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Land Ownership and Development Incentive: The Capitalization Externality

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LAND OWNERSHIP AND DEVELOPMENT INCENTIVES: THE CAPITALIZATION EXTERNALITY*

The development of land based resources and provision of associated social overhead capital are among the most important issues in public policy today. They have become increasingly important over time as we come to realize that the earth is a finite resource that can no longer be treated as a free good and must be managed carefully as with any scarce resource. Aside from a few countries (and the number seems to be shrinking every week) where the the government is directly involved in substantial production activities, the important issues for public policy are if and how to regulate private development and what public services to provide in conjunction. Brazil must decide how much clearing to allow in the Amazon basin and how many roads to build; the United States must decide how much drilling to allow on Alaska's North Slope; California must decide how many condominiums to allow on its Pacific coastline and what water resources to channel to southern California; Mexico must decide whether to allow Mexico City to become any larger and if so what public utilities to provide; and so on.

Even in "free market" economies it has been recognized for some time that some regulation is required when private operations generate externalities (such as environmental

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pollution).[1] However, once these are taken into account it is frequently argued that no further interference is justified: the profit motive can be counted on to provide incentives to undertake the socially desirable projects but not the undesirable ones. The process of allowing developers to compete for use of land is alleged to generate correct valuation of land; land will go to the developer who can put it to best use and its value will rise accordingly. Indeed, it has been further argued that developers need to be allowed to reap capital gains on the land they develop to induce them to provide the associated real social benefits.[2]

This argument that land values "capitalize" the benefits of associated projects is obviously important to evaluate. For example, it has been reported that a large percentage of the (intertemporal) profits made by developers in the Amazon basin comes from capital gains on land rather than profit from sales of outputs; indeed, many make losses in terms of real cash flow.[3] If such capital gains really are allowable as benefits, then the argument against such development must rely on the existence of somewhat tenuous externalities associated with loss of the rainforest, whereas otherwise they are clearly undesirable.

We will argue in this paper that while positive capitalization may occur to some

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[1]There are a wide range of externalities that are relevant and important in the contexts considered here. While not wanting to minimize these, we choose to concentrate on some problems that are not as well exposited or understood. See Arrow/Fisher (1974), Baumol/Oates (1975), Dasgupta/Maler (1990), Ehrlich et. al (1977), Johda (1986), and Johansson (1990) for discussion of the rich range of relevant externalities.

[2]The capitalization argument has been around in various forms for some time. See Starrett (1988), Chapters 11, 13, for a summary and references to earlier literature.

[3]See Binswanger (1989), Mahar (1988) and Repetto (1988) for detailed discussion of the Brazilian case.

degree in advanced urban societies, it is virtually **never** attributable to private development, especially in less developed countries; rent increases in such situations are more likely attributable to some concomitant improvement in social overhead capital. Not only should land profits be disallowed to developers but in some cases they should be made to pay some share of the cost of these improvements.

Further, we will show that in many other instances there are "hidden" externalities associated with land values, externalities that sometimes reverse the capitalization logic. Indeed, there are cases when the fact of increased land values is "proof" that the project is imposing undesirable social costs; developers should actually be taxed rather than rewarded in such situations.

The implications for social policy are extremely important. We will argue that the provision of social overhead capital in relatively undeveloped areas provides perverse incentives to overuse the corresponding natural resources unless the private developers are taxed appropriately. Further, we will show that the incentives are even more distorted in urban areas where apparently "neutral" policies leads to overconcentration in too few urban areas. These incentives are particularly damaging in political environments typically encountered in the third world and may go a long way toward explaining the obvious overcrowding in cities like Rio and Mexico City.

The paper is organized as follows. In the following section, we lay out a model of the economy that is structured to focus on policy issues with respect to land and land values. Then, we develop and explain the traditional view in welfare economics that changes in land values (or any other price for that matter) should have no net effect on social welfare; intuitively, gains to sellers welfare are just offset by losses to buyers. It follows, that in most situations, changes in land values should be counted only to the extent that they reflect benefits and costs associated with nonmarket variables such as environmental quality. Consequently, in section 3 we explore systematically the relationship between environmental quality and land values. Surprisingly, perhaps, we find that this relationship may be either positive or negative. Section 4 looks at the capitalization argument, deriving conditions under which it holds and showing why capitalization rarely will be attributable to private development, but must represent benefits from parallel public improvements. The following section then develops a correct calculus for evaluating development projects when they are undertaken in conjunction with concomitant public improvements. Section 6 develops the argument for "negative capitalization," while a relatively general formulation that includes both positive and negative capitalization is presented in the appendix.

1. The economic framework

We focus here almost exclusively on policy issues relating to environmental quality, public goods, and the treatment of land and land values. Thus in our modelling we abstract from many other issues in project evaluation. In particular, we ignore many standard sources of market failure (monopoly power, imperfect or missing markets and the like) to concentrate on some particularly associated with the treatment of land and social overhead capital.

We will aggregate all private goods except land and labor into a single numeraire (thus, we will not be concerned with how policy might affect the relative prices of such goods). Aside from this restriction, our modelling of consumers is relatively general. We do assume that they have no influence over prices, but we can allow them relatively more or less choice in their purchases on the labor and land markets. On the land market, consumers may have a choice over location and amount of land at that location; in all cases, we will think of location as a discrete choice among a finite set of alternatives (so everyone will have a single place of residence).

When full freedom of choice is allowed, 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 (numeraire, land, labor). 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. The household first stage problem typically takes the form:

$$\mathrm{Max}_{c,n,\ell}\ U(\alpha,c,n,\ell)$$

subject to

$$c - wn + r\ell = y,$$

where c,n and ℓ represent consumption, labor supply and land demand respectively, w and r are the market prices of labor and land (at the specified location), y is exogenous income (to be discussed further below) and α stands for a vector that may include public goods, amenities and environmental quality variables. This problem naturally defines an indirect utility function of the form $V(\alpha,w,r,y)$. At times we will consider restrictions on the choice of lot size or labor supply to see what difference (if any) it would make.

When the household has a choice over a set of locations indexed by {i} all of the above parameters will be correspondingly superscripted and the second stage problem may be represented as

$$\text{Max}_i \; V(\alpha^i, w^i, r^i, y).$$

(y 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.

The second major restriction we place on our model is to treat households as being alike in all respects and to count them equally in our welfare formulation. This will mean both that all have the same utility function and that all own equal shares of exogenous income (derived from land and profits). Such restrictions obviously are strong and require some justification. Our first reason for making them is that they lead to a very clean benchmark theory of differential rent: rent differences between locations must exactly reflect the differences in worth of those locations to the representative household. When people differ with respect to tastes or endowments, they will typically sort themselves out by location and the theory of rent is considerably more complicated.[4] However, we believe that many of the conclusions reached in the sequel will be qualitatively unchanged in such a model.

The other reason for assuming identical agents is to abstract from some fairly obvious equity considerations associated with land values. If we consider the users of land to be a

[4]For a discussion of relevant considerations involving heterogeneity, see Berglas (1976), Kanemoto (1980) and Starrett (1981).

more deserving group than the owners, then it is obvious that there will be a welfare loss associated with an increase in land values (ceteris paribus). While not denying that this might be a relevant consideration, we prefer to work in a model where the presumption is that price changes will have no net welfare impact in order to isolate particular features of the land market that generate counterexamples.

Of course, our modelling choice implies that we abstract from all equity issues, not just those associated with land use. There are some very powerful equity arguments for conserving the environment associated with guaranteeing survival to future generations and equally important equity considerations in reconciling "North/South" development interests.[5] Again, we do not mean to minimize these concerns but rather to focus on an orthogonal set of issues.

Our final restriction is to consider only an essentially static model. Again, we acknowledge here that there are very important dynamic issues involving conservation of resources over time, social discounting and the like, but we cannot deal with them effectively here. 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) and an ex post equilibrium which will depend on private development and public policy choices.

2. Land values and welfare: the case for neutrality

Conventional wisdom would have it that (in the absence of equity considerations) price changes have no net welfare implications. If a price goes up, sellers are better off but buyers

[5]See Dasgupta (1990) and Dasgupta and Maler (1990) for a discussion of these issues.

are worse off by an equal and opposite amount. Here we exposit the sense in which this view is correct as applied to land. The neutrality result will always hold when the total amount of land is fixed, the model is closed (so that there are no outside owners or users of land), and all nonmarket welfare impacts are correctly measured.[6]

A. <u>Income cancellation: the intuition</u>

For illustrative purposes, we demonstrate this result first in a special case with the following features: A project (parametrized by g) is contemplated that will generate net profit (in terms of the private good numeraire) and change land values, but will have no other direct effects on the economy. In particular, it will not affect amenity levels or the wage rate (which are assumed fixed at levels α^* and w^* respectively). The project "owns" land $\ell(g)$ which it rents out to households and produces profit equal to

$$\Pi(g) = \Pi^1(g) + r(g)\ell(g),$$

where $\Pi^1(g)$ stands for profits directly attributable to the development. Lot sizes are fixed at ℓ^* and households find consumption and leisure to be perfect substitutes at rate of exchange w^*. Thus, they have preferences of the form $U=U(\alpha^*,\ell^*,c-w^*n)$.

All exogenous income is held by residents in equal shares. Here, there are two sources of this income: project profits and land. Assuming a fixed population of size N and fixed land in the amount L, the income of a representative individual is

$$y(g) = [\Pi(g) + r(g)(L-\ell(g))]/N = [\Pi^1(g) + r(g)L]/N.$$

[6]For an exposition of this point and some of its general implications in a development context, see Little/Mirrlees (1969), (1974).

We see right away that it is completely irrelevant to project evaluation whether or not the developer owns land; everything in the economy is owned directly or indirectly by the households.

A representative household chooses consumption and labor supply to

$$\text{Max } U(\alpha^*, \ell^*, c - w^* n)$$

subject to

$$c + r(g)\ell^* - w^* n = y(g).$$

Due to the special structure we have imposed, it is a trivial matter to evaluate indirect utility from the project; the budget constraint implies

$$c - w^* n = y(g) - r(g)\ell^*$$

$$= [\Pi^1(g) + r(g)L]/N - r(g)\ell^* = \Pi^1(g)/N,$$

the last equality following from the fact that total land supply (L) must equal to total land demand ($N\ell^*$) in our closed model. Notice that potential effects through rents have cancelled again. Income from ownership cancels against rental costs. We are left with indirect utility $V(g)=U(\alpha^*,\ell^*,\Pi^1(g)/N)$. The project enters welfare calculations only through the direct profits it generates and all reference to rental changes disappears.

B. First order welfare calculus

Now we drop most of the special assumptions made above. However, we continue to assume that the wage is determined outside the model. This is done for notational convenience only; the reader should see that if we modelled the labor market as closed with the wage determined endogeneously, wage effects would cancel just as rent effects do below.

(See the appendix for a general demonstration of this fact.)

The project is as described above except that we allow for the possibility that it is a user of land; let $\ell_1(g)$, $\ell_2(g)$ stand for land owned by and used by the project respectively. Consequently, profit is now written as

$$\Pi(g) = \Pi^2(g) + r(g)[\ell_1(g)-\ell_2(g)].$$

Our representative consumer problem now takes the more standard form:

$$\text{Max}_{c,\ell,n}U(\alpha(g),c,\ell,n)$$

subject to

$$c + r(g)\ell - w^*n = y(g),$$

where

$$y(g) = [\Pi(g) + r(g)(L-\ell_1(g))]/N$$
$$= [\Pi^2(g) + r(g)(L-\ell_2(g))]/N.$$

Optimal choices imply an indirect utility function of the form: $V=V(\alpha(g),r(g),y(g))$. Although we can no longer evaluate this function directly, we can compute its derivatives with respect to g; that is, we can measure the effect on welfare of a small change in the project "level." This is done by taking a total derivative of V(.):

$$\frac{dV}{dg} = \frac{\partial V}{\partial \alpha}\frac{d\alpha}{dg} + \frac{\partial V}{\partial r}\frac{dr}{dg} + \frac{\partial V}{\partial y}\frac{dy}{dg}$$

and using consumer duality theory to evaluate its partial derivatives. Normalizing by the "marginal utility of income," multiplying by N (to convert to an aggregate measure) and letting Ω_α stand for the unobservable marginal rate of substitution between amenities and income, we have

$$N\frac{dV/dg}{\partial V/\partial y} = N\Omega_\alpha\frac{d\alpha}{dg} - N\ell(g)\frac{dr}{dg} - r(g)\frac{d\ell_2}{dg} + [L-\ell_2]\frac{dr}{dg} + \frac{d\Pi^2}{dg}$$

Again, we see that terms involving dr/dg cancel because the equilibrium demand for land must equal the total supply minus that amount used by the project, so we have finally:

$$N\frac{dV/dg}{\partial V/\partial y} = N\Omega_\alpha\frac{d\alpha}{dg} + \frac{d\Pi^2}{dg} - r(g)\frac{d\ell_2}{dg}.$$

Our more general approach leads to two modifications of the results in section A above. Any nonmarket amenities created by the project should be counted as benefits and land used by the project should be counted as cost; but induced capital gains or losses still play no role.

At the cost of notational complexity, we could further generalize this result on the welfare neutrality of rent changes. It continues to hold when land is heterogeneous (simply interpret all land use variables above as vectors over land types and the rent variable as a corresponding vector of prices; see appendix for details). It even holds with heterogeneous households as long as dollars of income are counted equally (regardless of who gets them) in the welfare aggregation (as they will be in a social welfare function formulation when lump sum transfers are allowed).[7]

Despite these facts, there are two reasons why changes in land values may legitimately

[7]For further discussion of first order welfare calculus with heterogeneous households, see Starrett (1988), Chapter 9.

enter welfare measures. First, if some land is supplied or demanded by agents "outside" the model, then the land market is not closed in the sense required above and neutrality generally will not hold. More importantly, land value changes may be a perfect proxy for unobservable changes in amenity values. Since we just saw that such changes ought to be included in the welfare calculus, capital gains and losses on land may be relevant even in a closed model. Thus, we need to examine the relationship between amenities and land values.

3. Environmental quality and land values

Since environmental quality has a direct influence on the intrinsic value of the associated land, it is natural to expect that land values and environmental quality would be positively related.[8] And as we just suggested, this is one possible justification for incorporating induced changes in land values into measures of project benefits. In this section, we examine this relationship systematically and find that the issue is not so clearcut. Indeed, there are times when an inverse relationship holds, and these will be important for policy implications discussed later.

There are two main reasons for positive land rents. Homogeneous land will command a positive rent if the aggregate demand for it exceeds supply at a zero price. However, even if homogeneous land were to be a free good, heterogeneity in land quality will lead to differential rent, with high quality land commanding a rent premium over lower quality land. We think that the second type of rent is more important in our present context. For one

[8] Anderson/Crocker (1971), Maler (1974) and Polinsky/Shavell (1976) were among the first to explore carefully the relationship between environmental quality and land values. See Maler (1971), Freeman (1979), and Johansson (1987) for general discussion of methods for estimating the value of amenities from market data.

thing, the lowest quality land is nearly a free good in many parts of the world. Further, we doubt that the aggregate demand for land is much affected by environmental quality; people will use the land regardless of its quality since there is no viable alternative.

Consequently, in what follows, we will assign a zero value to "marginal" land and concentrate on differential rent. The reader should note that the same qualitative results will emerge if we assigned a positive exogenously fixed value to such land. We discuss here only the partial equilibrium case where exogenous income (in particular land) is owned by households "outside" the model and wages are unaffected by amenity levels so that the only economic parameters that can respond to changes in amenities are land values. Even in this case, we will see that the relationship need not be positive.

Since everybody is assumed alike, the welfare level achieved will be independent of location (label the common level V^*). Consequently, for all occupied parcels (i), we find

(3.1) $$V(\alpha^i, w^i, r^i) = V^*,$$

whereas on unoccupied land (u),

$$V(\alpha^u, w^u, 0) \leq V^*.$$

We define <u>marginal land</u> as those parcels where equality holds above at a zero land rent. Suppose first that marginal land is unaffected by a change in amenities; that is, a change in amenities has no direct or indirect effects on the welfare of agents living on marginal land. This situation would apply for example if amenities involved urban pollution that never reaches to the countryside. In such situations, the common welfare level will be unaffected by changes in α and any welfare change through amenity levels must be exactly compensated for by a corresponding change in rents (if it weren't, people would be moving in or out from marginal land). In particular, implicitly differentiating (3.1) and using the assumption that wages are unaffected, we find

$$\frac{dr^i}{d\alpha^i} = -\frac{\partial V^i/\partial\alpha^i}{\partial V^i/\partial r^i} > 0,$$

where the inequality follows from our convention that amenities are positively valued and the fact that rent increases are bad for land users.

Thus, as long as marginal land is unaffected by amenity levels, we do indeed find a positive relationship between environmental quality and the corresponding rental values, and this relationship will hold not only in the aggregate, but at each separate location. However, let us now consider the possibility that marginal locations are affected. Let g stand for the policy variable that is affecting amenity levels at the various locations; thus, $\alpha^i=\alpha^i(g)$. Any change in welfare that does occur still must be the same on all occupied locations. Consequently, for each location i and any marginal location (m), we must have the relationship:

$$V(\alpha^i(g),w^i,r^i(g)) = V(\alpha^m(g),w^m,0).$$

Differentiating with respect to g and rearranging yields[9]

[9]Actually the derived relationship holds exactly only if a location that was marginal in the status quo remains marginal after sufficiently small changes in g; otherwise slight modifications are required.

$$\frac{dr^i}{dg} = \frac{V^m_\alpha}{V^m_r}\frac{d\alpha^m}{dg} - \frac{V^i_\alpha}{V^i_r}\frac{d\alpha^i}{dg}.$$

Now we see that rents move at location i in response to the differential movement in amenities. Consequently we may now find situations where aggregate rents and environmental quality move in the opposite directions. For example, suppose the amenity of concern is congestion (or lack thereof). An increase in congestion typically has a greater affect on those on the outskirts of a city (who must make a long commute) than those in close (so that the 'marginal' term above dominates the 'intramarginal' one). Such an increase (which obviously lowers environmental quality) will increase the rent gradient, thus raising aggregate land rent.

These relationships will naturally be more complicated when we incorporate general equilibrium considerations, but some (albeit less precise) associations are likely to remain. We defer further discussion to the appendix.

4. Increases in land values as reflecting real benefits:

The capitalization argument

The 'capitalization' view stands in stark contrast to our 'conventional wisdom' of section 2. According to this view, increases in land value measure real benefits of associated projects and should be counted as such in the calculus of project evaluation. The logic behind this view is based on the following modifications of last section assumptions. Suppose that users of land can always escape from the costs of increased land rents if they want to (for example by moving elsewhere). Then, if they choose to stay, we have revealed evidence that they are not worse off. Since the owners of land are actually better off, the rent increase must indirectly reflect a real increase in welfare. Frequently, we will find that this increase in welfare is associated with an improvement in amenities or environmental quality.

We start with a simple example to illustrate the possibilities. There are three types of agents: developers who hire workers and produce a private good numeraire, workers who rent land and work for developers and landlords who own the land and purchase the private good. Workers are alike everywhere and they always have a fixed outside option where rents are zero and wages w*; we assume that this wage is competitive in that it represents the value of the private good these workers would produce in the outside option. Developers offer a wage w' and rents near the development adjust to a level r'. Assuming that workers are freely mobile, this level must be such that workers are indifferent among locations; that is, $V(w',r') = V(w^*,0)$.

Suppose now that L workers move and are hired by a new development. We seek a correct measure of social profit from their operation. Since everything can be measured in terms of the single private consumption good, we can compute net benefits in these consumption units. Because there is no change in amount of labor supplied or amenities, net benefits are simply the net increase in output. This will be the extra output of the project (y) minus the lost output elsewhere (w*L). Thus, net social profit (NSP) is measured as

$$NSP = y - w^*L = \Pi + (w'-w^*)L,$$

where $\Pi=y-w'L$ is the actual profit earned by the developer. But now, from the fact that workers were indifferent between options, it follows that the extra wages earned in the new project are exactly equal to the extra rents paid. Consequently, it is legitimate to write:

$$NSP = \Pi + (r'-0)N.$$

We see that net social profit is indeed equal to private profit (as usually measured) plus the capital gain on the land (which had zero value in the ex ante situation).

However, even if we accept the mobility assumptions, the example is not very convincing as it stands. We should ask why it is that the developer paid wage w' instead of w*. If workers really were willing to come on any terms that left them indifferent (as we must assume to get our result) then there is no reason for wages to be bid up. But if w* is offered, rents are not bid up and the capital gain disappears.

To get capitalization in a consistent competitive model, one needs to have developers providing some real amenities not sold through the market (α'). The presence of such amenities will lead to a rent increase even if there is no wage premium: worker indifference now requires $V(\alpha',w^*,r') = V(0,w^*,0)$, so if amenities are desirable, r' will have to be positive to compensate. Assuming that workers are the only ones to benefit from amenities, the above analysis carries over exactly and net social profit again includes capital gains. Here, these capital gains reflect the real nonmarket benefit from amenities.

Nevertheless, it is still not clear that any correction to private profit will be required. If the developer really can vary the wage subject only to matching the workers outside option, why not lower it to the w' where $V(\alpha',w',0) = V(0,w^*,0)$. Then, actual profit ($\Pi$=y-w'L= y-w*L+(w*-w')L) correctly reflects the value of amenities measured as willingness to forgo wages [(w*-w')L] and there are no capital gains.

These examples suggest that capital gains on land will rarely if ever be attributable to developers guided by the profit motive as long as they have some way of controlling the terms. The general logic of this position is as follows. Developers rarely will own all the land affected by capital gains. Thus, to the extent that project benefits are allowed to accrue as capital gains, the developer will not appropriate all of them as project profits; he is better off in such situations to save costs by offering somewhat less favorable terms to those coming to occupy the land, thereby transferring the capital gains (accruing to landowners) to direct project profit. This analysis seems particularly likely to apply in less developed countries where market discipline generally is weak.

Consequently, when we see capital gains on land (in LDC's) at the same time private development is taking place, we should assume that other forces are at work. Frequently, these forces will involve the <u>public</u> provision of amenities. We show in the appendix that under certain circumstances such provision will generate increases in land values.

5. Public amenities and private development: the simultaneity problem

Most private projects are not carried out in isolation but are undertaken in conjunction with public provision of social overhead capital. For example, new farming operations in the Amazon basin and new logging operations in U.S. national forests are linked to public road building. In such situations there is an identification problem for project evaluation. To what extent are project profits attributable to efforts of the developer and to what extent are they attributable to the social overhead capital? Obviously, the answer should affect appropriate public policy toward private development. We just argued in the last section that capital gains on land are not likely to be attributable to the project.

In this section, we examine other aspects of this identification problem. We start with a simple example in which there are two potential uses for the land: a public use (recreation) and a private use (logging). Each of these will require a fixed piece of social overhead capital (road); without the road the land will have zero value while with it and one or both of the uses, it presumably will have positive value. We seek a correct benefit-cost calculus for determining what to do.

A. Mutually exclusive uses

We deal first with the case where we can do logging or recreation but not both. We assume that the land is owned publicly and ask how it should be valued. Consumers own the logging company and enjoy the recreation if it is provided. Assuming that no prices of things they consume are affected, we can think of their indirect utility as being a function of amenities and net private income only. Given the discreteness of our example there are three distinct options to evaluate:

1. Do nothing. In this case the utility level will be $V(0,y)$, where y stands for exogenous income and 0 is the (normalized) ex ante level of recreation amenities.

2. Build the road (q) for recreation. This option generates a utility level $V(\alpha(q),y-\Gamma(q))$, where $\Gamma(q)$ stands for the cost of the road.

3. Build the road for logging. Because recreation is then ruled out, the utility level will be $V(0,y-\Gamma(q)+\Pi(q))$, where $\Pi(q)$ is the net profit from logging given that nothing is paid for

the land.

We seek a benefit cost calculus that will guarantee that the right decision is made. Suppose first that recreation is not desirable; i.e.

$$V(0,y) \geq V(\alpha(q),y-\Gamma(q)).$$

Then we would know that logging should be carried out if and only if

$$V(0,y-\Gamma(q)+\Pi(q)) \geq V(0,y),$$

or, equivalently, if $\Pi(q)-\Gamma(q) \geq 0$. Thus, we see that correct accounting would have the logging operation treat the public road as a direct private cost. If the logging company builds the road directly, no further land rent charge is needed, but otherwise they should be taxed (or charged rent) to pay for it.

But now suppose that recreation would be desirable. How can we still be sure that logging is the best option? Let us define B by the equation

$$V(0,y+B) = V(\alpha(q),y-\Gamma(q)).$$

B stands for the amount of "money" we would need to add to incomes in the no recreation situation to compensate households for not having the recreation option. If recreation is desirable in the sense described above, B is positive and measures its net potential value. Now, logging will be the preferred option only if

$$V(0,y-\Gamma(q)+\Pi(q)) \geq V(0,y+B),$$

or equivalently if $\Pi(q)-\Gamma(q)-B \geq 0$. Consequently, to guarantee correct decisions, loggers must be made to treat B (in addition to Γ) as a cost. Since B represents the opportunity cost of the land, it is best thought of as a land rent.

Note here that land values have gone up as a consequence of improvements but the increase should still be treated as a cost, not a benefit to the private developer.

B. Potential joint use

One might argue that we have stacked the deck against logging by assuming that logging operations completely rule out recreational use. Let us see how the analysis changes when we allow joint use. To keep our options simple, we now assume that recreation cannot be prevented once the road is built. Consequently, there are still just three options to evaluate:

1. No road. This option has the same valuation as it did before.

2. Recreation only. The welfare valuation of this option is now expressed as $V(\alpha^o(q), y-\Gamma(q))$, where $\alpha^o(.)$ represents the amenities enjoyed from recreation in the absence of logging.

3. Recreation and logging. The value of this option is $V(\alpha^1(q), y-\Gamma(q)+\Pi(q))$, where $\alpha^1(.)$ represents amenities enjoyed when recreation and logging coexist. It is reasonable to assume that α^1 is worth less than α^o. We quantify this difference as follows: Define compensating variations B^o and B^1 as solutions to

$$V(\alpha^o(q), y-\Gamma(q)) = V(0, y+B^o),$$

$$V(\alpha^1(q), y-\Gamma(q)+\Pi(q)) = V(0, y-\Gamma(q)+\Pi(q)+B^1).$$

Clearly, B^o measures the value of recreation against the option of doing nothing (so, in particular, a road for recreation only would be desirable when B^o is positive), whereas B^1 measures the value of a dual use road against the (fictitious) option of having logging only. Note that if B^1 is positive, the road (once built) will be used for recreation, but otherwise not.

Now, dual use will dominate both other options if and only if

$$\Pi(q) - \Gamma(q) + B^1 \geq \text{Max } \{B^o,0\}.$$

In this situation, it is possible that logging need not pay the full cost of the road. This will be true if $B^1 \geq \text{Max}\{B^o,0\}$ namely if the incremental value of adding recreation to logging (with the road already in place) exceeds the value from building a road for recreation only versus doing nothing. Indeed, when recreation is justified on its own ($B^o \geq 0$) and is equally valuable whether or not logging is allowed (so $B^1 - B^o = \Gamma(q)$) then our efficiency criteria reduces to $\Pi(q) \geq 0$, and there is no need (from a pure efficiency standpoint) for the logging company to share in road costs.

The situation just described is one in which the road generates considerable surplus value and this surplus can be shared in any combination by pure profits to logging and utility surplus to recreational users/taxpayers; as long as these constituencies are equally valued (an assumption we might want to reconsider here), it does not matter who pays for the road.

But even if such a scenario does obtain at one point in time it is unlikely to persist for long if loggers are allowed to reap the surplus through profits and expand their operations in response to the profit motive. As operations expand they are sure to create negative externalities and otherwise interfere with environmental (recreational) quality. And notice from the analysis above that when logging seriously interferes with (environmental) recreational enjoyment, the logging company should pay and we may even find that it should pay a premium over the costs of the road (this will be so when $B^1 < B^o$).

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

We developed an argument earlier for positive capitalization based on assumptions of costless mobility and attractive outside options. Here we want to reexamine the treatment of land rent under alternative (and perhaps more realistic) assumptions concerning the outside world. Surprisingly, perhaps, relatively small changes in our mobility assumptions completely reverse the policy implications with respect to treatment of land.

In particular, we want to drop the idea that people always have an attractive outside option. Rather, we assume that people must choose among a limited set of options and will always take the best among these. We also drop the assumption that firms have control over the wage structure and assume instead that wage rates are determined through general equilibrium forces.

A. Projects in isolation

To illustrate the aforementioned reversal, we start with a simple 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 move in. 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 π_1 in two small projects and π_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.

	workers	developer	landlord
small	2nw	π_1	0
large	2n(w-t)	π_2	nt

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.

B. A general urban model

We think of ourselves now as being in an explicitly urban setting in which households locate at varying distances from the central business district. Let s index distance from this center. Being far away from the center is a disadvantage in that it requires that transport costs be incurred commuting (and we assume that households care about location only for this reason). Let ϕ_s stand for the commuting cost associated with location s. To illustrate the basic forces at work, we start with a situation in which there are no nonmarket amenities, lot sizes are fixed (and we normalize so that $\ell^*=1$) and labor supply is perfectly elastic at wage w*. (For a more general treatment, see the appendix.) Conditional on being at location s, our representative household faces the problem

$$\mathrm{Max}_{c,n} U(c-w^*n)$$

subject to

$$c - w^*n + r_s + \phi_s = y.$$

Looking at this problem, we see immediately that as long as households are mobile at the margin within the community, the sum of rents and transport costs must be constant over all locations (label this constant ψ). Note further the following relationship:

(6.1) $$R + \Phi = \Sigma_s N_s r_s + \Sigma_s N_s \phi_s = \Sigma_s N_s \psi = N\psi,$$

where R, Φ, N, are total rent, transport cost and population in the community, and N_s is the population residing in location s.

Furthermore, for the same reasons we explained in section II, y-ψ is a perfect proxy for the common utility level in the community. Let us now think of a project whose size (g) affects the economic parameters and generates numeraire profit $\Pi(g)$. The net effect of the project on community welfare (ΔW) can hence be measured as

$$(6.2) \qquad \Delta W(g) = N[\Delta y(g)-\Delta\Psi(g)] =$$

$$\Pi(g) + \Delta R(g) - N\Delta\psi(g) = \Pi(g) - \Delta\Phi(g),$$

where the last equality follows by substitution from (6.1) above. We see that rent changes exactly cancel as in section 2, but transport is an extra social cost.

In the examples given above there was a one-for-one relationship between transportation and land rents so that capital gains on land correctly measured the "extra" costs imposed by the project. Although the relationship is generally not so exact, we would always expect to see a positive relationship between transportation and rents whenever transport requirements influence the relative desirability of locations.[10] To illustrate by example, we work out the relationship for a simple urban model with radial symmetry and linear transport costs.

Radial symmetry will mean that rents and transport costs are the same for all locations at the same distance (s) from the center. Let σ be the distance to the boundary of the community, so ℓ_σ is marginal land and $r_\sigma=0$. Linear transport costs means that $\phi_s = \phi s$, where ϕ is the transport cost per unit distance. To facilitate computations, we assume here that distance is a continuous variable. Then, we compute transport costs as

[10]For a general discussion of the transport externality and its implications for optimal city size, see Mirrlees (1972), Starrett (1974) and Arnott (1979).

$$\Phi = \int_{s=0}^{\sigma} [2\pi\phi s^2] ds = \frac{2\pi\phi\sigma^3}{3}.$$

Now recall that rents at location s are linked to transport costs according to the relationship:

$$r_s = \psi - \phi s = \phi(\sigma - s),$$

the last equality following since $r_\sigma = 0$. Integrating to get total community rents yields Thus,

$$R = \int_{s=0}^{\sigma} 2\pi\phi s(\sigma - s) ds = \pi\phi\sigma^3 - \frac{2\pi\phi\sigma^3}{3} = \frac{\pi\phi\sigma^3}{3} = \frac{\Phi}{2}.$$

we see that for this special geometry, transport costs are exactly twice rents and we can if we like write our welfare measure (6.2) in the form

$$\Delta W(g) = \Pi(g) - 2\Delta R(g).$$

Now, the external ("congestion") costs imposed by the project is actually twice the induced capital gain!

Although the factor of two is special to a symmetric circular city, there is a strong presumption that transport varies more than one for one with rents in reality, and in any case certainly varies positively.[11] Consequently, projects that raise land rents in urban areas impose an important external cost; private profits may be positive when social benefits are negative. Note that this is true even if developers do not count capital gains as part of profits--clearly, the distortion only gets worse if such gains are counted. We believe that this distortion goes a long way toward explaining the apparent overcrowding of large cities (London, Mexico City, Rio, etc.) The problem seems most acute in third world countries

[11]See Starrett (1974) for a general discussion of this relationship.

where "new" labor is readily available and financial payments from developers to politicians/civil servants (for permits and the like) are commonplace.

The bottom line here is that transport costs should be thought of as an externality in exactly the same way that we think of congestion (indeed, transport costs are in some sense a type of congestion). To the extent that private development increases this congestion, it should be taxed just as with any nonmarket externality. Allowing profits to be made on capital gains is perverse in that it provides a subsidy in a situation where there ought to be a tax.[12]

[12] Of course, there may be a simultaneity problem here just as there could be one before; the land value increase might be attributable to public rather than private policy. However, we would argue that it is at least plausible that private development be responsible, whereas it was implausible before.

Appendix

Here, we generalize the examples given at various points in the text. We continue to assume a homogeneous population (for a discussion of models with heterogeneity, see Starrett (1981)) but otherwise employ a relatively general model of the closed economy. At the highest level of generality, we find that only the results of section 2 hold true. Then, we show what extra assumptions are required to get "capitalization" and "anti-capitalization" results.

Our generalization allows for a private goods vector of arbitrary length, a preexisting private production sector engaged in the production of these goods, and a public sector engaged in the provision of collective goods. We let c now stand for the vector of net consumption (that is, demand minus exogenous holding) of non-land private goods and p will be the corresponding vector of prices. Labor is naturally incorporated in this vector with c_n=-n. The private sector profit function now takes the form $\Pi=\Pi(g,p,r)$, where g continues to stand for the level of some new private development project whose benefits we seek to measure and (p,r) are private sector prices. We let q index the level of public projects which we assume are produced according to a cost function $\Gamma = \Gamma(q,p,r)$.[13] We assume that private firms are competitors on all markets and the public firm is a competitive purchaser of inputs. From these facts and the duality theory of production, it follows that

$$\nabla_p\Pi - \nabla_p\Gamma = z, \text{ and}$$

[13]Note that publicly provided social overhead capital (q) does not directly affect the developer's profits; this restriction is made for simplicity only--such an effect can be easily incorporated.

$$\nabla_r\Pi - \nabla_r\Gamma = v,$$

where (z,v) is the vector of net outputs (non-land,land) from the production sectors.

We continue to assume that households are alike and share equally in all exogenous income. Here this will mean that they own equal shares of land and firms, and that they pay equal shares of public goods costs (in the form of a nonshiftable tax). Consequently, a representative household at location i faces the problem

$$\text{Max}_{c,\ell} U(\alpha^i(q,g),c,\ell)$$

subject to

$$p^i c + r^i \ell = [R(r) + \Pi(q,g,p,r) - \Gamma(q,p,r)]/N,$$

defining an indirect utility function $V^i = V^i(q,g,p,r)$.

First we show that as long as direct effects of (g,q) are measured separately, private goods price changes have no net welfare effect. To see this, let us measure the welfare impact from a small change in g (holding q fixed).[14] In computing this measure, we count a marginal dollar equally no matter who gets it; since a dollar given to someone at location i is worth V_y^i in utility we weight i's utility change by $1/V_y^i$. Consequently, we compute marginal welfare change as $\delta W = \Sigma_i[\delta V^i/V_y^i]$. Let us compute $\nabla_p W$. Using duality theory we have

$$\nabla_p W = -\Sigma_i N^i c^i + z,$$

where N^i stands for the number of people at location i. But at a market clearing equilibrium net supply of all market goods must equal net demand, so $\nabla_p W = 0$. An exactly analogous

[14]The analysis for changes in q is very similar and is not included here.

argument assures us that $\nabla_r W = 0$. It follows that our welfare measure takes the form:

$$\frac{dW}{dg} = \sum_i \Omega^i_\alpha \frac{d\alpha^i}{dg} + \frac{\partial \Pi}{\partial g}.$$

Therefore, capital gains on land can enter welfare measures only as a proxy for unmeasured amenity values. To derive exact proxies we must add two more assumptions: 1) nonland prices do not vary systematically over locations, and 2) the marginal utility of income is the same everywhere. The first assumption will hold when goods markets are national in scope so that there is a uniform price throughout the country, and it could hold more generally as long as price differences are not correlated with marginal locations. The second assumption seems innocuous given that everyone is alike and gets the same utility level at equilibrium.[15]

Let us now write down the statement that utility change is the same at an arbitrary location (i) as it is at some marginal location where rents do not change (in doing so, we divide by the common value of V_y and cancel the common change in exogenous income):

$$\Omega^i_\alpha \nabla_g \alpha^i - c^i \nabla_g p^i - \ell^i \frac{dr^i}{dg} = \Omega^m_\alpha \nabla_g \alpha^m - c^m \nabla_g p^m.$$

Thus, as long as there are no systematic correlations of private goods market changes across locations, we can write

[15]Actually, the assumption is less innocuous than it seems due to the so called 'Mirrlees problem.' To the extent that marginal residents have less amenities they may have lower or higher marginal valuations on private goods than others even when all get the same utility. See Mirrlees (1972) and Starrett (1988) for further discussion.

$$\ell^i \frac{dr^i}{dg} = \Omega^i_\alpha \nabla_g \alpha^i - \Omega^m_\alpha \nabla_g \alpha^m$$

Rent change at location i measures the differential value of amenity change just as we saw in special cases earlier. If amenity values in marginal locations are unaffected by the project, we get full positive capitalization whereas if amenity values are more strongly affected in marginal than in intramarginal locations, we get some degree of negative capitalization.

REFERENCES

Anderson, R. and T. Crocker (1971), 'Air Pollution and Residential Property Values', Urban Studies, 8.

Arnott, R. (1979), 'Optimal City Size in a Spatial Economy', Journal of Urban Economics, 6.

Arrow, K. and A. Fisher (1974), 'Preservation, Uncertainty and Irreversibility', Quarterly Journal of Economics, 88(2).

Baumol, W. and W. Oates ((1975), The Theory of Environmental Policy (Englewood Cliffs, Prentice Hall).

Berglas, E. (1976), 'Distribution of Tastes and Skills and the Provision of Local Public Goods', Journal of Public Economics, 6.

Binswanger, H. (1988), 'Brazilian Policies that Encourage Deforestation in the Amazon', World Bank Environment Department Paper No. 16.

Dasgupta, P. (1990), 'Well-Being and the Extent of its realization in Poor Countries', Economic Journal, 100 (Supplement).

Dasgupta, P. and K. Maler (1990), 'The Environment and Emerging Development Issues', unpublished manuscript.

Ehrlich P. A. Ehrlich and J. Holdren (1977), Ecoscience, Population, Resources and the Environment (New York, W.H. Freeman).

Freeman, A. (1979), The Benefits of Environmental Improvement (Baltimore, Johns Hopkins

Press).

Jodha, N. (1986), 'Common Property Resources and Rural Poor in Dry Regions of India', Economic and Political Weekly, 21.

Johansson, P. (1987), The Economic Theory and Measurement of Environmental Benefits (Cambridge, Cambridge University Press).

Johansson, P. (1990), 'Valuing Environmental Damage', Oxford Review of Economic Policy, 6(1).

Kanemoto, Y. (1980), Theories of Urban Externalities (Amsterdam, North Holland).

Little, I. and J. Mirrlees (1969), Manual of Industrial Project Analysis in Developing Countries (London, OECD).

Little, I. and J. Mirrlees (1974), Project Appraisal and Planning for Developing Countries (New York, Heinemann).

Mahar, D. (1988), 'Governmental Policies and Deforestation in Brazil's Amazon Region', World Bank Environment Department Working Paper No.7.

Maler, K. (1971), 'A Method of Estimating Social Benefits from Pollution Control', in The Economics of the Environment, (P. Bohm and A. Kneese, eds.) (New York, Macmillan).

Maler, K. (1974), Environmental Economics, A Theoretical Enquiry (Baltimore, Johns Hopkins).

Mirrlees, J. (1972), 'The Optimum Town', Swedish Journal of Economics, 74.

Polinsky, M. and S. Shavell (1976), 'Amenities and Property Values in a Model of an Urban Area', Journal of Public Economics, 5.

Repetto, R. (1988), 'Economic Policy Reform for Natural Resource Conservation', World Bank Environment Department Paper No.4.

Starrett, D. (1974), 'Principles of Optimal Location in a Large Homogeneous Area', Journal of Economic Theory, 9.

Starrett, D. (1981), 'Land Value Capitalization in Local Public Finance', Journal of Political Economy, 89.

Starrett, D. (1988), Foundations of Public Economics (Cambridge, Cambridge University Press).

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