

# Integrating Land-Value Taxation with the Internalization of Spatial Externalities

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This paper describes procedures that might be used to combine collection of the full rental value of land for public purposes with assignment of appropriate taxes and subsidies for activities with spatial externalities. The paper begins with a discussion of reasons for pursuing these goals and the conditions that would obtain if they were satisfied. Next, procedures for collecting the full rental value of land for public purposes, and for internalizing spatial externalities, are described. The proposed procedures for internalizing spatial externalities are then compared with zoning. The following sections discuss the connections between the two sets of proposed procedures and the implications of the proposals for government structure. The paper closes with a brief summary.

## I. REASONS FOR THE GOALS AND CONDITIONS FOR ACHIEVING THEM

Collecting the full rental value of land for public purposes and internalizing spatial externalities complement each other as two parts of a system in which individuals are rewarded according to their marginal products and charged prices that reflect the marginal social costs of the activities they choose to pursue. These conditions are well known to economists as ones that are needed to induce individuals, out of concern for their own well-being, to make choices that maximize the aggregate market value of all activities.

The internalization of spatial externalities is a straightforward application of marginal cost pricing. If spatial externalities

were fully internalized, then for any activity that a person might undertake at any site, if the net benefit to all persons at all other sites were positive, there would be a subsidy of that magnitude for the activity, and if the net benefit to all persons at all other sites were negative, there would be a tax of that magnitude on the activity. An ideal system would not only match the external benefit or cost with a subsidy or tax, but would also collect money to finance the subsidies, and distribute the proceeds of the taxes collected, according to the impacts of the externalities. If these conditions could be attained, not only would each land user have an incentive to undertake each activity at precisely the efficient level, but every change in activities would be a Pareto improvement, making the person undertaking the activity better off and no one worse off.

A system that would filter proposed changes, permitting only efficient ones to pass, and would implement these as Pareto improvements, has long been a Holy Grail for economists. The Arrow Theorem (Arrow 1963, 12–31; 96–103) and the Gibbard-Satterthwaite Theorem (Gibbard 1973; Satterthwaite 1975) make it reasonably clear that this goal will never be achieved. These theorems nevertheless leave open the possibility of close approximations to the ideal, and that is what is sought in this paper. The closeness with which the ideal can be approximated will depend on the extent to which the preferences of individuals can be estimated by response of other individuals. If preferences could be identified perfectly in this way, then the ideal could be achieved. To the extent that preferences are imperfectly identified, there will be un-

intended redistribution in the implementation of efficient changes.

The collection of the full rental value of land for public purpose fits into the marginal-cost-pricing-marginal-product-payment framework in several ways. Since no one produced land, no one has a respectable claim to its unimproved rental value (George 1879, 333–94). Collecting this value and using it for public purposes is a way of sharing what no individual can rightly claim. Furthermore, some of the rental value of land arises as a consequence of publicly financed activities. Public collection of this value rewards governments for their productivity and provides them with revenue with which to finance valued activities. To the extent that the rental value of land is an externality arising from activities undertaken at other sites, public collection of this value provides governments with revenue with which to appropriately subsidize these activities. Collection of the rental value of land also obviates the need for taxes that would produce departures of prices from marginal costs, resulting in inefficient allocative decisions. For urban public finance this means in particular that if land were fully taxed it would be possible to remove taxes from improvements, so that individuals might be motivated to make efficient use of the land they held. In addition, private collection of the rental value of land induces individuals to seek public expenditures that increase the rental value of the land they hold, even if the total cost exceeds the total benefit. Removal of this opportunity for private gain from inefficient public decisions would eliminate the incentive for wasteful, “rent-seeking” uses of resources in promoting inefficient decisions (Mills 1989), thereby improving the prospect for efficient public decisions. Finally, the information about the rental value of land that is obtained by the institutional structure for collecting it publicly is useful for the purpose of internalizing spatial externalities.

If all of the rental value of land were collected publicly, the sale value of titles to land would be approximately zero. This means that it is not possible to implement

the public collection of the full rental value of land by a tax on the sale value of land. If the full rental value of land is to be collected for public purposes, the tax must be levied not on stocks but on flows. The base must be the rental value of land inclusive of taxes (which does not fall as taxes on it increase), and the rental value must be identified by a procedure that does not rely on the sale prices of titles to land. The next section describes a procedure for doing this.

## II. COLLECTING THE FULL RENTAL VALUE OF LAND FOR PUBLIC PURPOSES

If there were no durable, immobile capital, the rental value of a site for a particular year could be defined simply as the greatest price that a person would be willing to pay for the use of a site for that year. Rental values could be observed as actual prices paid. However, because the most valuable uses of land, particularly in urban areas, generally involve combining land with durable, immobile capital (buildings), leases of unimproved land for just one year are generally not observed in urban areas. While longer leases of unimproved land do occur, there would be no justification for assuming that the rental value of the land was the same in every year, and therefore such leases do not provide a basis for ascertaining current rental values.

The fact that durable, immobile capital must be employed to make the best use of land complicates the definition of the rental value of land. If land cannot be used most valuably unless there is time to amortize buildings, and if there is no reason to assume that rental value is constant through time, what is the meaning of the rental value at a given time? A reasonable answer to this question is that when efficient land use requires durable, immobile capital, the rental value of a site for a particular year can be defined as the minimum return that an existing use of the site must yield to justify postponing the next use of the site for one year. In mathematical terms, define  $V(x,y)$  as the present value at time  $x$  of the

stream of net returns from the site under consideration, beginning at time  $y$  (with  $y$  at the same as or later than  $x$ ), from that sequences of uses from  $y$  to infinity that maximizes the present value of net returns, starting with bare land at time  $y$ . Then the rent of the site for the span of time from  $x$  to  $y$  is defined as  $V(x,x) - V(x,y)$ . That is, the rental value of a site for the span of time from  $x$  to  $y$  is the cost, calculated at time  $x$ , of postponing the starting time for the next use of the land from  $x$  to  $y$ . (If the optimal path of development entails postponing construction at present, then the current rent of a site, by this definition, is its value for agriculture or parking.)

While the definition above suffices to express the rental value of land in theoretical terms, it does not in itself specify a way of observing rental values. To observe rental values, there must be a market in which a corresponding right is traded. The right in question would be the right to use a site for the current year, with an option to use it in future years upon payment of future rental value. And the right would have to be traded in a competitive market. While such a market could not be expected to develop spontaneously, it would be possible to induce its development, within an understanding that land is the common heritage of all persons.

What is needed is a competitive assessment process, such as the following. Each December, rental value assessments for the next year would be requested. Anyone who wanted to become an assessor would be permitted to do so. To become an assessor, a person would post an interest-bearing bond (for something like 2 percent of the rental value of the land she assessed) and specify a function describing land rents per square foot within a convex domain of her choosing, provided that the domain contained at least, say, 200 sites. The actual assessment for any site for the succeeding year would be the maximum, among all assessment functions whose domains included the site in question, of the rental value assigned to the site. (What is meant by a "site" is a connected area under the control of a single individual or corpora-

tion. Smaller units of analysis, such as square feet, would not be workable as the units for which assessments were assigned, because the unit used must be such as could conceivably be transferred to another person.) The assessor who provided the greatest assessment would be guaranteeing that if the site became available during the succeeding year, someone could be found who would be willing to pick up the title and pay the rent she specified, pro rated for the proportion of the year remaining. The assessor would have the option of being the one who did so; but if she did not wish to exercise that option, there would be an auction of the title, carrying with it the right to use the site for the rest of the year, and in future years upon payment of future rental value. Any shortfall from the rent specified by the assessor would be taken from her bond. The assessor assigning the highest rental value to each site would be given a small percentage (something on the order of 1 percent) of the assigned rent, for her services. Because different assessors would choose different domains and assign rental value functions of different shapes, it would be possible for an assessor to be the winning assessor for some sites in the domain she chose, but not others.

If there were no further rules, assessors would have an incentive to assign higher values to improve sites, because a person who owned durable, immobile improvements attached to a site would find it in his interest to pay more than the rental value of the site for its use, if he had to, rather than lose his improvements. The prospect of such losses would discourage improvements, thereby defeating the purpose of a tax confined to land. To avoid this additional taxation of those who improved, restrictions would have to be placed on the manner in which rent per square foot might vary over the domain that an assessor assessed. It would then be possible to take advantage of the principle of adverse selection to ensure that improvements were not taxed.

Suppose first that a city had a rental value per square foot that was known to be uniform, but of some unknown magnitude.

And suppose that while the city was generally built-up, there were a few sites that were either vacant or occupied by structures that had come to the ends of their economic lives. Assessors could then be told, "You must assign a rent per square foot at which you would be prepared to accept any site in the city." An assessor would find it unprofitable to name a rent that took account of improvements, because the sites that would first be offered if the assigned rent exceeded the rental value of vacant land would be ones without improvements. Competition among assessors would then reveal the unknown rent.

Next suppose the city is known to have a rental value per square foot that varies with distance from its center, but the shape of the rental value function is unknown. And suppose again that there are some sites, now scattered throughout the city, with no improvements of economic value. Assessors could be asked to specify, within the domains they chose to assess, the manner in which rent varied with distance from the center of the city. The prospect of receiving only unimproved sites would again keep assessors from assigning more than the rental value of unimproved land.

Now suppose that in addition to distance from the center of the city, land rents are influenced by a variety of other factors: corner effects; elevation effects (better views); positive effects from proximity to schools, parks, fire stations, libraries, and other public services; negative effects from proximity to freeways, sewage treatment plants, and airport landing and take-off routes; and effects that might be either positive or negative, from proximity to private activities such as a golf courses, parking garages, shopping malls, gas stations, junk yards, and high-rise apartment towers. As long as there are some sites throughout the city with no improvements of economic value, or sites that might, with non-negligible probabilities, be put in that condition by such accidents as fires, and assessors are constrained to offer "smooth" land rent functions, they will find that it does not pay to assess at more than the rental value of unimproved land; if they do

so they will find themselves renting unimproved land for more than it is worth.

An assessor would name a base rental value that applied throughout the domain she assessed, with adjustments for identified effects. Any such effects would be specified as additive or multiplicative adjustments to rent per square foot, with the amount of the adjustment varying in a specified way with distance from the site of the activity.

This set of procedures could be expected to yield a very close approximation to actual rental values. Values that were systematically too low would create opportunities for new assessors to make profits by naming higher values. Values that were systematically too high would create losses for the assessors naming them when overassessed sites that were ready for new uses became available and the bonds that the assessors had posted were docked for the shortfalls in offered rents.

A mathematical analysis of profit maximization by assessors provides further insight into this process. Let  $Z$  be the assessor's profit. Let  $p$  be the assessor's subjective probability that she will be the assessor who names the highest rent for a site. Let  $A$  be the rent that the assessor assigns to the site. Let  $f$  be the fraction of the rent that the assessor with the highest rent receives. Let  $g$  be the assessor's subjective expectation of the probability that the site will be relinquished by the current user. To allow for the differing consequences of offers at different times of the year,  $g$  should be expressed as the assessor's expectation of the fraction of the year for which she will be responsible for the rent. Let  $R$  be the assessor's estimate of the true rental value of the site—the rent that the site would yield if its use were offered at auction. Let  $C$  be the cost to the assessor of developing her estimates. Then the assessor's expected profit is

$$Z = p[Af - g(A - R)] - C. \quad [1]$$

In terms of [1], the reason that an assessor would expect negative profits if the assessments she submitted were much too

low is that then it would be virtually certain that someone else would submit a higher assessment.  $p$  would be insignificantly different from 0, so that the  $-C$  term would make profits negative. And if an assessment were extremely high, then  $p$  would be insignificantly different from 1. The  $-g(A - R)$  term would then dominate the expression and would be negative. On the other hand, positive expected profits are possible in intermediate cases. For example, if  $A$  equals  $R$  and the assessor is confident that no one else will enter the assessment competition, then  $Z$  reduces to  $Af - C$ , which will be positive as long as  $f$  is generous enough to cover the cost of being an assessor.

It can confidently be expected that at least one person would find it profitable to be an assessor because, if no one else were assessing, the first entrant could obtain a return from the most cursory and inexpensive assessment function, deliberately erring on the low side to avoid risk. Since the returns to assessing would fall with the number of assessors while costs would be independent of the number, their number would tend to stabilize at a level where all of them had positive expected profits but no new entrants could expect positive profits.

At the level of assessment that maximizes an assessor's expected profit, the derivative of [1] with respect to the variable that the assessor controls,  $A$ , is zero. Thus

$$\frac{dZ}{dA} = p[f - g - \frac{dg}{dA}(A - R)] + \frac{dp}{dA}[Af - g(A - R)] = 0. \quad [2]$$

Solving [2] for  $A - R$ , which is the excess value in the assessor's estimate,

$$A - R = \frac{p(f - g) + \frac{dp}{dA}Af}{p\frac{dg}{dA} + g\frac{dp}{dA}}. \quad [3]$$

Thus to motivate an assessor to report her estimate of the rent accurately, the numerator of the right-hand side of [3] must be zero. Let the elasticity of  $p$  with respect to

$A$  be denoted by

$$s = \frac{A}{p} \frac{dp}{dA}. \quad [4]$$

Then the condition for motivating accurate statements of rental estimates (the condition that the numerator of the right side of [3] be zero) can be expressed as

$$p(f - g + sf) = 0, \quad [5]$$

or

$$f = g/(1 + s). \quad [6]$$

Equation [6] specifies a condition upon the "commission rate" to be awarded to the assessor with the highest assessment, to motivate accurate assessments. The parameter  $g$  could be estimated by the frequency with which sites are redeveloped. The parameter  $s$  would be harder to estimate but could conceivably be derived from patterns of bids and plausible expectations. If there were only one bidder, because everyone recognized her skill and reliability and thought it not worthwhile to compete with her, then  $s$  would be 0.

In evaluating the idea of paying commissions to competitive assessors, one might wish to know how much assessment costs under existing institutions. To take one example, the city of Philadelphia has 84 assessors and 564,000 parcels (one assessor for each 6,714 parcels) and obtains about \$300 million per year in real estate taxes.<sup>1</sup> If the payroll cost for each assessor is \$50,000, then the assessors cost 1.4 percent of the proceeds, so 1 percent of the proceeds is in the neighborhood of the costs of existing procedures. However, much of the cost of the existing procedures arise from the fact that both land and improvements are assessed. Ted Gwartney, a California appraiser and former assessor, has offered the estimate that if only land were assessed,

<sup>1</sup>Remarks of Albert Letson, of the Philadelphia Board of Assessors, to the International Union for Land Value Taxation and Free Trade, Philadelphia, July 31, 1989.

it ought to be possible to do assessments with just one assessor per 50,000 parcels, while four or five times as many assessors are needed to assess both land and improvements.<sup>2</sup> (It is the spatial continuity of land values that make them so economical to assess.) There are also clerical costs, but it is hard to know whether these would be larger or smaller under the proposed institutions.

So far, only the first-order condition for profit maximization has been considered. The earlier comments about how the expected profit of an assessor would be negative for very low or very high assessments, but positive, in at least some cases, for intermediate assessments, explain why the maximum of profits will be at an interior rather than an extreme assessment. A mathematical statement of the restrictions on parameter values required for the second-order condition to be satisfied, and for there to be therefore a unique interior local maximum of profits, is as follows:

The second derivative of the expected profit condition [1] is

$$\begin{aligned} \frac{d^2Z}{dA^2} = & P[-2\frac{dg}{dA} - \frac{d^2g}{dA^2}(A - R)] \\ & + 2\frac{dp}{dA}[f - g - \frac{dg}{dA}(A - R)] \\ & + \frac{d^2p}{dA^2}[Af - g(A - R)]. \end{aligned} \quad [7]$$

If  $f$  is set equal to  $g/(1 + s)$ , then  $A = R$  when profit is maximized, so that every term that includes  $(A - R)$  multiplicatively is zero. This leaves as the second derivative

$$\frac{d^2Z}{dA^2} = -2P\frac{dg}{dA} + 2\frac{dp}{dA}(f - g) + \frac{d^2p}{dA^2}Af. \quad [8]$$

The terms  $P$ ,  $dg/dA$  and  $dp/dA$  are definitely positive, while  $(f - g)$  is non-positive, so that the first term is definitely negative and the second is non-positive. In the third term,  $A$  and  $f$  are definitely positive, so that the sign of this term depends

on the sign of  $d^2p/dA^2$ . This second derivative must be negative for very large values of  $A$ , since  $dp/dA$  is positive and  $p$  has an upper limit of 1 while  $A$  is unbounded. But to guarantee that there is a unique interior local maximum of profits, this second derivative must be negative everywhere, or at least not so positive as to outweigh the first two terms. The procedures described thus provide a way of using a competitive assessment process to collect something very close to the full rental value of land for public purposes, implying that land titles would change hands at prices that reflected only the value of the improvements to the land.

Potential complications are created by situations in which the value of the improvements is negative, as when a building has come to the end of its economically useful life, and it is time to demolish the building and replace it with a new one. The "value of the improvements" is then the negative of the cost of demolishing the building. The profit-maximizing action of the owner of the site at that point would be to abandon his claim. To guard against such events, any person who transformed a site in a way that made it expensive to restore that site to a condition of "bare land" could be required to post an interest-bearing bond that would run with the land, against the contingency that his site would be abandoned and require restoration. If this bond were posted at the time of construction and were calculated to be the present value of expected demolition costs at the end of the useful life of the improvements, with some margin of safety, the amount would in most cases be a small fraction of construction costs.

One of the ways of transforming a site that potentially makes it less valuable is to subdivide it. While it is possible that subdivision is required to make the best use of land, it is also true that land for which title has been subdivided can be used for projects that require large parcels only if an expensive assembly process is undertaken. It

<sup>2</sup>Conversation with the author, August 4, 1989.



might seem that, with all of the rental value of land being collected in taxes, the sale price of all land would fall to virtually zero and the land assembly problem would disappear. This is not so, however, for two reasons.

First, subdivided land would typically be used for a variety of different purposes, involving improvements that depreciated at different rates. It would thus be possible for subdivided land to have a higher rental value as a whole than as a set of separate sites, while at the same time the whole had a lower rental value as bare land than the aggregate rental value of the sites in their improved states. In this condition, if the sites are renewed at disparate times, it may never be efficient to reassemble the site, even though the rental value of the reassembled site would be greater than the sum of the rental values of the separate sites. Unsubdivided land, from this perspective, is like an exhaustible natural resource such as oil, and the theory of the optimal rate of subdivision is akin to the theory of the optimal rate of exploitation of an exhaustible resource.

A second reason why land-value taxation does not entirely solve the land assembly problem is that even if the value of the improvements on all of the parcels required for a potentially valuable assembly was virtually zero (which could occur prior to redevelopment even while each parcel had improvements that had some use), each holder would know that his consent was required to achieve a significant efficiency gain. This could lead to a profit-maximizing calculation that it was in one's interest to hold out for a substantial fraction of that gain, at the same time that no competitive assessor would be prepared to guarantee that any individual site, if auctioned, would yield a corresponding rent. Thus, the fact of selling prices that are generally very small does not in itself solve the assembly problem.

This hold-out aspect of the assembly problem could be solved, or at least greatly ameliorated, by complementing the tax on land based on competitive assessments with a self-assessed tax, at a very low rate,

on the right to continue using a site. That is, each holder of title would specify a price at which he was prepared to part with the site, and pay a tax at a very low rate (perhaps 1/10 of 1 percent per year) on that value. Then a land assembler could announce one day that she was acquiring all of the land in a designated area, and the existing users would have a specified time (perhaps six months) to remove any of their improvements that they wished to remove. People would report self-assessed values that reflected both the economic costs of moving or abandoning their improvements and the psychological costs of moving, but because the tax rate would be so low (\$100 per year for a \$100,000 house) they would be able to afford it. At the same time, since assemblers would be able to act without any delays, a person could profit from holding out only if he had very good, very private, information about which sites were likely to be assembled. The tax rate that would motivate a person to report his true opportunity cost and neither more (speculating on profits from assembly) nor less (desiring to save on his tax bill) would be a rate equal to the person's subjective probability that the property would be acquired by an assembler (Tideman 1969, 61–69). Such a self-assessed tax can be conceived of as a charge for the diminution of social flexibility that results from putting immobile improvements on land.

From the perspective of the legal theory of entitlements, such a dual tax system can be described as protecting land titles by a combination of liability rules and property rules, each carrying a separate price. Payment of the self-assessed tax establishes the "damages" that are due if someone else wishes to acquire title to one's land without obtaining one's consent. This is a liability rule at work. Payment of the tax assigned by the assessor provides one with the protection of a property rule for exchanges at prices below the self-assessed value. Such exchanges must have the consent of the title holder.

The competitive assessment process has two possible shortcomings. One is that the rewards to assessors will be too low to in-

duce them to incorporate all the gradations in assessments that might be observed. There will be incentives: The failure to incorporate a negative effect will raise the risk of having to make up a deficiency in rent, while failure to incorporate a positive effect will mean that one is passing up higher commissions and risking the possibility that another assessor will be the one with the highest assessments in that area, who therefore receives all of the commissions. The level of effort at accuracy that these will call forth is what might be questioned.

The second possible shortcoming of the competitive assessment process is the risk that assessors will find ways of raising the assessments of improved sites above those of unimproved sites. An area that had been completely developed could be assigned an excessive value without much risk that the assessor would be called upon to make up a deficiency of rent. There are two ways of responding to this concern. One is to say that since the probability of redevelopment,  $g$ , is lower in more highly developed areas, the fraction of rents assigned to the highest assessor,  $f$ , should also be lower. The lower commission rate would reduce the incentive to raise assessments, though it would also lower the incentive to incorporate all observable variations in rent. The other possible response is to use the competitive assessment process as an input into a process in which public officials determined the actual assessments, as with the existing property tax. They could use then their discretion to decide when "hills" of assessed rental value represented a competitive response to the lower probability that sites would be offered rather than truly higher rents. In any case, even if some improved value did get into the tax base, the tax cost of undertaking improvements would be lower than with existing institutions, where improvements are intentionally taxed on their value at the same rate as land.

### III. INTERNALIZING SPATIAL EXTERNALITIES OF LAND USE

The competitively developed maps of land rents that are produced by the proce-

dures of the previous section, with their identification of the sources of spatial anomalies in land rents, provide data that is needed to internalize the spatial externalities of land uses. For every activity that is identified by one or more competitive assessors as a source of positive or negative effects on the rent of surrounding land, it will be possible to compute the hypothetical increment or decrement to the aggregate of all rents that would result from the elimination of this activity. In most cases it would be appropriate to charge this increment, if positive, or pay the increment, if negative, to the person undertaking the activity that generated the effect.

An example of the kind of case where it might *not* be appropriate to charge an activity that generated an externality is as follows. Suppose there were a private school for handicapped children that was observed to depress the rent of the residential land around it. Assessors were agreed on this and occasional auctions confirmed it. The community might nevertheless decide that even if the presence of handicapped children did observably depress land rents, this was not a cost that ought to be borne by those who provided services to handicapped children and then passed on to the parents of those children. There may thus be some "aesthetic externalities" that individuals are entitled to impose on whoever experiences them. Such cases, however, are likely to be quite exceptional. I cannot think of an example of an activity that would be likely to generate a positive effect on land rents, but where there could be reasons of public policy for not awarding to the person undertaking the activity the increment in land rents that it generated. And it should be noted that under 100 percent land-value taxation, it would be the whole community rather than the immediate neighbors of the school that would experience a reduction in income by virtue of the external effects of the school.

Note that there is distributional neutrality in the practice of assigning increments and decrements in land rents to the activities that cause them. If an activity reduces surrounding land rents, not only does the activity pay this cost, but those who



hold the surrounding land are compensated by the fact that their land taxes are lower than for otherwise similar land not subject to the externality. If an activity increases surrounding land rents, not only is the activity rewarded accordingly, but those who benefit from this externality pay for it in higher taxes.

If all spatial externalities were reflected in land rents, this would be the end of the story. But there is reason to believe that there will be spatial externalities that will not be reflected in land rents. The principle by which land is the first factor one examines for spatial effects is that in order to be subject to a spatial effect, a factor must be either immobile or inelastically supplied. If an activity were initiated that increased the usefulness of personal computers, say a computer bulletin board containing locally useful information, sponsored by a city government, this could not be expected to increase the selling price of personal computers. They are too mobile and too elastically supplied. But there are other factors that are sufficiently immobile that they are affected by spatial externalities.

First there are the immobile improvements to land. Building a multi-story parking garage on the fringe of a commercial area might have no effect, or even a positive effect, on the rental value of nearby residential land (it would now have better commercial prospects) at the same time that it depressed the prices of residential houses (potential residents objected to the increased traffic). If the decision as to whether the parking garage is to be built is to be made efficiently, its cost must include this diminution in the value of houses.

It might seem that the cost of the interaction between the parking garage and the residences is being assigned arbitrarily to the parking garage, when it could equally be argued that presence of the houses is imposing a cost on those who would benefit from the existence of the parking garage. In fact, the framework offered here does not impose this asymmetry. The building of houses entails bringing in owners who can later object to the parking garage. If this has a foreseeable impact on the future prospect for a parking garage that would otherwise

be efficient, then the building of the houses could be expected to have a depressing effect on the value of the land that would benefit from the parking garage, which could then be charged to the building of the houses, thereby discouraging their construction if that was efficient.

A second factor, in addition to improvements to land, that is potentially affected by spatial externalities because of its partial immobility, is the "locational component of human capital." People derive value from their accustomed surroundings and cannot costlessly substitute alternative surroundings. Suppose for example that a new runway were built at an airport, which introduced the noise of take-offs and landings to a previously quiet residential neighborhood. It could conceivably be that there was no effect on land rents or on house prices, because there were enough potential residents who did not mind the sound. But if those who were already there did mind the sound and could not move without financial and/or emotional costs, then these moving costs, or the possibly lower costs of putting up with the changed circumstances and not moving, should be considered in deciding whether it is efficient to open the new runway and should be paid to those who experience the effects, to achieve distributional stability.

While the impact of land uses on rents is probably handled best by an annual charge, the impact on the value of improvements and on human capital, where this is adverse, is probably handled best by a one-time charge that would accompany an official land-use designation.

Suppose, for example, that someone wanted to open a gas station at a location where adverse spatial effects could be expected. The operator of the gas station would already have an obligation to pay the decrement in land rents that would be observed in future years to result from its operation. This would mean lower land taxes for those who lived near the gas station, which would have a tendency to reduce opposition, but it might not eliminate opposition entirely. The houses built near the site of the gas station might not be the ones that would have been built if the coming of the

gas station had been known. And the people living there might not be the ones who would have moved in if its coming had been known. It would be efficient and equitable to regard the operator of the gas station as having an obligation to compensate the neighbors for the losses of value to their houses and to their intangible human capital resulting from his decision to open the gas station.

But how should the magnitude of the compensation that is owed, and its distribution, be determined? The gas station operator would make an offer of aggregate compensation for effects on immobile improvements and intangible human capital. An "Office of Land Use Administration" would allocate the offered compensation among persons who lived or owned buildings near the proposed site of the gas station. This would not be an easy task, especially when the system was new. The principal determinant of shares of compensation would be distance of one's residence or structure from the proposed site of the change, but other factors might be relevant also; age, family size, duration of residence, size and age of the structure owned, and who knows what else. Mechanisms for improving the manner in which compensation varied with such factors are described after the system is outlined.

When the compensation had been allocated, an election would be held among the recipients of compensation on the question of whether the compensation was adequate.<sup>3</sup> It would be best if this election were not held by the usual one-person-one-vote rule. The reason is that to achieve efficiency, one would want to approve the proposed change if and only if the gains from those who were overcompensated were greater than the losses to those who were undercompensated. There would be a significant probability that the proposed compensation would be biased with respect to distance. In that event one might find the compensation approved by the preponderance of those who were close to the site but disapproved by the preponderance of those who were at a greater distance from the site, or vice versa. In such circumstances it

could easily happen that those at some distance from the site were a majority, while most of the aggregate discrepancy in compensation was felt by those who were close to the site. The majority would favor the inefficient outcome.

There are two possible ways to improve upon ordinary majority rule in these circumstances: weighted voting and the demand-revealing process. The argument for weighted voting is based on the idea that to achieve agreement between the voting outcome and efficiency, one would want to weight each vote according to the expected discrepancy between the assigned share of compensation and the share of externalities actually borne. On the ground that errors in assigned shares of compensation are likely to be proportional to the assigned shares, one would weight each vote according to the magnitude of the assigned compensation (Tideman 1976, 34–36). The proposed change would be deemed efficient if a weighted majority of those who had been offered compensation accepted the compensation as adequate.

It would not necessarily be appropriate to permit every change that was deemed efficient. Any departure from unanimous approval would be a sign that a proposed change included a component of unintended redistribution. The social cost of this unintended redistribution should be subtracted from the efficiency gains to determine whether the proposed change in land use was, on balance, attractive. One might contemplate revising the compensation pattern in light of the election result, so that the unintended redistribution could be avoided, but this is not likely to yield better results. Voters could be expected to respond to the possibility of such revisions by disapproving changes that actually benefited them, in hopes of increasing the share of compensation they received. Thus one is left with the need to decide whether the efficiency gains outweigh the unintended redistribution. With no actual measure of the

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<sup>3</sup>Such a mechanism was proposed in Tideman (1969, 47–51).

magnitude of the redistribution, the only way to trade off distributive stability against efficiency is to require a majority of more than 50 percent for approval. It is hard to find a basis for asserting that any particular level would be appropriate. One can say only that the appropriate requirement would be greater than 50 percent and less than 100 percent.

The continuing use of such a system for evaluating proposed changes in land use would create a body of evidence with regard to patterns of approval, which could be expected to permit improvements in the accuracy of assigned compensation shares over time. If a particular rule tended to yield higher rates of approval, say, near the site of the proposed change than at a distance, then a revision in which smaller shares were assigned to those close to the change and larger shares to those at a distance would be justified. To the extent that the patterns of compensation could be made more accurate, there would be a lower price in unintended redistribution to be paid for the implementation of efficient changes, and therefore a larger number of efficient changes would be worth approving. Such modifications in the compensation rule over time could be made not only with respect to distance, but also with respect to any other factor that was observed to be correlated with the probability of approval (Tideman 1969, 49).

As an alternative to weighted voting, proposed changes in land use could be evaluated by the demand-revealing process. In this case, the allocation of offered compensation by an Office of Land Use Administration would proceed as before. Affected parties would be told the amounts of compensation that had been allocated to them, but now instead of simply voting "yes" or "no," each participant in an election would state the amount of money that he was willing to pay to have the decision made in the way he favored. Those who found themselves more than adequately compensated would state the maximum amounts of compensation they would be willing to return and still accept the change. Those who felt inadequately compensated would state

the amounts of money they would be willing to come up with from their own resources to block the proposed change. The change would be approved if and only if the sum of the amounts offered by those who approved of the change exceeded the sum of the amounts offered by those who disapproved.

The demand-revealing process motivates honest responses to the proposals placed before voters, by specifying that a person will be obliged to pay a part of what he offers if and only if his statement of value alters the outcome. That is, a person must pay something if he is on the side that wins, and the winning margin is less than the amount that he offered. In that case, the amount that must be paid is what he offered minus the winning margin, which amount can also be expressed as "what the winning margin would have been in the other direction, if this voter had abstained." This rule makes the demand-revealing process an application of marginal cost pricing: A person must pay only if he alters the outcome, and in that case the amount that he must pay is the net cost to all other participants of changing the outcome. The ability of the demand-revealing process to motivate honest statements of willingness to pay can be understood as an example of the general ability of marginal cost pricing to induce efficient allocation (Tideman 1985, 182).

While the demand-revealing process is more complex than weighted voting, it has two advantages. First, it avoids the uncertainty inherent in ordinary voting, or in weighted voting, with respect to where efficiency lies. Efficiency lies with the side with the greater aggregate willingness to pay. Second, the willingness-to-pay information the demand-revealing process generates is more useful than simple yes-no information for the purpose of improving future allocations of compensation. One knows not just that a person was satisfied or dissatisfied, but how satisfied or dissatisfied he was. Whether the extra complexity of the demand-revealing process is worth the added information that it yields is the question that remains.

For an activity with positive exter-

nalities, say a local orchestra, the person contemplating the initiation of the activity could ask for not just the annual increments in land rent that would be observed to flow from the activity, but also some compensation for positive effects on existing structures and human capital. However, because the person initiating the activity would not be in a position to guarantee its perpetuation into the indefinite future, and to prevent that person from imposing liquidity problems on others, it would probably be best in such cases of positive externalities to collect from others each year the value generated in that year, rather than collecting the present value of all future effects upon initiation, as was recommended for adverse effects. Thus the person proposing the activity would name an amount of annual compensation for which he would be willing to undertake the activity, and the Office of Land Use Administration would allocate the subsidy among those predicted to benefit. As with an activity with adverse effects, an election would be held, either by weighted voting or by the demand-revealing process, to determine whether it was in the aggregate interest of those affected to pay the requested subsidy and receive the positive externalities. Thus both for activities with positive externalities and for those with negative externalities, the combination of efficiency and distributive stability is served by combining a charge or subsidy reflecting observed effects on land rents with a charge or subsidy reflecting effects on structures and locationally specific human capital.

#### IV. A COMPARISON WITH ZONING

The procedures described in the previous section may be contrasted with the institution of zoning as a device for dealing with spatial externalities. Under zoning, a governmental agency is assigned the responsibility of designating areas in which different categories of activities are permitted. Activities with negative spatial externalities (particularly negative spatial externalities for single-family residential housing) are confined to areas that limit

these externalities. A person who wishes to engage in an activity in a place where the zoning regulations do not permit it may petition for an exception, but as a general rule these petitions are not granted if there are objections to the petition. If a prohibited activity has adverse fiscal consequences for a community, these will sometimes be offset by a grant of land and/or capital improvements to the community in exchange for approval of a petition for a variance. Zoning does not provide for the possibility of compensation for individuals who are adversely affected by the activities of others, and therefore it necessarily entails either inefficiency (when worthwhile activities that have some adverse effects are prohibited) or else inequity—or at least haphazard redistributive consequences (when people are permitted to engage in worthwhile activities that generate negative externalities for their neighbors). The consensus of economists appears to be that inefficiency from excessive restrictions on development and redevelopment is the greater problem of zoning (Fischel 1985, 125–47; 231–70). The “NIMBY” (not in my back yard) syndrome, that is, the refusal of everyone to tolerate in their vicinity an activity that everyone acknowledges should occur somewhere, is one manifestation of the excessive restrictiveness of existing institutions.

An additional problem of zoning is that because some activities are severely restricted, the right to engage in those activities can add greatly to the market value of land titles. Therefore, to the extent that it is possible to influence the decisions of zoning bodies by premature development or by spending additional money on lawyers, consultants, etc., there will be rent-seeking reasons for paying these costs, without corresponding increases in the social value of output. Thus much of the possible value of zoning exceptions can be dissipated in rent-seeking (Mills 1989).

While rent-seeking has the capacity to dissipate gains, it also serves to motivate individuals to identify changes that will profit themselves, and in some cases thereby profit the community. If the social rules were to be changed so that no one

could ever receive a disproportionate profit from promoting a change, one might wonder whether people would ever bother to identify socially worthwhile changes. However, if this became a serious concern, the economically natural solution would be to institute explicit prizes for social innovation, financed by the increases in rents that would result from beneficial changes. To the extent that such prizes were expected to be awarded appropriately, people would have incentives to promote precisely those changes that were socially beneficial, rather than, as at present, the ones that benefit them personally, irrespective of the social consequences.

While it would be possible to implement the framework developed in this paper without using zoning at all, it would also be possible to build on existing zoning institutions. However, instead of determining which activities would be permitted on each site, the zoning boards would be charged first with determining, for each site, which activities could be undertaken without generating significant negative externalities. These activities would be permitted without further administrative process. For other activities, the zoning board would be charged not with determining *whether* the activity could be undertaken, but rather *at what price* the activity could be undertaken, and *how that price would be distributed among the adversely affected persons*. This would be determined not by holding hearings, but rather by holding a ballot among the affected persons.

#### V. RELATIONSHIPS BETWEEN THE TWO PROPOSALS

Besides being connected as two components of a framework in which people pay the marginal costs and receive the marginal products of their activities, collection of the full rental value of land for public purposes and the internalization of spatial externalities are also connected in the following way. If one were to seek to internalize spatial externalities without collecting the full rental value of land for public purposes, one possible measure of the magnitude of

externalities would be changes in the sale value of land titles. But if all of the rental value of land is collected for public purposes, so that the sale value of land titles falls to virtually zero, this source of information will not be available. Therefore some other source of information about spatial externalities must be identified if spatial externalities are to be internalized when the full rental value of land is collected for public purposes. It was shown that the information that is needed to collect the full rental value of land contains the required information in another form, so that the virtual disappearance of the sale price of land titles would not bar the internalization of spatial externalities.

The two proposals are nevertheless separable in the sense that each could be pursued without the other. It would be possible to collect the full rental value of land for public purposes without internalizing spatial externalities, though in that case it would be important to take account of zoning designations in assessing the rental value of land. It would be possible to internalize spatial externalities without collecting all of the rental value of land for public purposes, though in that case, as long as land was taxed to some extent, it would be important to take account of both the private effects and the fiscal effects (through changes in the tax base) in assessing the magnitudes of externalities.

#### VI. GOVERNMENTAL STRUCTURE REQUIREMENTS

The procedures described in this paper could be administered by governments that differed little from those of today. The principal required change would be in our thinking regarding the appropriate distribution of rent and returns from other forms of privilege. Thinking today is dominated by the idea that market transactions from the status quo would yield appropriate distribution of these returns. The framework elaborated in this paper presumes instead that, to the extent that there are activities that generate these rental values, those who undertake such activities are the appropri-

ate recipients of rent, and any rent not so accounted for is appropriately shared equally.<sup>4</sup> Furthermore, the local governments that are envisaged as collecting the rent of land do not themselves have a respectable claim to all of it. What they can respectably claim is the increase in the rental value of land that results from the presence of the community. The amount of money that the land the community occupies would rent for if the community were completely leveled and all utilities removed—the rental value of the land as a potential site for a new community—to that the local community has no respectable claim. Some of this can respectably be claimed by State and Federal governments as the product of highways and other elements of regional infrastructure. But part is purely the product of nature. Since no one can claim to have produced this, any person can respectably claim only a proportionate share of it.

Thus the full distribution of rent implied by the ethical framework of this paper is that to the extent that the rental value of land can be attributed to the activities of individuals, local governments, state governments, and the Federal government, the rent is to be directed to those entities; and to the extent that rent cannot be attributed to the activities of any such entity, it is to be shared equally, through a guaranteed income. Because institutions are generally more responsive the more local they are, it would be sensible to have all rent collected and distributed locally, with state governments and the Federal government billing localities for the beneficial impacts of their activities on local rental values, and with payment to and from a clearing house for variations among localities in the completely unimproved land value per capita.

<sup>4</sup>One apparent virtue of the present presumption is that it helps to avoid rent-seeking struggles that can consume vast amounts of resources. But this virtue is also possessed by the alternative of an equal distribution of returns from privilege. It is only the view that the distribution of returns to privilege should be determined by political struggle that entails the possibility and the likelihood of vast rent-seeking losses.

## VII. SUMMARY

The collection of the full rental value of land for public purposes requires information that is not available from existing markets, but can be obtained by the creation of competitive assessment process. This process would automatically generate a substantial part of the information that is needed to internalize spatial externalities, namely the effects on land rents. However, since other factors are also immobile, they too can be affected by spatial externalities. These effects can be taken into account by further taxes and subsidies. Because of the difficulty of observing or predicting the magnitudes of effects on factors other than land, this paper suggests that these effects be dealt with by a collective decision process among the owners of these factors. The person generating the externality would name a tax or subsidy payment that he thought appropriate, an Office of Land Use Administration would allocate this amount among those affected by the externality, and then an election would be held among those persons, using either votes weighted by the amount of compensation or the demand-revealing process, to determine whether the offered compensation was acceptable.

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