeowners. However, in the discussion to this point tax-price is calculated under the assumption that the median voter lives in the median value home. In the unlikely case that the distribution of tax-prices facing renters is identical to that of homeowners, then the median voter assumption may be satisfactory from an empirical point of view. Even if tax-prices differ, differences in other variables may be sufficient to compensate, so that demands are similar. For example, renters may face relatively low prices causing (other things equal) them to demand more of the public good. However, they may have fewer children or lower incomes, causing (other things equal) them to demand less. On net, it would be possible, although fortuitous, for renter demands and homeowner demands to be the same. However, most evidence suggests that renters' demands are different from homeowners in a systematic way and that voter turnout in local referenda is substantially lower for renters than for homeowners.[49] As a result, demand estimation that does not control for renters may lead to biased estimates of demand functions. Note that this problem is really due to aggregation, since with individual data one could estimate different demand functions for renters and homeowners. In any case, the usual solution for the renter problem is simply to include an explanatory variable of the percent of renters in the community. This solution is suspect, since it implies that renters have identical price and income elasticities as homeowners and that demands are multiples of one another.

By far the greatest econometric attention has been focused on the specification of the price term in the demand equation. One issue arises because the inclusion of tax base in the denominator of the price term implicitly assumes that an increase in the tax base of the jurisdiction will lower the price of public services. Whether this is true for commercial and industrial property depends upon the assumptions one makes about both the nature of public service demands by industrial property and the ability of commercial and industrial property to shift the property tax, either forward in terms of higher prices, backward in terms of lower wages, or to consumers living outside the jurisdiction who purchase the products.

[49]See Rubinfeld (1977), for example.

In response, Ladd (1975) has attempted to allow for different impacts of changes in the tax base on spending. To see how her procedure might work recall that $P_G = cpH/B$, where B is residential tax base. Now let C represent commercial and industrial tax base. We can account for various treatments of commercial and industrial base by writing

$$P_G = [cpH/B][1 - \alpha(C/(B + C))]. \tag{36}$$

If α equals 0, then commercial base does not alter tax-price (there is no shifting), while if α is greater than 0, commercial base lowers tax price. For example, when $\alpha = 1$, $P_G = cpH/(B + C)$. Ladd's empirical estimates of α are in the range of 0.6, suggesting that there is some forward shifting of the commercial and industrial base.

The specification of the price variable also depends on the nature of grants from higher levels of government. If all grants are matching and open-ended (no budgetary limitation), then the price term becomes $cpH(1 + m)/B$. The price variable is simply recalculated and the demand equation estimated as before. However, some aid is non-matching, while a number of matching grants are closed-ended with communities opting to receive all available aid. In either case the grant does not alter the price of the public good on the margin; rather, it serves to increase community wealth. As a result the magnitude of closed-ended matching grants and non-matching grants should be viewed as additions to income, since they increase the consumption possibilities of the median voter. To the extent that the presence of these grants is capitalized into land values, however both individual and community tax base may change, as may the tax-price facing the median voter.[50]

While the specification just suggested is theoretically correct, empirical evidence suggests that grants of a non-matching nature may have a greater impact on spending than would ordinary income. To account for this many authors include a separate grants variable in the demand equation, so that the effect of an incremental dollar of income need not equal the effect of an additional dollar of non-matching grant.

Most empirical estimates of demand functions assume that the distribution of tastes of voters is not different from that of non-voters. Evidence on this issue is quite limited, despite the fact that a number of socioeconomic variables are known to affect turnout. However, one must control simultaneously for all voter attributes when looking at differences in demands. One attempt to do this [Rubinfeld (1980)] provided a weak test that supports the median voter hypothesis. Rubinfeld considered three alternative models of non-voter behavior. The

[50] This statement is not quite correct, as discussed in Gramlich (1977). See Section 6 for more detail about the grants variables.

second hypothesis was that non-voters are indifferent in the sense of being content with current spending levels and thus do not find voting worthwhile. The third is that the distributions of voter and non-voter demands are no different, so that the choice to vote is essentially random and independent of tastes. The study concluded that the random hypothesis could not be rejected, while the others could. But, because the study was limited to one jurisdiction in the State of Michigan, the results may not generalize.

In studying public employee turnout and voting behavior in Michigan, Gramlich, Rubinfeld and Swift (1981) found the contrary. Their work suggested that non-voters are opposed to tax limits and generally support public spending relative to those who voted. In addition, Gramlich and Rubinfeld (1982) found that public employees with greater tastes for public goods voted at a much higher rate than private employees. Whether the turnout rates reflect differences in underlying tastes or the possibility of earning rents is difficult to say.

4.4. Estimating demand functions in a Tiebout world

The approach to estimating demand functions just described is based on a median voter approach to the within jurisdiction determination of the provision of local public goods. No recognition has been given in the previous discussion, and in much of the literature, to the fact that Tiebout-related migration might be occurring at the same time. Goldstein and Pauly (1981) raise this important issue, suggesting that the presence of interjurisdictional migration can lead to biased parameter estimation if demand function estimation is carried out as suggested. The following relatively brief discussion of the issue borrows directly from their paper.

In Section 4.1 I suggested that it would be appropriate to estimate a demand function of the form given in equation (33), repeated here:

$$\log G = \beta_1 + \beta_2 \log Y + \beta_3 \log P_G + \beta_4 \log N + \beta_5 \log Z + \varepsilon. \tag{33}$$

In the classic normal regression model the right-hand explanatory variables which determine public spending G are assumed either to be fixed (exogenous) or, more realistically, to follow a probability distribution that is independent of (or uncorrelated with) the disturbance term ε. The dependent variable, $\log G$, and the disturbance, ε, are assumed to be randomly distributed normal variables.

The Tiebout process which brought about the distribution of households and public spending demands is one in which individuals search and move on the basis of the level of public spending. In general one would expect that migration

income in the communities from which individuals leave and to which individuals move. If that change in distribution alters the income of the median voter then demand estimation will be biased. Broadly speaking this bias results from the fact that the demand and supply of public goods are being simultaneously determined. Properly, consistent estimation should take into account the fact that while changes in income cause changes in public spending, changes in public spending (through migration) cause changes in income. The same argument can be made with respect to tax-price as well, but the main point should be made clear. Except in unusual circumstances, if individuals sort themselves on the basis of public goods provision, least-squares single-equation estimation of demand functions will yield biased and inconsistent results.

The obvious solution to the problem of bias is to correctly specify a two (or more) equation system which determines income and public spending jointly and hopefully allows the demand equation to be identified. However, this is easier said than done, since identification requires information about the supply or migration relationship either in the form of a variable that affects migration but not public spending determination (i.e. affects Y, but not G) or in the form of a restriction on the covariance of the cross-equation error term, a restriction that may have little or no economic interpretation. Research work in this area, both theoretically and empirically, is currently underway, as in Rubinfeld, Shapiro and Roberts (forthcoming).

If one is willing to make further assumptions about the nature of the Tiebout process, then it is possible to determine the direction of the bias which results when least-squares estimation is used, and in the process to get some intuition about how an unbiased or at least consistent estimator can be determined. Assume (following the spirit of Goldstein–Pauly) that there are a number of communities containing individuals sorted on the basis of their demands for public goods. To simplify the analysis, assume also that income is the only determinant of the demand for public goods. The income elasticity of demand is also assumed to be positive.

Suppose that the demand for public goods is given by $G = \alpha + \beta Y + \varepsilon$, and concentrate on the lowest income community. If all low income individuals resided in the community, then we would have reason to believe that omitted variables would cause the error term ε to be symmetrically and perhaps normally distributed. However, consider what happens when individuals sort themselves on the basis of their demands for the public good. All those with relatively low demands, i.e. with ε less than zero, will choose to locate in the low income, low spending community, since there is no lower spending alternative. However, the choice is different with those with a positive disturbance. Some of them will choose (if the disturbance is large enough) to locate in the higher spending jurisdiction in which residents with somewhat higher incomes live. This suggests

when the grouping is based on the values of the dependent variable–spending on public goods. In this particular case the bias arises because the error term is positively correlated with income – high error term individuals are more likely to live in higher income, higher spending jurisdictions than those with negative error terms.

Of course, the opposite story would hold were we to discuss the sorting of individuals at the high end of the income distribution. Here negative errors would be associated with lower incomes. On balance, least-squares estimation in this truncated model will lead to overestimates of the income elasticity of demand for public goods. The cause of the misestimation is the fact that the individual with the median income will not be correctly identified when demand estimation is done using aggregated data. For example, one is likely to incorrectly think that the individual whose demand determines the level of spending in the low income community is the individual with the median income in that community.

If the Tiebout process works along the lines just described, what then is wrong with the estimation procedure suggested by Bergstrom and Goodman? One answer is that the assumption of proportionality of income no longer holds. In the community providing the lowest level of G, the income of the individual with a zero disturbance value will be less than the median income of those in the community. This follows because the community will contain a number of individuals with relatively high incomes but low demands for the public good (since those with low incomes and relatively high demands moved out). The reverse will be true for a community providing a high level of the public good. The distribution of income in that community will be skewed to the left, rather than to the right as in the low income community. The distribution of income in the high income community will as a result not be a multiple of the distribution in the low income community – the third as well as first moment of the distribution of income will have changed.

5. Applications of the demand approach

5.1. Alternative methods for estimating the demand for local public goods

The median voter model is the most popular, but not the only approach to estimating demand functions for public goods. While a number of alternatives have been tried, we will focus on two that seem particularly intriguing. The first approach uses micro (individual) survey data as opposed to macro or aggregated

cal nature of the questions asked.[51]

The ability to estimate demand functions using survey data depends upon the nature of the community or communities being studied. If there is no expenditure variation among communities being studied, demand functions cannot be estimated. With expenditure variation, the estimation process becomes feasible. To see how this approach might work, consider a referenda voting example.[52] The alternatives in a local millage election may be to increase local spending or to keep it at the current level of spending. Assuming that the millage increase is very small, a "yes" vote is a revealed preference for greater spending and a "no" vote for lesser spending (it is assumed that everyone votes). Obviously, public spending, to which voters respond, is the same for all individuals in a jurisdiction. In Figure 5.1, panels (a) and (b) illustrate two distributions of desired demands for public goods within the same community. In the distributions of both panels (a) and (b), survey studies of voter behavior in a millage election should show similar results. Roughly half of the voters would state that they voted yes and half would state that they voted no, whether the distribution of demands had a high variance or a low variance. However, the two distributions are likely to be associated with different demand functions for public goods. For example, if demand is monotonically related to income *and both communities have identical income distributions*, then the demand function in panel (b) would have a higher income elasticity of demand than the demand function in panel (a) (given identical tastes). Unique income elasticities and other demand parameter estimates cannot be estimated when actual expenditures do not vary.

To see how one might estimate a demand function when expenditures do vary, examine Figure 5.2 in which panels (a) and (b) describe two different distributions of demands for public goods, panel (b)'s distribution having a greater variance. Suppose that survey data are available for two communities, one with per capita spending of $1000 per pupil and the other with $1500 per pupil. In the first community 50 percent of the voters say that they want more spending and 50 percent say they want less. At this point either the distribution in panel (a) or panel (b) could represent the underlying demand for public goods. Now include information from the voting in the second community. Assume that 20 percent of the population say they want more spending and that the underlying characteristics of the population (income, price, etc.) are identical in the two jurisdictions. Then, given a normal distribution of desired demands, only the distribution in panel (b) is consistent with the survey responses in both communities.

[51]A great deal of attention in local public finance has been placed on the notion of designing schemes to get people to reveal their preferences correctly. For some examples of attempts to derive demand-revealing preference techniques, see Tideman and Tullock (1976).

[52]See Rubinfeld (1977) as well as Akin and Lea (1982), Fischel (1979), and Citrin (1979).

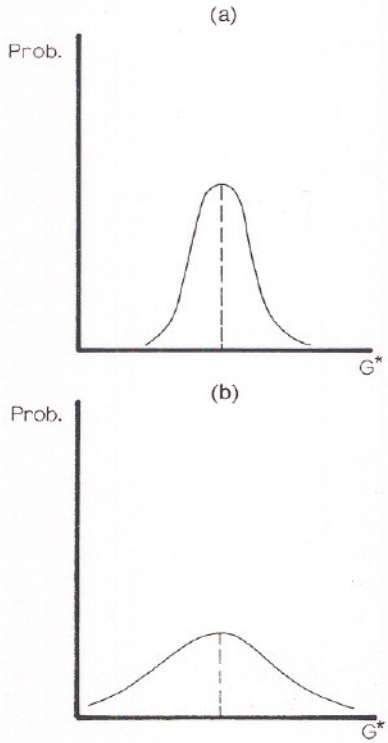

Figure 5.1

Obtaining survey information from more than one community enables one to estimate a demand equation, because it gives information not only about the mean of the distribution of desired demands but also about the variance. One expects that the greater the variance in spending levels among communities surveyed, the more likely we can accurately estimate the demand for public goods. Using survey data collected by Courant, Gramlich and Rubinfeld (1979), Bergstrom, Rubinfeld and Shapiro (1982) analyze school expenditures demands. Respondents were asked to state whether they preferred more, less, or the same spending on public schools, after being given information about the characteristics of schools, public spending on schools, and the tax costs of voting for higher spending. The qualitative responses are used to identify demand functions in the following manner.[53]

[53] This approach is similar to an approach taken earlier by Rubinfeld (1977) and by Shapiro (1975), and also relies heavily on the qualitative choice literature of McFadden (1973).

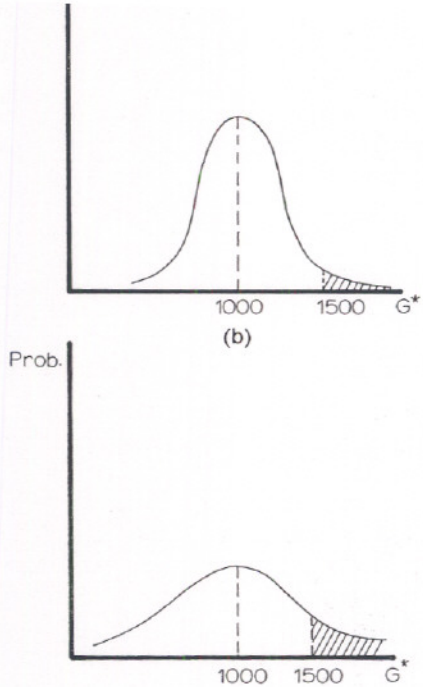

Figure 5.2

Assume that the demand for public goods is given by[54]

$$\log G^* = \log D_i - \log \varepsilon_i. \tag{37}$$

Here D_i summarizes the non-random portion of the individual's demand function, G^* is the desired public good, and ε_i is a random error term. The negative sign is solely for convenience.) Let G_i equal the public output in the individual's jurisdiction, and let d, a number greater than 1, be a threshold parameter that accounts for substantial differences between desired and actual output and triggers an individual response of dissatisfaction.[55] Responses for more spending or a vote for a millage, less spending or a no vote, or the "same" spending or a

[54] The fact that responses are made with error is not a problem as long as the random error is not systematically related to some of the explanatory variables.

[55] d can vary by individual without substantially complicating the analysis.

(ii) (less) $G^* < G_i/d$,

(iii) (same) $G_i/d < G^* < dG_i$. (38)

Taking logarithms (38) and substituting into (37), yields the following:

(i) (more) $\log \varepsilon_i < \log D_i - \log d - \log G_i$,

(ii) (less) $\log \varepsilon_i' > \log D_i + \log d - \log G_i$,

(iii) (same) $\log D_i + \log d - \log G_i > \log \varepsilon_i > \log D_i - \log d - \log G_i$. (39)

The key to econometric estimation of the micro demand model is to realize that the probability that (39, i) holds is given by the cumulative distribution function of the density of $\log \varepsilon_i$ when evaluated at $(\log D_i - \log d - \log G_i)$. Similarly, the probability that (38, ii) holds is equal to one minus the cumulative distribution function, evaluated at $(\log D_i + \log d - \log G_i)$, and finally, the probability that (39, iii) is equal to one minus the two previous values. The three numbers represent the probability or likelihood that an individual with a given demand function will respond more, less, and the same. Demand function parameters are estimated by maximizing the value of the joint likelihood function obtained by multiplying together the probability of an individual making a particular response over all individuals in the sample.

A number of alternative statistical assumptions are possible, but Bergstrom, Rubinfeld and Shapiro chose the multiple logit or logistic model (the ordered logit, to be specific) for estimation purposes.[56] To see how the approach works, assume that the systematic portion of the demand function is given by: $\log D_i = \beta_0 + \beta_1 \log Y_i + \beta_2 \log P_{Gi}$ and that the variance of the error term is σ^2. Then, each of the equations in (39) can be written in terms of the underlying demand parameters. For example (39, i) now becomes

$$\log \varepsilon_i < (\beta_0 - \log d) + \beta_1 \log Y_i + \beta_2 \log P_{G_i} - \log G_i. \quad (40)$$

Because of the normalization of the logistic distribution, the statistical output will usually include coefficients that are deflated by the standard deviation of the

[56] For a detailed discussion of the logit model, see Pindyck and Rubinfeld (1981, ch. 8).

[illegible] σ varies across jurisdictions, the right-hand side of the estimated equation, excluding the constant term, is as follows:

$$(\beta_1/\sigma)\log Y_i + (\beta_2/\sigma)\log P_{G_i} - (1/\sigma)\log G_i. \tag{41}$$

The dependent variable (not written) is the logarithm of the likelihood of being in a given group (more, the same, or less). The constant term will be a somewhat complex function of β_0, σ, and d, but is not of immediate concern here. The price elasticity of demand, β_2, is simply the negative of the ratio of the coefficient of $\log P_{G_i}$ and the coefficient of $\log G_i$, while the income elasticity is the negative of the ratio of the coefficients of $\log Y_i$ and $\log G_i$. Note that the coefficient of $\log G_i$ provides an estimate of the standard deviation of the error term and thus tells how accurately one can distinguish between alternative demand functions. If G_i does not vary, such as when data are from a single jurisdiction, one cannot estimate the error variance, and thus the parameters of the demand function cannot be determined.[58]

When this technique was applied to the Michigan survey data, the results were generally comparable to those obtained using aggregate data. Individual price elasticities were similar to those from median voter models, lending support to both approaches. Of course, survey data are more expensive to obtain than the data for cross-sectional median voter studies, but survey data have more detail about voter characteristics than other aggregate sources. In addition, the micro results were informative about the behavior and attitudes of individuals according to items such as race, income, occupation, religion, age, and family composition.

A very different approach to demand estimation uses the fact that with capitalization the price of housing and land reflects individuals' valuations of all of the attributes that are associated with housing, including the level of public goods. Assume that the supply of land and/or new communities is not perfectly elastic so that capitalization is maintained even after supply responds. Then, under reasonable conditions one can obtain information about preferences for public goods from variations in property values across communities. This hedonic approach has been emphasized by Rosen (1974) and evaluated empirically by a long list of authors, most of whom have focused on environmental attributes rather than on public goods.[59]

To develop the hedonic method I alter somewhat the utility maximization approach used earlier in this chapter. Rather than viewing housing and the public

[57] Log ε_i/σ is unit logistic, since it has mean zero and variance one.

[58] The constant term is a bit more difficult and depends on the nature of the computer program. In general, however, we can obtain a separate estimate of the constant β_0, and the threshold parameter d. See Bergstrom, Rubinfeld and Shapiro (1982) for details.

[59] See, for example, Harrison and Rubinfeld (1978), and Nelson (1978).

in the community. Other attributes might include structural characteristics of the house itself (house size, number of bathrooms, etc.), neighborhood characteristics (crime rate, socioeconomic status of the community, etc.) and accessibility characteristics (distance to work, distance to shopping areas, etc.). To distinguish this view of housing from the previous one, I let $h(G, a)$ represent the housing bundle, where G is the level of public good, and a represents the vector of all other housing attributes.

As before, p represents the price of housing, but now $p(h)$ is a function of the housing attribute vector. The $p(h)$ function might be linear as has been assumed previously, but it might be non-linear as well, depending upon one's assumptions about the extent to which housing attributes can be combined into housing bundles.

The utility-maximization problem is now:

$$\text{maximize } U(X, h(G, a))$$

$$\text{subject to } Y = X + p(h). \tag{42}$$

The first-order conditions with respect to G and to X are

$$\text{(i)} \qquad (\partial U/\partial h)(\partial h/\partial G) = \lambda(\partial p/\partial h)(\partial h/\partial G),$$

$$\text{(ii)} \qquad \partial U/\partial X = \lambda. \tag{43}$$

Combining (43, i) and (43, ii) yields:

$$W = (\partial U/\partial G)/(\partial U/\partial X) = \partial p(h)/\partial G. \tag{44}$$

The left-hand side of (44) is the marginal rate of substitution between the public and private good, while the right-hand side is the incremental change in house value associated with an increase in the level of the public good. In other words, (44) tells us that willingness-to-pay for the public good, W, can be measured by differences in house values, assuming that all other differences in housing attributes are held constant. Once information about the willingness-to-pay is known empirically, the demand function will also be known. The direct link occurs because the marginal rate of substitution is itself the *compensated* (equal utility) demand curve for the public good, which differs from the usual uncompensated demand function solely because of income effects.

The hedonic approach depends crucially upon the presence of capitalization. As a result it cannot be applied in the case of a long-run Tiebout model in which capitalization is not present. In the short run or intermediate run, however, with

There are a number of possible ways to proceed, but the most direct is to first estimate the hedonic housing price function $p(h)$. In practice the capitalized value of the property (PV) will often be measured rather than the annual price p, so that one must be careful to interpret the results as total willingness to pay, rather than an annual figure. Using PV as the dependent variable, a regression of the following form might be estimated:

$$\log(PV) = \beta_0 + \beta_1 \log(G) + \beta_2 \log(a) + \varepsilon, \tag{45}$$

where ε is a random error term. With this particular formulation it follows directly that

$$\partial(\log PV)/\partial(\log G) = \beta_1. \tag{46}$$

Now, using the fact that $\partial(\log X) = (1/X)(\partial X)$, (46) becomes

$$W = \partial(PV)/\partial G = \beta_1(G/PV). \tag{47}$$

Thus, the marginal increment to house value from high public service provision is equal to β_1 times the ratio of public spending to the individual property value. If the market is in equilibrium, then this number represents individuals' marginal willingness to pay for incremental amounts of the public good. Furthermore, if all consumers are identical, W is the marginal rate of substitution of public for private goods and characterizes the demand function for public goods.

The hedonic approach has its difficulties. In general one must worry about the confounding effects of supply and demand. For example, assume that the level of the public good in a community is determined in part by the income of the median voter. In this case income serves as a demand variable. However, assume also that the median voter's income arises from his or her wage rate as a public employee. Then income also represents a supply variable, the cost of producing the public good. Unless the supply and demand explanations can be sorted out, both theoretically and econometrically, the income elasticity of *demand* for the public good cannot be determined.

To illustrate how the approach is applied, consider the easiest case in which supply is fixed and not determined by income or other attributes. One can estimate equation (48):[60]

$$\log W = \alpha_0 + \alpha_1 \log G + \alpha_2 \log Y + \varepsilon, \tag{48}$$

[60] The more general analysis that worries about supply and demand is suggested in Rosen and attempted by several other authors such as Harrison and Rubinfeld (1978).

... public good and G is the level of public good. The estimate of the parameter α_1 tells how individual valuations of the public good vary with the level of that good, while the parameter α_2 tells us how valuations vary with income. From these parameters, the standard price and income elasticities of demand can be calculated (assuming sufficient variation in G). For example, the income elasticity of demand would be

$$(\partial G/G)/(\partial Y/Y) = \partial(\log G)/\partial(\log Y)$$
$$= [\partial(\log W)/\partial(\log T)]/[\partial(\log W)/\partial(\log G)] = \alpha_2/\alpha_1. \tag{49}$$

The hedonic approach to valuing non-market attributes is questionable if people have limited information, supply is somewhat elastic, or if markets do not equilibrate. In addition, proper specification of the functional form is crucial for empirical work.[61] However, most of these problems are common to a demand estimation approach. And, the hedonic method provides an interesting alternative approach to the estimation of demand functions which can be carried out and evaluated without unreasonable data collection needs. How this approach as well as the previous ones can be of value as a prescriptive as opposed to descriptive device is the subject of the following section.

The micro approach can provide one solution to the Tiebout bias problem discussed earlier. With micro data one no longer needs the assumption of Bergstrom and Goodman concerning proportionality of income distribution. Or, more generally, one need not worry about the problem of finding the income and other attributes of the individual whose demand for public spending is the median demand of those within the community. However, the Tiebout bias problem does not completely go away, even with micro data. If individuals sort themselves on G, then the simultaneity problem still exists, and a multiple equation, rather than single equation approach may be appropriate.

5.2. *Will the median level of services provided be efficient?*

Demand functions for public goods have a number of uses, both positive (predictive) and normative. In this section one of the normative uses of the

[61] Note also that I am not arguing that changes in property values themselves measure peoples' willingness to pay, but solely that information from property values can be used to induce demand functions. For a discussion of this issue, see Polinsky and Rubinfeld (1977). See also Brown and Rosen (1982) and Scotchmer (1986).

approach is micro or macro and whether one works with demand or utility functions, is not a central concern here. Of course the median voter determination of public output is a positive, not a normative result. And, not surprisingly, the median voter demand is generally inefficient for a number of reasons. First, if individual tastes and incomes vary, a Lindahl equilibrium is possible in which each individual's desired public good is equal to the level of public good provided. However, even under these conditions, sorting of individuals among jurisdictions can lead to interjurisdictional efficiency gains. Second, *given* the current distribution of individuals, the willingness-to-pay for public output, net of costs, is not necessarily maximized. It is this second intrajurisdictional inefficiency that is of concern here.

For an example of how this second type of inefficiency arises, recall that the marginal rate of substitution is a diminishing function of the level of public goods demanded (other things equal). If the utility function, U, is Cobb–Douglas, i.e. $U = \ln X + \alpha \ln H + \beta \log G$, then $MRS = (\partial U/\partial G)/(\partial U/\partial X) = \beta/G$, which is monotonically decreasing in G. Now consider the distribution of marginal rates of substitution of public for private goods *at the current level of spending*. Individuals, with an MRS less than that of the individual who desires the current level of spending will desire less spending, while individuals with MRS greater than the current MRS of the median voter desire more spending. If the distribution of MRS is not symmetric, then the median voter outcome is inefficient.

Consider a distribution of MRS which is highly skewed to the right, as in Figure 5.3. The mean of such a distribution is greater than the median. However, the median represents the level of public services demanded by the median voter

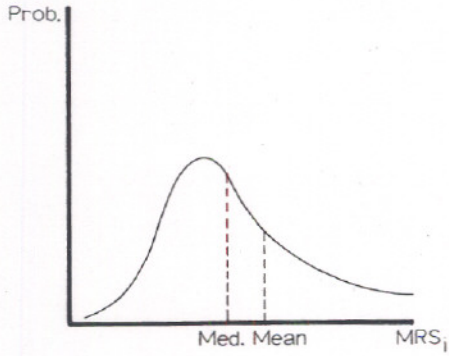

Figure 5.3

majority rule referendum, while the mean is the more efficient level of provision, since it weights preferences by willingness to pay. Of course, this formulation assumes that there are no side payments made, no logrolling, and no package deals.

This efficiency requirement is derived from Samuelson's condition that $\sum MRS_i = MRT$. Dividing both sides of the equality by the number of individuals in the community, N, yields $\sum MRS_i/N = MRS = MRT/N$. The left-hand side of the equation is the mean level of the MRS, and the right-hand side is the cost of an additional unit of public goods divided by the community population. If public goods are paid for with a head tax, i.e. an equal tax on all individuals, then the cost to an individual is MRT/N. For the individual with the mean marginal rate of substitution, his or her valuation of public goods equals his or her cost. Thus, to attain an efficient solution the preferences of the "mean" voter, not the median, should determine the referenda outcome. The "median" and "mean" outcomes will be equivalent when the distribution of MRS is symmetric.[62]

When a property tax is substituted for a head tax, the efficiency conditions are more complex. However, the concept remains the same; efficient provision of public goods focuses on the mean of the marginal rates of substitution, not the median.[63] Empirically, means and medians are difficult to distinguish, but there is a viable test. One fits a distribution to the marginal rates of substitution across the population and tests whether the mean equals the median, using a non-parametric test.[64] This test can also be used to see whether government is too large. If the sum of the marginal rates of substitution is less than the marginal rate of transformation, then overspending must have occurred.

This discussion is based, however, on a rather simplistic view of government. A more complete analysis distinguishes at least three different behavioral models that result in non-optimal public spending levels. First is the model of Niskanen (1971) in which the level of public spending is greater than that desired by the median voter (and presumably greater than the efficient level) because budget decision-makers have bureaucratic power. In a sense this argument is a generali-

[62] Note that a symmetric distribution of MRS is not the same as a symmetric distribution of demands, and that there will be a distribution of MRS for each level of spending possible. Consider the following example from Bergstrom (1979). If $U_i = \ln X_i + a \ln G_i$, c is the marginal (= average) cost of producing the public good, and a head tax is used, then $G^* = a/(1+a)(C/N)Y_i$. The median demand is then $G^*_{\text{med}} = a(1+a)(c/N)Y_{\text{med}}$. The MRS of each individual can be calculated to be: $MRS_i(G^*_{\text{med}}) = (Y_i - (c/N)G^*_{\text{med}})/G^*_{\text{med}}$. Note, however, that the person with income Y_{med} and median MRS gets to consume his or her most preferred level of public good, G^*_{med}. Since he or she is optimizing, his or her MRS is equal to the relative price of public goods, which is (c/N) under the head-tax scheme. It follows that the median MRS (evaluated at $G^*_{\text{med}}) = c/N$. Finally, the mean $MRS = (1/N)\ MRS_i(G^*_{\text{med}}) = [(1+a)(Y/Y_{\text{med}}) - a]$. If $Y_{\text{med}} = Y$, the median outcome is efficient, otherwise it is not.

[63] For a well-written extension of the head tax case, see Barlow (1970). For a detailed discussion of these efficiency conditions including the case of an income or wealth tax and their implications, see Bergstrom (1979). See also Akim and Youngday (1976).

[64] Such a test was used in a different situation to test whether voter and non-voter demands were equivalent. See Rubinfeld (1980).

government output but are not particularly concerned about higher wages for themselves or their employees.

The second model assumes that the wages of public employees are higher than they would be if they were determined competitively. This results in a tax-price which is above a competitively determined tax-price. Public budgets are higher than efficient budgets because public employees are earning rents. Presumably, these rents are the result of collective bargaining or political power on the part of public sector unions. This is the model considered in Courant, Gramlich and Rubinfeld (1979) and allowed for in the budgeting model of Inman (1981). In the papers by Courant, Gramlich and Rubinfeld, and Inman, there is limited mobility. Public employee unions have some power to set both wages and output, but must trade-off the advantages and disadvantages of each. Higher output, for example, may mean higher employment and greater bargaining power, while higher public wages may mean less output and less bargaining power. Courant and Rubinfeld (1982) show that even in the competitive world of the Tiebout model with unlimited mobility, the threat of public unions extracting rents is a real one.[65]

A third way in which government may be too large and inefficient, is that it may not be producing on the production frontier. Except for Fiorina and Noll (1978), there has been essentially no literature on the mechanisms by which such inefficiency may arise. One possibility is that government is perceived to be too large because there is waste due to the use of an inferior technology.

What are the uses of these alternative models? They have important positive implications for our ability to predict the effects of policy changes on the local public sector and normative implications about the appropriate use of constitutional and statutory limitations of government. As an example, Courant and Rubinfeld (1982) suggest that the limitation on the total spending level of the public budget may or may not be an effective policy, depending upon what causes the inefficiency in the public sector. They suggest that the "Niskanen-like" inefficiency can be removed, at least in part, by an expenditure limitation, but that the rent earning ability of public employees is likely to be enhanced rather than diminished under such a reform.

6. Fiscal federalism

6.1. The responsibilities of local government

The analysis of the provision of local public goods has shown us that with fixed jurisdictional boundaries and interjurisdictional externalities an efficient outcome

[65] The same general result is given in Epple and Zelenitz (1981).

ated with these interjurisdictional externalities in a model which is generalized to allow for multiple levels of government. Thus, it is natural for us to complete our overview of local public economics by briefly reviewing some of the problems and concerns associated with a federalist system. The analysis of federalism includes both normative and positive issues, but our focus will be primarily on the normative. This choice is made solely because of space limitations. The positive analysis of federalism is one of the more interesting areas of recent research in public finance.

The central issue of federalism is whether certain goods and services or government responsibilities can best be provided and financed at the federal, state, or local level. This breakdown greatly simplifies reality, since there are numerous intermediate jurisdictions such as special districts, counties, and so on, and because many of these jurisdictions overlap spatially. In 1977, for example, there were over 3000 county governments, 18 000 municipalities, 16 000 townships, 15 000 school districts, and 25 000 special districts in the United States. This actually represents a decrease in the number of jurisdictions from the 1950s.

Since space is limited and this chapter is primarily methodological, it will be useful to simplify the discussion of the important normative issues by assuming only two levels of government – local and national. The question then becomes: Which level of government is most appropriate for handling which public function?[66] The usual taxonomy for analyzing optimal fiscal federalism is due to Musgrave (1959), and has been elaborated by Oates (1968, 1972), among others. Since this taxonomy is analytically valuable, it is followed reasonably closely here. Musgrave distinguished between three "branches" of government: the stabilization, distribution, and allocation branches. Although not analytically independent, these branches are usually treated separately, an approach which I follow here.

6.1.1. Stabilization

One of the roles of any government is to use macroeconomic policy to stabilize prices and employment in an inherently cyclical national economy. Stabilization is not an important function of local governments, however, because local governments can use only fiscal rather than monetary tools and because they are relatively open to trade and migration. As a result, a good argument can be made that the federal government is in the best position to handle stabilization policy.

One argument against stabilization being a local function is that local governments are required by law to balance their budgets. The budget balance constraint eliminates the major source of fiscal stabilization – deficits in times of

[66] For a broader and more detailed discussion of these issues, see Oates (1972).

whether or not stabilization is the primary goal of assigning a government program to the federal or local level, that assignment can have stabilizing or destabilizing effects. Consider, for example, a recent (1982) Reagan Administration proposal to have state governments take over primary responsibility for managing welfare programs. Since welfare benefits are highest in times of recession, and state and local budgets must be balanced, the reassignment of functions can in itself be destabilizing, even though the goals of the program are primarily redistributive.

One possible role for stabilization at the local level involves situations in which there are substantial regional differences in income and unemployment.[67] For instance, one might argue that the Northeast and Midwest public sectors should engage in policies to counter local unemployment problems since they have first-hand knowledge about the nature of these problems. There are substantial problems with regional stabilization policies, however. First, vast leakages to imports and exports make attempts to stabilize local economies ineffective. Second, these policies may increase competition among regions and jurisdications to attract business and other revenue-generating facilities. The net effect of such competition may leave the regional economy relatively unchanged and make all local governments worse off. This might arise because of the increased taxation needed to finance the tax breaks given to government with the resulting deadweight loss. Third, even if competition does alter outcomes, it may be inefficient from a social point of view. If the Northeast economy is "moving" to a new long-run equilibrium in which real incomes are substantially lower than they were previously, attempts by the local regional government to counter this equilibrating move may be socially unproductive. This controversial point is one of substantial current interest which has not been analyzed thoroughly.[68]

6.1.2. Distribution

To the extent that government has a role in redistributing income, the redistribution branch will be seriously limited if it operates at the local level. For example, if the Tiebout model is correct, then there is likely to be substantial income homogeneity within jurisdictions. With no disparities in income within jurisdictions redistribution is simply not possible. Local redistribution is also limited by the prospect of migration. If one jurisdiction redistributes more income than the other (which is otherwise the same), then the poor would have an incentive to move to the community with the more redistributive policy. This migration would

[67] Tresch (1981) discusses these issues much more thoroughly than space allows here.

[68] See Courant (1983) for an interesting analysis of the tax and expenditure subsidy question among regions.

"too little" redistribution. All in all, these arguments suggest that a larger level of government is appropriate for redistribution, especially if redistributive goals are the result of a national consensus.

While the capacity of successful redistribution is greatest at the national level, there are some arguments for redistribution to be done by the lower levels of government.[69] These arguments focus on the limitations of the market model as well as the differences between municipal and federal decision-making processes. For example, a number of authors argue that at the metropolitan level the transactions costs of running government, including the ability to correct evaluate distributional needs (who is poor, etc.), are less than they are at the federal level. Within limits, redistribution can be somewhat successful since both individuals and businesses are not perfectly mobile. Whether a metropolitan government chooses to substantially redistribute income is problematic, however, since such a government may well be controlled by the middle and upper income suburban residents.[70]

A related, but somewhat different, argument has been made by Pauly (1973). Pauly assumes that income redistribution from rich to poor increases the utility of both parties. According to this view, income redistribution is a pure public good and its "provision" makes both parties better off. However, the public good is local, since individuals care more about helping the poor in their community rather than elsewhere. As a result, a first-best solution requires differing redistribution programs in each jurisdiction. Such a goal clearly cannot be achieved with a uniform national program. And, except under very strong conditions, a decentralized solution in which each jurisdiction sets its own program is suboptimal.

A more interesting income redistribution issue focuses on the distributional consequences of the local provision of taxes and services. If all local taxes and public goods provision are the same irrespective of household income, then the local public sector will be distributionally "neutral" and will not conflict with federal policies. However, if the outcome of the local public sector spending and taxing pattern is not neutral, and is different than the norms of the federal level, efficiency problems can arise. As an example assume that the outcome of a Tiebout-like process is for community tax bases to vary substantially. Then, some communities will be able to finance a given level of public services at a lower tax-rate than will others. Should the federal, state, or even metropolitan government involve itself in redistributing to equalize the "fiscal capacity" of communities? A number of authors have argued that the equalization of tax base is an

[69] See Tresch (1981, ch. 30) for details of this argument.

[70] For an argument for metropolitan government and redistribution, see Burstein (1980). See also Rose-Ackerman (1981).

finance is concerned. However, equalization of tax bases can be inefficient since it conflicts with what might have been the efficient outcome of a Tiebout sorting process.

The matter becomes even more complex when we recall that differences in fiscal capacity are likely to be capitalized into land values as individuals from low tax base communities migrate into high tax base communities. As a result capitalization will compensate, at least partially, for differences in fiscal capacity. In this case individuals who consume public services at a low tax-price are paying for part of that benefit in higher housing prices. Despite the effects of capitalization, some equalization may generate desirable fiscal and income distributions. One can argue, for example, that differences in fiscal capacity per se violate a principle of horizontal equity, since individuals in different communities will not be treated equally. However, why one should worry about a limit equity goal is not clear. Nevertheless, equality or near equality of fiscal capacity may be a means, albeit a costly one, of partially achieving a goal of equalizing expenditures on merit goods such as education. This issue is discussed in greater detail in the section on grants-in-aid which follows.

Empirical evidence on the fiscal equity aspects of the local public sector is quite limited and of questionable reliability. At this stage in the development of the subject area of local public finance both the underlying methodology and the actual empirical estimates of fiscal impacts on the distribution of income are in need of substantial improvement. Space, however, limits my analysis to a brief and necessarily somewhat cryptic description of the state of the art. For my purposes it is the qualitative nature of the distributional differences among levels of government that is important.

Inman and Rubinfeld (1979) summarizes previous empirical work by focusing on two measures of equity, one on the tax side and the other on the spending side. As shown in Figure 6.1, s, the tax-equity index, is the percentage increase in after tax income that occurs in response to a 1-percent rise in before-tax income. A value of s equal to 1 indicates a proportional income tax, less than 1 illustrates a progressive tax, and a value greater than 1, a regressive tax. The other equity variable is the elasticity of local service expenditures, v, which measures the percentage change in local expenditures given a percentage increase in family income. If service outlays are independent of income, then v is 0. However, v greatly increases when service expenditures rise with family income, making the distribution of service expenditures pro-rich.

Based on a detailed study of a number of incidence papers, Inman and Rubinfeld conclude that the federal level of government is the most progressive in terms of its tax and spending program, since spending is essentially proportional while taxes are mildly progressive. Welfare is viewed here as a federal and not a local program. The state level relies on an essentially proportional tax and a mildly pro-rich spending system. However, evidence from the local level suggests

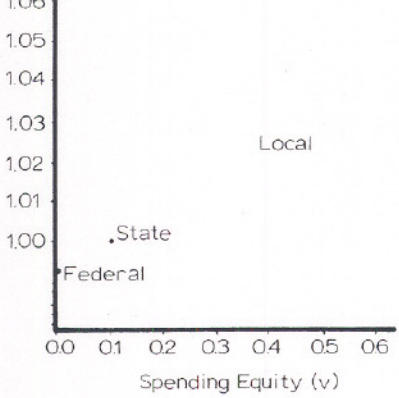

Figure 6.1

that the tax system is somewhat regressive and that spending levels are somewhat pro-rich. In light of the analysis of the Tiebout model, this outcome is not surprising, since any attempt to be substantially progressive at the local level is likely be thwarted by the migration of high income families. Legal attempts to alter distribution have concentrated on zoning laws as well as the distribution of tax liabilities and expenditure benefits within jurisdictions. Inman and Rubinfeld (1979) suggest that, while a number of legal decisions appear to be equity-improving, the economic impact of those legal decisions has been relatively small. Likewise, legislative attempts to achieve equity by equalizing tax bases among jurisdictions have also had relatively small effects. These failures are due in part to the fact that individuals can migrate to avoid what they deem to be adverse distributional effects, and partly to the ability of jurisdictions to exercise their political power to thwart changes in spending and tax patterns in the first place.

The inability to alter distribution follows from the fact that both legislative and judicial attempts to achieve equity do not confront the fundamental observation that there are substantial income differences among families within metropolitan areas. Attempts to achieve income redistribution through the local public sector are much less likely to be economically successful than a federal program of income redistribution through either the tax or the spending side of the budget.

6.1.3. Allocation

The third branch of government, the allocation branch, provides the best motivation for a multi-level federalist system. As the Tiebout model suggests, local

are likely to be most responsive to the variations in demands for public goods. What makes the federalism question interesting is the spatial nature of the public goods produced. For example, the theory of clubs suggests that there is an allocatively efficient size for government, where the marginal benefit from consumption of the public good is equal to the marginal cost of congestion.

When the jurisdictional boundaries are fixed, however, the benefits of certain public goods produced in one jurisdiction are likely to spill over to the residents of neighboring jurisdictions. In general, the externality results in an inefficient outcome if public spending and taxing decisions are entirely in the hands of the local governments. For example, if suburban residents use some of the services of the central city but do not pay either user fees or taxes on wages to compensate for the benefits received, then the city may underproduce the goods.

Economic externalities can be dealt with in two ways. First, the externality can be internalized by shifting the decision-making process to the metropolitan government level. Second, a system of taxes and subsidies can be designed that charges those generating the externalities for the costs and benefits they confer. For example, if the externality is generated by the community as a whole, a system of state and federal grants or taxes would work. Empirically, whether such externalities are important and which direction they flow is relatively unknown. The usual argument, suggested by Neenan (1981) and others, is that suburbanites are subsidized by the central city, but Bradford and Oates (1974) have argued that the suburban labor force generates benefits to central city residents in its productive role.

Fiscal as opposed to economic externalities occur with respect to the industrial base of the central city and suburbs. Fiscal externalities alter relative prices that jurisdictions face without necessarily changing the underlying production functions and thus do not necessarily involve allocative inefficiencies. Assume, for example, that heavily taxed commercial and industrial properties can pass on or export some of these taxes by raising prices. If the products are sold in a national market or at least a non-local market, then the property tax costs can be exported to those outside the jurisdiction. As a result, households residing in the jurisdiction may decide to increase public service output because of the low price they face. However, they impose external monetary costs on non-residents of the jurisdiction. These fiscal effects may or may not lead to inefficient outcomes, depending upon whether underlying productive relationships (e.g. scale economies and congestion) are altered. When economic externalities do arise, they can be remedied if revenues generated by a larger jurisdiction, say a metropolitan or statewide area, are shared with the smaller units of government.[71]

Obviously, the allocation branch has an important role in the assignment of taxes to the different levels of government. To minimize the inefficiencies which arise because people move to avoid the effects of taxes, one ought to tax mobile

[71] This argument has been developed in extensive detail in Brazer (1961).

federal level in the United States is rational, particularly since the personal income tax is progressive. Similarly, since the property and sales taxes are perceived not to fall heavily on the mobile factors of production, these state and local taxes are regarded as those that minimize inefficiencies.

However, the problem is much more complex than this brief summary suggests. For example, whether the property tax is an appropriate local tax depends upon one's view of the incidence of the tax. If the property tax is borne by owners of housing or land, then it is a desirable local tax from an efficiency perspective. However, if the tax is borne by all owners of capital or by businesses who pass it on by raising prices, then it is less desirable. In fact, the possibility of "tax-exporting" to non-residents is important at both the state and the local level. In an early study McLure (1967) estimated that roughly 25 percent of the taxes levied at the state level are shifted outside the state. Similarly, Roberts (1975) suggested that exporting (exclusive of the deductability under the Federal personal income tax) ranged from under 20 percent for the property tax, to over 25 percent for the sales tax in Michigan.

The spillover and tax exporting issues have been analyzed theoretically by a number of authors.[72] The following model, based on Oates (1972), should help to clarify some of the issues. It illustrates why the larger level of government must intercede in some manner when there are interjurisdictional externalities.

Assume that there are two communities, A and B, each with N identical individuals. Individual utility functions are $U^{A}(X_{A}, G_{A} + aG_{B})$ in the first community and $U^{B}(X_{B}, G_{B} + aG_{A})$ in the second. X is a private good, and G is a public good whose benefits spillover to the neighboring community so that a ranges from 0 to 1 and represents the extent of the externality. The externality here is real, not just financial. In addition, the local public good is produced by a production function, $F(X, G) = 0$, within each community and financed by a property tax on housing of which k percent is exported.

The inefficiency of the decentralized model can be seen by comparing the necessary conditions for a welfare optimum to the necessary conditions for utility maximization within each community. Given that the two utility functions are weighted equally, the social optimum is obtained by maximizing

$$NU^{A}\left(X^{A}/N, G_{A} + aG_{B}\right) + NU^{B}\left(X_{B}/N, G_{B} + aG_{A}\right) \tag{50}$$

subject to

$$F\left(X_{A} + X_{B}, G_{A} + G_{B}\right) = 0. \tag{51}$$

[72] See, for example, Arnott and Grieson (1981), Gordon (1984), Bird and Slack (1983), and Zimmerman (1983).

$$N(aMRS_A + MRS_B) = MRT$$

and

$$N(MRS_A + aMRS_B) = MRT,$$

where

$$MRS_A = (\partial U^A/\partial G_A)/(\partial U^A/(\partial X_A/N)),$$

$$MRS_B = (\partial U^B/\partial G_B)/(\partial U^B/(\partial X_B/N)),$$

and

$$MRT = (\partial F/\partial G)/(\partial F/\partial X).$$

If there are no spillovers ($a = 0$), then the standard Samuelson condition applies so that $\sum MRS_A = N(MRS_A) = MRT = N(MRS_B) = \sum MRS_B$ in each community. When $a = 1$, there is a single aggregate Samuelson efficiency condition that $\sum MRS_A + \sum MRS_B = MRT$. In the remaining cases, the efficiency conditions state that the joint benefit to individuals in both communities from an increase in G must equal the marginal cost in terms of foregone private consumption (the MRT).

What happens in the decentralized case when each community maximizes its own utility? For community A the level of G is determined by maximizing

$$NU^A(X_A/N, G_A + aG_B) \tag{52}$$

subject to

$$F(kX_A, G_A) = 0. \tag{53}$$

Here, the input necessary to produce a given level of public good has been reduced by the factor k to reflect the lower cost to the community of using a partially exported tax to finance the public good. The first-order conditions for maximization yield:

$$N(\partial U^A/\partial G_A)/(\partial U^A/(\partial X_{A/N})) = N(MRS_A)$$

$$= (\partial F/\partial G)/(k\,\partial F/\partial X) = MRT/k$$

If $k = 1$ and the production function is constant returns to scale, then community A would increase G_A until $MRS_A = MRT/N$. However, if there are spillovers, then they are *underproducing* the public good. Instead, community A should produce more G_A until $MRS_A = MRT/N - aMRS_B$.

When k is greater than one and a is less than one, the bias is in the other direction. Local governments tend to oversupply the public good for reasons analogous to the ones just given. Finally, in the general case, the direction of bias depends upon the magnitudes of the parameters. It is conceivable, but unlikely, that decentralized decision-making would result in A producing efficiently $(MRT/N - aMRS_B = MRT/kN)$ and B producing efficiently $(MRT/N - aMRS_A = MRT/kN)$. In fact, in a more general version of the model, decentralization never leads to a first-best outcome. Instead, state and/or federal grants must be used to remove the inefficiency.

One resolution to this externality problem is to have all production decisions made at a higher level of government. However, an alternative decentralized approach is to allow the higher level of government to use grants-in-aid to stimulate the appropriate spending levels by the local governments. It is this approach to the externality problem to which I now turn.

6.2. The role of grants in a federalist system

The various roles that federal and state grants might play in a federalist system are depicted in the four panels in Figure 6.2.[73] The horizontal axis measures the level of government spending or output G. The price of public output is chosen to equal 1 initially so that G can be represented in either real or money terms. The vertical axis represents total post-tax income in the community, and thus the budget line, AB, represents the constraint that the community decision-maker faces in trying to allocate goods between the public and private sectors. If there are no constraints, then the optimum is point E where the "community indifference curve" is tangent to the budget line. This indifference curve reflects the preferences of the city manager of "decisive voter" and is assumed to be a function of the preferences of the citizens in the community. While this is a plausible assumption if everyone in the community is identical, it is clearly unrealistic and causes serious problems if there is heterogeneity.

[73] This analysis builds on the early work on Wilde (1968). See also Thurow (1966), and Inman (1975).

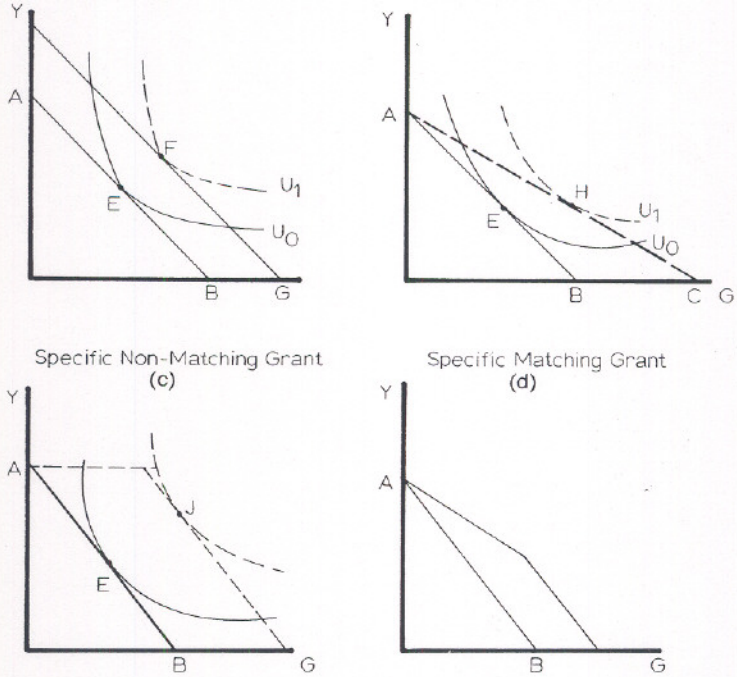

Figure 6.2. (a) Non-matching bloc grant; (b) matching grant; (c) specific non-matching grant; (d) specific matching grant

Panel (a) represents the case of the non-matching unconditional grant or the federal revenue sharing block grant. The non-matching grant adds to income and allows the community to expand its public spending as well as its after-tax income to move from point E to point F. Such a grant is logically used to redistribute income among jurisdictions since the lack of restriction on spending allows each community to maximize its own welfare.

What if there are externalities in which some of the benefits of local spending spillover into neighboring jurisdictions? In this case a matching grant, as shown in panel (b), is more effective, since the matching rate is chosen to induce the local government to spend more on the public good. If the correct rate is chosen, then decision-makers will equate the social marginal benefit to *all* individuals from the public good to the marginal cost.

If one assumes that the amount of money spent on the two grants is sufficient to allow the community in cases (a) and (b) to reach the same level of utility (not

changing price, while the matching grant changes price and thus has both income and substitution effects, point H must be associated with a higher level of public spending than point F. This result follows from the fact that the substitution effect is always negative. Thus, the matching grant is more stimulative and hence more cost efficient than a non-matching grant.

Panel (c) describes a conditional non-matching grant where money is received only if a minimum amount is spent on a particular public service. The grant acts like a pure non-matching grant with only an income effect if the community would spend more than the minimum amount required by the grant. Thus, the non-matching grant is effective in guaranteeing a minimum level of spending by a local government on a particular budgetary item. However, these grants do not have an effect different from a pure income grant unless the community is forced to spend more than it would have done otherwise.

Finally, consider a matching grant that is limited or "closed ended". As long as the community operates within the budget constraint set by the matching program, the grant has a price effect. However, if the community spends all the money available from the grant, then the analysis is the same as panel (a).[74] A closed-ended matching grant makes sense if there are some limited externalities and only a certain amount of additional stimulus is desired.[75]

This rather simplistic view of the effect of grants is flawed since it assumes that the community indifference curve reflects interests of the decisive voter or manager which are identical to the interests of the constituents. For example, the manager's political goals may not coincide with the long-run interests of those members of the jurisdiction, since his period of election or office is likely to be relatively short. Thus, the model just described is likely to be a poor predictor of government spending behavior, at least in the short run. After all, the simple model predicts that a dollar increase in grants has the same effect as a dollar increase in community income. However, grants often lead to greater spending increases than would result from an equivalent increase in community income. This phenomenon is sometimes called the "flypaper effect", since it describes the situation in which money tends to stick where it initially hits.

A number of authors have attempted to model the effect of grants on local spending to explain the flypaper effect by focusing on the various kinds of budgetary and fiscal illusions that may arise in a federal system. Courant,

[74] This has implications for the specification of the price and income terms in the regression analysis where grants can have both price and income effects. With a non-matching closed-ended grant, the closed-ended form of the grant acts simply as an addition to income, not as a price increment.

[75] For an extended and substantial analysis of the effect of grants, both theoretically and empirically on local spending, see Gramlich (1977). See also, Hamilton (1983b).

suggested models of fiscal illusion that focus on *individual* utility-maximizing behavior. The economic rationale for the flypaper effect in many of these models hinges on the inability of voters to perceive the true marginal price of public expenditures when non-matching grants are present. Of course, these models do not preclude the more popular political rationale that I discussed previously. The analysis of how the political process might work to explain the flypaper effect is one which should provide room for fruitful research.

One reason for the limited predictive ability of the spending models is that each assumes that the grant program and level of grants is exogenous to the model. In fact, the form, nature, and extent of grants is often the result of a complicated bargaining process between politicians and employees at each level of government involved. Empirically, these models may not fully reflect the specific income and price effects of the program. A number of authors have shown recently that better measures of the effects of grant programs can be obtained from models that account for these bureaucratic elements.[76]

The analysis of grants within a federal system is in many ways typical of the state of local public economics today. Normative analyses of the role of grants have been well developed within models that have little or no assumptions about the supply side – the politics and economics of the provision of local public goods. However, empirical work on the positive aspects of the grants side is somewhat less well developed. And, the area of greatest need combines the normative and the positive. We need to utilize our empirical base of knowledge of the local public sector to build better normative and positive models. To be effective, both in terms of proscription and prescription these models must include reasonable assumptions about politics as well as economics.

7. Conclusions

This chapter has covered a substantial amount of ground, and yet the subject-matter of local public economics has been barely scratched. Emphasis has been placed on the demand side of the public sector, and on normative rather than positive models. Hopefully, the models and issues sketched out here will whet the student's appetite to look further into the interesting and varied problems in local public finance. A detailed review of where the analysis has taken us is likely to be tedious at this point. In its place I will be somewhat more presumptuous in sketching out what I perceive to be some of the interesting areas of ongoing research and areas for future research as well. My apologies and thanks in

[76] See especially Johnson (1979) and Chernick (1979). See also Winer (1983), Fisher (1979, 1982), Filiman, Romer and Rosenthal (1982), and McGuire (1978, 1979).

(1) The political economy of the local public sector has been studied by both political scientists and economists, but efforts to combine the two have had limited success. At this point the addition of supply-side–political assumptions to Tiebout models has led largely to negative conclusions about the existence and efficiency of the local public competitive analogy. Positive models and a more careful specification of the political process by which public goods are provided may get us somewhere, however. My sketch of the arguments for inefficiency of public good provision and the need for tax limitation is one of many possible examples. Without a well-thought-out and careful description about how public goods are provided one cannot hope to accurately assess either the normative or the positive aspects of the recent move towards state and local limitations on tax revenues and public spending.

(2) The Tiebout model has provided one useful, albeit somewhat artificial, model of a more or less competitive local public sector. However, the value and usefulness of the Tiebout model is likely to diminish in the future, and an alternative or alternatives are needed. Several monopoly models of local government have been suggested and do provide a useful counterpart to the Tiebout approach. However, these models have not been nearly as well developed in the sense of taking adequate account of the multiple number of local jurisdictions and the general equilibrium nature of public spending and locational choices. There may be a good deal of mileage in pursuing the market structure analogy further. Some of the recent advances (as well as some of the older work) in the field of industrial organization may help us to understand this aspect of the local public sector. One possibility might be to view local governments as providing public goods which vary spatially in the attributes that they provide to the consuming public. Public goods could be viewed as brands which differ in one or more of the attributes. The extent to which local governments compete among themselves in the supply of the public good becomes an issue that can be studied using modern techniques of industrial organization.

(3) Local public economics is a subject area that is rich with empirical work, but a good deal of high quality work remains to be undertaken. The relationship between mobility of households and the provision of local public services is one area that typifies work in local public finance. We know a good deal about why and how often households move, but relatively little about the extent to which their moves influence and are influenced by public sector variables. Better empirical information about this subject is likely to suggest better lines of theoretical research. At the same time better theory is likely to substantially improve upon the empirical work that is undertaken and to make hypothesis testing possible. A well-specified and correctly estimated model may help us to evaluate the correct method by which the demand for local public goods can be determined.

local public sector and to the question of whether or not equilibrium exists. This is natural, given the tools of microeconomics currently available. However, many of the problems of the local public sector may be best explained by modeling an economy which is in disequilibrium. Modern tools, both theoretical and empirical, have only recently begun to be applied to these problems. For example, consider the question of whether the capital infrastructure in our cities is being efficiently provided. Are the cities of the Northeast "undercapitalized" and if so, what should the federal government do about it? Is it efficient for adjustments of population and the capital stock to respond solely to market forces, or do substantial externalities warrant government intervention?

(5) The federalism question was only lightly treated in this chapter, but is an extremely important one. Recent proposals for a major restructuring of the federal system by President Reagan have encouraged economists and others to rethink the basic Musgravian view of federalism. Should redistribution be moved in part to the state and/or the local level? Can individuals and individual local governments internalize interjurisdictional externalities or is a move to consolidation of governments a necessary step?

These are only a few of the areas in which interesting work is being and is likely to be done in local public economics. Future research should only serve to prove how limited and how narrow this list of suggestions has been.

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