

Land and Rent in Welfare Economics

by M. Mason Gaffney*

In the classical synthesis, human welfare and land rent were two parts of an integrated philosophy. As Smith, Mill, Marshall, and especially Ricardo scan us from their present eyries they must note with shock two virtually separate disciplines tagged "land economics" and "welfare economics." The first has come to connote Wisconsin Institutionalism with its skepticism of marginal analysis, its emphasis on evolution, its earthy pragmatism and inductive reasoning. The second designates a rarefied a priori Scholasticism that proceeds from sanitary postulates through tangencies and equations to anything from sweeping reforms to nagging doubts about the value of any economics. The division of the two constitutes an indefensible compartmentalization of thought, and the writer does not favor either over the other. Rather he suggests some paths toward reintegration.

The two subdisciplines contrast in a number of ways. Welfare economics tends to emphasize static optimality, with only perfunctory obeisance to the passage of time; land economics deals with long-run intertemporal changes. Welfare economics is generally spaceless, also, while space is the essence of land economics. Land economists have been impatient of theory to the verge of anti-intellectualism, while welfare economists exhibit more patience than most of their readers in spinning subtleties which, instead of being means to human welfare, sometimes

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seem to become the ends of their lucubrations. As to policy, land economists are probably too easily pleased, asking only to see movement in economical directions; welfare economists are often implacable, spurning mere "piecemeal" optimizing, pointing ever upwards and outwards to ideal and universal Platonic prototypes. Land economists are the more eclectic for they do read the welfare literature, which in its turn, however, yields no evidence that any pure welfare theorist since Pigou knew a shred of land economics.

As an earthbound land economist levitates through the pure welfare literature he sees much to admire: the rigor; the elegant marginalism; the normative pursuit of the general welfare; the suppression of subjective bias; the boldness with policy. He wishes he saw more of those in his own subdiscipline. But he also finds it a long way between drinks, and he wonders what earthlings can survive in these arid and vertiginous altitudes. He does not insist that all economists have met payrolls, but those who declaim on so humanistic a subject as welfare should exhibit some sign that they bleed when cut and weep when wounded. Between the Platonic peaks and the deeps of life and sin there must lie a temperate zone where the universals of theory come to bear on more humid human problems. Probably the greatest reciprocal contribution of land and welfare economics is to balance one another and keep within that temperate zone, where indeed we already see the tracks of Regan, Chryst, Margolis, Tolley, Clawson, Krutilla, Eckstein, Renshaw, Hirshleifer, Milliman, and others, who commendably defy subclassification: they are economists.

Welfare economics has a signal contribution for land economics in its normative outlook. Land economists are prone to accept the institutions they emphasize as ultimate constraints, fixed with the stars in their courses. They cast themselves, with notable exceptions, in the subsidiary role of commentators scribbling in the margins of history, annotating the ineluctable. Dulled by the gross wastes their profession keeps disclosing they grow uncritical.

Welfare economists are more delicately attuned, more imperious, and in an important sense more realistic. They look through and beyond institutional constraints to the ultimate goals of human organization. They assert the status of those ultimates over mere institutions, evaluate institutions accordingly, consign to perdition those found wanting, and rise on their hind legs with bold new gadgets such as social dividends, lump-sum capacity taxes, or open-ended stock issues to enhance the general welfare.

To accompany this attitude they supply an analytical apparatus on which land economists often rely who do render normative judgments. The apparatus may grow unwieldy with all the armor it has clad to fend off cynics and spoilers, but deep inside we still find a simple working rule, The Rule, the equimarginal principle, and many qualifications to temper it.

The obvious contribution of land economics to welfare economics is an element of reality, a wealth of experience, a feel for human possibilities. Welfare economics has a surplus of empty boxes, which land economics is peculiarly competent to fill.

But ironically the prime contribution of land to welfare economics is a higher degree of generality. For all its ecumenical purport, most of the "pure" welfare economics is both spaceless and timeless. It is all very well to abstract from localisms, but space and time are absolute

universals. It is welfare economics that preaches against "piecemeal" optimizing. Economizing at dimensionless points in space and time is piecemealism beyond sufferance. Space and time are the very stuff of land economics, and if it contributed nothing else to welfare economics that would be enough to fill several of those empty boxes.

Consider consumer surplus. In land economics that attaches not to free-floating individuals, but specific lands. If Connecticut commuters, for example, put more aggregate value on the New Haven Railroad than that unhappy bankrupt can collect at the ticket window, the surplus finds its way into Connecticut land prices. If California irrigators derive from water supramarginal benefits above the price, that surplus imputes to lands under the ditch.

Consider external economics. Their most general cause is spatial proximity, and land economics copes with them, both technological and pecuniary, constantly. Every irrigation development affects ground water levels and local trade. Urban buildings affect their neighbors' views, share their transport-utility lines and taxes, and pull customers to or away from them. A basic way to render external economies internal is to acquire more land, whereby one evolves from an atomistic parcel-holder to a competitor of the local government and democracy, which in turn maintains itself and the viability of atomistic landholdings, by judicious manipulation of external economies related to land.

Consider the welfare economist's problem of interdependencies. Again, these most often entail spatial proximity. Land economists have grappled for decades with problems of co-ordinating and synchronizing complementary public and private contributions to the interdependent land settlement process, both urban and rural.

Consider the welfare economist's specifications for an ideal tax, a lump-sum "capacity-tax" based on latent potentialities, uncontingent on actual economic behavior, without distortion or excess burden. Having given the specifications, welfare economists are at a curious loss to identify a suitable base, yet land not only affords a theoretical base of the requisite properties, but is so taxed and has been for centuries wherever assessments are based, as the law now directs in most American jurisdictions, on site potentialities regardless of current use.

Last, consider the welfare economist's problem of identifying decreasing cost operations, determining marginal costs, and meeting the deficits implicit in marginal cost pricing. The prototype of decreasing cost operations is the transport of utility service over a network within a fixed perimeter. Hotelling, recall, was discussing the general welfare in relation to problems of taxation and of railway and public utility rates. Dupuit was concerned with Ponts et Chaussées. The consumer surplus generated was clearly imputed to the rental value of lands served, where it could be measured and whence recaptured by lump-sum land-capacity taxes to meet the deficits of marginal cost pricing.¹

Since Hotelling, welfare economists, in their praiseworthy pursuit of generality, have abstracted his principle from its earthy genesis until the material referents are lost and the box emptied. But returned from the abstrusities of Laputa to the terra firma of Swift's admirable Houyhnhnms, the box is full of relevant experience with municipal transit,

¹Harold Hotelling, "The General Welfare in Relation to Problems of Taxation and of Railway and Utility Rates," Econometrica, July 1938, pp. 242-69, p. 256, and "The Relation of Prices to Marginal Costs in an Optimum System," Econometrica, April 1939, pp. 151-55.

irrigation districts, cheap power, et hoc genus omne. The "subsidy" which offends many conservative economists² is seen to be not properly a subsidy at all, not a redistribution from "other industries" or regions, but a means of extracting supramarginal surplus windfalls from specific beneficiaries by the approved capacity-tax method. Distributionally, it bears the earmarks of a charge on gainers usable to compensate losers --- again an ideal of welfare economics.

Those, then, are some reciprocal potential contributions of land and welfare economics which we now proceed to develop. First we define ground rent and differentiate it from other distributive shares. Second, we treat the role of ground rent as an economic constraint on the possession of land, both in space and time, by atomistic individual landholders. Last, we treat the role of ground rent as a guide to land development by transport-utility networks.

GROUND RENT AND OTHER DISTRIBUTIVE SHARES: SIMILARITIES AND DIFFERENCES

The concepts of land and ground rent have suffered a terrible mauling in recent decades. The new conventional wisdom has it that ground rent is only one of many rents, and land is scarcely worth distinguishing from other resources, if indeed it can be.

This is not the place for technical analysis of the imputation of ground rent. I have tried elsewhere to show how ground rent may be segregated from depletion and depreciation charges and from income of depletable virgin fertility and old improvements.³ In general it is my position that the ground⁴ has salvage value and a future opportunity cost where old improvements do not, so land is valued from the future and old improvements residually. In the same work I treat the traditional quibbles about "made" land, underground improvements, soil exhaustion, substitutability by capital, and Venus de Milo, none of which need detain us here.

This is the place to point up the importance for welfare economics of land's unique qualities: natural origin; fixed location; extension; permanence;⁵ fixed aggregate supply.

Fixed location is the quality that lets land serve as the measure and trap for localized consumer surpluses and external economies. Labor and capital immigrate to share local windfalls to their kind, and in due time compete them away entirely. Benefits to local land are rather imputed away in higher rents. Institutional barriers may preserve local benefits to local monopolies of labor or capital, but then the windfall imputes to the monopoly, not to labor and capital as such. The obstacle to land immigration is physical, inherent in the resource itself, and the windfall imputes to land as such, whose local monopoly is granted by Nature.

²For example, Howard S. Ellis and William Fellner, "External Economies and Diseconomies," *The American Economic Review*, September 1943, pp. 493-511.

³Mason Gaffney, "Ground Rent and the Allocation of Land among Firms," *Proceedings*, 1961 Land Economics Seminar, North Central Land Tenure Research Committee, to be published 1962.

⁴By "ground" I purport something more than "site" but less than "land" as the term is usually used. Ground is site plus permanent geological matrix, but excluding that much of virgin fertility which it is economical to deplete. In general the difference is small relative to other economic magnitudes, and in the present work "ground" and "land" are interchangeable.

⁵This excludes from the present discussion geological funds which are depleted by use.

Fixed location is also the key to land's unique relation to the inter-dependency question. Water service that opens up new lands, for example, requires the complementation of sewers, houses for customers, and ultimately the whole complex of transport-utility lines that make a finished community. The water service requires these complements not just anywhere but serving the same lands. The services achieve necessary scale economies by finding many customers not just anywhere, but compactly grouped in space.

The importance to welfare economics of land's natural origin and permanence is in the unique suitability those qualities give land as the base of a lump-sum "capacity-tax," a neutral nondistorting tax not contingent on man's creating the tax base by storage or saving, not avoidable by consuming or removing it. The only contingency is that the landholder retain title, but a financial flight from land titles removes no square foot from the supply. Ad valorem land taxes are simply capitalized into lower land prices and the net outcome is to substitute a tax burden for an interest burden, explicit or implicit. Insofar as that shift would cause reallocation of the fixed supply it is by the removal of a distortion --- unequal access to credit --- and not (assuming accurate assessment) by the imposition of a new distortion.

Natural origin and permanence of ground give it a unique place in the distributional ethic. Ground rent as private income is without functional rationale, as generations of economists have duly, if discreetly, noted. It neither elicits the supply nor preserves it. It only serves to allocate it to the high bidder, but this function is so badly distorted by speculation in anticipated increments to the market price of infinite future rents, as almost any city planner will document, that there is reason to believe public rent collection through heavy lump-sum ad valorem capacity taxes could serve the allocative function better.

When, however, we claim uniqueness of the ground in its fixity of supply we run afoul of the new conventional wisdom which preaches a blurring of such discriminations. Some leading arguments are these: man can increase the land supply; rent is one of many differentials; Roger Maris can earn more slugging than soda-jerking; labor supply is wage-inelastic; capital formation is interest-inelastic. Let us entertain them in order.

When urban economists speak of increasing land supply they apparently have in mind such operations as extending expressways and sewer mains, bringing new lands into the urban sphere. Farm economists who speak of "elastic" land supplies in turn have in mind reclamation and clearing. Cities may take land from orchardists, they from pig-farmers, who push on wheat-farmers. Wheat-farmers push on cattlemen, they on sheepmen, they on forestry, recreation, and the Indians, but none of that, as the displaced persons keep reminding us, creates new land. It intensifies the use of land formed when the Earth was young.

Similarly we intensify the use of labor when it grows relatively dear, and of capital. We do not describe that as creating new labor and capital, although over some range it substitutes for such creation. But in addition we actually do spawn new people, and store up net new capital. There is the difference.

The idea that rent means "differential" is I believe a case of confounding the incidental with the essential. The concept of rent arose to help explain why men should pay for something Nature supplied gratis, courtesy of the house. Its expositors, following Ricardo, have taken note

that lands differ in quality per acre and command different rents per acre. Some writers have seized upon that difference as the essence of rent, but it is a secondary aspect.⁶ Rent arises because land is scarce relative to demand and would arise in that circumstance if land were uniform.

The public celebrity analogy projects a resemblance between ground rent, a payment without the function of eliciting supply, and the income of theatrical and athletic stars who allegedly enjoy their work, are good for little else, and would work as much for less money. The analogy falls on two counts.

First, the alleged rental component of the star's income is indefinable. It is supposed to be the excess of his star income over his opportunity cost. Expositors describe that best alternative as remote and ill-rewarded: BB as a scrubwoman, Roger Maris as a teacher. Thus they make most of star-income a rent. But the alternatives are arbitrary and the rent is rubber. There is a whole range of closer alternatives, and what is rent and what is not depends entirely on the one specified, until we have Roger playing for another team, and Brigitte for another audience, near their present fees, and their rent vanishes into earned income.

Second, ground rent is a macro-economic concept, that is it applies to the whole class of land incomes without reference to allocation among different industries or uses. It would obtain if all land and labor were homogeneous and produced but one commodity. It is distinguished from wages by the curse of Adam that labor toward supertime grows irksome, and at all times represents a sacrifice of pleasant diversions. Wages in general serve the necessary function of enticing man from leisure. Rent in general evokes no supply response: the Creator never sees it.

If the remolders of terms and issues must describe celebrity income as "rent" let them at least spare the original term uncorrupted, and the language unimpoverished, by qualifying their concept as "micro-rent" or "transfer-rent." Then their readers could divine that land income is double-rent, macro and micro. The block at 34th and 5th Avenue, that is, that sustains the Empire State Building, is not only given freely by Nature, like true love without demand for requitement or threat of removal, but also might be a potato patch. And so its million-dollar yearly ground income is 100% rent and also 99.99%, double-damned to damn Brigitte once. No doubt we are all poor sinners, as the micro-rent concept intimates, who if we got what we deserve wouldn't get much. But among economic sinners, the ground rent collector holds a unique pre-eminence.

Those who regard wages as a form of rent have another string to their bow, however. They note that incomes are higher today than in 1900 but hours are shorter. Post hoc ergo propter hoc: pay them more and they work less. The argument of the road gang boss has been commandeered by the modern Cameralist. Wages do not elicit labor; labor is perversely elastic to wage rates.

The argument might be neater if ceteris were paribus. Over sixty years many things have changed. Today among other new things we have steeply progressive income tax rates, more accumulated wealth, longer subsidized schooling, big unions, seniority and tenure, reduced inter-professional wage differentials, social security, Freud, protection from

⁶Indeed, the area unit is an arbitrary one within which to define quality and supramarginal ranking. Low-valued acres may in some extensive uses produce more per man than high-yielding ones, be higher above the margin and slower to go out of use when costs rise or prices fall.

immigration, and Milton to bank the inner fires of workmanship, and it is a violent assumption to attribute all our modern otiosity to high wage rates. But is long-run response really relevant at all? Insofar as higher wages over time are responsible for reducing hours it is by helping us accumulate the wherewithal to put a higher price on leisure. The price we put on our leisure is not a function of the wage of our marginal efforts at a given moment, but of the wages we got yesterday and expect tomorrow, our property income, government checks, and a variety of things. The money we get for working from 4 to 5 P. M. on Friday, December 22, 1961 is necessary to elicit the supply under the conditions of that moment. In that sense wages are functional where ground rent is not.

The new conventional wisdom also has it that we save and create capital more or less by reflex, so that interest⁷ is a rent, too. It would be presumptuous in a few words to sum up decades of debate around and about this topic, but the lagging rate of capital formation in the United States during three decades of the new wisdom at least gives us license to wonder if the last word was spoken when the rentier was consigned to euthanasia. A land economist suspects that interest rates do affect capital formation, if not directly then through their effect on asset values and especially land values, with their high interest-elasticity. High land values, the result of low interest rates, satisfy without benefit of real capital formation their holders' demand for assets and so tend to weaken saving.

It also seems obvious, land values or not, that at zero interest we could live by borrowing indefinitely and would give up not only saving but our jobs and all unpleasantness, deprivation, and restraint whatsoever. The Gesellniks can hardly dodge that dilemma by pleading credit rationing, for at the end of the credit line lies capital scarcity and an interest rate. Zero interest is clearly a fantasy in which we would run through the accumulations of centuries in a few glorious days. As Natura non facit saltum, it is plausible to suppose that near approaches toward zero interest would likewise tend to discourage capital formation.

In a closed economy the effects of farther approaches toward zero interest would make interesting debating. But as a practical matter the issue is seldom so drawn. Taxing jurisdictions are defined as specific land areas, from which capital will flee for light and transient causes, while you can tax the very all out of the land and never a square foot will rise up and walk out of town.

In summary, when we speak of "rent" we mean an income share that appertains specifically to land and which is likened to other distributive shares only by specious analogies which never should have risen above the dignity of debaters' ruses.

GROUND RENT AS A CONSTRAINT ON LAND USE BY ATOMISTIC PARCELHOLDERS

Ground rent is a "surplus," we have maintained, differentiated from other distributive shares in lacking the function of eliciting the aggregate supply.

⁷I personally prefer "profit" to denote the net return on stored capital realized ex post, reserving "interest" as the price of money reflecting ex ante anticipations. But this is not the place to open that box and I here use "interest" in the classical sense.

But factor payments serve two functions. Besides calling forth the aggregate supply they ration it among competing demands. Rent serves the second function quite as much as do other shares. "Rent," wrote Ely and Wehrwein, "acts as the 'sorter' and 'arranger' of this pattern (of land use)." Rent pre-emptes the choicest sites for uses that most need their advantages, and ranks land uses in order of rent-paying capacity. The body of lore called "location theory" advanced by Thünen, Weber, Lösch, Hoover, Dunn, Isard, and others elaborates at length on this principle, so that the allocative function of rent is not only received but embellished doctrine.

The systematic and comprehensive welfare economist, however, must feel that land and location economists have not fully established the economic rationale of rent in a quantitative sense. They have rationalized the qualitative function of ranking land uses, but have slighted the quantitative function of arbitrating the margins between landholdings: just how much land should each firm occupy, and at what intensity? They have given us no demonstration that the rent of central sites serves optimally to constrain landholders from expanding and thereby imposing private and social costs on utilities and peripheral land users who must traverse their holdings. They have generally been content to accept private transport-utility costs as equal to social costs, even though that is conspicuously untrue, and have asked no very deep questions about the nature of social transport costs, nor therefore about the effect of land occupancy on those costs.

The geo-welfare economist would note with approval that location theorists demonstrate that individuals with greater demands on transport tend to locate centrally, thereby tending to minimize transport costs, at least the part paid by individuals. That is important information. But transport costs also vary with the over-all intensity of land use. If all land users, preserving their ordinal ranking, were to double their landholdings, they would much increase the miles they, their supplies, customers, and products had to travel, and very likely the social costs per mile as well.⁸

Clearly, an important function of rent is to constrain such extension, to the end of minimizing aggregate transport costs and maximizing productive linkages. Clearly, too, this is one of the more interesting questions in an era of rapidly increasing per capita space use, both urban and rural. But it is a question on which the geo-welfare economist finds precious little guidance. Transportation economics has yet to be integrated with land and location economics.

The interrelations are rather extended. For example, suppose it be true that at urban fringes, private transport-utility costs are less than social costs. That would first, obviously, open up excess peripheral lands. But that in turn would relax rental constraints on intramarginal lands, and reduce intensities there below economical levels. This in its turn would disperse population wider, and impose more transport costs on the society that underwrites them. The burdens imposed by uneconomical transport rates are not simply the obvious short run misuse of sunk social overhead, but the long run thinning of land settlement, the relocation of population, with demands for further extension of subsidized

⁸Hoover's and Dunn's assumption of decreasing costs per mile refers only to private costs in trucking. Social overhead costs are another matter--unit costs rise as trade territory density declines.

transport facilities. Those are the extended interactions of land use and transport-utility rates that a geo-welfare economist would want worked out explicitly.

Rent as a Constraint on Spatial Extension

Let us begin with the atomistic individual landholder and define the positive expansive force within, against which the constraint of external opportunity cost must contend at every margin. Rent is too crude a term for this kind of quantitative analysis - rent is an average concept, and we need a marginal one. If rent from an integral land-using operation is the average net product per acre, the outthrusting force is not that, but the marginal net product, which we can call "marginal rent," which may be higher or lower than the average depending on whether the operation is too small or too large. While that may seem obvious to any marginalist economist, it has not to my knowledge been explicitly developed in the literature, and certainly its implications are widely flouted. Let us then develop the concept of marginal rent.

To proceed step by step, first abstract from scale by assuming constant returns. Let us also at first abstract from the transport question and discuss simple adjacent farmholdings on homogeneous soil and without significant location differences. That leads directly to some interesting welfare conclusions about equilibria at the margins between adjacent landholdings.

In Figure 1 we signalize the assumption of constant returns by plotting on the abscissa not land alone, but the ratio of land to complementary inputs. The two solid curves represent per acre figures: Average Gross Revenue per acre (AGR); and Average Complementary Costs per acre

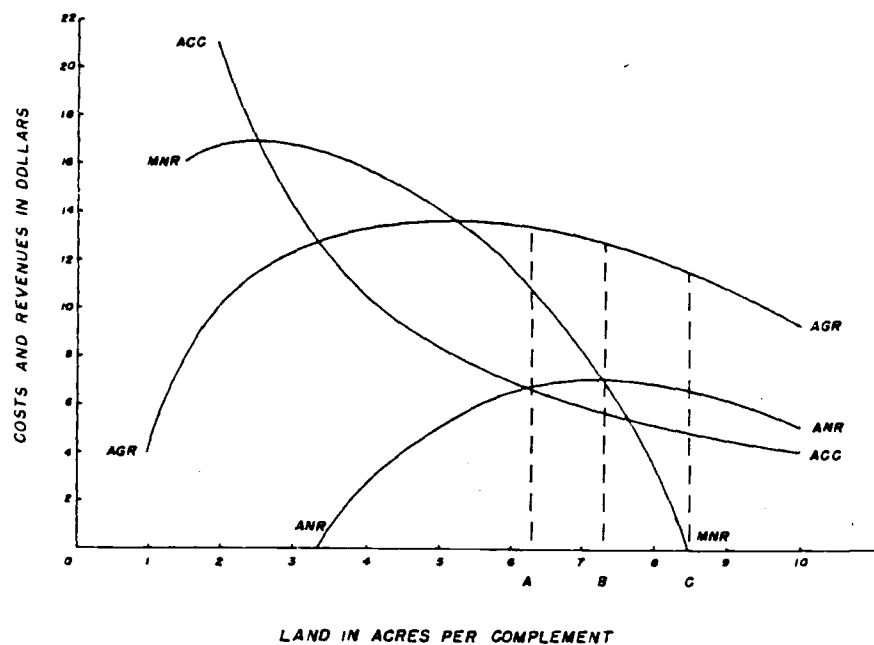


Figure 1. Complementary costs, revenues, and derived average and marginal net products of land with assumed constant returns to scale.

(ACC). The ACC curve is a rectangular hyperbola.⁹ AGR behaves as any conventional average product curve, showing the result of varying proportions on output. Note that "average" here means "per acre," and not "per unit of output."

The vertical span between AGR and ACC, their difference, is Average Net Revenue (ANR), or rent, which is also graphed separately (dash line). ANR, of course, peaks farther to the right than AGR peaks. Note the characteristic lenticular form of the area between the AGR and ACC curves. It is a form we will meet several times.

The most interesting curve is the last, Marginal Net Revenue (MNR), or marginal rent, and the most interesting thing about it for the present analysis is the contrast it draws between two firms, one of which is a little too intensive (at A), and the other of which is a little too extensive (at C). The average net value of land is the same to each, and if that were our sharpest tool we would be at a loss to choose between them, and to allocate marginal acres between them. But we would probably give the acres to C because it is very much the fashion these days to applaud lower costs per acre and overlook output per acre, and that would be exactly wrong because the marginal rent, the proper arbiter of boundaries, is much higher for A.

The curves of Figure 1 do not exaggerate how quickly marginal rent falls with a slight decline of average rent. Table 1 is a numerical example of such a relationship. Marginal rent falls from 15 down to minus 3 while average rent barely changes.

Table 1: Relations of average and marginal gross and net revenues with declining intensity of land use

| (1) Land (Acres Per Complement) | (2) Gross Revenue (GR) | (3) Average Gross Revenue (AGR) (2)-(1) | (4) Marginal Gross Revenue (MGR)* | (5) Comple- mentary Costs (CC) | (6) Average Comple- mentary Costs (ACC) (5)-(1) | (7) Net Revenue (NR) (2)-(5) | (8) Average Net Revenue (ANR) (7)-(1) | (9) Marginal Net Revenue (MNR)* |
|--|---------------------------------|--|---|--|---|--|--|---|
| | | | 4 | | | | | 4 |
| 1 | 4 | 4.0 | | 42 | 42.0 | -38 | -38.0 | |
| 2 | 20 | 10.0 | 16 | 42 | 21.0 | -22 | -11.0 | 16 |
| 3 | 37 | 12.3 | 17 | 42 | 14.0 | -5 | -1.7 | 17 |
| 4 | 53 | 13.3 | 16 | 42 | 10.5 | 11 | 2.8 | 16 |
| 5 | 68 | 13.6 | 15 | 42 | 8.4 | 26 | 5.2 | 15 |
| 6 | 81 | 13.5 | 13 | 42 | 7.0 | 39 | 6.5 | 13 |
| 7 | 91 | 13.0 | 10 | 42 | 6.0 | 49 | 7.0 | 10 |
| 8 | 97 | 12.1 | 6 | 42 | 5.3 | 55 | 6.9 | 6 |
| 9 | 97 | 10.8 | 0 | 42 | 4.7 | 55 | 6.1 | 0 |
| 10 | 94 | 9.4 | -3 | 42 | 4.2 | 52 | 5.2 | -3 |

*MGR and MNR are here identical, because Marginal Complementary Costs (MCC) are zero, throughout.

MGR and MNR are tabulated between rows because they represent changes between the defined values of Gross Revenue.

⁹Determined by the definition of the abscissa, of which it is the reciprocal.

The implication of all that is that, insofar as our analysis comprehends the relevant considerations, adjacent users of similar land for similar purposes should be drawn by the rental constraint toward comparable intensities, with due allowance for differences of managerial energy and skill. We cannot rationalize the extensive use of valuable land by citing lower costs per acre, higher output per man, and that sort of thing. The relevant driving force is the marginal rent of land and it is, given the rein, a strict taskmaster.

But need we limit the conclusion to land used "for similar purposes?" I think not. Let the ACC curve of Figure 1 be an envelope type curve, representing not just the best adjustment to different intensities of producing one product, but the best adjustment of products to each intensity as well. Adjust the other curves, all measured in the economist's universal ruler, to the new definition of ACC. Their positions and curvatures will change, but not their basic shapes nor critical intersections, nor the conclusion they impose on us. Of two uses yielding the same rent per acre, the more intensive should, in a perfect market, acquire marginal lands from the less until the intensities are equal.

The observation of extensive land uses persisting in central places on valuable sites has seemed to call for rationalizations, such as those of Ely and Wehrwein. But it is also possible that these are evidences of badly distorted markets. I do not believe that a meticulous geo-welfare economist would give the standard apologetics very long shrift. He would even find the assumption of managerial differences stretched beyond capacity. He would insist that a perfect market should achieve an equi-marginal balance at the fence lines: that the outthrusting force of operator A should be the marginal rent of land to him, and the opportunity cost surrounding and constraining him should be the marginal rent of land to his neighbors, like C. He would have to deplore the failure of most land economists to apply such a standard in their judgments and comparisons.

Rent as a Constraint on Scale

Or is it just that he doesn't yet understand the marvels of large-scale production? Let us now drop the assumption of constant returns to scale, retaining yet however the homogeneous soil, and locational indifference. The analysis changes surprisingly little, so long as we limit it to atomistic individual landholders who do not capture many of their own external economies. Land, to the atomistic landholder, is much more divisible than labor or buildings or machinery, so that scale economies are almost synonymous with spreading the overhead of large capital and labor inputs over more land. Thus the scale question can be analyzed as a variation of the intensity theme. The necessary adaptations are in Figure 2.

Figure 2 differs from Figure 1 in these ways: the abscissa is now simply acres, instead of acres per complement; ACC is no longer a rectangular hyperbola but is appreciably flatter, being an envelope representing optimal adjustment in all respects to increased acreage, of which adjustments reduced intensity is only one;¹⁰ MNR is no longer identical with MGR but lesser, because MCC are now positive (in Figure 1 they were zero;) MNR intersects AGR to the left of the latter's peak, or not

¹⁰When scale economies spring from landholders' entrapping their own external economies, the ACC curve may rise over some range. But ANR still traces a lenticular figure, so that comparable conclusions emerge.

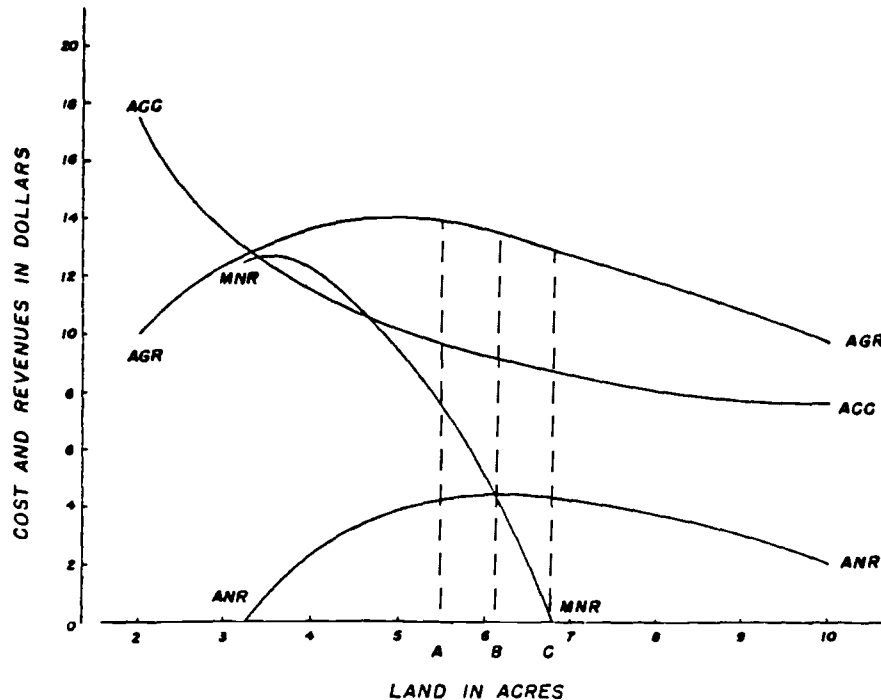


Figure 2. Costs, revenues, and derived average and marginal net products of land with increase of scale.

at all; and AGR peaks nearer the peak of ANR, at least relatively so, because of the flatness of ACC, and AGR (which is easy to measure) becomes more nearly normative.¹¹

The essential lenticular shape of the ANR curve is still with us; likewise the normative value of its peak, its intersection with MNR, which now represents optimal scale as well as intensity.

As before, the most interesting curve is MNR, and this time it draws a pointed contrast between the firm at A which is a little too small, and another at C which is a little too large. Their average rents (ANR) are the same. But the marginal rent curve (MNR), which the geo-welfare economist insists on, reminds us that in private as in public welfare economics it is not good practice to let the supramarginal parts of an operation carry the submarginal. There are substantial social gains from transferring marginal acres from the too-large firm to the too-small, so long as the latter remains viable.

In its long love affair with scale economies, the profession of agricultural economics has tended to overlook such nagging marginal considerations. It has leaned heavily on that falling ACC curve to the neglect of the others. Geo-welfare economists have a mission to bring equimarginalism into the picture. We have come to imagine small farmers as weak and inferior, to be preserved, if at all, only for sentimental, military, or "sociological" reasons. But in terms of the marginal revenue productivity of additional lands for their cramped holdings, overmanned, overimproved, and perhaps overequipped relative to their land base, some of them must be as ravening wolves. Just what keeps those wolves behind fences should make an interesting study in market imperfections.

¹¹It is worth signaling the implications of the last point. The great emphasis of production economists on minimizing costs per acre may be misleading. If we must emphasize a single criterion of good combination of inputs, maximum output per acre (AGR) comes closer to the norm.

The scale question now appears as an aspect of the intensity question.¹² Rent is more than a constraint on "extensity" abstracted from scale. In the process it assumes a key role as an absolute limit on scale, because it is one cost that does not decrease with scale. That is most obvious in the short run: as one expands his landholding he presses on his neighbors and meets increasing costs per acre. In the long run the cost of homogeneous land is constant, while the cost of land within finite distributive networks tends, as we see later, to increase.

By contrast, there are definite economies in larger buildings, larger rooms, larger machines, and so on. One doubles the floor space of a house, for example, without doubling the building cost. The role of rent as a constraint on scale is well exemplified by observing the evolution of autos and trucks, which are partly exempted from the constraint thanks to public underwriting of progressively wider and straighter streets and highways, and vehicle taxes based on criteria other than space occupancy. As the roads widen and straighten the vehicles widen and lengthen, and if they were publicly garaged, too, might eventually approach the dimensions of yachts and railroad cars. When they have to pay for the space they pre-empt, or when traffic congestion applies a constraint, they shrink again.¹³

Another aspect of land's special role in limiting scale economies is that the MCC required to integrate fringe lands with a firm's operating center include rising internal transportation costs. The essence of a firm's individuality, and hence of scale economies it may realize, is its integral organic nature centered about some nucleus like a farmstead. Land added to a firm is marginal not just in quantity, but in location relative to the nucleus. Increasing internal transportation costs result from both longer lines and, after some point, overcongestion at the nucleus. The TNEC Fetterites and others have pointed to analogous diseconomies in the administrative nexus, but the geo-welfare economist need not reason by analogy. The long lines and congested centers are physical facts.

And so the landholder adding an acre to his operation must discount its net product for remoteness in space, just as he does future net products for remoteness in time. But whereas we swim through time together, we occupy different points in space, and one man's remoteness is another man's proximity. As A encroaches on B, therefore, the MNR of land falls to A, but rises to B, constraining the encroachment and limiting economies of scale.

Yet a third way in which rent serves to constrain scale of firms is by penalizing the lavish use of land-time that characterizes large-scale operations. Large scale of capital inputs is associated, as a rule, with durability, and the economy depends on spreading initial costs over a long period. Annual rent, an inexorable function of time, is a serious brake on

¹²One could also interpret the risk question as a variation of the intensity theme, but space limitation precludes that here.

¹³In the example, road space, although partly a human product, is made analogous to bare land, which is entirely a natural product. I do not allege that road space is generally synonymous with land -- only analogous, in the particular example, and in the short run. In the long run, streets and roads and highways may be widened, and in that process the unique role of rent as a constraint on scale is manifest in the contrast between rural roads, where land is a minor cost, and downtown streets, where land is the major cost. Widening rural roads, we meet decreasing costs per foot of width; widening city streets, we meet sharply rising costs, as the street clips off the fronts of small and valuable lots.

all such grand conceptions. We proceed next to chrono-welfare economics: the role of rent as a constraint on extension in time.

Rent as a Constraint on Temporal Extension

Extension in space, with fixed complementary inputs, obviously makes land use less intense by spreading the fixed or indivisible inputs over more land. It is a little less obvious, but equally important, that one reaches a similar end by spreading fixed inputs over more land-time. One does this by letting buildings depreciate and yet survive over many years at low values unrenewed, thus encroaching on the time-margin of land use.

The primary constraint on this temporal extension is again rent, which the chrono-welfare economist views as part of the marginal cost of time. Rent as an opportunity cost puts land uses under pressure not just from all sides but from the future. Rent is not the only marginal cost of time--all costs have a time vector. But rent behaves in time as in space, that is it holds up inexorably at fixed or rising levels as one approaches the margins of decision where other costs as a rule taper off.

The usual capital input occupying land depreciates and obsolesces with time and has little, no, or negative salvage value toward its senility. Without rent, old buildings would almost never be demolished. On a base of zero any return is infinite. Along Park Avenue today a sound 30-story building has just fallen to the wreckers' ball to release the site for a larger modern improvement. The same building in St. Louis, or another part of Manhattan, would survive another half-century; in Aberdeen, S. D., perhaps two centuries; in Malta Bend, Mo., until it fell of its own weight, for it could always be used for storing grain, or old equipment, and ultimately for disposing of junk. There is always a use, however humble, for an old building. If the site beneath has no salvage value there is no limit to economic life but sheer physical collapse.

This function of rent is known to urban land economists, and ably expounded by Ratcliffe, but somehow it has never found its way into the main body of production economics which has tended to remain not only spaceless but timeless. Open almost any tome on cost analysis or price or production economics and you will see the axes labeled "Input A" or "Output B" with no reference to the time unit assumed, or the method of annualizing fixed costs. It is to the credit of Boulding that he has made the effort to apply marginal analysis to time economics, but he has concluded--I believe mistakenly--that marginal analysis there breaks down.¹⁴ Literature on capital theory has tended to neglect both marginal analysis and the role of ground rent. I hope I am not preaching to the converted, therefore, in expanding on the role of rent as a temporal constraint.

The rental constraint on time-extension operates more specifically as follows. Let us adopt Terborgh's expressive wording and describe old and new rivals for a site as "defenders" and "challengers." The time to salvage an old site arrives when the defender's current annual income net of operating costs falls below the top challenger's anticipated annualized

¹⁴Kenneth Boulding, Economic Analysis (3rd edition) (New York: Harper & Brothers, 1955), Chapter 39. For a criticism see Mason Gaffney, "Concepts of Financial Maturity of Timber," A. E. Info. Series No. 62 (Raleigh: North Carolina State College, 1957 and 1960), pp. 45-52. See also p. 54, which seeks a reconciliation -- it is not alleged that Boulding is entirely wrong, by any means.

rent net of all costs. Note that we are biased for the defender because its capital costs are already sunk and nonsalvageable, so in the marginal comparison we deduct no charge on sunk capital, neither depreciation, obsolescence, nor interest. What's done is done and historical costs are irrelevant even if embodied in outstanding debt.

The challenger's annualized net rent is a more difficult concept. Since the challenger is typically not another firm but another land use contemplated by the same firm we have little excuse to assume this rent has been correctly determined "externally." We will have to compute it ourselves.

A new use usually entails heavy initial costs, compensated by revenues tapering off over many future years until the next challenger succeeds to the site. The entire cycle of investment and liquidation is an indivisible unit that must be evaluated as a whole.

The challenger's rent must be an average of its performance over time. A simple mean will not do, however, for in addition to the quantities of costs and revenues, we must consider their distribution in time. A "time-average" is necessary. This is found by annualizing all costs and revenues--for brevity let us henceforth say simply "net revenues." Annualizing a quantity of given time-position, \bar{n} , means finding the amount, call it \bar{a} , which if received as a constant annual sum from now to \bar{n} would be of equal present value with the said quantity received once \bar{a} at \bar{n} .

Net revenues in the terminal year, \bar{t} , are annualized by the following standard formula:

$$a = \frac{i R_{\bar{t}}}{(1+i)^{\bar{t}} - 1} \quad (1)$$

where R is net revenue, i is the relevant interest rate, and \bar{t} is the terminal age of the improvement.

Net revenues in any other year, \bar{n} , are annualized by compounding them forward to the terminal year, \bar{t} , before applying the annualizing operations of equation (1). Thus the complete annualizing formula is:

$$a = \frac{i \sum R_{\bar{n}} (1+i)^{\bar{t}-\bar{n}}}{(1+i)^{\bar{t}} - 1} \quad (2)$$

It only remains to select the value for \bar{t} that maximizes \bar{a} , which one may do in a number of ways.

It reassures one's faith in marginal analysis to note that one way of doing so is to find the year when $R_{\bar{n}} = a$, that is when the marginal revenue of time ($R_{\bar{n}}$) equals the marginal cost of time (a). In the first years of heavy initial costs the values of R_1 , R_2 , and so on may be less than \bar{a} , and ordinarily will be even less than zero as the initial costs are counted as negative revenues. That is inevitable in the nature of long-term improvements. But toward the later years any value of $R_{\bar{n}}$ which fell below the running time-average, \bar{a} , established by preceding years, and not representing a new investment to be requited by later revenues, would lower the time-average of the whole and call for demolition and renewal.

Which is also to say that in time analysis, as in space analysis, and as in the timeless-spaceless abstract analysis on which economists still

nourish their young, a marginal revenue intersects the corresponding average revenue function where the latter is a maximum.

The accelerated replacement constrained by rent is a form of intensification of land use, as one would expect from the operation of a land constraint. Without the constraint the individual's motivation would be to squeeze the last drop of income from the initial inputs by spreading them over as much land-time as they would endure, thus minimizing the time-average of his costs without regard to the time-average of his revenues.

The intensity that the time-constraint encourages is of a sort that is not necessarily obvious if we should observe the static ratio of land to improvement at any given point of time. Intensity over time takes the form of faster turnover of improvements, rather than heavier initial improvements. Rent as a spatial constraint, it is true, prompts heavier initial improvements, but rent as a temporal constraint, chopping off the last years of each cycle, puts a premium rather on quick recoverability of capital, on flexibility and speedy replacement. Rent penalizes the ponderous and the monumental, and so has a tempering influence on initial costs. Its influence is rather toward maximizing volume of business, the joint product of capital times turnover. It is worth emphasizing that this rapid turnover of a nation's capital is a major factor tending to enhance employment opportunities for labor.¹⁵ Conversely, all factors that weaken the operation of rent as a time-constraint tend thereby to reduce employment opportunities.

This influence of rent is pervasive, affecting not only buildings but the daily use of rooms, floors, and shelf space. Rent is no less the executioner of the creaking lathe and the stale bread than of the firetrap apartment and the tired orchard. A high-rent economy is one that economizes on land-time by introducing a note of urgency into all phases of life.

Rent is not, however, entirely the enemy of quality, substance and durability. It is an optimizing force that abhors extremes. While it does not let the minimization of time-average costs dominate decisions to the extent of overlooking time-average revenues, neither does it the opposite. It rather strikes a golden mean, maximizing the excess of time-average revenues over time-average costs.

In Equation (2) we submerged this relationship by combining revenues and costs in one inscrutable expression, R_n . Let us now express them separately and observe graphically a typical interplay of the time-averages of costs and revenues with increasing life of improvements (Figure 3).

Here we see the now familiar lenticular shape of average net revenue (ANR), manifesting the same general principle as in Figures 1 and 2, only here applied to spreading fixed costs over time instead of space. The rental constraint precludes indefinite rightward drift because the slight decline of time-average costs is offset by the sharper decline of time-average revenues. The rental constraint does not however drive us clear back to the maximum of time-average revenues at A, for there time-average costs are too high. It drives us rather to B, where the curves are parallel and farthest apart, and time-average rent is a maximum.

The systematic chrono-welfare economist would now want to explore many more dimensions of this analysis and fill in many missing details. He would want to trace the behavior of the challenger's marginal net

¹⁵Cf. Knut Wicksell, Lectures on Political Economy, Vol. I, General Theory, trans. E. Classen (New York: The Macmillan Company, 1934), pp. 127 ff.

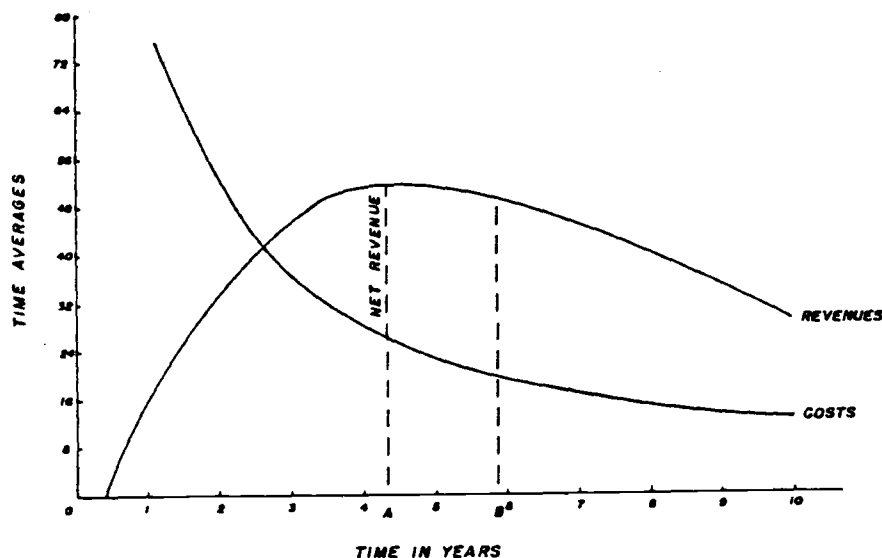


Figure 3. Time-averages of costs and revenues over building life.

product of land-time and assure himself that it equalled average net product at the latter's peak. He would want to trace out optimal intertemporal marginal arbitration when the challenger's future was constricted by an impending higher use so that his average net product could not be maximized--and he would discover he could improve a good deal on the "ripening-cost" apologetics of R. T. Ely. He would want to adapt his analysis to land uses like stock-feeding in which the capital appreciates over time--there he would discover the German forester Martin Faustmann to have anticipated him by over a century. But in this wide survey we must leave the question here.

Rent as an Expression of Traversal Costs

Our geo-chrono-welfare economist is now equipped, albeit crudely, for an excursion into transport costs and their relation to land use.

Rent serves to constrain excessive pre-emption of space generally, but most particularly of space that others must traverse. It is a most important principle for the layout and rating of transport-utility networks that the force of the constraint equal the increased traversal costs imposed by extension of land occupancy. While that may appear a welfare truism, it has not to my knowledge been formally expounded, and its policy implications are widely ignored both in practice and theory.

Let us suppose a row of five plots, equal in all qualities save location, running uphill from a common source of free water, S. A Water District serves them from a common pipeline, delivering to the uphill corner of each plot. Pipe capacity fits demand all along the line, declining after each outlet gate, in the likeness of an untelescoped telescope, but with enough excess capacity to permit a small adjustment.

Water is free at the source but not at the outlets. Service at each outlet is priced optimally to cover marginal costs, in a graduated manner we detail later. Now it is enough to note the water users feel the full social costs, exemplified by pumping, so that each successive user pays a higher rate.

In Figure 4 the capacity needed for each plot is represented by a line running from its service outlet to the water source, S. The plots are designated in ascending order, A, B, C, D, and N. N is the marginal plot, and as our curtain rises it is dry-farmed.

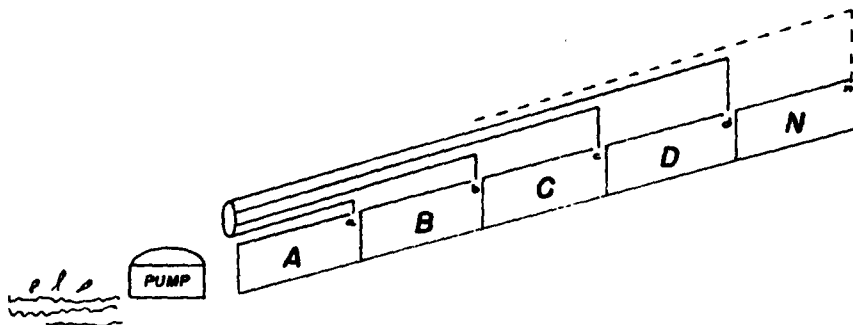


Figure 4. Schematic diagram of water service to hillside parcels.

In order for each plotholder to justify his tenure, both total and marginal, in the court of welfare economics, he must impute a marginal rent to the land as great as the traversal costs he imposes on landholders above, all of whom his presence pushes one slot uphill and who must pay for lifting water past his entire holding.

Let us concentrate on the margin between A and B. It is now affected by more complex factors than in our earlier example where location was unimportant. The outthrusting force of A is still the marginal rent he imputes, but B's resistance is tempered by his higher water rates, because he can encroach on C whose land is cheaper, or move to N. B has in fact a large family of interesting alternatives to scan, but for an introduction, the basic forces are exhibited by supposing A to buy plot B outright, and B to skip up to plot N. We now make that supposition.

When B leapfrogs over C and D to plot N he leaves C and D virtually unaffected, so the costs imposed on society are largely summarized in the costs felt by B. That is encouraging, for it suggests that B will require of A a price for plot B, or any slice thereof, equalling the social costs of his total or partial move uphill. Such a price would constrain A optimally.

The costs imposed on B are those of acquiring land at N, hopefully at the price of its marginal rent without water; the cost of lifting water past plots C, D, and N; and the loss of producer surplus on the water that he took at plot B but now thinks submarginal at the higher pumping cost.

It is encouraging, too, further to note that the additional pumping costs imposed on B equal the sum of everyone's cost of traversing the land onto which A has expanded. That is, B's cost of pumping one supply past three plots, (C, D, and N,) represented by the dash line in Figure 4, equals the cost of pumping three supplies, for B, C, and D, past one plot (B.) Thus the new transport costs imposed on society are the costs of traversing A's new territory. The removal of B to plot N gives the same result as

though A's expansion had simply boosted B, C, and D uphill in order.

So far, then, it seems that market rents can be accurate constraints guiding social economy of central space whose extension imposes traversal costs on outsiders.

To be sure the elegant geo-chrono-welfare economist would be aghast at the crudeness of our model. He would resolve to do a monograph embellishing the finer points at an early opportunity and lay no claims of accuracy until that was done.

But he would also note the futility of piecemeal optimizing. The normative welfare implications of our pumping model depend utterly on the assumption that privately felt transport costs equal social costs, and the fact is they do not. Where is there a water service that graduates rates with pump lifts? I know of none. Postage-stamp and capricious pricing are the rules in transport and utilities.

The location theorists have been content to spin out elaborate detailed models of lacy geometry on the assumption that private transport costs equal social costs, and that is their privilege. But it seems a poor allocation of their scarce time and abundant talents when not only is the assumption untrue, but no welfare theorist seems to be telling us what normative rate structures would look like. There is also an economy of economists, and our geo-chrono-welfare economist would wonder if he shouldn't rather go back to where Hotelling left us and develop a welfare pricing for transport and utilities as a framework within which to economize on land.

He would note that if B can get water at plot N and beyond as cheaply as at plot B, little restrains B from ranging and roaming gaily up the hillside, heedless of the costs underwritten by society. Looking back toward the valley, that release of constraint would cause B to sell plot B too cheaply, and relieve A of a proper constraint to economize on valley lands. If the valley lands --- here made analogous to central city lands --- had already, as in actual history, been intensively improved before the release of constraint, A would make his adjustment in the temporal margin of land use, reducing intensity over time by letting improvements age without renewal. Demolition is another name for salvaging land, and if land is made too cheap, renewal comes too slowly.

One reason some of the worst slums are found in American cities, of all places, is the same reason we have some of the world's worst-used soils, and some of the sloppiest camping manners: rather than renew we migrate. We have had that nearly-empty frontier, and a series of races to get out their firstest with the mostest, which seemed to justify the whole uneconomic process. We have subsidized one after another new form of transportation, spreading thin the ground rent that otherwise would have concentrated about the older centers and mandated their intensive renewal. The result has been careless exploitation at the fringes, and stagnation at the cores. Periodically, the process has brought on stagnation at the fringes, also, as rents have collapsed following bursts of overexpansion. Low rents, recall, mean low constraints on the temporal extension of land uses, hence a freezing of capital turnover, and reduced employment of labor.

And so our geo-chrono-welfare economist's train of thought leads him back to one of the great figures of welfare economics, Hotelling, who initiated a goodly share of marginal-costing and all that, back in 1938, by inquiring into criteria for setting railway and utility rates. He now sees that question as integrally related to a normative economy of land.

THE ROLE OF GROUND RENT IN PLANNING OPTIMAL TRANSPORT-UTILITY NETWORKS

We now rise above the viewpoint of the atomistic individual landholder, to whom rent is an external constraint, and adopt the vantage of the municipality, or utility, or large land company -- very large, that is -- which is presiding over the layout of a transport-utility network to service large numbers of atomistic plots. This latter activity is land "development," as distinct from the "improvement" of individual plots. It differs from mere improvement among other ways in this, that development creates rents on the atomistic parcels served, which parcels capture consumer surpluses and external economies from transport-utility networks. Municipalities and large landholders can recapture these spillovers, the one by taxation and the other by ownership, and use them to help finance development and to optimize rate structures along the guidelines of welfare economics. Let us assume a municipality in charge of development, dedicated to practice an art we will call enlightened Ricardian Cameralism, in the light of the best geo-chrono-welfare economics. What policies should it adopt for distributing water from a single free source?

To begin, it would mince no words quibbling whether to apply Lerner's Rule. The logic is inescapable. Price should be equated to marginal cost in every possible dimension, until the point where the cost of fiddling with prices exceeds the gains. No enlightened individual land manager would deny himself the gains of internal equimarginalism, and the enlightened Ricardian Cameralist can do no less.

We may abstract from and defer the short-run question by noting that a planner should aim roughly toward building and sizing so as to equate long-run marginal costs with the time-average of short-run marginal costs over project life --- a straightforward application of chrono-equimarginalism. There will be an early developmental stage of excess capacity, with short-run costs below long-run costs, and a terminal stage of the opposite. Here we discuss simply long-run marginal costs.

We must not be taken in by a specious sort of "increasing cost" that appears when we lengthen the pipelines to serve more lands. That is not a true increasing cost because the product is not homogeneous. "The product" we are supplying is not water -- that, recall, was assumed free at the source -- but transportation. We are producing place utilities. As we carry water farther, costs per gallon rise because the gallons are carried farther.

The homogeneous gallon is that delivered to one outlet. There, we increase the product by delivering more to one buyer at one place. And there we find decreasing costs, long-run costs, among other reasons because the cross-section of our pipe grows with the product of the radius times the circumference.

The Ricardian Cameralist is therefore selling not one product in increasing costs, but many products each in decreasing costs. He requires not one indiscriminate rate for the whole, but a graduated structure rising with distance from the source. Once having freed himself from the fallacy of regarding his product as homogeneous, he can allocate costs to each outlet individually, and marginal-cost pricing comes into its own.

First, note another problem we can solve jointly with the marginal cost pricing problem. Each outlet represents not just an individual product but an individual market, a perfect bilateral monopoly. Society pro-

protects the buyer from the seller, after a fashion, by regulating rates, but nothing protects the seller from the non-buyer, the landholder who does not choose to participate, although the physical nature of space gives the seller no choice but to make service available and to invest money in capacity traversing the holding. Ricardian Cameralism will give the seller an equipoise.

Now the Ricardian Cameralist sets a water rate equalling marginal cost as allocated to the individual outlet. The resulting deficit he covers by a lump-sum land-capacity tax on the land served from that outlet. The tax is a price paid for having water service made available -- an insurance premium if nothing else -- and a means of collecting consumer surplus. The landholder is compensated by getting water transported at low marginal-cost rates, with the net social gains thereby effected, and by the great economy of a compact distributive network. He loses the option of keeping his land out of the system, a welfare question we return to later.

The problem of allocating pipe costs to individual outlets is straightforward. Each section of pipe may be conceived as a large sleeve telescoped full of smaller sleeves. One sleeve is cast off after the pipe reaches each outlet, until the last outlet is reached by a simple, narrow, empty sleeve, the core of the pipe. A complete sleeve-length running clear back to the source, is allocated to each outlet.

In computing marginal cost the outermost sleeve does multiple duty, being allocated to each outlet. It is generally the cheapest sleeve per unit capacity, although the big trunks near the source will in a large system exhaust their scale economies. The allocation of total costs among individual parcels does present some complications, but as it is a less critical question we will not dwell on those here. It is certain, however, that the outermost sleeve should be allocated to the outermost parcel of land, for there we have the marginal decision to make: how far to extend service. That we take up now.

Marginal cost pricing is commonly criticized for providing no test of whether an operation is economical overall. It is a strength of Ricardian Cameralism to supply such a test, for each extension of a system and of course thereby for the whole. Our sculptor is pressing us for a decision where to locate his bust to the ancient god Terminus. How do we calculate an answer?

We have given the peripheral landholder shabby treatment so far, at least by his lights. We have let rates increase roughly with distance from the source, and actually somewhat faster because, although we allocate him the cheap outermost sleeve all the way, toward the end of the line that sleeve is at or near the expensive inner core. We are not following the common practice of letting the profitable center of the system carry the margins. The peripheries are segregated and must stand on their own feet, receiving only those economies inherent in the large-scale distribution system in which they participate.

It is therefore with a clear conscience that the Ricardian Cameralist resorts to the ultimate weapons of marginal cost pricing to justify extending service. Indeed he can do no other, for he will not have exhausted the last economy inherent in his position until he has done so.

He has already deployed his penultimate weapons: marginal cost pricing itself; and allocating the outermost sleeve to the outermost parcel. He has one other, usually reserved for sick railroads and submarginal reclamation schemes, but which actually should be marshalled to pinpoint

the margins of every distributive network. The ultimate weapon is this: he measures and recaptures every last shred of consumer surplus and external economy created by water service --- his yardstick is a land assessment and his reaper is a lump-sum ad valorem tax --- and applies it to cover the deficits of marginal cost pricing. He proceeds outwards until the surplus which he creates and reaps just covers the deficit. Thus far and no further. There we raise the bust to Terminus, the ancient god of boundaries. Thus we determine the total supply of land within our system.

At the termini we can be certain to find costs decreasing more steeply than further in, because a larger proportion of the sleeves allocated to the terminal parcel will be near the core. The Ricardian Cameralist must expect, therefore, to have relatively greater need of the land tax toward the termini, even though marginal costs and water rates are absolutely higher there. Figure 5 exemplifies the penultimate situation and makes the points graphically.

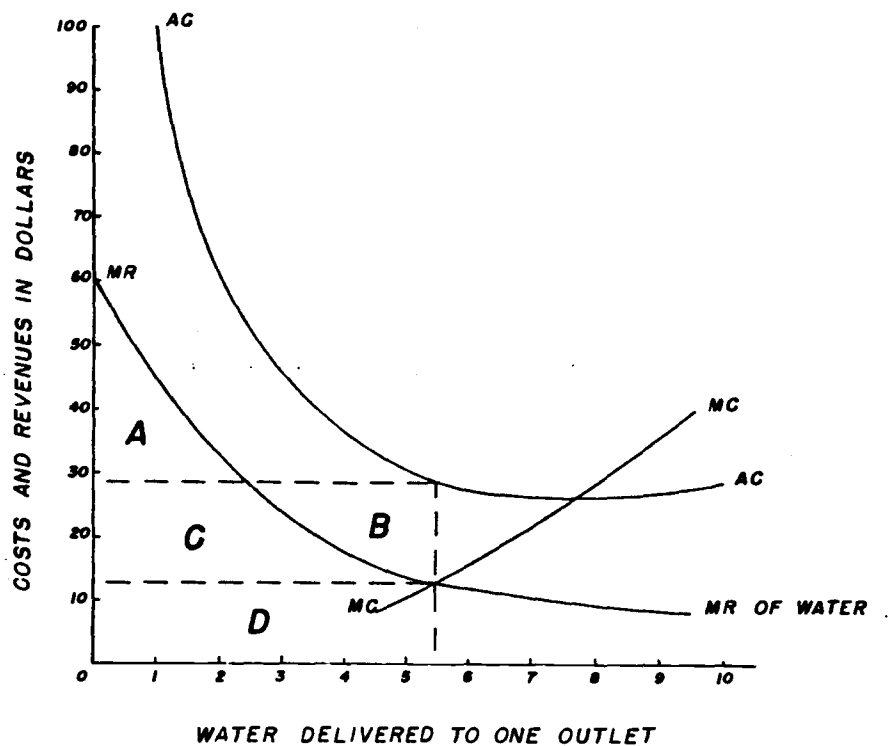


Figure 5. Costs and revenues of water service to a penultimate outlet.

As we proceed outwards along the water pipe, the AC curve, which represents costs allocated to just one outlet, rises bodily. Demand is here synonymous with the marginal net revenue of water applied to the land. Total benefits are the area $C + D + A$. Total costs are $C + D + B$. It is economical to extend service until area B waxes to equal or exceed area A, which in turn wanes as the AC curve ascends.

In terms of deficits and taxes, the deficit is $C + B$. Consumer sur-

plus, captured in land rent, is $C + A$. The lump-sum land tax can cover the deficit and still leave some rent unrecaptured so long as A outmeasures B .

It is geometrically obvious that as the AC schedule ascends, and we approach the terminal outlet, the intersection of MC and MR drifts leftward, beneath ever steeper reaches of AC, where costs are decreasing more rapidly, where the net social gains from marginal cost pricing are greater, and where, as we said, relative reliance on the lump-sum land tax must be greater.

Having pushed Ricardian Cameralism to its spatial limit, let us again don the chrono-welfare hat and return to the short-run vs. long-run question. When a system is new it should generally be overbuilt, anticipating increased demand. In those early years even the central parcels may exhibit the marginalistic traits shown in Figure 5, even though the time-average outcome is to be supramarginal. In those early marginal years, of course, price should be set to equal short-run marginal cost, which will be low, and the heavy deficits met by land-capacity taxes, which also serve as mandatory injunctions on landholders to accelerate improvement, thereby synchronizing interdependent investments. Thus at the temporal as at the spatial margins of the system the Ricardian element of Cameralism assumes greater importance.

There, then, are the bare bones of a transport-utility rate structure wherein social transport costs would be privately felt, and it would make sense to economize carefully on atomistic land parcels by geo-chrono-welfare principles. It is a system in which rent plays a central role, and which would in turn profoundly alter the present pattern of rents, were it applied.

The proposed system departs radically from present practice. Now, instead of subsidizing decreasing cost distributive operations we relinquish them to the publicans as tax-collecting machines, setting rates to cover not only average costs but the city deficit as well. With decreasing costs, and elastic demand, the excess burden from this form of indirect taxation, especially at the centers of the systems, is awful to contemplate.

Now, instead of graduating rates with distance we maintain postage-stamp rates over wide areas, letting surpluses from the center underwrite extensions into no-one-knows how deeply submarginal outlands. In respect to city streets we may temper the felony with gas taxes, but we compound it with taxes on vertical transportation, and indeed all manner of intensification, in private buildings, doubling the bias against the underfilled third dimension. The predictable result of taxes on downtown buildings and subsidies to capricious horizontal extensions is the checkerboarding and leapfrogging that we get.

Why do we subject ourselves to those hardships? Certainly not because you and I are the first who ever noticed that transport costs increase with distance; and lump-sum land taxes have been imposed in some measure throughout recorded history. The counterforces to Ricardian Cameralism fall also within the scope of welfare economics, and of them I would dwell on three most prominent: freedom of choice; economies of aggregate social scale; and the conflict of distributive equity with allocative efficiency.

As to freedom of choice, it strikes many people that to charge a landholder for transport-utility service whether he wants it or not is to bereave him of a dimension of freedom in choice, and reduce his welfare.

The view is specious, but I believe must yield to deeper values.

For one, whatever increases the community's net product increases the individual's free choice, quantitatively of course, and doubtless qualitatively as well. To permit holdout landholders to disrupt the spatial integrity of the community is to permit a distance-barrier among all citizens, a barrier to the linkages in space that give richness and reality to the abstract freedom of choice. There is not a wide range of alternatives in an isolated homestead at the end of a mud road.

For another, hyper-individualistic welfare economics may have under-sold the value of the freedom of men to act in concert. Man is a social animal, after all, and to allow one or a few holdouts to veto group projects and frustrate neighborly co-operation may be carrying a good thing too far. It certainly implies an interpersonal comparison in which the holdouts' freedom to say "No" is ranked above the majority's freedom to act as a community.

Last, the alleged loss of freedom is based on an implicit indivisibility, the identification of particular men with particular parcels of ground. But there is certainly no welfare postulate more basic than that man is the measure of all things; and an option denied to a square of land does not deny it to the man. He is not a serf, to the glebe adscript, but a free agent, master of his fate in society with many alternatives including other squares of land. In a word, people can move around. We complicate social problems needlessly if we impute the immobility of land to the men who own it.

Once the man is loosed from the matrix we see that Ricardian Cameralism would compensate for the loss of veto power by adding a new dimension to free choice. Today we can choose different quantities at a given price; then we could choose the price as well, by choosing the location: low rates in the center, high at the fringe, and a full spectrum in between. Let the individual choose freely just which combination of lump-sum land charge and variable use-rate best suits him. Today we impose a dull uniformity on all sites, epitomized in the grid system and postage-stamp pricing, in a crude gesture toward some pre-monetary barter concept of distributive equity, with every man's plot made as good as his neighbor's; Ricardian Cameralism would differentiate sites, fully exploiting and accentuating the natural advantages of the center, leaving the extreme peripheries for the misanthrope. To secede from co-operative society is certainly every man's inalienable right, and worth protecting, but not, please, right in the middle of it.

Now let us entertain the second counterforce to Ricardian Cameralism, the economies to aggregate social scale. Ricardian Cameralism may appear to be an introverted and short-sighted policy. Cheap subsidized peripheral transport, as today, helps to widen markets and so open the way for scale economies at the center. That is a point from which our examples abstracted by assuming water free at the source. But it is no problem now to price water at the source, before it enters our pipe price system, which is only a means of pricing transport. If there are scale economies at the source they can be optimally encouraged by marginal-cost pricing. There is no magic in scale economies that exempts them from comparison with other values in the price balance, and it would be folly, it is folly, to enshrine them as national idols and sacrifice net welfare to them.

But the hyper-scale economist looks beyond the present. If his city,

his utility company, his region, his agency, his nation doesn't stake claim to untapped peripheral resources now, preclusively, some other empire-builder may sneak out there first. While we aren't quite sure what we want with the territories today, we certainly don't want those other fellows taking over and discrediting all the lies we tell about the destinies of our crossroads and its merchantable real estate, our corporation and its public shares, etc.

So to secure those figments of future economies we acquiesce in otherwise uneconomical transport-utility extensions. In the process we sacrifice true present economies in scale of distribution lines serving compact populations, economies that come from broadening or thickening rather than lengthening lines, economies of a sort to put most modern American cities in at once both the stages of increasing returns to scale but negative returns to more space.

As to the hopeful future economies, it is now some 100 miles across what passes for the city of Los Angeles, to cite an extreme example, with precious few possibilities of true economic sharing of common costs between extremes, and two-thirds of the downtown sterilized by the space demands of the insolent chariots. The New York Regional Planning Authority recently estimated a need for \$50 billion in the next 25 years for transport-utilities to reintegrate the fragments of what used to be New York City. It is noble to sacrifice the present for posterity, but it is stupid to sacrifice both to an illusion, which we may have let get a little out of hand, just as our daddies did before us on several immemorial occasions.

It would seem wiser for most cities, and analogous distributive organisms, to grow compactly, at peace with their neighbors, and when the time came to break out of the shell and integrate with other organisms to the end of widening markets and achieving scale economies, to do so at the wholesale and trunk-line level, proceeding in order and the fullness of time toward complete integration. That would present its problems, to be sure; but the alternative is the interurban mess we have today.

Finally, there is the conflict of allocative efficiency with distributive equity, and there is a counter-dominant to sunder the social fabric indeed. By this point I trust no reader remains unapprised that the distribution of utility services in space has an important bearing on that other kind of distribution -- of income, of wealth, hence ultimately of that other kind of utility of which the welfare economists write. Setting rates, locating lines and terminals here instead of there, those are key activities that make or break the value of lands, and the men who hold their titles.

Ricardian Cameralism, as sketched out thus far, appears to favor the center over the circumference. It charges the outer landholder not only a higher use-rate but a higher lump-sum tax as well, thus abusing him thrice: initially he received lands less favored by Nature, from those lotteries of Fate we call history and patrimony, next we would raise his utility rates; and then, instead of compensation, on his groaning back we heap the bulk of municipal taxes! But that is insufferable. It not only overburdens the outlanders, it cuts off their escape routes and throws them back on the mercies of the inner few, mercies not always tender. Clearly we have developed only a partial philosophy and must think farther.

Terminus, the god of boundaries, has not found favor in American history because so often he appeared as an agent of the inner interests, the Establishment, a sort of sheep dog hounding us to the clipping houses. It

is curious that economists who, since discovering monopoly 30 years ago have defined it into every jar and carton on our shelves, have given so few words to the most transcendent and entrenched monopoly of all, that community of interest of important local landholders organized openly and aboveboard as city councils and county boards and state legislatures. But the outsiders, although they may not have known a cet. par. from a mut. mut., have maintained a healthy skepticism of the Establishment, and American history is a series of successful revolts against overcontainment. George III sculpted Terminus on the Appalachian Trail, the Proclamation Line, and reaped The Revolution. Hamilton tried the Ohio River line but got Jefferson and Louisiana. The Whigs tried again and got old Hickory and the canal boom. The southern Democrats tried once more and got Oregon, Lincoln, transcontinental railroads, the Homestead and Morrill Acts, and all the rest. Downtown has tried and reaped the shopping center. The Budget Bureau tries but cannot contain the Reclamation and Flood Control Associations. You cannot hold the American people behind fences. Negative containment policies do not work, and we wouldn't like them if they did.

The inner few, therefore, seeing the limits of power, have accommodated the demand for admission and expansion as befits shrewd cartel managers. They are custodians of a surplus, a potential social dividend, which we have called ground rent. They need a formula to distribute it among their retainers, and they have used for this the atomistic land parcel, a quota in the cartel, with postage-stamp utility rates a means toward a crude communion, a species of distributive equity, among members. The institution of property in land ceases to be a means toward efficient allocation of a resource and becomes (perhaps it always has been) a means to maintain a viable political structure. I do not belittle the achievement. It is worth some sacrifice.

How might Ricardian Cameralism resolve the problem and reconcile distributive equity with allocative efficiency? The answer clearly lies in levying on those central rents. The containment effected by graduated transport-utility rates would multiply those rents over present levels, and we could with clear consciences go after them on the welfare principle of taxing the gains of winners to compensate losers. We could use the same lump-sum land-capacity tax already described, which would have the important bonus of converting a large share of the landholder's implicit rent, a soft and easy-going sort of constraint, into an explicit cash obligation, a regular fixed charge, which would increase the leverage of the remaining net rent and so whet his incentives remarkably.

The question next arises, which Ricardian Cameralist should collect those central rents? The local distributive organism has already been adequately financed from the charges levied as constraints on peripheral parcelholders. Here is a pleasant sort of dilemma, and the obvious answer is that the central surpluses are the proper preserve of state or federal government. From the larger view, indeed, the analogy is almost perfect between the State-local relationship and the local-individual relationship. To the State, presiding over trunk highways, power pools, natural gas lines, interregional canals, and the like, the local distributive organism is an atomistic parcel, a cell surrounding a nucleus, with marginal rents declining toward the peripheries, just as in the individual parcel, and for perfectly analogous reasons: growing internal transport costs.

The ground rents generated at the centers of these local organisms are but the reflection of natural location advantage, in the larger scheme of things, plus the artificial enhancements of natural advantages constituted by the trunk distribution lines that link the cells in the nexus of the regional, national, and world superorganisms. Ricardian Cameralism in the larger sense would simply entail applying at the regional and national levels the same principles already worked out at the local. We might then discover that an increasing population can live quite comfortably on no more lands than we presently pre-empt, but a good deal less.

And so the geo-chrono-welfare economist, who began by joshing welfare economists for dreaming of unattainable Platonic prototypes, culminates with a model that will strike some readers as farther-out than any scheme yet hatched by the Cam or the Thames. Yet, so rough and ready a monarch as William the Norman was able to apportion his feudal levies among his vassals by the capacity of their lands, and produce in the Domesday Books a tolerably useful national cadaster. Not long ago most American States levied directly on every lot and acre, and few would deny today that State Boards of Equalization assess land more truly than their local counterparts. Even without any Ricardian Cameralism, the Federal Bureau of Internal Revenue today must check the market value of every parcel when it changes hands by sale, gift, or death, and while that is the thousandth part of its present impossible task, it is virtually the whole of the Ricardian system. As to overambitiousness, the Ricardian system can be writ small as well as large, approached gradually as well as abruptly, applied piecemeal as well as whole.

I do not believe the barrier to Ricardian Cameralism, therefore, lies in any complexity or remoteness, but only in the minds and customs of men. Western man has now been pushing back frontiers, and running away from problems behind him, for some 1500 years, and the realization has not quite fully broken that the world is round and finite. Without question the world offers still more frontiers where, with the usual elbowing and throat-slitting, we could expand beachheads, but to what avail? Manifest Destiny has already stretched us thin from sea to shining sea; world resources may be tapped through trade. With the problem of atomic survival now uppermost, today's challenge is rather to demonstrate that a free economy can prosper without forever thrusting outward to encroach on its neighbors; that it can reorient a vigorous people's aggressions into heightening and deepening our capital and culture on the land we already have. Too, we are challenged to find better modes of balancing and reconciling the legitimate claims of society and individuals, of socialism and free enterprise. Toward those ends the land economist and the welfare economist, severally and jointly, can offer society more plausible alternatives than those it now faces so distraughtly.