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Imperfect mobility and local government behaviour in an overlapping-generations model

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Abstract

This paper reconsiders the implications of land-value-maximizing local governments in an overlapping-generations model with imperfect mobility. Specifically, residents develop an 'attachment to place' or 'location-specific capital' once they reside in a town for a single time period. The analysis shows that attempts by governments to capture the resulting rents from less-mobile individuals create inefficient migration, leave all workers worse off in an ex ante sense, and place relatively high burdens on those workers who have high migration costs. Public good levels are also inefficiently chosen.

Keywords: Local government; Local taxation; Labor mobility; Overlapping generations; Mobility costs

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1. Introduction

The seminal contribution of Tiebout (1956) has inspired a large body of research which attempts, among other objectives, to understand the nature

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of the process that determines the public expenditure decisions of local governments. Just as a positive theory of household and firm behavior is the foundation of the normative analysis of the functioning of a market economy, a predictive or positive theory of local government is a necessary prerequisite to a normative analysis of fiscal decentralization. Local governments must determine expenditure levels and tax rates, and the overall efficiency and equity properties of a system of such governments clearly depends on how these policies are chosen.

Broadly speaking, most models of local government policymaking fall into one of two categories. One category builds on the public choice tradition by modeling explicitly the local political process. One standard approach is to assume that local decisions are made by simple majority voting, but many variations and refinements on this approach have been developed in a long line of studies.[1] Generally speaking, public choice models do not lead to very definitive conclusions concerning the efficiency of local public policies. For instance, simple majority voting may result in levels of public expenditure that exceed, fall short of, or are equal to the efficient level of spending.

A second type of model abstracts from explicit representation of the local political process and assumes instead that local governments choose their policies in such a way as to maximize local property or land values. Land value maximization is a natural hypothesis to consider in models where, in the spirit of Tiebout, the mobility of households plays a crucial role. In an economy with many small local governments and freely mobile households, public policies chosen by any one locality that tend to raise (or lower) the welfare of mobile households will cause households to enter (or leave) the locality until welfare levels within the jurisdictions are equated to those outside. The policies of small jurisdictions will have negligible effects on these external welfare levels; such jurisdictions are usually described as 'utility-taking', in analogy to the characterization of small competitive firms as 'price-taking'. Although the policies of utility-taking jurisdictions may not affect the utility levels of mobile households, they will in general affect local land values, since the price of land (or property) must adjust to changes in local policy in order to equilibrate migratory flows and equalize the internal and external utility levels of mobile households. Landowners therefore have an interest in the setting of local policy, since local policies affect their wealth. It is noteworthy that policies that are chosen to maximize land

[1] See, for example, Borcherding and Deacon (1972), Bergstrom and Goodman (1973), Inman (1978), and, for further references, Wildasin (1986) and Rubinfeld (1987).

values are typically efficient, given the crucial assumptions that jurisdictions are small and households are costlessly mobile.[2]

Superficially, the assumption of land-value maximization probably has less descriptive accuracy than the alternative hypothesis that local policy is determined through some political process. However, as several authors (such as Henderson, 1980, 1985) have observed, land developers often play an important role in the provision of roads, parks, and other local public services and infrastructure, and their behavior is presumably motivated by the quest for profits through appreciation in land values. Furthermore, in communities where significant numbers of households are owners of their own property, voting behavior may be motivated by land-value maximization considerations; to the extent that this is so, there is no real difference between a voting model and a model based on the assumption of land-value maximization. Even if voters are not landowners, it is not implausible to assume that the interest of landowners is reflected in the local political process, if that process can respond to pressures brought to bear by mechanisms other than voting. From the perspective of predictive modeling of local government policymaking, therefore, the hypothesis of land-value maximization is of greater interest than might at first appear to be the case.

The present paper reconsiders the implications of land-value maximization in a world where one of the idealized assumptions of the standard model – that of costless mobility – is relaxed.[3] In particular, we develop a model in which the cost of mobility is different at different stages of the life cycle, reflecting the notion that people develop various kinds of 'attachment to place' or 'location-specific capital' after staying in one place for a period of time.[4] To capture this phenomenon, we suppose that households live for

[2] The linkage between land-value maximization and efficient local public expenditure has been developed in Brueckner (1982), Sonstelie and Portney (1978), Wildasin (1979), Wilson (1987); in studies of literature on the theory of clubs, such as Berglas and Pines (1981), and in studies of the effect of local public policies on property values, such as Oates (1969). Many further references to this literature can be found in Wildasin (1986) and Mieszkowski and Zodrow (1989).

[3] A number of papers have explored alternative government objective functions. Brueckner and Joo (1991) discuss how a single voter balances his or her own preferences for a public good against those of the eventual buyers of his or her house. This is a promising start towards an equilibrium analysis of voter behavior. Mansoorian and Myers (forthcoming) compare the Nash equilibria for several possible government objective functions, using a two-jurisdiction model in which interregional transfers are available to influence the location decisions of imperfectly mobile labor. Following previous analyses of fiscal policy with costly migration under uncertainty by Hercowitz and Pines (1991, forthcoming), a recent paper by Cukierman et al. (1993) studies the implications of a seniority-based franchise on voting equilibria.

two periods, and that they choose a community in which to reside in each of these periods; however, whereas they are costlessly mobile in the first period, they must incur some costs of migration in the second period. We assume that these costs are distributed differentially among households, so that second-period moving costs are small for some of them but large for others. We then consider how local governments choose their fiscal policies so as to maximize land values in this setting. Seen from the viewpoint of the land-value-maximizing jurisdiction, the fact that mobility is not perfectly costless for all households implies the existence of differential locational rents that governments might try to capture. That is, while each locality must compete for those households that are mobile, there are at least some households for whom migration is a costly option, and local governments are therefore not so constrained in the provision of a bundle of tax and expenditure policies for these households.

To analyze the implications of costly migration, we begin in Section 2 by setting out a stylized model of a system of local governments with two-period lifetime utility-maximizing households. All inessential differences among localities and households are assumed absent, so that the equilibrium assignments of households to jurisdictions and the equilibrium policy choices of local governments will be identical. These strong symmetry properties greatly simplify the analysis. In Section 3 we analyze how local governments choose their fiscal policies, and more specifically their tax policies, so as to maximize local land values, deriving a set of necessary conditions that can be used to characterize the equilibrium of the system. Section 4 discusses the properties of this equilibrium. One major finding is that local governments will choose policies that are *not* efficient, in contrast to the usual findings of previous studies. The analysis shows that the attempt by localities to capture rents from older, less mobile residents results in socially costly and inefficient migration. It also shows that the burden of these efficiency costs falls on households rather than landowners, in the sense that ex ante lifetime net incomes for households are reduced by the expected value of migration costs. However, migration also introduces ex post inequality among households. Those who develop a strong attachment to place and who therefore have high migration costs will end up worse off than those who, in the second period of life, are more mobile and who can therefore escape from the heavier burden of fiscal policies imposed on those who remain behind.

[4] According to the Statistical Abstract (1992, Table 22), approximately one-third of the US population, aged 20–29, move in a given year, whereas this proportion drops to less than 20% for those aged 30–44 and to less than 10% for older groups. Careful empirical analyses, such as Topel (1986), confirm that young workers are more likely to move in response to income differentials than the old, as the basic data on mobility might lead one to expect.

In Section 5 we consider explicitly the use of public expenditure policy by land-value-maximizing local governments in a world of costly mobility. Under some special assumptions about the distribution of migration costs and the nature of the local public good, we show that local governments may not choose efficient levels of local public good provision; rather, an equilibrium with land-value-maximizing policies may result in overprovision of local public goods. Section 6 summarizes some of the main results and discusses directions for further research. We observe there that the model can be interpreted in terms of costly turnover of workers in an economy with profit-maximizing firms.

2. The model

We consider an economy consisting of a large but fixed number of identical towns, each possessing the same amount of homogeneous land. The economy lasts forever, and time is measured in discrete units. In each period, the residents of each town supply labor to competitive firms. These firms combine this labor with the town's land to produce a single output via a constant-returns-to-scale technology. This output may be used as a final private good, or it may be transformed into a public good, which is supplied to the resident-workers. Until Section 5, we treat the supply of the public good as fixed at some common value across towns, so that we can focus on inefficiencies associated with the towns' inefficient tax choices. However, we allow the cost of public good provision to depend on the population level, which is an important consideration for the design of tax policies.

Workers live for two periods. The same number of workers is born each period, so there is always an equal number of 'young' and 'old' workers at any moment of time. While young, a worker is free to choose a town in which to reside and work, supplying one unit of 'young labor'. Upon turning old, the worker may elect to remain in the same town and work there, or the worker may relocate and work in another town, supplying one unit of 'old labor' in either case. Young and old labor enter each town's production function as separate arguments: $F(L_{yt}, L_{ot})$, where L_{yt} and L_{ot} are young and old labor in period t, respectively, and the fixed land supply is omitted as an explicit argument.[5]

Costly mobility is modeled by assuming that, after the first period of life, a worker incurs a cost if he or she chooses to change residences. This

[5] Old and young labor may, but need not be, perfectly substitutable in production. If they are, then certain indeterminacies may arise in the details of the equilibrium allocation of workers among towns. These do not affect our substantive results, but it is most convenient to exposit the model by ignoring this technicality.

'moving cost', denoted c, is known to each worker in the second period, but it is not publicly known. Moreover, this cost is unknown even to the worker in the first period of life, implying that all workers are identical ex ante. Instead, all workers are assigned a moving cost that is randomly distributed according to a continuous cumulative distribution function, $M(c)$, with a continuous density function, $M'(c)$. This function is public information and is the same for all workers in all locations. To eliminate the possibility that no old workers migrate simply because moving costs are prohibitive, we assume that some workers possess zero migration costs (i.e. $M(c)$ is positive for any c arbitrarily close to zero). For now, we interpret c as a monetary cost, but our results about migration inefficiencies would not change if c were viewed as a psychic cost, such as the level of 'attachment' to the town where the worker resides when young. As another interpretation, c might represent 'town-specific human capital'.

In any given period, then, a town may employ workers of three types: young workers, old workers who resided in the town in the previous period ('stayers'), and old workers who resided elsewhere in the previous period ('movers'). We shall assume that towns can differentiate the fiscal treatment of these three types, since they are all observable. However, since individual moving costs are private information, towns cannot implement policies that discriminate among older residents on the basis of differential attachments to place. In other words, the policy instruments of local governments are constrained by the information at their disposal.

Of course, it could be argued that legal or other informational impediments may constrain the ability of localities to differentiate the fiscal treatment of their residents. While this view has obvious merit, localities nevertheless have sufficient instruments, on both the tax and expenditure side of public policy, to shift fiscal benefits and burdens among broad population groups. For example, differentially heavy assessment of some rental properties could be used to shift property tax burdens onto younger households and away from older owner-occupiers. The development of neighborhoods to attract retired individuals provides an opportunity to tax them differentially from established older residents and the young. On the expenditure side, education provides fewer benefits to older households than to young families with children. Parks, police protection, and other local services are valued differently by different groups in the local population, so that changes in the provision of these services will change the net fiscal benefits accruing to different groups of residents. The same is true of fees and user charges, which may be assessed more or less heavily for different types of local public services.

Our assumption of a head-tax system that distinguishes between the young workers, movers, and stayers is intended to capture, for our purposes, the essential features of these complex details of local fiscal policy. As observed by Hamilton (1975), for example, property taxes are equivalent to head taxes when perfect zoning is possible. In any case, the assumed availability of head taxes ensures that the inefficiencies uncovered in this paper do not stem from the familiar types of consumption and production distortions associated with common forms of local taxation.

Thus, three separate net-of-tax wages may be offered in a given town at any time t: a young wage, w_{yt}, a stayer wage, w_{st}, and a mover wage, w_{mt}. We have assumed that public good levels are fixed at a common value in all towns. Thus, there is a single mover wage at which each town is able to attract movers, and each town treats this wage as exogenously fixed, reflecting the lack of market power. Furthermore, we focus on symmetric, steady-state equilibria, in which case the mover wage is also constant across time. We denote its equilibrium value by w_m and similarly omit time subscripts to denote the steady-state values of other variables (but time subscripts are retained in the optimization problems that determine the equilibrium values of variables).

The choice problem for an old worker in period $t+1$ is particularly simple: emigrate to another town if the moving cost c is less than the excess of the prevailing mover wage over the stayer wage. Thus, in each town, there is a critical level of moving costs, $\bar{c}_{t+1}$, that defines a 'marginal emigrant' and satisfies

$$\bar{c}_{t+1} = w_m - w_{s,t+1} . \tag{1}$$

All workers with $c > \bar{c}_{t+1}$ stay, and all workers with $c < \bar{c}_{t+1}$ move. In terms of the distribution function, $M(c)$, the fraction of old residents who emigrate is then

$$M_t = M(w_m - w_{s,t+1}) . \tag{2}$$

A young worker in period t faces the more complicated problem of choosing where to reside on the basis of which town offers the highest expected lifetime utility. Given the current young wage, w_{yt}, expected future old wage, $w_{s,t+1}$, and the known steady-state mover wage, w_m, the young worker's expected-utility-maximization problem within a given jurisdiction consists of choosing present consumption, x_{yt}, future consumption as a stayer, $x_{s,t+1}$, and future consumption as a mover, $x_{m,t+1}(c)$ given a moving cost c, to maximize

$$(1 - M_t)U(x_{yt}, x_{s,t+1}) + \int_{c \leq \bar{c}_{t+1}} U[x_{yt}, x_{m,t+1}(c)]M_t'(c)\, dc , \tag{3}$$

subject to the lifetime budget constraints,

$$x_{yt} + x_{s,t+1}/(1+r) = w_{yt} + w_{s,t+1}/(1+r) \quad \text{for a stayer ,} \tag{4}$$

$$x_{yt} + x_{m,t+1}/(1+r) = (w_{yt} + w_m - c)/(1+r) \quad \text{for a mover}\,, \tag{5}$$

where $U(\cdot)$ is the lifetime utility function and r is an exogenous interest rate.[6,7] Solving this problem yields the indirect expected-utility function, $V^e(w_{yt}, w_{s,t+1}, w_m)$, the form of which depends on the distribution of moving costs. The mobility of young workers ensures that the value of this function for a given town equals the expected utility obtainable elsewhere, U^*:

$$V^e(w_{yt}, w_{s,t+1}, w_m) = U^*\,. \tag{6}$$

Each of the many small towns treats both w_m and U^* as fixed in this 'migration constraint'.

We assume that each town maximizes the present value of after-tax land rents, which are distributed to a group of absentee landowners. Land-value maximization has been shown to possess desirable efficiency properties when employed by local governments in a system of many towns (as discussed in Section 1). One of the main points of the present study is that such efficiency properties disappear when labor is imperfectly mobile.

In any period t, the value of a town's land, R_t, is given by the discounted sum of land rents in each period, which equal the excess of the total value of output over the sum of public good costs and total wage costs. To allow for the possibility that the cost of providing a given level of the public good may depend on the size of the population being served, let $K(L_{yt} + L_{ot})$ denote this cost, defined as a function of the town's total population. The total number of old workers is given by $L_{ot} = (1 - M_t)L_{y,t-1} + L_{mt}$, where L_{mt} is the number of movers hired in period t and $M_t = M(w_m - w_{st})$. We shall consider equilibria in which each young worker treats the town's future stayer wage as fixed at its steady-state value, w_s, which is identical across towns. Given this expected future wage, the migration constraint (Eq. (6)) determines the steady-state young wage, w_y, that the town must offer. Hence, only w_{st}, L_{yt}, and L_{mt} remain as control variables for a town maximizing the value of land in period t. This value is given by

$$R_t = \sum_{i=t}^{\infty} \frac{F(L_{yi}, L_{oi}) - w_y L_{yi} - w_{si}[1 - M(w_m - w_{si})]L_{y,i-1} - w_m L_{mi} - K(L_{yi} + L_{oi})}{(1+r)^{i-t}}\,. \tag{7}$$

[6] Because the level of public good provision is assumed to be fixed at the same level in all jurisdictions, its presence in the utility function can be suppressed.

[7] To justify the assumption of a fixed r, we could suppose, for example, that the system of jurisdictions is small and open with respect to external capital markets. Alternatively, the domestic production technology could be characterized by a constant marginal productivity of capital.

Notice that the only variable to enter this problem from periods prior to t is $L_{y,t-1}$, which enters through the equality $L_{ot} = (1 - M_t)L_{y,t-1} + L_{mt}$. As discussed in Section 4, M_t is positive in the steady state, reflecting positive turnover in the residential population each period. Thus, small variations in $L_{y,t-1}$ from its steady-state value have no impact on the wages or land rents from period t onward, because the town offsets them by changing the number of movers (L_{mt}) to keep L_{ot} equal to its steady-state value.[8] For this reason, the problem of maximizing R_t can be formulated under the assumption that young workers possess 'static expectations', and the first-order conditions for this problem will include no future wage changes.

The three first-order conditions for the land-value maximization problem are described in detail in the next section. Here we observe how these three conditions combine with the other equilibrium conditions to determine the symmetric, steady-state equilibrium. In this equilibrium, all towns choose identical time-invariant policies, so that $(w_{st}, L_{yt}, L_{mt}) = (w_s, L_y, L_m)$ for all towns in all periods. These variables must clear the young and old labor markets. With n denoting the exogenously-fixed number of towns and L^T the total number of workers born each period, the two market-clearing conditions are

$$nL_y = L^T , \tag{8}$$

$$L_m = M(w_m - w_s)L_y . \tag{9}$$

Thus, the equilibrium is obtained when (7) is maximized at (w_s, L_y, L_m), and (w_s, L_y, L_m) and (U^*, w_y, w_m) satisfy (6), (8) and (9). These last three equations, plus the three first-order conditions, provide a system of six equations to determine the equilibrium values of six variables. Examples can be constructed in which an equilibrium does exist, although we suspect that there may be special cases where existence is a problem.[9] For the remainder of the paper we will be concerned with characterizing the properties of any equilibrium that does exist.

3. First-order conditions

This section describes the first-order conditions for a town's land-value-maximizing policy. As discussed above, the economy is assumed to be in a

[8] The only way in which the town would be unable to return to the steady state in period t following a deviation in $t-1$ would be for $(1 - M_t)L_{y,t-1}$ itself to exceed the steady-state L_{ot}, in which case the town would be constrained by the requirement that $L_{mt} \geq 0$. Thus, only large deviations of $L_{y,t-1}$ from its steady-state value can prevent the town from reaching the steady state in the next period.

[9] Pines (1991) discusses some potential existence problems in models with rent-maximizing communities.

steady-state equilibrium characterized by 'static expectations' about future wages. When we later endogenize the public good level, a more complicated expectations structure will be required.

To begin, the first-order condition for the optimal number of young workers is obtained by differentiating (7) with respect to L_{yt}. Omitting time subscripts to denote the steady-state values of variables, this first-order condition may be stated

$$F_1(L_y, L_o) + \frac{1-M}{1+r} F_2(L_y, L_o) = w_y + K' + \frac{1-M}{1+r}(w_s + K') , \tag{10}$$

where K' denotes the 'marginal congestion cost' associated with public good provision. Condition (10) is a straightforward generalization of the requirement in single-period models that marginal products equal factor prices. Specifically, the expected present value of the output produced by a young worker over his or her lifetime should equal the sum of the expected present value of the wages paid to this worker and the cost of providing him or her with the public good. These expectations depend on the worker's probability of remaining in the town for two periods, which has a steady-state value of $1 - M = 1 - M(w_m - w_s)$.

The contemporaneous terms on each side of (10) would be equal to each other if competitive firms paid workers their marginal products in each period and the town collected head taxes in each period equal to current marginal congestion costs. In contrast, condition (10) implies only that the town collects head taxes with an expected present value equal to the expected present value of marginal congestion costs.

In fact, however, the town does not choose head taxes equal to marginal congestion costs in each period, because the presence of moving costs gives it monopsony power over the stayer wage. To see this, differentiate (7) with respect to w_{st} to obtain the following first-order condition for the stayer wage:

$$F_2(L_y, L_o)\left(-\frac{dM}{dw_s}\right) = (1 - M) + (w_s + K')\left(-\frac{dM}{dw_s}\right) \tag{11}$$

or, in elasticity form,

$$w_s = F_2(L_y, L_o) - \left(K' + \frac{w_s}{e}\right) , \tag{12}$$

where e is the elasticity of the supply of old workers with respect to the stayer wage:

$$e = \frac{d[\log(1 - M)]}{d[\log(w_s)]} . \tag{13}$$

Thus, if firms pay stayers their marginal products, then the town government should collect a tax from stayers that exceeds K'. It follows from (10) and (12) that young workers pay a tax that falls short of K'.

In contrast, the town has no monopsony power over movers from other towns. Thus, it accepts movers until their marginal product equals the mover wage plus the marginal congestion cost. In symbols, the first-order condition for L_{mt} is

$$F_2(L_y, L_o) = w_m + K' . \tag{14}$$

This condition is satisfied if competitive firms pay movers their marginal products and the government collects a head tax equal to their marginal congestion costs.

4. Properties of the equilibrium

In this section we discuss the efficiency and distributional properties of the equilibrium that has just been described. As we shall explain, the equilibrium is inefficient because migration is wasteful. This form of inefficiency goes unrecognized in standard models in local public economics, which typically examine the polar cases of complete immobility and costless mobility. Thus, the case of imperfect mobility is unlike either of the extreme cases that might be used to approximate it. From a distributional viewpoint, we shall see that the burden of moving costs falls solely on workers, not on landowners. Ex ante, all workers are worse off because of moving costs. Ex post, however, some may be better off.

As a benchmark, suppose first that mobility is costless. In this case, no town has monopsony power over workers, so *all* workers are paid their marginal products for *each* period, net of marginal congestion costs. As in any symmetric, steady-state equilibrium, each town employs $L^* = L^T/n$ young workers and L^* old workers. Thus, (12) and (14) give $w_s = w_m = F_2(L^*, L^*) - K'(2L^*)$, and (10) then implies that $w_y = F_1(L^*, L^*) - K'(2L^*)$. Obviously, the present value of lifetime income must then equal the present value of marginal products minus marginal congestion costs. This costless-mobility equilibrium is also first-best efficient, and again the distribution of income is determined by marginal productivity considerations.

When mobility is costly, each town continues to employ L^* young workers and L^* old workers, with marginal products $F_1(L^*, L^*)$ and $F_2(L^*, L^*)$, respectively. But now the old workers consist of stayers and movers, where the latter have engaged in inefficient migration to avoid being paid less than their net marginal product. Specifically, (12) and (14) imply that the steady state satisfies

$$F_2(L^*, L^*) = w_m + K' = \frac{(w_s/(w_s + K')) + e}{e}(w_s + K') . \tag{15}$$

In other words, movers are paid their net marginal product, whereas stayers are paid less by an amount that is negatively related to the supply elasticity, e. Those old workers with sufficiently low migration costs choose to migrate to increase their wage from w_s to w_m, and our assumption that some workers possess arbitrarily low moving costs (i.e. $M(0) > 0$) implies that some old workers will indeed choose to move. This migration is clearly inefficient.

The full cost of this inefficient migration is borne entirely by workers. To see this, consider first their lifetime wage incomes. Landowners pay the members of a given generation an amount w_y when young and $Mw_m + (1 - M)w_s$ when old, where M is again the portion of the old who move. By substituting from (10) and (14) for w_y and w_m we find that

$$w_y + \frac{Mw_m + (1 - M)w_s}{1 + r} = F_1 - K' + \frac{F_2 - K'}{1 + r} . \tag{16}$$

This is the lifetime wage income received under the first-best allocation, where workers are paid their marginal products in each period. Thus, *allowing for costly mobility does not affect expected discounted lifetime wage income*. It follows, then, that the workers' expected net income is lower in the imperfect mobility equilibrium by the amount of the expected moving costs,

$$\frac{M(\mathrm{E}c)}{1 + r} , \tag{17}$$

where $\mathrm{E}c$ is the expected cost of moving. Thus, in an ex ante sense, workers bear the full costs of mobility; no costs are passed on to landowners.

However, moving costs may actually leave some of these workers better off, in an ex post sense, than they would be in the first-best allocation (and in the equilibria with costless mobility or, as discussed below, with complete immobility). Those workers who happen to draw low moving costs from the $M(\cdot)$ distribution will end up better off than those whose moving costs are so high that they do not move. So, paradoxically, while moving costs lower expected utilities for all workers, *those workers who actually relocate and incur the moving costs are better off ex post than those who remain behind*. It is these workers who may actually be better off ex post than they would be under the first-best allocation. To see this, note that the present value of lifetime income for a worker who changes towns is $w_y + (w_m - c)/(1 + r)$. Using (10) to substitute for w_y and then using (14), it follows that the ex post lifetime net income of a migrating worker exceeds that in the first-best equilibrium if

$$w_y + \frac{w_m - c}{1+r} - \left[F_1 - K' + \frac{F_2 - K'}{1+r}\right] = \frac{(w_m - w_s)(1-M) - c}{1+r} > 0 ,$$

or

$$c < (w_m - w_s)(1 - M) . \tag{18}$$

Under our assumption that some workers possess arbitrarily low moving costs, it follows that a non-negligible set of workers will end up with higher lifetime incomes in the presence of moving costs than in the case of complete immobility. Even if all workers possess moving costs above some positive value, (18) can still hold for some subset of them. Of course, these gains for some are more than offset, in ex ante terms, by the losses suffered by those with high mobility costs. Costly mobility not only lowers mean incomes for workers, as shown by (17); it also increases the variability of lifetime net incomes. Given that workers are risk averse, the ex post inequality of net incomes creates additional social costs.

With workers bearing the full costs of mobility, the determination of land values will obviously not depend on these costs. However, land values *are* directly affected by the differential taxation of young and old workers. To see this, observe that (7) can be rewritten as follows in the steady state:[10]

$$R_t = \sum_{i=t}^{\infty} \frac{[F - (F_1 - K')L^* - (F_2 - K')L^* - K(L^* + L^*)] + (r/(1+r))(1-M)(F_2 - K' - w_s)}{(1+r)^{i-t}} . \tag{19}$$

The first term represents the land rent each period that landowners would receive if they paid all workers their marginal products net of marginal congestion costs. The second term is present because of the reduced wage paid to stayers. In particular, (12) shows that $F_2 - K' - w_s = w_s/e > 0$.

This extra term may seem at odds with the previous finding that the lifetime wage incomes of workers are unaffected by costly mobility. However, land values in any period t depend not only on lifetime wage incomes paid out to generations of workers born in period t and thereafter, but also on the wages paid out to stayers in period t, who were born in period $t-1$. Costly mobility results in a reduction in these stayer wages,

[10] Proof: Rewrite Eq. (10) as follows in the steady state:

$$w_y + (1-M)w_s = F_1 - K' + (1-M)(F_2 - K') + \left[\frac{1}{1+r} - 1\right](1-M)[F_2 - K' - w_s] .$$

By substituting this expression into (7) and using (14), we obtain (19).

thereby lowering the discounted value of all wage payments from period t onward. The second term in (19) reflects the resulting gain in the value of land.

We should not jump from the observation that costly mobility raises R_t to the conclusion that these costs benefit landowners. In fact, an anticipated elimination of moving costs in period $t+1$ will neither benefit nor harm landowners. To see this, observe first that the old in period t will be unaffected by this change. Because mobility is still costly for them, they will continue to suffer monopsony exploitation. Workers born in period t and thereafter will no longer receive a wage premium while young, but neither will they be exploited when old; the present value of their wage incomes will remain unchanged. Thus, landowners pay the same amount as before to the old in period t, and they pay the same amount, in present value terms, to the period-t young and to all future generations. Hence, the net value of land in period t, or any other period, is unchanged by this elimination of moving costs. In terms of Eq. (19), the second term is eliminated in the summation from period $t+1$ onward, but the fall in the young wage in period t causes the landowner income to increase in period t by an amount that exactly offsets the future losses. If the elimination of moving costs were not anticipated, then the period-t young wage would not decline, implying that landowners would indeed be harmed. But we can say that an *anticipated* elimination of moving costs is Pareto improving; all workers gain in an ex ante sense, and landowners are unaffected.

As a final comparison, assume that workers are completely immobile. In this case the supply elasticity, e in (15), equals zero. Thus, w_s is lowered to the minimum level at which stayers are willing to supply labor, which is zero in this model, i.e. all wage income of older workers is taxed away. By setting $M=0$ in (10), however, we see that competition for young workers then drives up the young wage to the value where

$$w_y = F_1 - K' + \frac{F_2 - K'}{1+r} . \tag{20}$$

In other words, young workers receive a wage equal to the expected present value of their lifetime marginal products net of marginal congestion costs (and this expected value now equals the actual value because there are no uncertain moving costs). Under our assumption of perfect capital markets, there is no problem with this amount being paid entirely in the first period. This no-mobility equilibrium is clearly first-best efficient, although R_t again reflects a redistribution of income from old workers to landowners, as described above. Note also the lifetime incomes for all workers are identical.

To conclude, there is an ex ante sense in which costly mobility, as compared with complete immobility or complete mobility, leads to a Pareto-inferior outcome where all utility losses come at the expense of workers.

5. Public good provision

This section shows that the public good supply is also inefficiently chosen by local governments. Specifically, we present a simple example in which the Samuelson rule for efficient public good provision is violated in the direction of overprovision. Initial intuition might suggest that this should not be the case. We have proved the existence of wasteful migration, due to the exercise of monopsony power by local governments, but why should a local government provide the workers who choose to live in the town with an inefficient mix of private income and public goods? The answer is that changing the mix that confronts young workers alters their saving behavior, thereby affecting the supply curve for these workers when they turn old in the next period. By tolerating some violation of the Samuelson rule, the town can effectively 'commit' to a future tax policy that keeps fewer workers from migrating.

For our example, assume that each worker possesses a lifetime utility function which is separable between private goods, the public good, and moving costs. Assume also that the worker benefits from public good provision only while young. (For example, young workers are households who benefit from sending their children to public schools, whereas the children of old workers have completed their schooling.) In symbols, the lifetime utility function for a young worker in period t is

$$U = u_{\mathrm{y}}(x_{\mathrm{y}t}) + u_{\mathrm{o}}(x_{\mathrm{o},t+1}) + v(G_t) - c \,, \tag{21}$$

where c is again moving costs, $x_{\mathrm{y}t}$ is private consumption while young, $x_{\mathrm{o},t+1}$ is private consumption while old, and G_t is the public good level. In this formulation, c may be thought of as representing the level of 'attachment' that the worker develops for a town while young. For simplicity, we also assume that the public good is pure in the Samuelson sense (no congestion costs). Finally, we assume that the distribution of moving costs is uniform.

In deciding whether to reside in a given town, a young worker in period t faces wage $w_{\mathrm{y}t}$ and public good level G_t, and predicts the value of the town's future stayer wage, $w^{\mathrm{e}}_{\mathrm{s},t+1}$. The analysis of the rent-maximizing stayer wage is made slightly more complex by the assumption that moving costs are specified in utility terms. A unit change in $w_{\mathrm{s},t-1}$ affects the utility of an old resident by an amount equal to the marginal utility of second-period consumption. This marginal utility determines the proportion of period-t young workers who become stayers in $t+1$, and it depends on the stayers' consumption level and, therefore, their savings while young. To take this savings effect into account, we may solve a young worker's utility maximization problem to obtain the value of the worker's wealth carried forward into period $t+1$, defined as a function of the young wage in t and the expected stayer wage in $t+1$: $s(w_{yt}, w^e_{s,t+1}) = (1+r)[w_{yt} - x_{yt}(w_{yt}, w^e_{s,t+1})]$. The mover wage available outside the town is omitted as an explicit argument of this function, because we again consider a steady-state equilibrium where this wage is constant across time at w_m. Of course, expected wages must equal actual wages in equilibrium. Thus, we may substitute the function $s(w_{yt}, w_{s,t+1})$ into the government's first-order condition for $w_{s,t+1}$ in period $t+1$. As a result, w_{yt} becomes an 'initial condition' for the optimization problem in $t+1$, and the optimal value of $w_{s,t+1}$ is then a function of w_{yt}: $w_{s,t+1} = \beta(w_{yt})$.

The critical property of this function, which the appendix proves, is that $\beta'(w_{yt}) < 0$, i.e. a rise in the period-t young wage leads to a reduction in the period-$(t+1)$ stayer wage. This negative relation is caused by the positive effect of a rise in w_{yt} on savings, which gives workers more income when they turn old. With more income, the marginal utility from the stayer wage, $w_{s,t+1}$, declines, thereby lowering the negative impact of a decline in $w_{s,t+1}$ on the number of stayers. As a result, the government responds in period $t+1$ to a rise in w_{yt} by lowering $w_{s,t+1}$.

Consider now the town's choice of the public good supply in period t. The solution to a young worker's utility-maximization problem allows us to write expected lifetime utility as a function of the wages and public good supply, $V^e(w_{yt}, \beta(w_{yt}), w_m, G_t)$. In equilibrium, the town is constrained to choose values of w_{yt} and G_t that equate this expected utility with the expected utility available elsewhere:

$$V^e(w_{yt}, \beta(w_{yt}), w_m, G_t) = U^* . \tag{22}$$

Thus, we may incorporate this equality into the land-value-maximization problem as a constraint. The objective function is again discounted land rents, which we write by amending (7) as follows:

$$R_t = \sum_{i=t}^{\infty} \frac{F(L_{yi}, L_{oi}) - w_{yiyi} - w_{si}[1 - M_i]L_{y,i-1} - w_m L_{mi} - G_i}{(1+r)^{i-t}} , \tag{23}$$

where the unit cost of the pure public good is set at one. Letting λ_t denote the Lagrange multiplier on constraint (22), differentiate the Lagrangian with respect to G_t to obtain the following first-order condition:

$$1 - \lambda_t(\partial V^e / \partial G_t) = 0 . \tag{24}$$

Next, differentiate with respect to w_{yt}:[11]

$$L_{yt} - \lambda_t[\partial V^e/\partial w_{yt} + (\partial V^e/\partial w_{s,t+1})\beta'(w_{yt})] = 0 . \tag{25}$$

By combining (24) and (25) and omitting time subscripts to denote the steady state, we have

$$L_y \frac{\partial V^e/\partial G}{\partial V^e/\partial w_y} = 1 + \frac{(\partial V^e/\partial w_s)\beta'(w_y)}{\partial V^e/\partial w_y} < 1 . \tag{26}$$

The left-hand side of (26) is the sum of the marginal rates of substitution between the public good and income. Under the Samuelson rule for efficient public good provision, this sum should equal the marginal cost of the public good, which is set at unity. Instead, (28) shows that this sum falls short of one, implying overprovision of the public good.

To better understand this result, let us rewrite (26) in a more revealing form. First use the envelope theorem to write $\partial V^e/\partial w_y$ and $\partial V^e/\partial w_s$ in terms of the marginal utilities of consumption for young workers and stayers:

$$\partial V^e/\partial w_y = u'_y \quad \text{and} \quad \partial V^e/\partial w_s = (1 - M)u'_s . \tag{27}$$

By substituting these equalities into the RHS of (26) and then making use of the first-order condition for the stayer wage (Eq. (A.4) in the appendix), we have the final expression:

$$L_y \frac{\partial V^e/\partial G}{\partial V^e/\partial w_y} = 1 + \frac{u'_s}{u'_y}[F_2 - w_s]M'u'_s \beta' . \tag{28}$$

The second term on the RHS is present because the fall in w_y needed to finance a rise in G leads to an increase in the future w_s, causing fewer old workers to leave the town. Given that these old workers are paid less than their marginal product, this behavioral change benefits the landowners, lowering the marginal cost of public good provision. The second term gives the present value of this benefit.

There is a simple policy that will raise everyone's expected lifetime utility without changing migration levels: introduce a 'central planner' who can credibly commit to preventing towns from changing their future stayer wages from the current equilibrium level. This policy severs the connection between w_{yt} and $w_{s,t+1}$ given by the function β. Thus, towns can move resources out of public good production and into a higher young wage without incurring the cost of a fall in future stayer wages, which would discourage old workers from remaining in town. This hypothetical use of a

[11] By the envelope theorem, no derivative of period-$(t+1)$ land rents with respect to $w_{s,t+1}$ enters Eq. (25), because this wage is chosen to maximize the value of land.

central planner illustrates the main cause of inefficient public good provision in this model: local governments tolerate this inefficiency as a costly indirect means of committing themselves to a higher stayer wage in the future.

6. Conclusion

The preceding analysis has shown that relaxation of the assumption of costless migration means that local fiscal policies that maximize land values may not be compatible with economic efficiency, even when other idealized assumptions (e.g. the existence of many small jurisdictions) are maintained. The model has been deliberately structured so as to highlight one set of incentives for local policy that can arise when migration is costly for some households, namely the incentives for localities to differentiate their fiscal treatment between households that are more or less mobile in order to capture some of the locational rents that would otherwise accrue to the latter. In our simple model, all localities are symmetric and all households are identical in virtually all respects other than their attachment to place when old. For this reason, there is no real economic benefit to migration in the second period of the life cycle, and all such migration is driven by the efforts of relatively mobile households to escape fiscal exploitation. This migration, though individually rational, is socially costly.

The essential cause of inefficiency in this model is the response by mobile households to the efforts of local governments to exploit their monopsony power over some of their residents. In the extreme case of complete mobility, where migration is costless, this monopsony power vanishes and local policies are chosen efficiently. Somewhat surprisingly, inefficiencies also disappear in the extreme case of complete immobility, where migration costs are infinite and no old households are able to migrate. In this case, discriminatory fiscal treatment involves a lump-sum rent transfer from the old, who cannot respond by undertaking costly migration. Inefficiencies can arise only in the intermediate case of imperfect mobility, a result that suggests the need for caution when extrapolating results from idealized polar cases to more realistic intermediate cases. Similarly, the 'unequal treatment' property of the ex post equilibrium arises only because mobility costs are positive but not prohibitive and are not identical for all households. The attempt by local governments to maximize land values may therefore give rise to ex ante risk and ex post inequality in intermediate cases, even though this cannot occur in either of the polar extremes of costless migration or no migration.

The existence of inefficiencies with imperfect mobility suggests that there may be opportunities to structure institutions so as to obviate the inefficiencies. In the present case, it is the unequal treatment of older households that gives rise to inefficiencies. One way to prevent this would be for households to enter into binding long-term contracts to stay in the communities where they originally settle. Such contracts would prevent costly second-period migration. All households are assumed to be ex ante identical, so contracts could be written that would raise the ex ante utility of all residents. This would insure residents against the ex-post inequality in the distribution of welfare that would otherwise result from the unequal distribution of moving costs. However, in more realistic models, one can imagine that the costs of such contracts would outweigh their benefits, since households would value the freedom to migrate in order to take advantage of other locational differences among jurisdictions (for instance, employment opportunities) that could arise over time in ways that cannot be foreseen ex ante – considerations that are admittedly not present in our simple model but which would seem to be important in practice.

Another way to eliminate the inefficiencies associated with imperfect mobility is to insist on equal fiscal treatment of households, so that localities cannot exploit the differential locational attachments of different households. To some extent, public sector institutions do seem adapted to this purpose, since there are often basic legal constraints on the discriminatory fiscal treatment of resident households. On the other hand, efficiency might require some degree of differentiation of taxes and public service provision among different groups, and constraints on equal treatment might stand in the way of efficient tailoring of local policies to the differing demands of different groups – a complication that, again, is not explicitly captured in our model but which could be important in practice.

These remarks suggest lines of further research that might be fruitful. From an empirical viewpoint, it could be useful to investigate the extent to which local governments do or do not treat different types of households differentially in their tax policies and in their provision of local services. From a theoretical viewpoint, it would be useful to extend our model to reflect some of the heterogeneity of households that would give rise to some positive benefits from fiscal discrimination, in order to analyze the efficiency tradeoffs between socially costly and socially useful migration.

Finally, it is interesting to note that our model can be given a quite different interpretation. Suppose that there are many identical firms, each with some amount of a fixed factor. These firms employ both young and older workers and attempt to maximize profits. Some old workers find it relatively costly to switch jobs while others are more mobile, and firms may differentiate the wages that they pay to each category of worker. This is a rather natural description of labor markets with costly turnover. It is clear that the analysis of Sections 2–4 applies without change to this model. The public goods model of Section 5 could refer to some on-the-job amenity (e.g. child care) that benefits only younger workers. We may immediately conclude that such turnover is socially inefficient and inequality-increasing, and that its burden falls on workers but not on the profits of firms. This interpretation of the model, and its possible applications to issues of labor market institutions and policy, deserve further study.

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Appendix

This appendix derives the expected future stayer wage as a function of the current young wage: $w_{s,t+1} = \beta(w_{yt})$. To begin, the first-order condition for $w_{s,t+1}$, originally given by (11), requires only a slight modification to account for the current specification of moving costs as an argument of the utility function. The distribution of moving costs is again given by the function $M(c)$, but now the c possessed by the marginal emigrant in a given period $t+1$ equals the difference between utility levels of movers and stayers, instead of the difference between their wage rates:

$$\begin{aligned} \bar{c}_{t+1} &= u_o[s(w_{yt}, w^e_{s,t+1}) + w_m] - u_o[s(w_{yt}, w^e_{s,t+1}) + w_{s,t+1}] \\ &= u_{m,t+1} - u_{s,t+1} \, . \end{aligned} \tag{A1}$$

Thus, the fraction of old workers who leave the town in period $t+1$ is

$$M_{t+1} = M(u_{m,t+1} - u_{s,t+1}) \, , \tag{A2}$$

and the impact of a rise in $w_{s,t+1}$ on this fraction is

$$\mathrm{d}M_{t+1}/\mathrm{d}w_{s,t+1} = -M'u'_{s,t+1} \, , \tag{A3}$$

where M' is constant under the assumption of a uniform distribution of moving costs. Thus, the only change from (11) in the form of the first-order condition is the inclusion of the marginal utility $u'_{s,t+1}$:

$$F_2(L_{y,t+1}, L_{s,t+1})M'u'_{s,t+1} = (1 - M_{t+1}) + w_{s,t+1}M'u'_{s,t+1} \, , \tag{A4}$$

where use is made of the assumption that the public good is pure (no congestion effects). By combining this condition with first-order condition (14), and using the equilibrium requirement that $w^e_{s,t+1} = w_{s,t+1}$, we get

$$(w_m - w_{s,t+1})M'u'_{s,t+1} - (1 - M[u_{m,t+1} - u_{s,t+1}]) = 0 . \tag{A5}$$

Given the dependence between the utilities in (A5) and wages w_{yt} and $w_{s,t+1}$, we see that the left-hand side of (A5) defines a function $\Omega(w_{yt}, w_{s,t+1})$ with derivatives

$$\Omega_1 = (w_m - w_{s,t+1})M'u''_{s,t+1}(\partial s/\partial w_{yt}) + M'(u'_{m,t+1} - u'_{s,t+1})(\partial s/\partial w_{yt}) \tag{A6a}$$

and

$$\begin{aligned}\Omega_2 = &-u'_{s,t+1}M' + (w_m - w_{s,t+1})M'u''_{s,t+1}[1 + (\partial s/\partial w_{s,t+1})] \\ &-M'u'_{s,t+1}[1 + (\partial s/\partial w_{s,t+1})] .\end{aligned} \tag{A6b}$$

Since the income of movers exceeds the income of stayers, concavity of the utility function implies that $u'_{m,t+1} < u'_{s,t+1}$. If consumption in both periods is a normal good, $\partial s/\partial w_y > 0 > \partial s/\partial w_s > -1$. Together with the fact that $w_m > w_{s,t+1}$, it follows finally that $\Omega_1 < 0$ and $\Omega_2 < 0$. Hence, (A5) defines the function $w_{s,t+1} = \beta(w_{yt})$, with the derivative $\beta'(w_{yt}) = -\Omega_1/\Omega_2 < 0$, as required.

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