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Mobility and Redistribution

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The ability of individuals to move freely from one jurisdiction to another is generally seen as a constraint on the amount of redistribution that each jurisdiction within a system of governments can undertake. In this paper, we look at this proposition by developing a positive analysis of income redistribution by local governments in a federal system. We ask how much redistribution occurs when only local governments can have tax/transfer instruments, individuals can move freely among jurisdictions, and voters in each jurisdiction are fully aware of the migration effects of redistributive policies. Local redistribution is shown to induce sorting of the population, with the poorest households located in the communities that provide the most redistribution. While the threat of out-migration affects the potential for redistribution, our results suggest that significant local redistribution is nonetheless feasible. Numerical computations indicate that the proportion of residents who are renters is a major factor affecting the local choice of level of redistribution.

I. Introduction

The ability of people to move from one jurisdiction to another is generally seen as a constraint on the amount of redistribution that

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each jurisdiction within a system of governments can undertake. In this paper, we look at this proposition by developing a positive analysis of income redistribution by local governments in a federal system. We ask how much redistribution occurs when only local governments can have tax/transfer instruments, people can move freely among jurisdictions, and voters in each jurisdiction are fully aware of the migration effects of redistributive policies.

A model must have several features to make it a useful vehicle for studying redistribution by local governments: (1) Clearly, it must have more than one locality, and households must be able to move among localities. (2) For the study of income redistribution to be interesting, the population must be heterogeneous. Thus the assumption of identical individuals used as a convenient simplification in many investigations of local governments (Courant and Rubinfeld 1978; Epple and Zelenitz 1981; Wilson 1987*a;* Wildasin 1988) is untenable in studies of local redistribution. (3) Redistributive decisions of localities must be endogenous. In a positive model, it is desirable that decisions of localities emerge from a collective choice process such as majority rule. In existing models of multicommunity equilibrium with voting (Westhoff 1977; Epple, Filimon, and Romer 1984), voters treat the community tax base and population as fixed when voting on the community tax-expenditure policy. This is unsatisfactory in a model focusing on the limits that mobility imposes on redistribution since one would not want results driven by the assumption of voter myopia.[1] A model of local redistribution must endow voters with greater sophistication than models to date have done, and this proves to require a different approach to analyzing voting. (4) The potential importance of differences in incentives faced by homeowners and renters has been emphasized in discussions of local governments (Oates 1986), but previous research has not provided a way of modeling the differing preferences of owners and renters.[2]

These observations lead us to develop a model of multicommunity equilibrium in which the population of each community is endogenously determined. Tax rates and levels of redistribution are chosen by majority vote of residents of each local jurisdiction. Voters anticipate changes in housing prices and the in- or out-migration that will occur in response to changes in the local tax rate and level of redistri-

[1] As a technical matter, we show in this paper that no equilibrium exists when voters behave in this myopic fashion.

[2] In a model with only owner-occupants, Yinger (1982) introduces a distinction between "movers" and "stayers." This device serves to contrast choices facing households selecting a community with those facing households residing in a community. The stayers do not plan to change houses, and hence they ignore capital gains and losses when voting.

bution. We distinguish between renters and owners and show this distinction to have a central role in determining preferences for local redistribution. By bringing these features together in a single model, we not only provide a framework for studying the substantive problem of local redistribution but also broaden the set of phenomena that can be encompassed in models of equilibrium among local jurisdictions.

To provide further insight into the limits of redistribution by local governments, we use functional forms and parameters that are consistent with American data to compute equilibria. These computations illuminate the relationships among redistribution, relative community sizes, and patterns of property ownership. They also illustrate the potential usefulness of the analytical framework for further study of questions that arise in the political economy of systems of governments.

This paper draws on several previous lines of research. Important early discussions of the subject of redistribution in a federal system may be found in Stigler (1957) and Oates (1972). They emphasize that mobility of households is likely to undermine attempts by local governments to redistribute income. More recent contributions by Oates (1977) and Ladd and Doolittle (1982) point to migration as the central issue in the normative evaluation of which level of government should undertake redistribution.[3] A positive analysis of redistribution by local governments under direct democracy is offered by Brown and Oates (1987). Following Orr (1976), they emphasize concern by the wealthy for the poor as the factor giving rise to income redistribution policies. The alternative approach, adopted here, treats income redistribution as an outcome of majority rule with self-interested voters. In following this approach, the paper builds on the work of Romer (1975) and Meltzer and Richard (1981). Altruism may be important in practice. In this paper, however, we are concerned with identifying the prospects for redistribution even when altruism is absent. Rather, the motives for redistribution, if any, emerge from the majoritarian nature of the political process. The political side of the model abstracts from explicit consideration of the role of bureaucrats or politicians in determining levels of redistribution. Again, such influences may be important in practice, but valuable insights can be obtained without the complications introduced by attempting to model these influences. As to the analysis of equilibrium among local

[3] Empirical studies of migration in response to differentials in local redistribution have been made by Gramlich and Laren (1984), Rosenzweig and Wolpin (1988), Peterson and Rom (1989), and others. A review of some of the empirical evidence is presented in Brown and Oates (1987).

jurisdictions, this paper extends the work of B. Ellickson (1971), Westhoff (1977), Rose-Ackerman (1979), and Epple et al. (1984).[4]

In Sections II and III, we present the model, define equilibrium, and establish some of its properties. We develop a computational model in Section IV and present results based on it. We make some concluding observations in Section V.

II. The Model

Our framework is a two-good, many-community model with a continuum of households. The local government in each community imposes a tax proportional to the value of property and divides the proceeds equally among the residents of the community. The tax rate of each jurisdiction is endogenously determined, as well as the population and tax base of each community. The two goods in the model are housing and a composite good. Thus communities do not supply a distinct local public good; the good they distribute is a perfect substitute for the composite commodity.

The model is sufficiently general to allow a locality to be thought of simply as one of a system of jurisdictions among which households are free to migrate. One natural interpretation is that the locality is one of several municipalities in a metropolitan area. For convenience we shall refer to the collection of localities as a metropolitan area, but it should be understood that the model is not limited to this interpretation. For example, one may think of subunits of a nation among which households are free to locate.

More specifically, consider a metropolitan area inhabited by a continuum of households. There are two goods: housing, h, and a numeraire bundle, b. All households have the same strictly quasi-concave, twice continuously differentiable utility function, $U(h, b)$. We assume that both commodities are normal goods. Households differ only in their endowed income y. The distribution of income over all communities is characterized by a continuous density function $f(y)$, with support $[0, M]$.

[4] Bucovetsky (1982) recognizes the importance of mobility-related effects in analyzing the response of systems of local jurisdictions to changes in public-sector policies. He focuses on exogenous policy changes and is not concerned with community collective choice. In two recent papers, Wilson (1987*a*, 1987*b*) has explored the role and patterns of trade in private goods in an economy with mobile factors and multiple jurisdictions. In both papers, he focuses on the efficiency properties of local taxation and public goods provision. For the most part, the analyses deal with a setting in which individuals are identical, so political processes or redistributive issues play no role. Goodspeed (1988) uses a simulation model to investigate the welfare losses and extent of redistribution in decentralized provision of a "congestable" local public good. Steen (1987*a*, 1987*b*) looks at multicommunity equilibrium in a spatial setting, with the level of public services in each community set exogenously.

A look at U.S. data reveals that once boundaries dividing the land area of a region among a set of local jurisdictions are drawn, they are rarely redrawn (Epple and Romer 1989*b*). Hence, we assume that the homogeneous land in the metropolitan area is divided among J jurisdictions, each of which has fixed boundaries.

Jurisdictions may differ in the amount of land contained within their boundaries. Each jurisdiction may impose a proportional tax, t, on the value of housing and use the proceeds to pay a lump sum, g, to each resident. Hence, the budget constraint faced by a household with income y located in community j is

$$y + g^j = p^j h + b,$$

where p^j is the gross-of-tax price in community j. From now on, the household with income y will be named y.

From a household's viewpoint, a community is characterized by the grant/housing price pair (g, p). For given g and p, the utility of a household is given by the indirect utility function V:

$$V(p, g, y) = U(h(p, y + g), y + g - ph(p, y + g)). \tag{1}$$

On the right-hand side of (1), $h(p, y + g)$ is y's demand function for housing, capturing the way consumption of housing services responds to changes in the gross-of-tax price of housing and gross-of-grant income. With the assumption that housing is a normal good, y's indifference curves in the (g, p) plane are upward sloping:

$$\left.\frac{dp}{dg}\right|_{V=\bar{V}} = -\frac{\partial V/\partial g}{\partial V/\partial p} = \frac{1}{h(p, y + g)} > 0. \tag{2}$$

The slope of an indifference curve through a point (g, p) decreases with y:

$$\frac{\partial(dp/dg|_{V=\bar{V}})}{\partial y} = -\frac{1}{[h(p, y + g)]^2} h_2 < 0, \tag{3}$$

where h_2 is the derivative of $h(\cdot)$ with respect to its second argument. (Since housing is a normal good, h_2 is positive.)

We define *equilibrium* in the system of communities as an allocation such that

1. all communities are in internal equilibrium; that is, within each community
   a) the housing market clears,
   b) the community budget is in balance, and
   c) there is a majority rule voting equilibrium, and
2. no one wants to move.

We begin by developing the implications of part 2 of this definition. The requirement that no one wishes to move is natural in any static model of residential location. With costless mobility, a household's locational choice must maximize $V(p^j, g^j, y)$ over $j = 1, \ldots, J$.

Consider two points (g^i, p^i) and (g^j, p^j) such that $g^j > g^i$. Then (2) and (3) imply that

$$V(p^i, g^i, y) \geq V(p^j, g^j, y) \Rightarrow V(p^i, g^i, y') > V(p^j, g^j, y') \quad \text{for } y' > y \tag{4a}$$

and

$$V(p^i, g^i, y) \leq V(p^j, g^j, y) \Rightarrow V(p^i, g^i, y') < V(p^j, g^j, y') \quad \text{for } y' < y. \tag{4b}$$

This ordering of preferences by income means that locational equilibrium generates considerable structure on community characteristics.[5] These are summarized in the following proposition. (The proposition follows readily from the properties of $V(\cdot)$. For more details, see Epple et al. [1984].)

PROPOSITION 1. Consider an allocation in which no two communities have the same housing price. Necessary conditions for such an allocation to be one in which no one wishes to move to another community follow:

a) *Stratification:* Each community is formed of households with incomes in a single interval. If y and y' live in the same community, with $y' > y$, then $y'' \in [y, y']$ also lives in that community.

b) *Boundary indifference:* Communities can be ordered from lowest to highest income levels. When they are ordered this way, there is a "boundary" income between two successive communities. The "border" household (i.e., one with the boundary income) between any two adjacent communities is indifferent between the communities.

[5] Conditions (2) and (3) imply that the indifference curve of a given household crosses the indifference curve of any other household at most once and that the indifference curve of the poorer of any two households cuts the indifference curve of the wealthier of the two from below. Models in which indifference curves are assumed to have these monotonicity and single-crossing properties have been studied in a variety of contexts. B. Ellickson (1971), Westhoff (1977), and Epple et al. (1984), among others, use such an assumption to study equilibrium in models of local jurisdictions. Matthews and Moore (1987) provide an illuminating review and discussion of the use of analogous marginal rate of substitution assumptions in screening models. In these models, the marginal rate of substitution property is employed to demonstrate that certain self-selection constraints are satisfied. In our model, the marginal rate of substitution condition plays this role (proposition 1), and it also plays a key role in characterizing the outcome of the voting problem (proposition 2). In the context of voting, Roberts (1977) named this condition "hierarchical adherence" and relied on it to prove the existence of a voting equilibrium. An attractive feature of the model we study in this paper is that the marginal rate of substitution condition relevant to our analysis, condition (3), emerges naturally from the economics of the problem.

c) *Decreasing bundles:* If y^i is the highest income in community i and y^j is the highest income in community j, then, in equilibrium, $p^i < p^j$ and $g^i < g^j$ if $y^i > y^j$.

Proposition 1 focuses on allocations in which no two communities have the same housing price. Next, we consider allocations in which this is not so, that is, allocations in which at least one pair of communities has the same housing price. For such an allocation to be an equilibrium, it must be the case that any two communities with the same housing price also have the same grant, g. Otherwise, all households would prefer the member of the pair with the higher g. Hence, in equilibrium, households will be indifferent between two communities with the same housing price. Thus to generalize proposition 1 to the case in which more than one community has the same price, assign all communities with the same price to a group. Proposition 1 then applies, with "community group" replacing "community" in the statement of the proposition. The population will be stratified across community groups, but there is no necessary stratification within community groups. There is no loss of generality, however, for the analysis that follows in assuming that households are stratified within community groups as well. For convenience, we shall adopt this convention.

Part *a* of proposition 1 implies that redistributive taxation will induce sorting by income groups. Part *c* predicts that redistributive expenditure per household will be inversely related to household income in a comparison across communities. These are precisely the outcomes hypothesized by Oates (1977, p. 5): "an aggressive policy to redistribute income from the rich to the poor in a particular locality may, in the end, simply chase the relatively wealthy to other jurisdictions and attract those with low incomes."

By condition *a* of proposition 1, in any equilibrium the total population must be partitioned into a set of single-interval communities. We shall therefore restrict our attention to such communities. Henceforth, let y^j denote the income of the household at the border between communities j and $j + 1$, with $y^j < y^{j+1}$, and let $y^0 = 0$ and $y^J = M$. From part *b* of the proposition it must be the case that

$$V(p^j, g^j, y^j) = V(p^{j+1}, g^{j+1}, y^j), \quad j = 1, 2, \ldots, J - 1. \tag{5}$$

Next, we turn to *internal equilibrium*, that is, equilibrium within a community (pt. 1 of the definition of equilibrium). We begin with the housing market. Aggregate demand in each community is determined by integrating the household demand function over the income interval of households in the community, so for community j we have

$$H_d(p^j, g^j, y^j, y^{j-1}) = \int_{y^{j-1}}^{y^j} h(p^j, y + g^j) f(y) dy. \tag{6}$$

We assume that the housing supply function, $H_s^j(p_h^j)$, for a community with fixed land area is continuous and strictly increasing for $p_h \geq 0$, for all $j = 1, \ldots, J$. The gross-of-tax price of housing is determined by the identity

$$p^j = p_h^j(1 + t^j). \tag{7}$$

In equilibrium the housing market must clear:

$$H_d(p^j, g^j, y^j, y^{j-1}) = H_s^j(p_h^j). \tag{8}$$

It is also necessary that the community's budget balance:

$$g^j \int_{y^{j-1}}^{y^j} f(y)dy = t^j p_h^j H_s^j(p_h^j). \tag{9}$$

Voting on Local Grants

Finally, we need to characterize the way that public-sector choices are determined in each community. We assume that the (t, g) pair in each community is chosen by majority rule. In each community, voters assume that the (t, g) pairs in all other communities are fixed. Since we are interested in the limits to redistribution in the face of mobility among jurisdictions, we assume that voters are sophisticated about the impact of taxes and grants in their community. They recognize two types of effects of changing (t, g) in their own community. First, changing taxes and transfers affect housing prices and, hence, housing consumption of current inhabitants. Second, a change in the (t, g) pair in the community (given policies in other jurisdictions) will induce migration into or out of the community.

Let $t^{-k} = (t^1, \ldots, t^{k-1}, t^{k+1}, \ldots, t^J)$ and $g^{-k} = (g^1, \ldots, g^{k-1}, g^{k+1}, \ldots, g^J)$. The alternatives facing voters in community k when other communities' tax-transfer policies are (t^{-k}, g^{-k}) are defined as follows: (i) equations (5)–(8) hold for all communities, and (ii) community k's budget is in balance; that is, equation (9) holds for community k. Together, parts i and ii determine a relationship between the gross-of-tax housing price p^k and the feasible levels of the grant g^k perceived by the voters in community k, given (t^{-k}, g^{-k}). We shall call this relationship the *redistribution possibility frontier* (RPF).

For a given community, a point (g^*, p^*) is a majority voting equilibrium if and only if it is on the community's RPF and there is no point on the RPF strictly preferred to (g^*, p^*) by a majority of the community's residents. In general, neither voter indifference curves in the (g, p) plane nor the RPF will be concave or convex. Consequently, voters' preferences over points on the RPF (and, effectively, over tax-transfer policies) will not be single-peaked. In the absence of single-peakedness, it is usually the case that majority voting equilib-

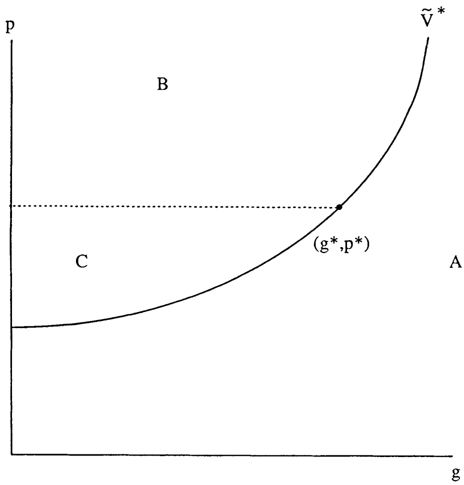

FIG. 1

rium fails to exist: voting cycles occur. An attractive feature of this model, however, is that we can show the existence of voting equilibrium even without single-peaked preferences.[6]

PROPOSITION 2. A point on the community RPF that maximizes the utility of the median-income voter in the community is a majority voting equilibrium.

To prove the proposition, consider an arbitrary community. Suppose that the point (g^*, p^*) in figure 1 is a point on the community RPF that maximizes the utility of the median-income voter in the community. Let $\tilde{V}^*$ be the indifference curve of the median-income voter through this point. There are no points on the community RPF anywhere in region A of figure 1. The existence of such a point would contradict the assumption that (g^*, p^*) is a point on the community RPF that maximizes the utility of the median-income voter. Thus points on the community RPF must fall in regions B and C or on their boundaries.

We can apply (4a) and (4b) to comparisons of points within a single community. By (4a), all voters with incomes greater than the median, $\tilde{y}$, strictly prefer (g^*, p^*) to any other point within region B or on its boundary.[7] Since the median-income voter will also vote for (g^*, p^*) over any other point within or on the boundary of region B, a majority will vote for (g^*, p^*) over any other point within or on the bound-

[6] Proposition 2 is based on a result of Roberts (1977).

[7] All voters strictly prefer (g^*, p^*) to points in B such that $g < g^*$ and $p > p^*$. By (4a) we can compare (g^*, p^*) to other points in region B, for voters with $y > \tilde{y}$.

ary of region B. Similarly, by (4b), all voters with incomes less than $\tilde{y}$ strictly prefer (g^*, p^*) to any other point within or on the boundary of region C. Thus a majority will vote for (g^*, p^*) over any other point within or on the boundary of region C. Thus no point on the community RPF is preferred to (g^*, p^*) by a majority, and so (g^*, p^*) is a majority voting equilibrium.[8] Q.E.D.

The analysis thus far has established sufficient conditions for a proposed allocation to satisfy our definition of equilibrium. With the results in propositions 1 and 2 combined, an allocation is an equilibrium if it satisfies stratification, boundary indifference, decreasing bundles, and, within each community, the allocation yields a (g, p) pair that is a point on the community RPF that maximizes the utility of the median-income voter in the community. These results thus embody the implications of our definition of equilibrium in the context of the model we are studying.

An Aside on Voter Myopia

We have taken voters to be quite sophisticated in their assumption about how others adjust. Had we assumed myopic voters, the analysis of voting in a pure redistribution context would not be particularly illuminating. Suppose that voters take no account of adjustments in aggregate housing demand, from either current residents or possible migrants. This means that, when voting, they take p_h as fixed and assume that the aggregate housing stock stays constant at H and community population at N. The perceived community budget constraint then is $tp_hH = Ng$, so that the perceived RPF is given by

$$p = p_h + \frac{Ng}{H} = p_h + \frac{g}{\bar{h}},$$

where $\bar{h}$ is average perceived housing consumption. The perceived RPF is linear with slope $1/\bar{h}$. As an illustration of voting outcomes, consider the case in which $U(h, b)$ is homothetic, so that the income elasticity of demand for housing equals one. Then for income distributions skewed the usual way, the housing consumption of the median-income voter, $\tilde{h}$, is less than the average housing consumption, $\bar{h}$. For any pair (g, p), the slope of the decisive voter's indifference curve $(1/\tilde{h})$ is greater than the slope of the perceived RPF at that (g, p), which is $1/\bar{h}$. This implies that any value of g would be defeated

[8] There may be more than one point on the community RPF that yields global maximum utility for the median-income voter. Let E be the set of such points. Any point in E will defeat all points not in E, so E is the set of majority voting equilibria. (In our computations, E was always a singleton.)

by a higher value: no voting equilibrium would exist. Or if there were an arbitrary limit set on the magnitude of g, the voting equilibrium would occur at that limit. With more general preferences, nonextreme values of g could be equilibria only in the unlikely case in which $\tilde{h} \geq \bar{h}$.

One might foresee other formulations with voter myopia. For example, voters might be assumed to take community population as fixed when making their assessments of the effects of changing the community tax rate. Any such characterization of voter myopia is inherently arbitrary. To guard against the possibility that some such arbitrary assumption about myopia might drive our results, we have opted for a formulation in which voters correctly anticipate the consequences of changes in their community's tax-grant package.

A Two-Community Illustration of Equilibrium

A two-community example will serve to clarify equilibrium in the model. The opportunities facing voters in community 1 may be determined as follows. Community 1 takes the tax rate and grant (t^2, g^2) in community 2 as given. For given (t^2, g^2), the choice of a tax rate in community 1 determines prices in both communities, the population in both communities, and the grant in community 1. To see this, recall that equation (5) must be satisfied, that (7) and (8) must be satisfied in each community, and that community 1's budget must be in balance: equation (9) must hold for $j = 1$. Thus, given (t^2, g^2) and a choice of t^1, all remaining variables are determined by the equations above. By varying t^1 over the set of feasible (i.e., nonnegative) values, we can trace out the opportunities perceived by voters in community 1. Notice from the indirect utility function (1) that voters' utility depends on p and g but not on t. Voters care about t only as it affects the values of p and g that emerge.

The top half of figure 2 illustrates the (g^1, p^1) pairs traced out as community 1 (assumed to be the poor community) varies its tax rate over the set of feasible values. This is community 1's RPF, given (t^2, g^2). The lowest point at which the RPF intersects the vertical axis corresponds to $t^1 = 0$. Clearly, when $t^1 = 0$, $g^1 = 0$. As t^1 is increased, g^1 rises, and the gross-of-tax price p^1 rises. Eventually, a point is reached at which the increase in revenue from further tax increases does not offset the loss in tax base due to out-migration. At that point, the RPF in figure 2 begins to bend back. In general, the RPF need not be as "well behaved" as we have drawn it here and may be neither concave nor convex.

The community's housing market clears and the community's budget is in balance for all points on the community RPF. Hence, a point

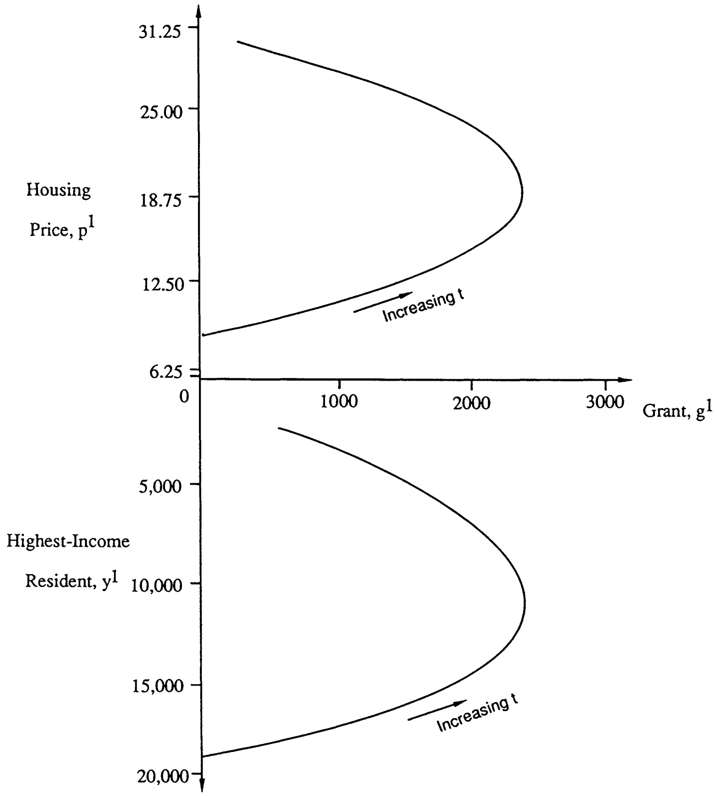

FIG. 2.—Effects of redistributive taxation in community 1 on housing prices, grant level, and migration.

on the community RPF that is a majority voting equilibrium will be an internal equilibrium in the community. An example of such an equilibrium with an interior solution is shown in figure 3 as a point at which the indifference curve of the decisive voter in community 1, labeled $\tilde{V}$, is tangent to the RPF of community 1. (The equilibrium may, in some cases, involve a corner solution, with $g = 0$.) By proposition 2, the income of the decisive voter, $\tilde{y}^1$, is the median income in community 1.

In general, the RPF in community 1 will differ for different (t^2, g^2) pairs in community 2, and the decisive voter in community 1 will differ as well. Figure 4 shows a two-community equilibrium. The utility of the decisive voter $\tilde{y}^i$ is maximized over points on RPF^i. The RPF in community 1 is drawn with the (t^2, g^2) pair corresponding to (g^2, p^2) taken as given, and the RPF in community 2 is drawn with the (t^1, g^1) pair that corresponds to (g^1, p^1) taken as given. The border

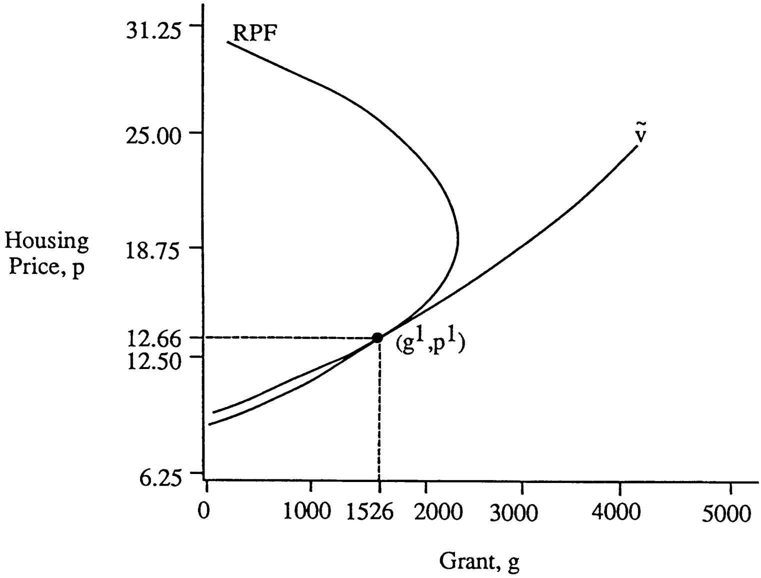

FIG. 3.—Voting equilibrium at (g^1, p^1)

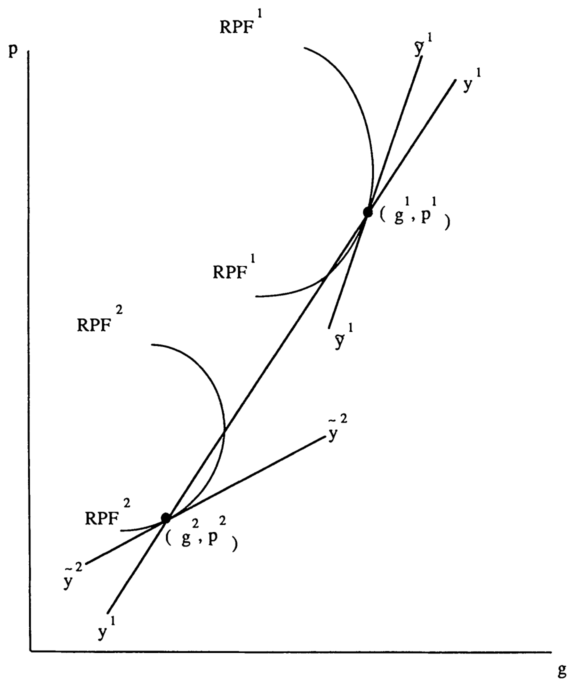

FIG. 4.—Equilibrium with two communities

household is indifferent between the two communities. For this to be a two-community equilibrium, proposition 1 requires that all residents in community 1 have incomes less than y^1 and all residents in community 2 have incomes greater than or equal to y^1. If this is the case, the stratification and "decreasing bundles" conditions will be satisfied. These conditions, the "boundary indifference" condition, and internal equilibrium within each community are sufficient for the existence of a two-community equilibrium.

With more than two communities, equilibrium is determined in a similar fashion. The RPF of community j is the (g^j, p^j) frontier traced out as community j varies t^j over the set of feasible values (the nonnegative real line). Tax rates and spending levels in other communities (t^{-j}, g^{-j}) are held fixed while t^j is varied. Housing markets in all communities clear, and the budget constraint in community j is balanced for each t^j. As in the two-community case, a point on the community RPF that is a majority voting equilibrium is an internal equilibrium. An allocation that satisfies proposition 1 in which all communities are in internal equilibrium is a J-community equilibrium.

Effects of Changing Relative Land Areas

One would expect the community's RPF to expand if the community's share of metropolitan land area were increased. Expansion of the community's share of land will tend to increase its share of total population. Since community 1 in our two-community example is occupied by the low-income portion of the income distribution, expansion of its population will increase the income of the border household, y^1. It follows that the average income level of the community will rise. Ceteris paribus, this will increase the tax base per capita. In addition, an increase in the share of metropolitan land occupied by the community will increase the community's "market power," in that land outside the community becomes scarcer and housing relatively more expensive. The increase in market power provides greater latitude for the community to engage in redistributive policies.

The net effect of an increase in the share of land area depends not only on the expansion of the RPF but also on how the income of the pivotal voter changes. These effects may be offsetting. With two communities, for example, the RPF of the poor community may well expand as the community's share of land increases, making higher grants per household feasible. But, for any given (g^1, p^1, g^2, p^2), a higher fraction of the total population occupies the low-income community when that community's share of total land area increases. Thus, for any given (g^1, p^1, g^2, p^2), the income of the decisive voter increases as the community's share of total land area increases. Ceteris paribus, higher-income voters prefer lower g. As a result, although higher grants are *feasible,* the political process may limit the increase in transfers.

III. The Contrasting Preferences of Owners and Renters

The discussion so far has treated all residents of local jurisdictions as renters. Rents are paid to absentee landlords who do not vote in any of the communities.[9] Suppose, by contrast, that all residents of local jurisdictions are owner-occupants. They locate in a jurisdiction and purchase housing there before participating in the voting process that determines the level of redistributive taxation. There are no transactions costs in the purchase and sale of housing. Households can adjust their level of housing consumption (i.e., sell their current house and purchase another dwelling) in response to price changes without incurring transaction costs. As in the preceding model with rental housing, households correctly anticipate how their housing consumption will change in response to a change in the price of housing induced by a change in redistributive taxation. Households also anticipate the capital gain or loss that they will incur as a result of a change in the net-of-tax price of housing induced by a change in the level of redistributive taxation.

Let h_0 be the amount of housing purchased at price $p_{h,0}$ by a household with endowed income y. When making decisions about whether to change their consumption bundle, homeowners face the budget constraint

$$y + g + (p_h - p_{h,0})h_0 = ph + b,$$

with h_0 and $p_{h,0}$ fixed. The third term on the left-hand side is the capital gain from selling the household's existing dwelling.[10] The demand function for housing for such a household is of the form

$$h = h(p, y + g + (p_h - p_{h,0})h_0).$$

[9] This treatment of absentee landlords is consistent with a strict interpretation of current legal doctrine. R. Ellickson (1982) has noted that cities generally have one-resident, one-vote rule. Challenges by nonresident landowners to this voting rule have typically met with failure, at least since Avery v. Midland County, 390 U.S. 474 (1968).

[10] Suppose that housing does not depreciate and that the real rate of interest is r. Then the capital gain from sale of the house is the present value of the change in annual implicit rentals on the house: $(p_h - p_{h,0})h_0/r$. This increase in wealth will pay an annuity of $(p_h - p_{h,0})h_0$. This annuity is added to the household's annual endowed income y and grant g to obtain its total annual income.

Substituting this demand function into the budget constraint and substituting both into the utility function yields the indirect utility function $V(p, g, y + (p_h - p_{h,0})h_0)$. The slope of the indifference curve through a point (g, p) is

$$\left.\frac{dp}{dg}\right|_{V=\bar{V}} = \frac{1}{h} + \frac{h_0}{h}\left.\frac{dp_h}{dg}\right|_{\text{RPF}}. \tag{10}$$

In contrast to the renter case, dp/dg for a homeowner depends on the net-of-tax price of housing as well as its gross-of-tax price, because capital gains depend on p_h. In characterizing voting equilibrium when all voters are owner-occupants, we assume that dp/dg given in (10) is decreasing in y for all $p \geq 0$ and g such that p_h and dp_h/dg are defined along the RPF. It can be shown that a point on the RPF that maximizes the utility of an owner-occupant with median endowed income is a majority voting equilibrium among points such that this assumption holds (Epple and Romer 1989*a,* app. 1).

As is standard in static models, we assume that all transactions occur in equilibrium.[11] Evaluating (10) for $h_0 = h$ and $p_{h,0} = p_h$ yields

$$\left.\frac{dp}{dg}\right|_{V=\bar{V}} = \frac{1}{h} + \left.\frac{dp_h}{dg}\right|_{\text{RPF}}. \tag{11}$$

Since all transactions occur in equilibrium, the results in proposition 1 continue to hold as in the renter case. Thus when the assumption in the previous paragraph holds, sufficient conditions for equilibrium in this owner-occupancy model are the same as in the renter model: stratification, boundary indifference, decreasing bundles, and maximization (given the RPF constraint) of the utility of the median-income voter in each community.

An increase in the grant (and the associated tax rate) will typically lead to a reduction in the net-of-tax price of housing. Hence, the second term on the right-hand side of (11) will normally be negative.

[11] While the actual process of achieving equilibrium is not typically captured in static models, a heuristic "story" about how equilibrium might emerge may be useful. In our models with only renters, this requires no elaboration. In the model with owners, perhaps the easiest process to visualize is the one in which all land is initially owned by price-taking absentee owners. When they locate in a community, households in the model buy from these absentee owners. Since there is no uncertainty, transactions occur at equilibrium prices.

The key difference between owners and renters in the model is that owners would suffer any capital gains or losses that would arise from a change in the tax rate or grant level in the community in which they choose to locate. As voters, they take account of such potential gains and losses when choosing among feasible tax rates and spending levels. Since they choose not to vote for departures from the equilibrium tax rate and grant in the community in which they live, such capital gains and losses do not arise in equilibrium.

Thus a homeowner with a given level of income will normally have a flatter indifference curve through the point (g, p) where (11) holds than a renter with the same level of income (for whom $dp/dg = 1/h$). Hence, for a given RPF, *an owner with a given endowed income will prefer a lower level of redistributive taxation than a renter with the same income.*

In summary, the theoretical analysis thus far gives insight into the general structure of equilibrium in our model. Comparative-static analysis yields ambiguous results, as often happens with equilibrium models. Development of more specific implications about the features of equilibrium requires more specific information about preferences, technology, the distributions of income and housing tenure, the number of communities, and the land area of each. We therefore turn to numerical computations based on the structure we have presented. To do this we have chosen functional forms and parameter values that are broadly consistent with empirical evidence on housing supply and demand functions and the distribution of income in the United States.

IV. Computed Equilibria

Households have the Cobb-Douglas utility function $U(h, b) = h^{\alpha}b^{1-\alpha}$. The unitary price and income elasticities implied by this utility function are well within the range of values found in empirical studies (Polinsky 1977; Harmon 1988). This utility function implies the following indirect utility function for a household with income y in a community with housing price p and grant g:

$$V(p, g, y) = \alpha^{\alpha}(1-\alpha)^{1-\alpha}p^{-\alpha}(y+g).$$

Net-of-tax expenditure shares on housing of 25–30 percent coupled with property tax rates (as a percentage of annual implicit rent) of 20–30 percent suggest a gross-of-tax expenditure share for housing on the order of one-third. Hence, we chose a value of $\alpha = .33$.

We assume the following constant-elasticity housing supply function: $H_s^j(p_h^j) = L^j(p_h^j)^{\theta}$. This supply function is implied by a constant returns to scale Cobb-Douglas production function, with θ being the ratio of the value of nonland to land inputs in production. On the basis of a land share of roughly 25 percent (Mills 1972), we set $\theta = 3$.

A lognormal distribution is generally considered to be a reasonably good characterization of the U.S. income distribution (except possibly for the upper tail). The parameters of a lognormal distribution can be calculated using data on the mean and median from the population (Lindgren 1962, p. 89). With 1979 mean (\$21,418) and median (\$17,880) income for households in U.S. standard metropolitan statistical areas (SMSAs) (U.S. Bureau of the Census 1980*a*, table 107), the implied mean for the distribution of the logarithm of income is 9.8 and the variance is 0.36. Hence, in our computations, incomes are assumed lognormally distributed with $\ln(y) \sim N(9.8, 0.36)$.

The computations assume three communities: a poor community, a middle-income community, and a wealthy community. We assume throughout that one community does not redistribute income (i.e., for this community $t = g = 0$). We know from the descending bundles condition of proposition 1 that in any equilibrium this community will be the one in which the highest-income people live. Land areas of the three communities are varied in the computations to illustrate the effects of changing relative community sizes. We chose units of land so that the combined amount of land in all three communities sums to one unit.

The structure of our three-community examples should not be interpreted literally as meaning that all the wealthy households live in a single community, although for computational reasons it makes sense to do so. The spirit of these examples is better captured by thinking of the wealthy as living in many small communities that do not redistribute and that in the aggregate occupy a given fraction of the available land area. These nonredistributing communities provide the opportunity for anyone who wishes to migrate to a jurisdiction in which no redistribution occurs. (In equilibrium, by proposition 1, this must be the one in which those with highest income locate.) Since we are interested in how much redistribution occurs even when it is possible to escape taxation altogether, we have allowed in our examples for half the land area to be occupied by the jurisdictions that are constrained to have zero taxes.

All-Renter Communities

We look first at the case in which all residents are renters. To compute equilibria, we rely on the results of propositions 1 and 2.[12] To provide an intuitive feel for the behavior of the model, we first present results for the case in which at most one community engages in redistribution. (By proposition 1, this will be the low-income community.) The top half of figure 2 shows the RPF of community 1 when $L^1 = .25$ and $L^2 + L^3 = .75$. The bottom part depicts the out-migration (decline in y^1) that occurs as community 1's tax rate increases.

Figure 5 shows the RPFs obtained with four different values for community 1's share of metropolitan land area: $L^1 = .1, .25, .5$, and

[12] Details of our computational procedure appear in Epple and Romer (1989*a*, app. 2).

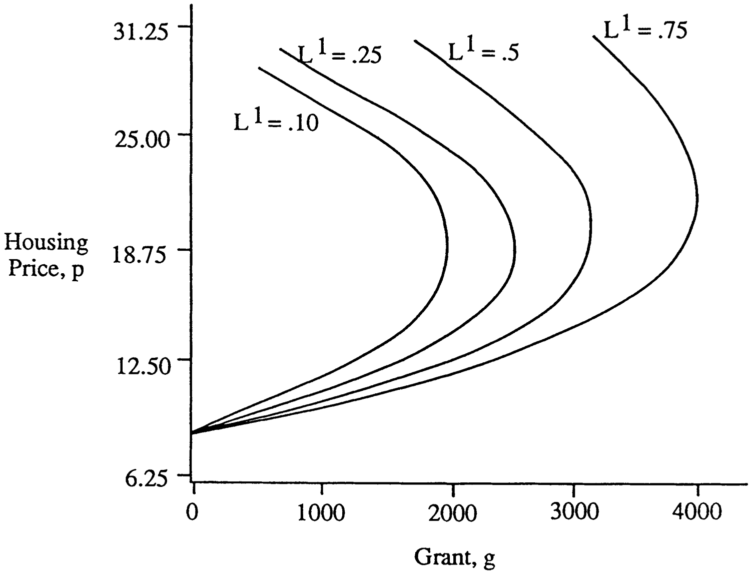

FIG. 5.—Redistribution possibility frontiers for four different community 1 shares of metropolitan land area.

.75. In addition to having the anticipated shape, the RPF does indeed expand as community size increases.

Voting equilibrium in community 1 when $L^1 = .25$ is shown in figure 3. This is the point on the RPF most preferred by a voter with income y = \$10,542, the median in community 1. Since, by assumption, the other communities do not undertake redistribution, the outcome in figure 3 is an equilibrium. In this equilibrium, g^1 = \$1,526 and 37 percent of the metropolitan area population lives in community 1. The gross-of-tax price of housing in community 1 is \$12.66, and in the other communities it is \$9.41.

An investigation of equilibrium with various values of L^1 reveals that the outward shift of the RPF slightly outweighs the effect of increasing the income of the pivotal voter as the population of community 1 rises. The equilibrium level of grants per household rises as the land area of the poor community rises. For example, increasing the land area of the poor community from .25 to .45 results in an increase in the equilibrium grant per household from \$1,526 to \$1,744.

Results for the case in which both communities 1 and 2 may redistribute income are presented in table 1. For these results, the land area of the community constrained to have $g = 0$ is fixed at $L^3 = .5$, and the relative land areas of the low- and middle-income communi-

TABLE 1

Effects of Varying the Relative Amounts of Land Occupied by the Low- and Middle-Income Communities for Two Alternative Tenure Arrangements

	All Households Rent			All Households Are Owner-Occupants		
	(1)	(2)	(3)	(4)	(5)	(6)
p^1	12.40	12.39	12.39	9.28	9.35	9.37
p^2	12.28	12.21	12.18	9.21	9.22	9.22
p^3	9.72	9.70	9.70	9.20	9.22	9.22
g^1	1,780	1,799	1,804	68	120	133
g^2	1,711	1,684	1,676	5	0	0
t^1	.62	.58	.57	.014	.025	.028
t^2	.31	.29	.28	.0006	0	0
N^1	.54	.60	.61	.68	.71	.72
N^2	.07	.01	.000013	.04	.009	8×10^{-6}
y^1	19,145	20,980	21,459	23,844	25,222	25,574
y^2	21,213	21,436	21,460	27,725	25,609	25,575
L^1	.45	.49	.49999	.45	.49	.49999
L^2	.05	.01	.00001	.05	.01	.00001

Note.—$L^3 = .50$ in all cases. N^j is community j's share of the total population ($j = 1, 2, 3$). $N^3 = 1 - N^1 - N^2$.

ties are varied. In this and other tables, the tax rates should be interpreted as rates *per dollar of rental price.* To obtain the more familiar tax rates per dollar of *property value,* the rental value of housing must be capitalized at some discount rate. With a 10 percent discount rate, this would imply property tax rates of *one-tenth* the rates listed in the tables.

The most striking finding of the model with only renters is that relatively high levels of redistribution are chosen by the middle-income community when that community has a comparatively small land area.[13] This is illustrated in columns 1–3 of table 1, where we present equilibria for cases in which community 2 has 5 percent, 1 percent, and 0.001 percent of the metropolitan land area. Another striking observation about these results is that the levels of local redistributive expenditures are quite high compared to levels observed in U.S. municipalities.[14]

Consider column 3 of table 1. The land area of the middle-income community is a small fraction (.00001) of total land in the metropolitan area. In equilibrium, the population is a comparably small fraction (.000013) of the metropolitan area population. The residents of the community are essentially homogeneous; the range of incomes between the wealthiest and poorest households in the community is less than \$1.00. Household income in the community (\$21,560) is well above the median (\$17,880) and mean (\$21,418) income for the metropolitan area. Roughly 39 percent of the households in the metropolitan area live in communities that do not tax or redistribute income. Nonetheless, households in the middle-income community

[13] There may be multiple intercommunity equilibria (Epple and Romer 1989*a*, app. 2). Since (along with much of the literature) we expected that mobility considerations would rule out equilibria with g much greater than zero, it is instructive that such equilibria are possible.

[14] Data on local redistributive taxation and expenditure are difficult to obtain for two reasons. First, redistribution often takes the form of goods and services rather than money, and the selection of the set of expenditures to classify as redistribution is not entirely straightforward. Second, local expenditures for redistribution may be financed by contributions from several levels of government so that the local revenue contribution is often hard to isolate. Taking an expansive definition of local government redistributive expenditures—including all items classified by the census as public welfare, health, and hospitals—and counting all local government expenditures in these categories regardless of source of funds, one can obtain an upper-bound estimate of local redistributive expenditures. The per capita average of these expenditures across all municipalities in the United States in fiscal year 1985 was \$84. The average in municipalities with a population greater than 1 million was \$389, while in municipalities with a population under 50,000 it was \$26. For all local governments in 75 major SMSAs, the fiscal year 1983 figure was \$192 per capita. For amounts per household, the per capita numbers should be multiplied by approximately three. There is great variability across states and municipalities, but these numbers suggest the order of magnitude (see Tax Foundation 1988, tables F2, F9).

vote to impose a 28 percent tax on the value of housing services and use the proceeds to finance grants per household of $1,676. (This would correspond to a 2.8 percent tax on property value if one uses a 10 percent rate for discounting.) They do this recognizing that it will induce migration out of the community and increase the equilibrium housing price to $12.18—26 percent higher than the no-tax equilibrium price of $9.70.

These results contradict the widely held belief that small communities cannot opt for high levels of transfers. The results show that they can, and that the decisive voter may well prefer a high level of grants. Moreover, the RPFs reveal that the politically chosen grants are significantly lower than the highest feasible grant. In other words, were the communities interested in maximizing the level of grants per household, they could choose higher g than those shown in the table, even given all the mobility considerations.

Why do residents of small and relatively high-income jurisdictions opt for such high grants in this model? Taxation for redistribution increases the gross-of-tax price of housing and decreases the net-of-tax price of housing relative to the no-tax level. The reduction in the net-of-tax housing price implies that a portion of the cost of redistribution is borne by property owners. Since land is immobile and jurisdictional boundaries are fixed, landowners cannot move their land to avoid paying a portion of the redistributive tax. Again, consider column 3 of table 1. The net-of-tax price of housing in the middle-income community is $9.51. This compares to a no-tax price of $9.70. Thus owners of land in the community receive a lower net-of-tax price than that obtained by those who own land outside the community. Landowners pay $0.19 (= $9.70 − $9.51) of the $2.67 difference ($12.18 − $9.51) between the gross- and net-of-tax price of housing in community 2. The incidence of the tax is such that landowners pay roughly 7 percent of the tax, and this is sufficient to induce residents of the community to adopt a relatively high redistributive tax.[15] Thus even in small, relatively high-income jurisdictions, residents find comparatively high levels of redistributive taxation to be attractive. These results echo the finding by Epple and Zelenitz (1981) that governments in small local jurisdictions can follow discretionary policies that expropriate a portion of land rent.

A key message of the computations in this section is that "smallness" of local jurisdictions need not prevent relatively high transfers. We should stress that the results are not due to voter myopia; voters

[15] Thus a portion of the tax is exported to nonresidents (absentee landlords). Johnson (1988) discusses tax exporting as a possible source of redistributive motives in a federal system.

correctly perceive how taxation for redistribution will affect migration and housing prices. The functional forms and parameter values in these computations are realistic enough that the results are not likely to be an artifact of the specification. The argument presented above suggests that these results arise because residents are renters who shift a portion of the burden of redistribution to property owners.

Owners-Only Communities

We used the functional forms and parameter values of the renter model to solve the owner-occupancy model.[16] The results, shown in columns 4–6 of table 1, change dramatically. *In this table, for all values of relative community size for the poor and middle-income communities, the equilibrium level of redistributive taxation is quite modest.* The change in results from those in columns 1–3 is due entirely to the change in voter preferences induced by homeownership. With owner-occupancy, any reduction in the net-of-tax price of housing caused by an increase in redistributive taxation leads to a capital loss for the owner-occupant. This capital loss is sufficient to offset almost completely the benefits of redistribution for median voters in communities of the sizes shown in table 1.

Investigation of the preferences of nonmedian voters in the case in which $L^1 = L^2 = .25$ reveals that there is a large majority of voters (roughly 47.5 percent) in the low-income community who prefer positive levels of redistribution. Since the observed proportion of owners in the United States is lower at low incomes than at high ones, this suggests that a model with both owner-occupants and renters might yield results quite different from those with only renters or owners. We discuss this next.

Equilibrium with Both Renters and Owner-Occupants

In order to consider communities with a mix of renters and owners, let $\rho(y)$ be the proportion of residents with income y who are renters. Since transactions occur only in equilibrium, the choice of community depends only on income, not on whether the household will own or rent. Proposition 1 holds for a model with both owners and renters.

For owners, assume that dp/dg as given in (10) is decreasing in y. Then it can be shown (Epple and Romer 1989*a*, app. 1) that the

[16] In our computations, we verified that dp/dg as given by (10) is decreasing in y and that proposition 2 can be applied over all the points on the RPF. For details, see Epple and Romer (1989*a*, app. 1).

preferences of owners as a subgroup vary systematically with income, as do the preferences of renters. It is therefore possible to determine the identity of pivotal voters in each community in equilibrium even when there are both owners and renters, and both are free to move among jurisdictions.

Since there are two types of voters, we shall be looking for voting equilibrium in each community, such that it is a point on the community RPF that maximizes the utility of renter-voter $\tilde{y}_r$ and owner-voter $\tilde{y}_o$, where $\tilde{y}_r$ and $\tilde{y}_o$ satisfy

$$\int_{\underline{y}}^{\tilde{y}_r} \rho(y) f(y) dy + \int_{\underline{y}}^{\tilde{y}_o} [1 - \rho(y)] f(y) dy = \frac{1}{2} \int_{\underline{y}}^{\bar{y}} f(y) dy, \tag{12}$$

and $\underline{y}$ and $\bar{y}$ are, respectively, the lowest and highest endowed incomes of residents of the community.

Equation (12) indicates that a majority voting equilibrium will be an allocation in which an owner ($\tilde{y}_o$) with income below the community median income and a renter ($\tilde{y}_r$) with income above the community median are both pivotal voters. They are pivotal since one-half of the voters in the community prefer a lower point on the community RPF and one-half prefer a higher point on the community RPF than $\tilde{y}_o$ and $\tilde{y}_r$ do.

To investigate the model with both owners and renters, we need to specify the function $\rho(y)$ parametrically. We adopted the specification

$$\rho(y) = \begin{cases} \gamma y^{-\delta} & \text{for } y > \gamma^{1/\delta} \\ 1 & \text{for } y \leq \gamma^{1/\delta}. \end{cases}$$

We chose this function for analytic convenience, but it provides a good fit to the available data. We estimated the parameters γ and δ as follows. The U.S. Bureau of the Census (1980*b*, tables B-3, B-4) presents the number of renter- and owner-occupied housing units in U.S. SMSAs for nine household income classes. We computed average income, $\bar{Y}$, in each income class, using the lognormal distribution of household income presented in Section III. Regressing the log of the proportion of households that are renters, $\bar{\rho}$, against the log of $\bar{Y}$ gives estimates of γ and δ. The resulting regression, with *t*-statistics in parentheses, is

$$\ln \bar{\rho} = \underset{(6.43)}{5.98} - \underset{(7.69)}{.729} \ln \bar{Y}, \quad R^2 = .89.$$

This regression confirms that the proportion of households that are renters declines as income rises ($\gamma = \exp[5.98] = 395$, $\delta = .729$).[17]

[17] Using time-series data, Rosen, Rosen, and Holtz-Eakin (1984) obtain an estimate of .707 for the elasticity of homeownership with respect to permanent income. This is remarkably close to our estimate of δ.

As in the all-renter and all-owner cases, increasing the relative size of the lowest-income community will tend to cause the community's RPF to expand. As before, this effect tends to favor an increase in the level of redistribution. An opposing effect, also present in the renter model, is that more high-income voters occupy the community when the community expands. Those voters oppose high levels of redistribution. A second opposing effect, which is not present in the renter model, is that the proportion of residents who are homeowners increases as the share of land occupied by the low-income community rises and, ceteris paribus, homeowners prefer less redistribution than renters.

Results of our computations for the mixed-tenure cases are shown in table 2.[18] Comparing these results to those in table 1 reveals that the equilibrium grant levels are lower in the model with both owners and renters than in the model with only renters. It is interesting to note that increasing the size of the low-income community results in a decrease rather than an increase in the equilibrium level of redistribution. The changes in community 1's composition as its share of land area increases are sufficient to offset the effect of the expansion of the community RPF, with the result that the equilibrium level of grants falls as the size of the community increases. (In the low-income community, the proportion of renters falls from 64 percent in table 2 to 41 percent as community size increases. The community's median income rises.)

Looking across the columns of table 2, one sees that the amount of redistribution in community 2 falls as the size of community 1 increases relative to community 2. This result is due in part to the declining size of community 2. However, the major factor causing the decline in redistribution in community 2 is the increase in household income and owner-occupancy in community 2 as the size of community 1 rises relative to community 2. This is evident in the increase in income of the poorest resident in community 2 (y^1) as the share of metropolitan land area occupied by community 1 rises. These results are in sharp contrast to those in columns 1–3 of table 1.

Finally, we varied the parameter δ that determines the proportion of renters at each income level.[19] The results are graphed in figure

[18] An interesting feature of our computations is that in both the all-owners model and the all-renters model, for values of L^1 on the order of .34 or less, our computations find allocations satisfying stratification, boundary indifference, and internal equilibrium. However, these allocations do not satisfy decreasing bundles, and, hence, they are not equilibria. By contrast, in the more realistic mixed-tenure case, our computations yield equilibrium allocations for the full range of values of L^1 that we investigate, as illustrated in table 2.

[19] We thank an anonymous referee for suggesting these computations.

TABLE 2

EFFECTS OF VARYING THE RELATIVE AMOUNTS OF LAND OCCUPIED BY THE LOW- AND MIDDLE-INCOME COMMUNITIES IN THE MODEL WITH BOTH RENTERS AND OWNER-OCCUPANTS

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
p^1	12.09	11.31	10.87	10.71	10.65	10.64	10.64
p^2	10.22	10.01	9.78	9.62	9.49	9.45	9.44
p^3	9.42	9.38	9.36	9.36	9.40	9.43	9.44
g^1	1,213	1,030	920	904	933	954	960
g^2	647	528	359	215	74	15	0
t^1	.80	.48	.32	.26	.24	.23	.23
t^2	.13	.10	.06	.03	.01	.002	0
N^1	.13	.24	.40	.53	.63	.67	.68
N^2	.55	.45	.29	.16	.05	.01	.00001
y^1	9,284	11,756	15,473	18,796	22,072	23,405	23,741.0
y^2	23,868	24,210	24,423	24,350	24,019	23,804	23,741.4
$\bar{y}^1_o$	4,250	6,454	8,777	10,377	11,642	12,082	12,187
$\bar{y}^1_r$	8,322	10,515	13,264	15,273	16,876	17,432	17,564
$\bar{y}^2_o$	14,189	15,859	18,538	20,843	22,856	23,572	23,741.2
$\bar{y}^2_r$	18,914	19,976	21,504	22,647	23,464	23,694	23,741.3
PR^1	.64	.56	.49	.45	.42	.41	.41
PR^2	.35	.33	.30	.28	.26	.25	.25
L^1	.10	.15	.25	.35	.45	.49	.49999
L^2	.40	.35	.25	.15	.05	.01	.00001

NOTE.—L^3 = .50 in all cases. PR^j is the proportion of community j's population that are renters. N^j is community j's share of the total population (j = 1, 2, 3). $N^3 = 1 - N^1 - N^2$.

6, for $L^1 = .45$ and $L^2 = .05$. In the figure, PR^1, PR^2, and PR^T are the proportions of renters in community 1, community 2, and the total population, respectively. As δ increases, the proportion of households at each income level that are owners increases. (The dashed line in fig. 6 indicates the case corresponding to col. 5 of table 2.) The all-renters and all-owners equilibria emerge at extreme values of δ. Parametrically varying δ illustrates the decline in the level of the grant in each community as the fraction of households that are owners increases.

The striking differences in equilibrium grant levels among the all-renters, all-owners, and mixed-tenure settings make a compelling case that housing tenure plays a central role in local redistribution. The effects of tenure arise not by changing what is feasible but by changing what voters prefer. The computational results thus highlight the interplay between individual incentives and collective actions that is a central focus of our model.

V. Conclusions

Some results of the analysis in this paper accord very well with prior expectations. Local redistribution leads to a sorting of the population,

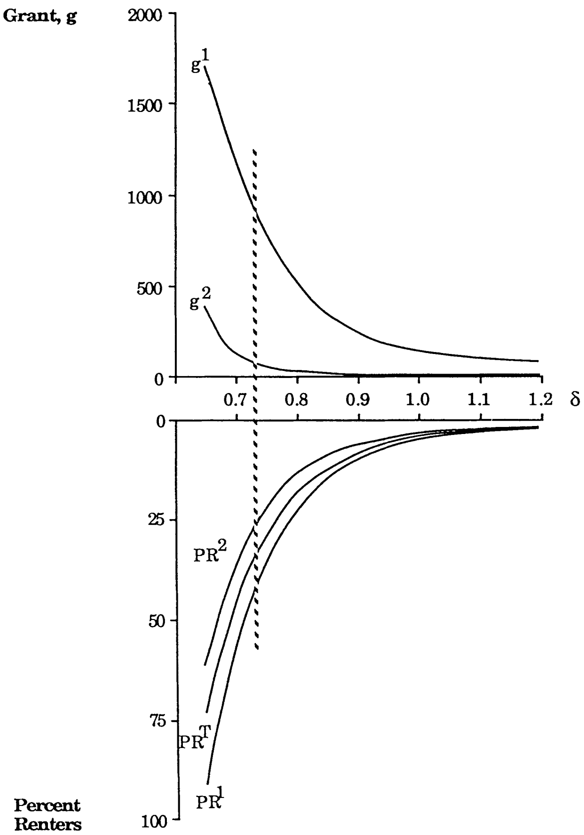

FIG. 6.—Effects of varying δ; $L^1 = .45$, $L^2 = .05$, $L^3 = .50$

with the poorest households located in the communities that provide the highest levels of redistribution (proposition 1). Larger communities within a system of jurisdictions have greater scope for redistribution than smaller ones do.

Some results of the analysis are unexpected. Even though mobility is costless in this model, high levels of transfers can emerge in equilibrium in computations with reasonable parameter values. Indeed, as shown in Section IV, even small, relatively high-income communities opt for high grant levels if all voters are renters. Results with owner-occupancy contrast sharply with those with only renters. Owner-occupants prefer less redistribution than renters. It therefore appears that it is not the threat of out-migration that leads to observed low levels of local redistribution in most municipalities in U.S. metropolitan areas. Costless mobility does not shrink the feasible set of grants sufficiently to prevent local redistribution. Instead, our results suggest that the preference for low levels of redistribution is a political one, and it is closely linked to the relatively high proportion of owner-occupants in most municipalities. The results in the model with both owners and renters suggest that the proportion of residents who are renters is a major factor affecting the local choice of level of redistribution. It would be worthwhile to explore this implication of our model more directly with data on U.S. municipalities.

A central assumption of our model is that moving is costless. Empirical evidence suggests that households do migrate in response to differentials in welfare payments (Gramlich and Laren 1984; Peterson and Rom 1989). However, the evidence also suggests that the response is not instantaneous, and it is clear that perfect stratification does not emerge in practice. Hence, it would be desirable to extend the model in this paper by introducing factors that lead households to be attached to particular locations. Perhaps the most straightforward way to do this would be to endow households with preferences for some locations relative to others. Another approach is to have the system of jurisdictions vary in location relative to a central area, so that communities would differ in some important respect, such as the amount of time required to commute to the center. As we show in Cassidy, Epple, and Romer (1989), our framework is quite amenable to incorporating a spatial dimension to the analysis.

The debate about local redistribution has focused on whether mobility makes local redistribution infeasible. In our model, local redistribution proves to be feasible. The amount of redistribution turns out to be relatively modest in the empirically most relevant cases because anticipated capital losses by homeowners deter them from voting for high grant levels per household. It is likely that local redistribution would be limited further by demands for other services from local governments. A useful direction to develop the model would be to introduce a local public good in addition to local redistribution. This would permit investigation of the allocation of public expenditures between redistribution and the provision of services. This extension poses a substantial challenge since the voting problem becomes more complex.

Our model focuses on the implications of one resident, one vote and ignores the possibility that absentee owners may attempt to influence the political process within the jurisdiction through means other than by casting a vote directly. The introduction of these more indirect channels of political influence in the context of a model of mobile households is an intriguing problem for future work.

Our existing model or its straightforward modifications can readily be applied to a variety of policy issues. The level of redistribution that would be chosen with a single central government can be compared to the case in which only local governments redistribute. When both central and local governments redistribute, one can investigate how changes in redistribution by the central government affect the amount of redistribution done locally. The effect of intergovernmental grants on the level of local redistribution can be studied. The model can be used to determine how consolidation of local governments affects the amount of local redistribution. Our framework, in sum, provides a useful way of combining the essential features we enumerated in the Introduction. The computed equilibria provide insight into the way these features interact and suggest the value of addressing other issues in fiscal federalism using extensions of this structure.

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