MOBILITY AND CAPITALIZATION IN LOCAL PUBLIC FINANCE:

A REASSESSMENT

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Abstract: We examine models of local public finance in which separated communities offer different development packages and agents choose among these. We challenge the prevailing view that mobility of agents imposes the correct development incentives on communities through effects on land values. We develop an alternative theory of migration incentives and show that it generates an incentive to overdevelop in that it leads to communities that are too congested relative to a first best ideal.
The main paradigm in local public finance has two features which have been up until now relatively uncontroversial, but which taken together have very strong implications for welfare economics. These assumptions are (1) free mobility among communities and (2) insulation of one community from the actions taken by other communities. In their strongest versions, these two assumptions interact to guarantee that local public decision-making cannot make anyone worse off and under weak behavioral assumptions must lead to a Pareto efficient outcome.

The Pareto efficiency mechanism frequently involves land values and is linked to the capitalization literature. When utility levels are given from outside, then improvements in amenities at home will raise land rents (thus, benefits are capitalized into land values) and local “club” managers who own the land will have appropriate incentives to institute such improvements. In this paper, we take issue with this paradigm. In particular, we will challenge the mobility assumption and show that when it is relaxed, land values may play a completely different role and decentralized decisionmaking may have quite undesirable welfare implications.

The paper is organized as follows. Section 1 sets out a framework for studying the local public issues of interest. The next section formalizes the two assumptions alluded to above, show why they are closely linked to capitalization and discuss the associated welfare economics. Sections 3 and 4 explore the consequences of dropping assumptions and demonstrate that a wide range of relationships (both positive and negative) are possible between land values and public amenities (broadly defined). We argue that under quite plausible conditions, the relationship will be negative and there will be private incentives to overdevelop. In the concluding section, we discuss the
implications of this analysis for applied welfare economics and, in particular, for the evaluation of
development projects in advanced economies.

1. The economic framework

Location choice plays a central role in the local public goods paradigm. Here we will think
of location as a discrete choice among a finite set of alternatives (so everyone will have a single
place of residence). This modelling choice forces us to treat land at each discrete location as
homogeneous, but is nonetheless more palatable (at least to us) than alternative 'continuous
location' models. Later in the paper we indicate how some of the relationships will look in a
continuous location formulation.

Since land plays a special role we will have separate notation for it and write the private
goods net consumption vector as $(c, l)$, where $l$ stands for land consumption and $c$ is the
consumption vector of all other private goods. We will distinguish between two types of collective
goods. First, there are those directly provided through group decisionmaking (label these $g$).
Examples would be museums, parks and civic centers. Second are those indirectly determined as
functions of economic activity (labelled $G$), such as congestion and pollution. Both these types are
collective in that they are not allocated through the market and are enjoyed (or suffered) to some
extent by everyone in the sharing group. Of course, use of services on such facilities (e.g. museum
visits) may be sold privately, in which case the associated variables are included in the consumption
vector.

Local public goods, and the associated local public economics are distinguished by their
limited local impact on citizens. Consequently, we model them in a way that admits local structure.
The most general way to accomplish this is to allow location to enter the utility function directly.
Then, localness can be captured through complementarities between location ($s$) and the collective
provision levels \((g,G)\). A much studied special case is that of pollution, where the air quality at location \(s\) is a function of ambient pollution and abatement activity at the source (say \(\alpha^s(G,g)\)).

It will be convenient to think of households as solving a two stage problem. First, conditional on being in a particular location they solve the problem of choosing the continuous consumption variables. Then, they optimize over the discrete choice of location. The outcome of this process is naturally the same as if all choice variables are contemplated simultaneously, but our sequencing is mathematically convenient. We allow households to be heterogeneous both with respect to preferences and incomes; however, we do assume there are only a finite number of different types (indexed by \(h\)).

The household (type \(h\)) last stage problem (conditional on location \(s\)) takes the form:

\[
\text{Max}_{c,\ell} U^h(g,G,c,\ell,s) \\
\text{subject to} \\
p^s c + r^\ell = y^h,
\]

where \(p\) and \(r\) are the market prices of goods and land (at the specified location), and \(y\) is exogenous income (to be discussed further below). Note that we are allowing all market prices to depend potentially on location in the formulation. This problem naturally defines an indirect utility function of the form \(V^h(g,G,s,p^s,r^\ell,y^h)\). Frequently, we will abbreviate this and other similar functions as \(V^h\).

When the household has a choice over a set of locations \(S\), the first stage problem may be represented as

\[
\text{Max}_{s \in S} V^h(g,G,s,p^s,r^s,y^s) \\
(y \text{ is not indexed, since exogenous income must be independent of location choice.})
\]

Note that if similar individuals end up residing at different locations they must get the same level of utility at each of these locations.

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\(^1\)We treat \(g\) and \(G\) as scalars for convenience. However, there is no difficulty in principle to let them be vectors of arbitrary dimension.
Our final restriction is to consider an essentially static model. The only sequential element in our model will be of the ex ante/ex post type: We assume that there is an ex ante status quo (before projects are initiated) in which all private markets clear so that prices are determined as functions of the status quo provision levels; these functions will be represented as \( r(g) \), \( p(g) \). After a project is initiated a new ex post equilibrium is immediately established and capitalization occurs to the extent that the resulting capital gains (or losses) on land reflect the associated changes in amenity levels.

2. **Sufficient conditions for exact capitalization**

The two conditions discussed at the outset can be formalized as follows. Suppose that for each type \( h \) living at location \( s \), we assume that there exists a location \( \sigma \) (which may depend on \( h \) and \( s \)) satisfying

1. **Isolation**: For those living at location \( \sigma \) there is no marginal direct effect from a change in \( g \), or \( G \), nor is there any induced marginal effect on the rental rate at \( \sigma \). Stated mathematically:
   \[
   \frac{\partial V^{\sigma}}{\partial g} = 0, \quad \frac{\partial r^{\sigma}}{\partial g} = 0
   \]  
   (and similarly for \( G \)).

2. **Substitution**: Type \( h \) lives at location \( \sigma \) and is freely mobile between residence locations. Mathematically, \( V^{hs} = V^{ho} \) for all locations \( s \) at which \( h \) is resident.

Thinking of a world in which congestion plays a significant role, the isolation assumption makes the most sense when location \( \sigma \) is at a considerable distance from location \( s \), namely when the two locations are in different states or metropolitan areas. Then, the substitution assumption will hold as long as metropolitan areas are heterogeneous in types and households are freely mobile between areas. We postpone for the moment a discussion of the reasonableness of these assumptions taken together, and show how they are related to capitalization.

A. Conditions for land value capitalization

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\(^3\)Implicit in these definitions is the assumption that any type living at \( s \) before the project continues to live there afterwards. This stipulation can be removed at some cost in complexity in the precise statement of assumptions and conclusions.
Suppose a local public improvement is made in the community of region $s$. Then, our pair of assumptions implies that people from region $\sigma$ will want to move in unless prevented from doing so by some change in market variables. If land rents are the only variables with the flexibility to serve this function, we will find that benefits are capitalized into land values. To see, this, add the assumption:

3. Market connection: We state two versions of this assumption:

   **Strong market connection**: Market prices (to households) for all nonland private goods at all locations are unaffected by the marginal project. Mathematically: $\nabla_g p^s = 0$, all $s$.

   **Weak market connection**: The change in nonland market prices is the same at $s$ as it is at $\sigma$, and the corresponding demands are location independent (separable). Mathematically: $\delta p^s = \delta p^\sigma$, and $c_{hs} = c^h$ all $s$ and $h$.

Capitalization can take a number of different forms and be represented in a corresponding variety of different ways. For a compendium of such results and references to the earlier literature, see Starrett (1988). For a discussion of empirical work in this area, see Yinger et al (1988). Here, we will confine ourselves to first order analysis; namely, we will assume that projects are sufficiently small so that a first order approximation to the corresponding change in utility is exact. Such a first order project change will be represented as $\delta g$, and enough smoothness will be assumed so that a sufficiently small change in $g$ generates first order changes in all other variables (including $G$).

There are several variants of capitalization depending on exactly what is measured. Here, we will focus on **hedonic capitalization** which occurs at a set of locations when first order change in land rent there is exactly equal to the first order change in net valuation of direct benefits from amenities and indirect costs from congestion/pollution (all measured in numeraire units). We show now that our three assumptions together imply hedonic capitalization.

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3For a compendium of such results and references to the earlier literature, see Starrett (1988). For a discussion of empirical work in this area, see Yinger et al (1988).

4For further discussion of capitalization variants, see Starrett (1988), Ch.13.
Since the substitution condition holds before and after the project, it can be thought of as an identity in \( g \). Differentiating this identity, normalizing by the marginal utility of numeraire\(^5\) and using duality relationships yields:

\[
\Omega^h g \delta g + \Omega^h G \delta G - c^h g \delta p^s - v^h r^s + \delta y^h \\
= - c^h g \delta p^a + \delta y^h,
\]

where \( \Omega \) stands for the marginal rate of substitution between collective good \( x \) and numeraire, and we have omitted terms involving \( g \) and \( r \) on the right hand side using the isolation assumption. Further, not only do the income changes (which must be independent of location choices)\(^6\) cancel, but due to market connectedness (either version) so do the terms involving \( \delta p \). Rearranging terms, and summing over all affected locations yields the hedonic capitalization formula:

\[
\sum_{h,s} \Omega^h g \delta g + \sum_{h} \Omega^h G \delta G = \sum_{h,s} \delta y^h \delta r^s.
\]

**B. Assessing the assumptions**

The full implications of our framework for welfare economics can be best understood by thinking about the ways in which the isolation and substitution assumptions interact. Notice that whenever both assumptions hold, the model takes on a competitive flavor--each agent is at all times indifferent between the 'active' community and an outside option which is affected only indirectly, if at all, by the project. In the extreme case where price and income effects in the outside world are negligible, reservation utility levels would be given, and all welfare benefits are capitalized into local land values. In this context, various authors have shown that if the local government owns local

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\(^5\)Actually, even though we are comparing people who are identical in all respects, there is reason to believe that the marginal utility of income may not be the same at all residence locations. This possibility has interesting implications for welfare economics first noted by Mirrlees (1972). However, we will assume that it does not arise here.

\(^6\) The one caveat here is that there cannot be any location specific head taxes. If there were then, except by chance, two people of the same type (and thus, the same disposable income) could not live at different locations and the substitution assumption never could hold. Aside from this restriction, nothing need be assumed about the method of public finance.
land and maximizes land values (thus internalizing the local public externality) the resulting decisions will be Pareto efficient; and in any event, there is no way any agents can be 'hurt' by the public action except as their incomes might be indirectly reduced through price changes.

The capitalization part of this story does rely in addition on market connectedness. It is easy to see that this assumption is necessary. For example, in Starrett (1991) we show that when the developer has some discretion over the wage at the development site (so that the wage market is local in character), land value capitalization is unlikely and 'wage capitalization' is more likely. However, regardless of what market variables do the equilibrating, the welfare economics will be much as described above.

Obviously, the two assumptions in conjunction are very powerful, but are they jointly reasonable? We think it is hard to argue that the substitution and isolation assumptions can simultaneously hold exactly--when households are constantly on the margin of moving in or out, such movements are almost certain to generate some degree of fiscal externality. The most general capitalization models recognize this and introduce appropriate externality terms into the formulas; these vitiate the exact one-for-one nature of the relationship but still tend to leave a strong positive association.

However, we want to argue that the structural mobility assumption is in fact inappropriate in this context anyway, and that replacing it with something more reasonable has farreaching consequences for the resulting welfare economics.

In particular, we want to ask what motivates the people who migrate across significant distances. Of course, this is an empirical question and one which we cannot answer definitively here. However, we think it is easy to argue that such people are not in 'infinitely elastic' supply (at

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7There is a big hidden assumption here, namely that the decisionmaking process would generate an equilibrium outcome after households vote with their feet; unfortunately, such an equilibrium does not exist in many circumstances; see, for example, Bewley (1981). Also it is important to note that the free rider problem is not 'solved' by these models but essentially assumed away by having common knowledge of preferences.

8This literature is summarized in Starrett (1988), Chapters 11,13.
a given utility level) as required by the full capitalization model. We made this case for the LDC context in Starrett (1991) where we argued that the numbers of people leaving peasant societies are quite limited and the decision was not motivated by purely economic considerations.

But even in more advanced societies (where economic motivations are presumably more important) these same considerations would apply to new households, whose numbers are determined by the (mainly noneconomic) decision to have children and who have no well defined fallback option. They also apply to those who are transferred or lose jobs. We think that these groups constitute the main source of intercity migration.

3. A model with noneconomic migrations

We consider a model now in which some subset of economic agents are always moving for noneconomic reasons. On top of this we retain some market discipline in that there will be long run tendencies for agents to move to areas where their type enjoys higher utility. We will show that in this circumstance, overdevelopment is a distinct possibility. In the subsequent section we will see how incentives linked to land values can exacerbate the overdevelopment.

For this discussion, we simplify the model in a number of ways. First, we drop the spatial reference and assume that private goods prices are unaffected by project decisions. Further, we assume that congestion can be measured by the number of agents sharing the local public good(s). (The sharing group will now be referred to as a club). Finally, we assume a representative agent model where there is only one type and equal treatment, whereby all members of a club get the same allocation. With these simplifications, the indirect utility of a representative agent effectively depends only on local public goods provision \((g)\) and number sharing \((n)\); we label this function \(W(g,n)\).

Here we suppose that group decisions are made centrally in an optimal way (given the equal treatment restriction). We label this assumption rational behavior (RB):

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\(^9\text{Again, there would be little qualitative difference in results with many types, as long as there were no ‘Tiebout sorting’ of types among clubs.}\)
In this section we drop the type index since there is only one type.

Differentiability in \( n \) is naturally problematic if we think of households as integer units. As in much of the related literature, we employ an approximation in which \( n \) is treated as continuous. Clearly, this approximation will not be very good unless communities are large relative to the size of a household. For more discussion of the issues involved here, see Starrett (1988) and Berliant (1985). Quasiconcavity captures the idea that increasing membership with a fixed facility first increases representative utility (as the fixed cost is spread) and then decreases it (as congestion dominates). Note that the last part of this assumption is there simply to assure that scale economies are worth something; otherwise, all outcomes will degenerate to ones in which service clubs dominate.

The superscripts on \( g \) and \( n \) now index club, the second superscript indexing production sector will be summed over and suppressed in this section.

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\(^{12}\)The superscripts on \( g \) and \( n \) now index club, the second superscript indexing production sector will be summed over and suppressed in this section.
ized by levels of services per person and resource tax per person and yields utility level per member of $w^o$. We will maintain throughout the assumption that there are some economies of size in other types of communities. Namely, we suppose that there exists a range of sizes for which $V(n) > w^o$.

The main role played by service clubs in the sequel is to prevent us from getting locked into a 'one-club' configuration; when a single club gets too big, members will prefer to opt out into a service club. Indeed, in much of the sequel we will assume that no two-club configuration could survive such forces. To be precise, we assume the presence of scale diseconomies (SD):

(SD) For any $n^1$, $n^2$ that sum up to total population,

$$\min_{i} V(n^i) < w^o.$$  

Verbally, if we tried to put the total population into two clubs, at least one of them would be sufficiently congested so that its members would prefer to opt out to a default service club. We let $n$ stand for the largest 'viable' club, satisfying $V(n) = w^o$.

Households take as given club offerings (including membership) and will make an economic decision to move only if some existing club dominates their own. As in evolutionary models, we are prevented from being stuck in configurations where memberships are badly wrong by the presence of exogenous perturbations (mutations). The role of mutations in our concept will be played by m-migrations. Given any ex ante configuration $(n^1, \ldots, n^f)$, a m-migration occurs when $m$ people move from an existing community $(j)$ to another community $(k)$, which could be an existing community or a new service community.\(^\text{13}\)

Because of scale economies and diseconomies, allocations will necessarily change when migrations occur. In principle people might be able to predict this and use the information in deciding where to move. However, here we rule this out by assuming Naive Sorting (NS):

\(^{13}\text{It would be more reasonable to assume that when M people happen to leave a particular community, they tend to disperse among a variety of other communities and similarly, that when M people arrive, they come for a variety of other places. Our assumption could be written in that way with very little change in the results (but considerable extra expositional complexity).}
(NS): Given any status quo configuration, each household chooses (in the subsequent moving phase) a community \( j \) for which

\[
j \in \arg \max_i W(g', n');
\]

in addition \( M \)-migrations up to size \( M \) occur from time to time among all pairs of existing communities. Notice that sorting is myopic here in that no one takes into account the impact that moving could have on sharing numbers.\(^{14} \) Note further that, in the absence of \( M \)-migrations, all communities that retain members after a moving stage must have offered the same status quo utility level.

The migrations are short term phenomena that will be permanent only if they are consistent with long run incentives. A \( M \)-migration is termed reversing relative to a reference utility level \( v \) if

\[
V(n^k+m) < v \text{ and } v > V(n'-m).
\]

Suppose we are at a status quo of the iterative process with associated utility level \( \psi \). Then if an \( M \)-migration is reversing, there will be an immediate incentive (even after reoptimization) for households to leave the temporarily larger community and to join the temporarily smaller one. Conversely, if an \( M \)-migration is not reversing, then at least one of the two affected communities has 'staying power' in that it will not revert immediately toward the previous state. (Note, however, that this 'instability' interpretation does depend in a subtle way on our assumption (SD) that any viable equilibrium will involve at least three clubs; only if there are at least three clubs will the status quo utility level still be represented in the population after a \( M \)-migration.)

The current set of assumptions motivates the following definition of equilibrium: A configuration of public facility packages and associated memberships \( <g', n'> \) constitutes a \( M \)-stable equilibrium if there exists a number \( \psi \) such that

\[
(M1) \ V(n') = W(g', n') = \psi \geq w', \text{ all } j \text{ with } n'>0,
\]

\(^{14}\) Of course, when numbers change, the public provision levels generally will change in the next voting phase; however, except by chance the subsequent utility level will differ from that expected.
(M2) For all 0 < m ≤ M, every m-migration is reversing relative to ψ.

M-stable equilibria will constitute the rest points for dynamics of the following sort. Some household must always want to move if another club is enjoying higher utility than they are in the status quo (so that movement surely will not stop until a ψ of (M1) is established). Further, regardless of utility levels, there will be random m-migrations (up to size M) occurring all the time; condition (M2) requires that these moves be 'shortlived' in that as soon as they occur, they generate countervailing movements: members of the new 'larger' community will want to move out (to somewhere in the world at large) and others from the world at large will want to move to the new 'smaller' community.\(^{15}\)

We characterize the set of M-stable equilibria in a series of claims. For simplicity, we deal with the case in which there is only one local maximum to the function \(V(.)\);\(^{16}\) to be more precise, we assume

(SQ): \(V(.)\) is strictly quasiconcave and achieves an interior maximum at \(n^*\). It is immediate from the definitions that we can associate with a M-stable equilibrium the unique utility level that will be achieved by its 'stable' communities. Label this level \(ψ\).

Claim 2: Given (RB), (SD), (NS) and (SQ), No M-stable equilibrium contains service clubs. Proof: If a service club were to be included, the utility level would have to be \(w^o\). Consequently, in any m-migration (m sufficiently small), the service club losing members cannot be made worse off and such a migration would not be reversing.\(^2\)

Claim 3: Under the conditions of claim 2, all communities in a M-stable equilibrium are identical. Proof: Given (RB) and (SQ), if the M-stable equilibrium contains two 'different' communities \((i,j)\) it must be that \(r_i < n^* < r_i\) (after a possible relabelling). Also, using quasiconcavity again, if \(m\) is small enough so that \(r_i + m < n^* < r_i - m\), we must have

\(^{15}\)The presence of at least one outside world community is assured for any configuration satisfying (M1) by our assumption (SD). It is possible to conduct a parallel analysis without assuming anything about scale diseconomies if two-community situations are handled separately.

\(^{16}\)For analysis of more general forms for \(V(.)\) See Starrett (1993).
\[ V(n^i+m) > V(n^i) = \varphi \] and also \[ V(n^i-m) > \varphi. \]

But the first of these inequalities implies that an \( m \)-migration from \( j \) to \( i \) is not reversing relative to \( \varphi.\)

Next, define a community size \( N(M) \) as follows:

\[
N(M) = \inf\{n > 0 | V(n-M) \geq V(n)\}
\]

Clearly, under maintained assumptions, \( N(M)-M < n^* < N(M) \). (see Figure 1)

**Claim 4**: The only candidates for \( M \)-stable equilibria are sets of identical clubs of size \( n \in [N(M), n] \).

Furthermore, if the population can be divided into such a set of clubs, that set constitutes an \( M \)-stable equilibrium.

**Proof**: If \( n > n \), members would leave to join service clubs. On the other hand, when \( n < N(M) \), then by the definitions, \( V(n-M) < V(n) \) so that an \( M \)-migration among such clubs will not be reversing. By contrast, with \( n \in [N(M), n] \), every \( m \)-migration \( (m<M) \) is reversing since (then) \( V(n-m) > V(n) > V(n+m) \), the last inequality following from quasiconcavity.

Note that the 'window' \([N(M), n]\) may be empty, in which case there are no equilibria. This is the case in which there are insufficient scale economies to prevent communities from dissolving into service
clubs in response to out- migrations. But even if the window is not empty, equilibria still need not exist due to the aforementioned integer problem.

Generally, there will be a range of equilibrium club sizes. Note that all of these will be too large (and therefore too congested) relative to the utility maximizing club size. The model is incomplete in that it does not resolve the attendant indeterminacy. This is partly because “club managers” are completely passive with respect to choice of club size. We next relax that assumption and show that under certain behavioral assumptions, the largest sizes compatible with equilibrium will be chosen.

4. Development in crowded areas: the capitalization argument in reverse

In the spirit of the previous section, we assume that migrating households must choose among a limited set of options and will always take the best among these. Club managers or developers within the club will provide the options and we will examine their incentives. Consider first an example. There will be three types of agents: landlords who own all the land and rent it out, workers who rent the land and work for developers and developers who hire workers and produce the numeraire good. Developers have a choice between "large" and "small" operations. A particular set of households (2n) can be accommodated by one large or two small operations. A small operation is sufficiently compact that all workers can live next to the "factory" and no transport costs are incurred. By contrast, in a large operation, half the workers live close, but half must live further out and incur a transport cost t. We assume that lot sizes and labor supply are fixed (and normalized to one) so that a worker’s net income is measured by wage minus rent minus transport paid.

Further, let the wage be exogenously given and the same in all operations. Note that rental rates cannot be the same even though all marginal land still has zero value. Those living close to a large operation will have to pay a rent of t in order to deter those living further out from wanting to

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17This example was first presented in Starrett (1997). We reproduce it here because we want to argue that it has much more general applicability than claimed there.
move in (we continue to assume free mobility within a community). Thus, large operations generate positive rent whereas small ones do not. All workers in large operations have net incomes of $w-t$; those outside incur the extra cost as transport while those inside pay it as a rent.

Suppose that developers make a net profit (in numeraire units) of $\pi_1$ in two small projects and $\pi_2$ in one large project (recall that these options absorb the same amount of labor). The following table summarizes the benefits to agents from two small projects versus a single large one.

<table>
<thead>
<tr>
<th>workers</th>
<th>developer</th>
<th>landlord</th>
</tr>
</thead>
<tbody>
<tr>
<td>small</td>
<td>$2nw$</td>
<td>$\pi_1$</td>
</tr>
<tr>
<td>large</td>
<td>$2n(w-t)$</td>
<td>$\pi_2$</td>
</tr>
</tbody>
</table>

Assuming that all these benefits count equally in the welfare calculations, we see that the large project is preferable if and only if

$$\pi_2 - nt \geq \pi_1.$$ 

Since, $nt$ measures the rent attributable to a large development, the capitalization argument has been turned on its head! Not only is there no net benefit attributable to rent increases, but there is actually a cost.

Note several key features of the example. First, the welfare of newcomers depends on what is done and in fact their interests are at odds with the developer's interests, especially if the latter own the land; newcomers are worse off when they must pay rent (or transport) since their wages are the same in both regimes. Obviously, such a conflict cannot occur in the utility taking model. Second, we have introduced an 'urban' spatial consideration through the presence of transport costs attributable to spatial separation. Here, transport costs are avoidable and constitute a deadweight loss to the economy as a whole. In such situations the market system, which counts transport as part of market cost, will distort the allocation of resources and ownership of land by developers worsens rather than improves this distortion. We will see now how these features carry over in a general urban model.
A. Structural characteristics of urban development

We examine a model with the following general features. Development activities will take place at a number of distinct 'sites' in an urban area. 'Improvements' might take the form of local public consumption goods (such as museums), local public production goods (such as roads and communication networks) or even private production goods (such as office space). Development projects will induce extra activity: new employment in connection with the improved production environment and new visits to the local public consumption facilities. We no longer assume anything about the alternatives available to these workers elsewhere and concentrate on the welfare of people assuming that the required extra workers will show up via a noneconomic migration. We will however generally assume a competitive labor market so that wages paid will be the same for all workers (of a type).

In the presence of urban spatial separation, increased activity will be accompanied by increased transport/congestion. Whereas we allowed such congestion to affect utility before, we now want to model it more explicitly. Transport will go up along routes between residence and workplace or public facility; congestion at a particular location is a function of density of traffic at that location and, consequently, can be expected to go up as well. This induced congestion imposes social costs (either by increasing transport requirements and/or directly lowering utility). Note in particular, that when people are commuting to the central place, total congestion suffered is likely to increase rather than decrease with distance.

Aside from the explicit modelling of transportation and congestion, the spatial model is just as in earlier sections of this paper. However, we will treat non-land private good prices as fixed (effectively assuming strong connectedness).16 Most of the time we will employ a nonland private good aggregate, although at certain points it will be useful to separate out labor time.

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16Similar results can be proved using weak connectedness; the analysis would parallel closely that in section 2.
The equilibrating forces of location choice will result in land rent changes and we seek to relate these to nonmarket project net benefits. We work out this relationship for a bare-bones prototype that captures the essential spatial features of the previous example, and indicate later how the results will be modified in a more realistic fleshed-out version.

B. A simple prototype

A general story with many sites will generate multiple spillovers among sites. We abstract from these at first by considering a single site and its surrounding area. To keep the congestion computations simple, we think of the congestion site and surrounding area as separately homogeneous (as in the preceding example) in that congestion will be thought of as uniform within each of these areas and transport distance will be thought of as uniform between any point in one of these areas and any point in the other.\(^{19}\) The development site region and surrounding area are labelled \(s\) and \(\sigma\) respectively.

Congestion in \(s\) (\(G\)) is simply a function of total employment there (\(L\)), and we choose units so that \(G=L\). We suppose that the 'damage' done by congestion can be represented by an associated increase in transport costs incurred by those who must commute from the outside area;\(^{20}\) \(T(G)\) will stand for this cost function.

As before, a project entails a first order change in amenity levels (\(\delta g\)) together with an associated incremental direct cost which is borne by the users (independently of where they choose to live in the community). The project will have further indirect effects on income and employment as it stimulates increased economic activity. We can model this effect explicitly as follows: Suppose \(F(g,L)\) stands for a private production function with \(\delta F/\delta g > 0\) (reflecting the role of \(g\) as a public input). Private firms will choose the employment level to maximize profits \((\pi = F(g,L) - wL)\), and assuming

\(^{19}\)This is the simplest possible spatial structure, and is essentially the same as the one employed in our example earlier.

\(^{20}\)It would make very little qualitative difference if we allowed congestion to affect utility directly as well; however, the following expressions would be somewhat more complicated.
that \( g \) and \( L \) are complementary in production \( (F_{g,l} > 0) \), both employment and indirect profits will go up with an increase in \( g \). Finally, there will be an indirect effect on land rents as land market equilibrium is reestablished.

Now we examine the problem faced by agents in the two areas. (We assume that everyone is alike, although there would be no essential differences with many types as long as they did not systematically sort themselves between the areas.) An agent in region \( s \) solves a problem of exactly the same form (absent congestion) as in previous sections since no transport costs are incurred, whereas an agent in region \( \sigma \) solves

\[
\text{Max}_{c,i} U(g,c,i,\sigma)
\]

subject to

\[
c + r_{i} + T(G) = y(g).
\]

where \( y(g) \) stands for disposable income after payment of taxes to support the local public expenditures. Disposable income depends on \( g \) because of these taxes; it may have a further indirect dependence to the extent that there is local ownership of land and local firms. Optimal choice generates an indirect utility function \( V(g,G,r_{i},y,\sigma) \).

The condition that agents are indifferent between the two locations yields the following identity in \( g \):

\[
V(g,G(g),r_{i},y(g),\sigma) = V(g,r_{s}(g),y(g),s).
\]

(Note that we assume that rent in the surrounding area is fixed by outside forces.) Differentiating and using the envelope theorem as before, we find

\[
i_{s} \delta r_{s} = [\Omega^{s} - \Omega^{i}] \delta g + (dT/dG) \delta G. \tag{1}
\]

Observe that (1) is general enough to nest the results of section 2. In particular, if there are no direct marginal effects at \( \sigma \), and no congestion, we are back to hedonic capitalization. However, in the present urban context where everyone is commuting to the site of extra 'amenities' (the central

\[21\text{Again, assuming the marginal utility of income does not vary over locations (see footnote 5).}\]
business district or CBD), it is much more reasonable that there be no differences in direct marginal effects between the regions, in which case our formula reduces to

$$\ell_s \delta \delta s = (dT/dG)\delta G.$$ (2)

Now, increases in land rent measure increases in transport (congestion) cost much as in the previous example. As happened there, the result would hold exactly in the aggregate if there happened to be the same numbers of people in the two regions. Note carefully that the incremental congestion is attributable directly to the project; in the particular story told above where congestion is proportional to employment in the CBD, we find

$$\delta G = \delta L = [-F_{gl}/F_{gL}]\delta g > 0,$$

but it should be clear that (2) holds more generally regardless of exactly how the extra congestion is induced.

The welfare-economic implications of our analysis are somewhat ambiguous due the presence of new agents and the accounting for absentee owners (if any). The desirability of the project depends on what alternatives (if any) there were for new households and how the owners of land and firms are counted. If there are no other alternatives for the new agents, the extra congestion may be unavoidable. However if, as in the first example, there is an uncongested alternative, this extra transport is a deadweight loss and the project involves an element of overdevelopment.

In any case, newcomers and old residents are worse off unless they own the resources whose value is enhanced. Especially if they own the land, developers will have an incentive to accommodate migrants in a way that increases the size of agglomerations and moves us away from the utility maximizing club sizes. And as we saw in the last section such migrations will not be reversing.

Therefore, in this situation land ownership by developers could create perverse incentives in that it would tend to make development more profitable the more congestion it generates. Even if the relationship is not exact as above, the same tendency will be present as long as there is a positive correlation between rent change and incremental congestion (see below).
C. Measures for the general urban model

The reader will see that our prototype was designed to parallel as closely as possible features of the example. Here we want to argue that similar qualitative results would emerge from a more general treatment. We consider extra complications in sequence.

1. location heterogeneity

Obviously, the location framework above is very special and we may expect our extreme discreteness assumptions to have an impact on the form of results. A general treatment would recognize far more locational complexity, explicitly identifying transport routes and measuring congestion/transport costs as a function of the distribution of commuters across the various zones within the overall urban area. However, as long as congestion costs incurred are greater for those commuting from outside the immediate development area than for those inside, land rent changes (in the development area) will respond positively to congestion increases. We can get a feeling for the likely form of this relationship by considering briefly a standard model with continuous location heterogeneity.

We examine the 'linear city' model of Solow and Vickrey (1971). Commercial activity takes place in a central business district (CBD) that (for convenience) we assume takes up no space. Residents live on both sides of the CBD and we assume that residential density is constant (and normalized to one). Note that with this assumption, increased employment necessarily expands the boundary (σ) of the residential area. Indeed, normalizing so that each household supplies one unit of labor, we will have δσ = δL/2. Congestion and transport costs depend only on distance from the CBD. Furthermore, the transport cost function is assumed linear in congestion (T(G) = T'G).

Congestion is determined as follows. Congestion at a particular location is measured by the volume of traffic through that location. At location s this is the number of people commuting from further out: σ-s. A household residing at τ experiences congestion G(τ,σ) equal to the total congestion associated with all locations it passes through while commuting, namely
\[ G(\tau, \sigma) = \int_0^1 (\sigma - s) \, ds = \sigma \tau - \tau^2/2. \]

Consequently, the incremental (first order) cost suffered by such a resident (label this \( \delta \Gamma(\tau) \)) is given by

\[ \delta \Gamma(\tau) = \Gamma'(\partial G/\partial \sigma) \delta \sigma = \Gamma' \delta \sigma. \]

(Note that congestion does increase with distance, in fact proportionally under this particular set of assumptions.)

Assuming (as above) that none of the other effects of the project are local in character (at least over the distances commuted), rents must adjust so that the net total cost of all locations changes by the same amount (say \( \Delta \)), namely,

\[ \delta \Gamma(\tau) + \delta r(\tau) = \Gamma' \delta \sigma + \delta r(\tau) = \Delta = \delta r(0), \text{ all } \tau \in (0,\sigma). \]

From this relationship it is clear that since the rent change is zero at the new boundary (where congestion is highest), it must be positive at all interior locations when congestion increases.

To obtain a neat exact relationship, define a location \( v[\tau] \) by the formula:

\[ \delta r(0) - \delta r(\tau) = \delta r(v[\tau]) - \delta r(\sigma), \]

and note that \( v[\sigma] = 0 \) and \( v[0] = \sigma \). Furthermore, given the linearity in \( \delta r(0) \), \( dv/d\tau = -1 \). Now, substituting (4) into (3), integrating over all regions in the town, and using the change of variable theorem, we find

\[ \int_0^\sigma \delta \Gamma(\tau) \, d\tau = \int_{v=0}^\sigma (\delta r(v[\tau]) - \delta r(\sigma)) \, d\tau = \int_{v=0}^\sigma \delta r[v] \, dv - \sigma \delta r(\sigma). \]

The left side of this expression represents total incremental congestion cost; we see that this quantity must fall short of total incremental rent increase (in the old community) to the extent that rent goes up at the old boundary.\(^{22}\) Thus, expansionary projects that increase community employment tend to raise local rents in a way that is still closely related to the increase in congestion costs imposed.

\(^{22}\)Note that rent cannot go down at the old boundary, since \( r(\sigma) = 0 \).
Exact relationships such as those derived above clearly are going to depend on the particular functional form assumptions employed. However, it seems likely that any reasonable modelling of congestion in the context of commuting to a central place will lead to positive correlations between congestion and rent changes, ceteris paribus.

2. Local effects of positive amenities

If the benefits of marginal amenities have differential spatial effects, then cancellation will not occur in (1); however, except in the aforementioned case of air quality (where living in the suburbs is likely to be more pleasant than living nearer the pollution source), it is hard to think of amenities that will be local enough in scope to matter much over the distance ranges we are considering. Consequently, it seems likely that the differential congestion effect will dominate.

3. Multiple sites and spillovers

The presence of multiple sites introduces spillover effects from the presence of households that work in one site, yet enjoy amenities at other sites. Such ‘outside users’ have an ambiguous effect on the welfare calculus above. Since outsiders are not obliged to visit the development site, and probably are not ‘at the margin’ of living near the site, their presence can have independent effects on rents near the site and net benefits conveyed by the site. To the extent that their use is increased, they will exacerbate congestion, raise rents near the site and reinforce ‘reverse capitalization.’ However, to the extent that their net utility from visits is increased (holding number of visits fixed), they will increase hedonic benefits with no corresponding effect on rents; if rents are going up due to increased congestion, this factor will generate a mitigating positive correlation between rents and hedonic benefits.

5. Summary and conclusions

Free mobility to and from an exogenous outside option has been a central feature of most models in local public finance. These features combine to create a competitive environment in which public decisionmaking cannot go too badly wrong and may in fact lead to first best outcomes under
certain behavioral assumptions. In this paper, we have challenged these underlying assumptions and shown that an alternative model may lead to quite perverse incentives to overdevelop in a way that will lead to communities that are too large and congested relative to the first best.

If communities do get too large and congested in the way just suggested, it is clear that a planner could improve things by forming a new community. And if the 'surplus' from so doing can be appropriated, we should ask why it does not happen. Note that we did not allow such experimentation in section 3 except at the level of small service communities. So at this point we should address the question of entry and why it might be restricted. The first reason involves scale economies and coordination failure. As we know, the underlying model of agglomeration involves scale economies in the provision of public services (or some other element of production). A significant and growing literature has demonstrated that decentralized decisionmaking in the presence of private information will fail to realize social economies of scale in these circumstances.\textsuperscript{23} This was our main motivation for restricting entry to constant-returns-to-scale service communities.\textsuperscript{24}

Further, even if the coordination failure difficulties could be circumvented, the incentives might not be there. The mere fact that a Pareto improvement is possible does not guarantee that developers will see the incentives to initiate the associated change. In the model of section 4, part of developers profits are derived by imposing negative externalities on third parties. The private benefit they appropriate from these externalities may well exceed any surplus they could recover from a first best plan. They may be better off by adding onto established communities than by starting a new one even though the latter course of action would be better for the overall social good.


\textsuperscript{24}Naturally, allowing for more aggressive entry will mitigate the severity of inefficiency in section 3.
REFERENCES


