STUDY S-324

LAND AS AN ELEMENT OF HOUSING COSTS:

THE EFFECTS OF PUBLIC POLICIES AND PRACTICES

THE EFFECTS OF HOUSING DEMAND

Two Papers by:
Mason Gaffney
Richard F. Muth

October 1968

INSTITUTE FOR DEFENSE ANALYSES
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HUD H-931

FOREWORD

This Study represents a portion of the work done by the Institute for Defense Analyses for the Department of Housing and Urban Development in response to Contract H-931. As defined in the contract, "The objective of [the overall study] is to examine, broadly, the possibilities for achieving marked reductions in the cost of urban family housing by introducing major innovations and efficiencies into its design, 'marketing,' and production in an organized way." The overall study was conducted over a period of six months and the work is summarized in IDA Report R-148, An Investigation of the Opportunities for Reducing the Cost of Federally-Subsidized Housing for Lower-Income Families, by J. A. Stockfisch.

The component research tasks include the work reported in this volume and the following IDA Studies:

a. S-322 - Effects of Constraints on Single-Unit Housing Costs by Richard F. Muth and Elliot Wetzler

b. S-323 - Supply Conditions for Low-Cost Housing Production by Neil S. Weiner

c. S-325 - Cost-Reducing Condominium Systems for Low-Cost Homes by G. C. Szego

d. S-321 - Constraints on the Aggregation of Federally Subsidized, Low-Cost Housing by the International and Social Studies Division.

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SUMMARY

This Study comprises two separate papers addressing the general problem of the cost of land for low-income housing. The first, by Mason Gaffney, discusses how public policy affects land costs and the second, by Richard Muth, presents a quantitative model that shows the impact of the demand for housing and the demand for land on the price of land.

A. POLICIES AND PRACTICES AFFECTING URBAN LAND COSTS AS AN ELEMENT OF HOUSING COSTS

Three determinants of urban land value--investment necessary to transform raw or agricultural land into usable urban land, differential site value, and a capitalization or valuation process--interact in complicated ways through the urban land market and pricing process. Critical public policy elements--zoning, the location of public works and facilities, property taxation, and Federal income tax practices--further complicate the operation of the urban land market and pricing process.

One effective proposal for lowering land cost would be to raise land taxes. It is the public equity in the land, as asserted through taxation, that directly motivates local governments and individuals to "produce" land for housing. Thus a higher tax rate should motivate cities to add to land stock by extending public works. Higher tax rates can therefore increase land supply, if the tax system is administered so that the tax base is an assessed value estimating the "opportunity cost" or best alternative use of land, and assessment is uniform. At present these conditions are seldom met.

Present tax assessment practices have an inimical effect on releasing land for low-cost housing--practices such as exemptions,

underassessments of land, tax delinquency with the option to redeem if the land appreciates, and resisting annexation by the city. These assessment practices, combined with low-intensity zoning, operate to reduce the supply of land available for urban use. The smaller supply increases the market price of land that is available. An important policy implication of these points is that local governments may have at their immediate disposal untapped resources to finance public works.

The property tax system operates as a general tax on the earnings or income from wealth, and as such it lowers the rate at which all asset earnings are capitalized. The implications of the character of the property tax system are that land yielding an economic or differential "rent" must be taxed at a higher rate than other assets are taxed. Otherwise, land will become an attractive asset to hold, and improvements will be discouraged to avoid a tax reappraisal.

Several features of the Federal tax system--write-offs of undepreciated and appreciated land, exemptions, and deferrals--combine to make land an especially attractive vehicle by which taxpayers can reduce their income tax liabilities, and in this way increase land prices and hold land off the market.

The present system thus impacts unfavorably upon housing costs for low-income individuals. However, it may be concluded that through review and revision of some of the features of the Federal income tax system there are possibilities for legitimate reduction of housing costs without subsidy.

B. THE DEMAND FOR HOUSING AND THE DEMAND FOR LAND

The demand for land and for structures is derived from the demand for housing and from technological conditions in the production of housing. Thus land and structures may be viewed as inputs into the production of housing. A model was constructed to analyze the impact of changes in land prices and construction costs. Estimates of the parameters which determine the demand function for land and for structures were made from data relating to new FHA financed housing

in different parts of the country. These estimates were used to show how various housing policies might affect the housing market.

A 10 percent housing subsidy, by raising the demand for housing which in turn raises the demand for land, leads to a 15 percent increase in the price of land per square foot. Similarly a 10 percent decline in construction costs would lead to a 3 percent increase in the price of land per square foot. The implications of the analysis are that the long-run impact of housing subsidies will increase the consumption of housing, but by less than the amount of the subsidy.

I

POLICIES AND PRACTICES AFFECTING URBAN LAND COSTS AS AN ELEMENT OF HOUSING COSTS

by Mason Gaffney

A.

INTRODUCTION

Land is a major cost element of urban housing. Site values of improved urban lots are about 20 percent of the total value of new single unit dwellings. However, this ratio varies significantly between neighborhoods and regional areas in the United States. For example, for the third quarter, 1967, FHA data for proposed one-family homes to be financed under Section 203, indicated that house lot prices per square foot varied from $1.72 in Orange County, California, to $.16 in Birmingham, Alabama--with the national average at $.38 per square foot.[1] Cost per unit of land is much higher in densely populated areas. For example, the acquisition cost of 110 acres for a co-operative apartment project in a decaying area of Queens, New York was $6.5 million, or ~~$59,000~~ $59,000 per acre, or nearly ~~$9~~ $1.35 per square foot.[2]

The cost of any parcel of urban land is derived from two elements. First, a private investment must be made to transform raw land into something usable for urban purposes. This private investment is embodied in the form of streets, sewers, utility facilities, and other privately financed improvements necessary for modern, urban living. Second, much urban land derives a value, and hence a cost

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1. See Area Trends, Second Quarter 1967, RR:250-M, (Department of Housing and Urban Development, FHA, Division of Research and Statistics).

2. See "Rochdale Village," a brochure prepared by the United Housing Foundation (New York, November, 1967). In addition, over $1.4 million was spent by the developer for water lines and sewers. Overall cost of the project was $100 million, including $85 million for buildings and other site improvements.

to any user, from an advantageous site location and from public works. In the economic literature treating the subject of land, the source of this second element of land cost is often viewed as economic rent, or simply as land rent or the earnings of land per se. As such, it is conceptually distinct from the return on any private investment in land improvements which is necessary to make raw land useful.

We may illustrate these two elements of land earnings as follows: Suppose it requires private initial investment of $2500 (to include a pro rata share of streets, sewers, and so forth) to transform a piece of raw land into a usable house lot. If the opportunity rate of return on investment is 10 percent, the annual earnings of the lot will be $250 (the public bears any costs of maintaining and replacing the facilities). The $250 might also be viewed as the rental price, or hire, of the land. As such it represents the value of the flow of services provided by the land improvements.

Assume next an identical parcel of land that is favorably located. It could be within walking distance of an efficient urban transportation system, or provide its owners an inspiring view, or both. As a result of this favorable location, it may be worth $1,000 a year for a homeowner to live in that location, in contrast to a "marginal" location. Here there is a differential flow of services, which has a value to consumers, associated with the particular location. If the rate of return on investment is 10 percent, the $1,000 annual value of the services due to the choice location of the land parcel will be capitalized at the 10 percent rate. Its capital value is $10,000. This capital value is in addition to the $2,500 investment in improvements necessary to make the parcel usable. The total capital value of the land, or its acquisition cost, is $12,500 if we assume a 10 percent capitalization rate. The annual cost of the land's services (including that which is derived from its preferential location) is $1,250.

These determinants of urban land value--i.e., investment necessary to transform raw or agricultural land into usable urban land, differential site value, and a capitalization or valuation process--

interact in complicated ways through the operation of land market and pricing process. The operation of urban land markets and pricing are further complicated by their interaction with critical public policy elements: zoning, the location of public works and facilities, property taxation, and Federal income tax practices. What follows is an attempt to clarify some of these relationships.

B.

ELEMENTS OF LAND COSTS AND PROPERTY TAX

1. THE STABLE CASE: ANNUAL FLOWS VERSUS PRESENT VALUES[3]

Table 1 illustrates by means of a hypothetical example the nature of land cost. It is assumed that Parcel "A" possesses no particular locational advantage; whereas Parcel "B" enjoys a favorable locational advantage as illustrated by the $1,000 annual site advantage. Both parcels are assumed to have embedded $2,500 worth of investment which renders them useful for urban housing. (The mechanics of how this kind of investment occurs--which is also the process by which the supply of urban land is increased--will be discussed later). The rate of return on investment, and the capitalization rate by which all future income streams is discounted, is assumed to equal 10 percent. It is further assumed that the land itself, including the investment embedded in it, is nondepreciable--i.e., the returns and benefits flow indefinitely.

Under these assumptions, Table 1 illustrates that the annual cost and present worth methods of looking at land values are different ways of viewing the same phenomenon. It should be emphasized, however, that in the case of urban land--because the supply can only be increased in roundabout ways and because urban land is nondepreciable--some special forces operate that warrant clarification. These forces operate through a capitalization process.

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1. For a more rigorous development of the material in this section, in terms of the mathematics of investment, see Appendix A.

Table 1

ILLUSTRATION OF URBAN LAND VALUE DETERMINATION

	Parcel A	Parcel B
Investment Cost	$ 2,500	$2,500
Annual Return on Investment @ 10%	250	250
Annual Differential Site Advantage	0	1,000
Annual Benefits (Cost)	250	1,250
Present Cost (Worth)		
Discounted @ 10%	2,500	12,500

If we assume the stock of urban land is fixed, the primary focus on the cost of the annual flows should be $250 and $1,250 for Parcels A and B respectively. The cost is unchangeable. For example, a lowering of interest rates which will reduce the capitalization rate to, say, five percent, will not benefit the prospective homeowner. The fixed earnings of the land will be capitalized by the lower five percent rate; parcel A's price will increase to $5,000 and parcel B's to $25,000. The purchaser of parcel B, therefore, will have to borrow $25,000 at 5 percent, instead of $12,500 at 10 percent. The lowering of interest rates, per se, does not benefit the housing consumer insofar as he consumes the services of urban land.

Let us next assume that parcel B is subjected to special property taxes, say $500 a year (possibly because it is in a "high tax" jurisdiction). The net private rent (or benefits derived from the land site) fall to $750 ($1,250 annual benefits, less $500 annual tax). The $750 annual rent after tax is capitalized at a rate of 10 percent and the market price of the land is $7,500. The prospective purchaser of the land confronts a market price for the parcel of $7,500, plus a

present worth of future tax obligations of $5,000. The cost of the land remains the same. Conversely, if the property tax is reduced, only the land owner benefits. The market price of the land increases to reflect the reduced property tax obligation. The essential elements of land cost remain. Students who propose property tax reduction as a means of permitting lower cost housing should not be surprised if in fact no cost reduction occurs. Rather, under certain conditions such property tax reduction may only increase the net worth of land owners.

To summarize, there are certain inescapable costs associated with urban land. Land parcels that enjoy a preferential location, and hence an "economic rent," incur a cost that cannot be avoided. Lower interest (or capitalization) rates, more or less differential property taxation, merely operate to change the prices which are registered in the market for the land itself.

By recognizing these points, we can dispose of some specious but ineffective proposals for lowering land cost:

(1) Lower interest rates: These raise the land price base in the same proportion that they lower the capitalization rate, leaving yearly carrying costs constant.

This argument presupposes a supply of land that is not elastic (or responsive) to lower interest rates. It would have to be modified under assumptions which made land supply rise with a fall of interest rates. For example, subsidized low cost credit for housing helps housing take land from industry, trade, recreation, charitable institutions, and agriculture. The supply of land for any one activity has some elasticity, especially if that activity is subsidized at the expense of others. The critical point is that there is no magic in low interest rates as a <u>general</u> policy that will circumvent holding costs.

(2) Lower tax rates: The basic general analysis is exactly the same as for interest rates. Lower tax rates can raise land prices. The net result is to substitute an added interest cost for the reduced tax cost.

Due to the nature of credit markets, the tradeoff between interest and taxes is not perfect and has an allocative effect. It removes a cost (property taxes) that bears equally on all landowners and replaces it with one (interest) that varies inversely with the credit rating of the individual. Credit ratings vary directly with income and wealth. Lower property taxes, therefore, can operate unfavorably against the low income groups seeking to acquire homes.

(3) Higher land taxation: It is often asserted that higher land taxes will reduce the cost of land. Although it is correct that through a capitalization process, higher property taxes will reduce the market price of land, the prospective buyer should also include the present worth of future tax obligations as part of the acquisition cost of land. However, there is a case for higher land taxes, as indicated in (2) by the criticism of the effects of lower land taxes. Raising the land tax substitutes an impartial tax cost for an interest charge that bears more heavily on lower-income groups. Land taxation lowers thus the capital that must be raised by private parties to achieve land ownership. If low-income individuals encounter higher costs of raising capital than do high-income individuals (and groups, including corporations), property taxes which lower land acquisition costs will operate to the relative advantage of those in the lower income groups. In addition, the added tax revenue from higher land taxation can assist local governments to handle their financial problems, or substitute for such taxes as payroll taxes (i.e., city "income" taxes), sales taxes, and perhaps taxes on building improvements. As noted earlier, however, an increase of land tax rates implies a wealth loss to those owning the land at the time the rate increase is anticipated. This loss occurs to <u>all</u> land owners--including lower income individuals who own their homes.

2. LAND COST AND THE SUPPLY OF LAND

a. <u>Some General Relationships</u>

A large share of what we normally call land value is not produced by private people in the same sense that buildings are, and land rent is not a reward for producing land. It may be described as a "public value," the joint product of appropriation and tenure protection provided through the police power of government, and access and utility provided by public works. The worth of land also arises from spillover benefits of private works on neighboring land. These spillover benefits values are "public" too, in the sense of not being captured by their producers, but by the neighbors of the producers.

For these reasons we can speak of land cost as not serving very directly to elicit the stock of land, and to treat stock as inelastic to price. This is not to say the stock is fixed in a meaningful economic sense. Area is fixed, but the productive and want-satisfying

potential of the fixed area is indefinitely expansible as spillover benefits from social progress and public works accumulate. But this process occurs mostly without the work of the landowner as such: there is no direct market mechanism whereby the public value of land stimulates its own production.

High land costs do motivate landowners to intensify the use of their land, where zoning allows it. This is a vital economic function of land price, without which the limited stock of valuable land would be used wastefully. The good use of a fixed stock has many effects that resemble an increase of supply, and the two are often confused. A 20-story building on a site uses less land per unit of building. When fill is dumped into the bay, use is made of a marginal underwater site. Higher land costs also takes land from lavish users--sportsmen, gentleman farmers, nurseries, and so forth--and causes it to be used for the needs of those who are willing to pay a higher price for less land per capita. In the process, a new set of prices is established, which is a necessary condition to attain the new and more intensive use of land.

But there is only a weak and indirect stimulus from land price to motivate people to "produce" land for housing. High land prices might motivate local governments to extend public works. But it is the public equity in the land, as asserted through taxation, that is the direct motive. A higher private equity motivates public works insofar as it moves landowners to exert political pressure to promote public works.

With these relationships in mind, let us review the effects of lower interest (i) and tax rates (t). No longer are they parallel, but at odds, for the public and private equities are divided in the proportions of $\underline{t}$ and $\underline{i}$. (Compare Eq. A14 in Appendix A, "The Mathematics of Land Costs.") The public share of rent is $P \cdot t$, and the private share is $P \cdot i$. If $\underline{i}$ falls, the public share of rent $(\frac{t}{t+1})$ rises. This should motivate cities to extend public works. Thus it may, through the tortuous path of city councils, add to land supply.

A higher tax rate should motivate cities to add to land stock by extending public works because a higher tax rate means a higher public equity in land. Thus higher land taxes should not reduce land supply; rather, they actually can cause it to be increased.[4]

b. Some Administrative Practices

The points that land taxation can operate to increase the supply of urban land, and to lubricate the functioning of the market mechanism, depend on the assumption that the tax system is administered in a certain way: that the tax base is an assessed value estimating the "opportunity cost" or best alternative use of land, and assessment is uniform. In practice this assumption is seldom perfectly met, and often not even approached. Let us now review the aspects of assessment and other practices most inimical to releasing land for low-cost housing.

(1) Exemptions. A large share of real property is exempt from the property tax. The privilege does not attach to the property, in rem, but to the organization - church, school, charity, foundation, brotherhood, cemetery association, state and Federal government, etc. It is therefore indefinitely expansible as these privileged groups accumulate more assets. Today, more and more human activity is being channeled into tax-exempt institutions.

The privilege being granted by the state, the local government has only weak defenses against erosion of its real estate tax base. The result is to limit the use of the property tax because the privilege is naturally worth most where tax rates are highest. Any municipality that taxes its property to provide superior local

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4. There is also some deliberate private production of land value to consider. Large private landowners can consciously plan to deliberately create spillovers--"internalize externalities"--as in shopping centers, or other large, integrated land developments. If this were the predominant source of land values, indeed, the conclusion of the preceding paragraph would have to be reversed. On the whole, however, it is secondary to public works financed by government.

services will be that much more attractive to tax-exempt institutions. Thus the very existence of the threat of invasion by exempt institutions serves to limit the positive good that might be done by raising tax rates on land.

The primary direct damage done to low-income housing by tax exemption, of course, is the withholding of land from home seekers. The exempt holder has lower carrying costs, and can outbid the taxable rival for at least some land. In addition, exempt parcels in other uses, or unrelated uses, break up neighborhood symbiosis and synergism. In a perfect market, the highest use of a site is generally that which maximizes the present value of the net income stream. Such a use would be most complementary to the use of neighboring sites. This is most obvious in commercial centers. Churches, cemeteries, or schools at key places--which would not be located in a given site if they had to pay property taxes--break up the integrity of retail centers, reducing their aggregate power to satisfy wants, and sending retailers out in search of other sites. In this search they compete with homesite seekers over wide areas.

(2) Underassessment of Land. Although in some cases it does not matter how the total assessment is divided between land and building, in other cases to be discussed below, it does.

(a) Land under old buildings--When a builder buys an old "junker" and demolishes it, he obviously has bought land. The "land value" is the purchase price plus demolition cost. On the eve of demolition, therefore, old buildings should be assessed at zero or less (salvage less demolition costs); and the land be assessed at the full value of the parcel, or more. However, a study of about 1500 demolitions in Milwaukee over the last six years has brought out that just before demolition the assessor attributed over half the assessed value to the building. This suggests that the assessment practice may be generally biased in favor of land. This practice, which probably prevails nationwide, has a number of effects inimical to the production of buildings.

First, it lets new buyers of "junkers" redepreciate much of the purchase price for income tax shelter, so long as they do not renew. The Internal Revenue Service accepts local assessor's allocations of value between depreciable building and nondepreciable land.

Second, it puts a bias in favor of larger and more valuable grounds around buildings. If a parcel with a larger lot is assessed higher on account of the lot, it is not assessed enough higher when the proportion of the land to building is understated. Gasoline stations with wide aprons, for example, would receive lower assessments.

Third, to the extent that the assessment on neighboring vacant parcels is set and defended by comparison with nearby land, it biases downward and appears to justify low assessments on parking lots, unused land, vast grounds, etc.

Fourth, it makes an artificial incentive for owners to demolish old buildings of some residual value--often supplying low income housing--and leave land vacant, to lower their tax assessment.

Fifth, it partially converts the land tax into a tax on new buildings. Landowners may or may not succeed by demolition and waiting in keeping the land assessment down when they renew the site. Local practice varies widely. In New York, it is common for the land assessment to be raised when a new building goes up on the site. That practice makes the "land" tax partly[5] a tax on new

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5. It is still partly a land tax because on land of low value the land assessment could not rise much or at all when a new building is erected. In general, so long as the rise of land assessment bears some relation to the land value, and is not simply a fixed proportion of the building cost, it is partly a land tax. Indeed, it is conceivable that the increase of land assessment could be entirely a function of the land's market value and independent of the building value. Then it would act as a building tax in respect to time of renewal, but as a land tax in respect to intensity and quality of the building. A land tax assessment administered this way would probably increase rather than reduce intensity when renewal occurred; the builder would want to minimize the amount of land whose assessment rose when he renewed the site. The net result would be sites renewed

buildings, and provides an incentive to defer renewal. In some jurisdictions, sale of land is the occasion for reassessment, making the "land" tax really a tax on change of ownership, locking in old owners and penalizing new ones--usually builders.

It might seem healthier for builders, by comparison, if land assessments simply remained frozen on the occasions of building or sale; and there are cases of that, too. But that means gradual tax exemption for land altogether, putting the whole burden on buildings, requiring a higher tax rate, reinforcing the disincentive effects of taxing buildings.

The proper standard against which to compare present practice is one in which land assessments are based on value, as the law directs. Value at any time is what the land if bare would sell for. It is value in the best alternative use: the economists' "opportunity cost." It is independent of present use or ownership. It changes year by year, usually gradually, as demands and neighborhoods change. A proper land assessment changes in step with these exogenous determinants, ignoring the specific response that individual landowners make to their environmental challenge. A simple test of land assessment technique is whether the assessor uses a map of land values that may be contoured, showing the dependence of land value on location. Most assessors, astoundingly, have no such map. Their assessed land values jump up and down from lot to lot.

The rarity of proper land assessment practice is attested to by the commotion aroused when an assessor applies it. Currently Assessors Francis Austin in Rosslyn, Virginia; Theodore Gwartney in Southfield, Michigan; and Irene Hickman in Sacramento, California are following the practice, apparently with positive results.

"too much, too late." As we now observe durably constructed high-rise buildings rising in many downtown areas long overdue for renewal, it is worth hypothesizing that this pattern of land assessment practice plays a role in determining land use.

(b) Appreciating Land. The Census of Governments in 1957 and periodically thereafter has supplied the most thoroughgoing nationwide evidence on assessment discrimination. Underassessment of vacant land was unquestionably the most extreme and consistent discrimination. Many fragmentary earlier studies had shown the same pattern, although obviously there have been periods (like the 1930's when vacant land was being abandoned for taxes) when this pattern did not prevail.

The pattern develops from several causes, other than explicit intent. One is that assessors tend to confuse the in rem property tax with the in personam income tax, and base assessments on present land use, income, and ownership, regardless of land potential. Thus land used for farming is regarded as "farm land," a class bearing lower assessments, regardless of urban value. Sometimes they confuse it with the welfare system and hold down assessments for "widows and orphans," although here one must register skepticism about who is hiding behind the widow's skirts. Sometimes they wait for a "happening," like a sale, raising the assessment on the parcel sold but not on the neighboring parcels.

Often assessors wait for subdivision. Subdivision raises square foot values and differentiates parts of a tract, so it is an occasion for reassessment; but assessors make it the occasion to tax not merely the gain from subdividing, but all the prior increment in acreage value as well. The effect must certainly be to defer subdivision. Another probable effect is to raise density in subdivisions in order to minimize the area of land whose assessment rises. The last may be a saving grace for low-income buyers but if it allocates capital inefficiently it is not for long a favor to low-income buyers most vulnerable to a shortage of capital.

Another way to avoid subdivision and still profit from urban demand is to sell off acreage having frontage on a road someone else has paid for. The inefficient land-use pattern is commonplace in urban fringes: individual driveways attached like suckers to a tree trunk; interior acreage idle, or farmed. As this

can occur without formal subdivision it costs the landowner less. If he avoids a tax increase as well, he is doubly motivated to suburbanize his land in this way, losing half of its potential to satisfy human wants.

(c) Missized lots-- Assessors often regard the unit of assessment to be the lot, or ownership unit, with its existing boundaries, rather than the square foot. Thus they can put a lower square foot value on a large lot than a neighboring small lot, without seeming to depart from market value as the criterion. They do not assess unrealized "plottage"--the gain from optimizing size of parcel.

Thus lots larger than the optimum are not assessed more in proportion to their land content. In newly dividing land, this puts a bias toward larger lots.

In older areas, where apartments are succeeding single family dwellings, the plottage problem is rather the reverse: lots below optimal size are assessed lower because they are too small. This strengthens the hand of holdouts, helps to make land assembly for apartments more costly than it should be, and contributes to a pattern of "apartment sprinkle" in the inner city that, in terms of apartment intensities, is more extreme than "urban sprawl" at the urban fringe. It not only slows apartment building but also casts its own floating value pattern over interstitial land, pricing it too high for new low income housing other than apartments.

(d) Zoning devices-- When assessors finally do catch up with rising market values of appreciating land, owners seeking to minimize their carrying costs have another bowstring in low-density zoning. Low-density zoning, if credible, holds down actual market values and so justifies low assessments and carrying costs. Even if it carries low credibility in the market, it may still get by in court and justify low assessments. The holder has the best of both worlds where low-density zoning is coupled with a lax policy of granting zoning variances and spot zoning to individuals at the time they are ready to cash in.

Low-density zoning has become almost universal in suburbs. The practice operates to keep low-income homeseekers out of a municipality because they have school age children and are therefore feared to be net fiscal liabilities. The only effective counterforce will be state school aid based on population or attendance. But some suburbs even zone so low and strictly that they virtually destroy the resale value of land. This succeeds in holding down assessments and school costs, but would seem to be biting the nose to spite the face. However, there are tax motives here, too.

First, the loss of revenue may be largely to an outside body, the county or a large school district, rather than to the municipality that imposes the zoning. In Wisconsin, with its shared state income tax obviating property tax revenues for rich municipalities, this is a common motive. The zoning is essentially a species of fraud against the countywide equalization process, sparing the suburbs' having to contribute much in county property taxes, during the years while they await their capital gains that can result from generally increasing land values. These they will reap at some future date, as yet undisclosed, when they will change their zoning and allow subdivision. Another force behind low-density zoning is the open-space conservation movement. On the whole advocates of open space may be relied on to oppose cities, subdivisions, and land taxes, on whatever ground the issue may be joined at a given time. Although not explicitly committed to perpetuating ghettoes and slums, open-space advocacy inspires low-density zoning and is a powerful force to reckon with.

(3) Delinquency With Option to Redeem. Most state laws grant landowners extended rights to reclaim land after letting taxes go delinquent for some years. In the late twenties and early thirties it was common for speculators to hold land tax delinquent, on the chance that it might appreciate. Should it do so, they could pay their back taxes with light penalties. Should it not do so they let it go for back taxes: heads they win, tails the county loses. In the meantime the land was frozen, unavailable to builders; and those who improved their own land had to pay taxes for them.

(4) Fighting Annexation by the City. Some landowners can successfully resist annexation by the city. Often quite near the city center there are wild lands that the city cannot saddle with services and taxes. In the absence of county zoning, wealthy resident landowners generally use extra space for insulation against nuisances that their neighbors might inflict: midget auto racing tracks, dumps, and so forth. Commitment of capital to individual wells and septic tanks, low capacity roads, and so forth during the early succession period strengthens resistance to incorporation and full urbanization, often leaving such lands for decades at much lower densities than otherwise.

More common is preemptive incorporation. Landowners in the path of urban growth established a "city" dedicated to being rural, or much less dense than the adjacent and sometimes surrounding city. Here a group of landowners manage to maintain a low density of land use. Snob zoning is used, but more is involved than zoning. Street and utility networks are kept primitive, so that tax rates may be low--the "septic tank suburbs." These practices hold down the unit value of land for resale, a disadvantage to owners wanting quick cash, but an advantage to owners seeking deferred capital gains and minimum carrying costs for tax purposes.

c. Summary

The principle mechanism by which higher prices of urban land operate to increase the supply of land is through the local government, which provides the social investment necessary to convert raw or agricultural land into land usable for urban purposes. Through a well administered property tax system, the local government can also have a powerful financial incentive to increase urban land supply. The sine qua non for a well administered property tax system, however, is to appraise land for tax assessment purposes in such a way as to reflect the economic or opportunity cost of the land. There is a widespread tendency to undervalue land for property tax purposes, which simultaneously is contrary to the stated intent of legislators when they write the tax laws. These assessment practices,

combined with low-intensity zoning, operate to reduce the supply of land available for urban use, including housing. The lower supply increases the market price of the land that is available.

An important policy implication of these points is that local governments may have at their immediate disposal untapped resources to cope with their financial difficulties. The property tax, potentially, is a means of financing public works improvements which can enhance the local setting and thereby increase land values. Conversely, public works financed by high government units (e.g., state and Federal) can often operate mainly to enhance local land values in such a way as to benefit only the land owners. This possibility suggests that grants from the state and Federal governments to local governments should primarily be employed to provide support for services oriented toward people, to include educational programs. However, any program of grants to local governments must be very carefully designed and administered if they are to achieve the effects purported for them, rather than being a mere transferral of Federal taxing power to state and local governments. Such actions, in turn, contain a high probability of extensive Federal "interventionism" in local government affairs, which creates a further set of problems.

3. PROPERTY TAXES: THEIR GENERAL SETTING

The previous sections treating land costs and their relationship to property taxes should be placed in a proper general setting. Actually, property taxes are also imposed on all "real estate," including buildings and housing, and on "personal" property. "Personal" property includes industrial equipment, machinery and inventory, as well as agricultural and commercial inventory. Public utilities, including railroads, telephone, and other service utilities, also bear substantial property tax burdens.

Table 2 shows the extent to which the US property tax system taxes assets other than housing, as well as housing.

Table 2

EFFECTIVE PROPERTY TAX RATES,
BY MAJOR TYPES OF ASSETS, 1956[a]

Type of Asset	Asset Value (Millions)[b]	Property Tax Payments (Millions)[c]	Effective Property Tax Rate (Percent)
Non-Farm Housing	$406,780	$5,195	1.28
Agriculture	149,117	1,164	.78
Total Non-Farm Business	503,286	5,544	1.10
Selected Utilites and Transport	118,158	1,541	1.30
Manufacturing	161,814	1,620	1.00
Other	189,314	2,383	1.07

a. Source: Dick Netzer, Economics of the Property Tax, (Washington, D. C. 1966) pp. 20, 28-29.
b. Asset value data primarily from Goldsmith; The National Wealth of the United States (Princeton: Princeton Univ. Press, 1962).
c. Property tax data from the Census of Governments, which encompasses fiscal years ending in 1956-57.

When viewed in this broader context, it is apparent that the property tax operates as a general tax on the earnings or income from wealth, including land. As such, it can cause the private earnings from all investment activity to fall and it lowers the rate at which all asset earnings are capitalized. For example, if the before tax rate of return on new investment is 10 percent, a property tax system which taxes 17 percent of total net asset earnings will lower the capitalization rate to 8.3 percent. In 1966, property taxes amounted to 17 percent of total asset earnings in the United States. Table 3 shows the derivation of these estimates.

Table 3 also illustrates that property taxes have increased in both their absolute and relative impact on property earnings. A recognition of this general character of the US property tax system has two important implications.

Table 3

DERIVATION OF ASSET EARNINGS, 1956 and 1966[a]
(Millions of Dollars)

	1956	1966
Net National Product	384,768	697,782
Employee Compensation	242,502	435,719
Property Earnings		
Corporate Profits	41,990	82,196
Rental Income	10,913	19,374
Net Interest	11,716	20,163
Property Taxes[b]	12,147	25,392
Total Property Earnings	76,766	147,125
Total Earnings[c]	319,268	582,844
Property Earnings as Percent of Total	24.0	25.2
Property Taxes as Percent of Property Earnings	15.8	17.3

a. Source: Survey of Current Business, July, 1961, 1963 and 1967.
b. Comprises property and vehicle license taxes identified as "business" taxes, and classified as an element of "indirect" business taxes in the national accounting scheme. Does not include an element of property taxes (specifically personal property taxes and vehicle license taxes) imposed on individuals which in the national accounting framework are classified as "personal" taxes. In 1966, these taxes were $1,956 million.
c. Remainder of net national product claimed by non-farm and farm proprietors (which the national accounts do not identify in terms of labor and non-labor earnings), and the non-property tax elements of "indirect taxes"--specifically sales and excise taxes.

First, to produce the effects on land values discussed in Section B of this Study--whereby a land tax is "capitalized" and the market price of land falls--land yielding an economic or differential "rent" must be taxed at a higher rate than other assets are taxed. If land earnings are reduced by only the same proportion as are the

earnings of other assets, the capitalization rate and the land earnings fall by equal proportions. Lower earnings are discounted by a proportionally lower rate, and land values remain unchanged.

On the other hand, to the extent that land is not as heavily taxed as are other assets, like improvements and industrial assets, possibly as a result of assessment practices discussed above, land values will be higher than they would otherwise be. Land thus becomes an attractive asset to hold; and improvements on it may be discouraged insofar as they call the assessor's attention to reappraise it. Property tax administration appears to be a critical factor in urban land cost and use.

The general nature of property taxes causes many students to ignore a second important point when they focus on the subject of housing. Some students suggest that the property tax is an important cause of high housing costs in urban areas.[6] The policy implication is that property taxes should be reduced. For example, a property worth $20,000 in an urban area might bear an annual property tax of $400 to $600 which would be an effective tax rate of 2 to 3 percent. Thus property taxes, along with mortgage interest, appear to be a major item in the annual, or "full cost" of housing services. The property tax is thus viewed as a "consumption" tax. It is also tempting to translate property tax liabilities into estimates of the "burden" they place on housing owners and occupants (as consumers) as a percentage of their income.[7] Thus it is held that property taxes especially burden the poor since they allegedly spend a larger share of their income on housing than do middle and upper income families.

This line of thinking warrants careful examination. First, it does not fully take into account the fact that property taxes are "general" insofar as they are imposed on property other than housing.

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6. See e.g. Dick Netzer, Impact on the Property Tax: Effect on Housing, Urban Land Use, Local Government Finances (printed for the use of the Joint Economic Committee) Washington, GPO, 1968.

7. Ibid, p. 19.

Consequently, the property tax may be considered to be a tax on wealth generally. Viewed in this way, the property tax simply reduces the earnings of the wealth and of property owners generally--including landlords (rich and poor) as well as low income individuals who own their homes.

A recognition of the general impact of this tax does not deny that if the tax were eliminated from housing but kept on other assets, an increased flow of investment into housing would be encouraged. However, a recognition of this possibility only means that tax exemption of some selected activities, when all other activities are taxed, is a subsidy and can indeed increase the output and reduce the price of the subsidized commodity. It would be equally appropriate to recommend that businesses and workers engaged in housing construction be exempted from income taxes. Such exemption, by making housing activity attractive relative to other activities would stimulate the flow of workers and capital into the housing sector.

Second, to the extent that tax assessors in urban areas may in fact be imposing heavy taxes on land values, and to the extent that those heavier taxes are reflected in lower land values, the effective tax rate, i.e., the ratio of tax to the market value of the property, will be high. Empirical evidence of high effective property tax rates in urban areas (particularly central cities) may in fact reflect heavy taxation of the favorable location of the property. If such tax capitalization has occurred, lowering of property taxes may only operate to enhance the earnings of the land owners, and to increase land values. No reduction in housing costs will occur.[8]

In summary, property taxes should not be viewed as "consumption" taxes--on housing or anything else. Rather, they reduce the earnings from creating and holding assets (which is the main reason property

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8. Prof. Netzer's cited works (especially his Economics of the Property Tax Washington: Brookings, 1966) take this effect into account in his excellent treatment of site value taxation. However we believe that he has not yet fully incorporated that analysis into his general statements about forward shifting of the property tax. Nor has he given due weight to the fact that even taxes on buildings may be borne by landowners in the form of reduced land values.

owners complain about them). Given an overall level of asset taxation, higher taxation of land earnings due to favorable location can reduce the market price of land and capture for the local government a share of the land rent. Under-taxation of land, on the other hand, benefits only the landowner and causes the market price of land to be higher. Tax relief for housing in densely populated urban areas may or may not benefit consumers of housing. To the extent that it does not, it makes landowners more wealthy; to the extent such tax relief does benefit housing consumers, it does so only insofar as the property tax system is simultaneously taxing other kinds of assets more heavily, and in this fashion is forcing capital investment out of nonhousing activities and into housing. In this case the property tax system is operating to subsidize one form of consumption at the expense of others. In most cases, property tax relief for housing in urban areas will probably exert effects both favorable to landowners and to subsidized housing consumers.

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C.

THE FEDERAL INCOME TAX AND LAND VALUE

The Federal income tax system is characterized by major differences in the rates at which different kinds of earnings or gains are taxed: personal income at a scheduled rate of 14 to 70 percent, corporate profits at 48 percent, and realized long-term capital gains at one-half the personal or corporate rate or a maximum of 25 percent or at a minimum of zero percent. Important items like depreciation (particularly accelerated forms of depreciation), interest on borrowed money, and charitable giving are deductable for purposes of computing taxable income. These and other features of the Federal tax system combine in ways to make land an especially attractive vehicle by which taxpayers can reduce their income tax liabilities, and in this fashion increase land prices and hold land off the market.

1. COVERT WRITEOFF OF UNDEPRECIATED AND APPRECIATED LAND VALUE

Urban land is nondepreciable for tax purposes, on the ground that it is physically indestructable. If a nondepreciating asset could be written off, its income would achieve complete tax exemption as follows: Let t be the income tax rate. When the taxpayer writes off the asset, he reduces his tax liability by that amount, and his tax payments by t percent of that amount. Now the Treasury has put up t percent of the value of the asset. It also receives t percent of the income of the asset. Thus the Treasury simply receives a return on its investment. As for the owner, he has now invested only (1-t) percent of the value; and he gets (1-t) percent of the income. On his equity[9] he would earn a tax-free income in perpetuity.

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9. We assume 100 percent equity financing, for expository simplicity. Actually the game is leverage, or using borrowed funds to finance the venture. The mortgaged landowner who writes off land could easily end up receiving income on no equity at all.

The way to write off land is to buy it under an old building and allocate most of the acquisition cost of the property to the building, which is depreciable. If the remaining life of the building is short, it is rapidly depreciable (although there are limits to what one can get away with). The IRS has no well organized defense against this practice. It permits taxpayers to use the land-building allocation reported by the local tax assessors as evidence supporting their allocation. These allocations consistently understate the land component by a very large factor.

Covert writeoff of land is a factor above and beyond the multiple writeoff of buildings. This latter is a more or less intended consequence of accelerated building depreciation, which reduces book value of the depreciable asset below its remaining resale value. Land depreciation occurs when the buyer of an old building allocates less value to the land than it had originally, even though it has not declined; or allocates the same, even though it has risen.

There might seem to be recapture of land writeoff when one sells and pays a tax on the excess of sale price over book value. But this tax is twice diluted. First, it is deferred until sale, whereas writeoff came earlier. Second, it is at capital gains rates; the writeoff was from ordinary income. If the owner never sells there is never an occasion to recapture.

But actually taxpayers can do even better than that by selling, because the buyer starts writing off the land all over again--no matter how many times it was done before. Thus land, which the law says is not supposed to be depreciated at all, is written off several times. The only proviso is that it must remain under an old building.

Were it not for this device, the income tax might promote urban renewal. Once the initial cost of a building was completely written off, accelerated or not, its current cash flow would be fully taxable.[10]

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10. Indeed, if a building underwent locational obsolescence due to land appreciation, writeoff should end before the life originally contemplated, as soon as the "challenger" land value equalled the "defender" value of land with old building.

Thus in the year after the last allowable writeoff, the slum owner would suddenly face a much higher tax bill. If he wanted a tax shelter in real estate, he could get it only by actually building; not by redepreciating old slums.

But under present practice the surest way to lose the privilege of depreciating land is to clear it and erect a new building. For then the IRS perceives that what was bought was not the depreciable building but the nondepreciable site underneath it. It denies writeoff. Even demolition cost is nondepreciable. Or, if there was no recent purchase, the IRS allows depreciation only on the cost of a new building construction, not the land. The net effect: an owner can depreciate land so long as he does not improve it.

Thus the tax law biases owners of older buildings to delay renewal, to milk the last drop of tax shelter out of old buildings before releasing the land for new.

2. EXEMPTIONS

a. Exemption of Imputed Income

Durable goods used for the owner's consumption yield an income "in kind" that is not taxed. The price of land is more affected by this than is that of other assets because the service flow from land is 100 percent income--no wearing out.

The availability of land that builders might use is reduced in urban fringes by the high propensity of the affluent to "reside" over considerable acreage. Teamed with large-lot zoning (which holds down assessed values and property taxes), expensing of taxes and interest, expensing of "conservation" investments, capital gains on breeding stock, indefinite deferral of tax on sale of "residence," and a host of favors to deferred land increments (all to be treated later), this exemption of imputed income serves greatly to fortify the holdout power of landowners surrounding every city.

It is true, of course, that buyers of new homes on this same land would also enjoy the exemption of imputed land income, partially neutralizing the bias. But there is normally a tax-bracket

differential--appreciating suburban land gravitates to the strongest hands. Higher prices mean higher credit barriers all around, screening out the poor. Where the new use is an apartment and the income is taxable there is no offset at all--that is, there is an unmitigated or total bias against apartment owners and renters.

b. Exemption of Unrealized Appreciation

The form of income known as capital gains is not taxed until realized by sale.[11] If the land is never sold, there is no tax. Some landowners therefore prefer to lease ripe land rather than sell--prominent examples are the Big Five of Oahu. Others prefer to buy many years in advance of their own anticipated needs, even very conjectural ones. When and if the needs materialize, they have on tap needed land, now of high value, acquired at a low value. The difference is tax-exempt income. The motive is strengthened by, and mutually strengthens, the motive to acquire advance reserves of a raw material whose supply is jeopardized by the absence of a vigorous free market. The combination magnifies the area of reserves which individuals and firms find it advantageous to hold. Thus it raises the holdout price of land.

c. Capital Gains at Death

Capital gains taxes on appreciated assets are forgiven at death. There are death taxes to pay instead, but these would also be due on whatever other asset was substituted for appreciated land. It is therefore very costly for individuals to sell any appreciated asset during a period of several years before death; usually land is just held off the market.

d. Bequests

Eleemosynary bequests of appreciated land enjoy exemption from capital gains tax; yet they are fully deductible at appraised value for purposes of computing taxable income. Thus the taxpayer can

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11. Eisner v. Macomber, 252 U.S. 189 (1920), 40 S. Ct. 189.

deduct a value which he has accumulated tax free, in addition to enjoying the prestige and satisfaction of supporting his favorite church, college, or foundation. This adds to the motives to hold land for appreciation.

Another aspect is the gift with life estate. Under this arrangement, the taxpayer deducts the appraised value at time of bequest, but enjoys use of the home and grounds for life with no tax on the imputed income. During this period he cannot sell and the land is frozen.

e. Capital Gains of Eleemosynary Owners

Churches and other tax-exempt owners are normally not allowed exemption on business-type, profit-making activities. The exception is gains on land sales. The central city church that goes suburban takes the full selling price along with it. Edified by the experience, the church will probably select a large site with ample grounds and parking space, with one eye to future tax-free gains. It may buy its future site years before it is ready to build. Cemetery associations especially are large land speculators which benefit from this provision. The benefits from income tax exemption are usually coupled with exemption from local property tax.

3. DEFERRAL OF TAX ON REALIZED APPRECIATION

Land value can appreciate in two ways. First, its value can increase due to increased population and growth, which increases the relative scarcity of its services. Second, inflation can increase the money value of its services. Both these forces can operate to increase the value of all assets, including those which can be produced but which depreciate with use. However, land--because it does not depreciate with use, or because it is especially long lived--possesses more potential to increase in value from these forces.

This characteristic of land combines with the "realization doctrine" embedded in the Federal income tax to make the long-period holding of land a very attractive tax shelter. The

essence of the realization doctrine is that gain cannot be taxed until the taxpayer actually realizes it through a sale or other explicit transaction. Appreciating land is like a corporation that does not distribute profits to avoid taxation of dividends, but plows them back into capital and lets the shareholders realize the income at their tax convenience in the form of appreciated stock values at capital gains rates. This loophole for corporations has been recognized and somewhat compensated by the double taxation inherent in the corporate income tax. In the case of appreciating land, however, there is no such compensating device. There are rather a number of fortifying loopholes, discussed elsewhere.

The desire of landholders to defer taxes on gains is often colloquially described as the "locked-in" effect. To show the force of the locked-in effect and its tendency to defer sale, Table 4 shows how after-tax rates of return increase with holding periods.

Table 4 is derived from a formula that assumes that selling price of land rises yearly at an assumed rate $\underline{i}$. A tax rate, $\underline{t}$, is applied to the excess of sales price in any year, $(1+i)^x$, over cost of $1 at time zero. The landowner's rate of return after tax is $\underline{r}$.

$$(1+r)^x = (1+i)^x (1-t) + t \qquad (1)$$

Using a standard set of interest tables, Table 4 shows numerical examples of how $\underline{r}$ rises with $\underline{x}$, the year of sale.

The speculator who sells in one year bears the full stated tax rate--his rate of return is halved, as the nominal tax rate of 50 percent contemplates. The speculator who sells in 20 years bears less than three-fourths of the nominal tax rate. The old settler who waited 50 years bears less than half the tax rate.

At the same time that investors seek to defer tax liabilities they seek to advance deductions. Here the landowner again receives favorable treatment because he deducts his holding costs as he spends the money--i.e., he "expenses" local land taxes and interest on borrowed money, even though the increment of land value which they finance will not be taxable for many years to come, if ever. Hence, even without preferential treatment of capital gains, the realization doctrine makes

land an attractive investment. Taxation of realized gains at lower capital gains rates makes holding land even more attractive. But even if long term capital gains were treated as ordinary income, the realization doctrine would still make land holding attractive.

Table 4

AFTER-TAX RATE OF RETURN FOR DIFFERENT HOLDING PERIODS[a]

Year of Sale	Value of 1 Compounded at 8% for x years	Value of 1 Compounded at After-Tax Rate of Return for x Years (r=.04)	After-Tax Rate of Return
x	1.08^x	$(1+r)^x$	r
1	1.080	1.04	.040
5	1.469	1.24	.043
10	2.159	1.58	.047
15	3.172	2.09	.050
20	4.661	2.83	.053
25	6.848	3.92	.056
50	46.902	23.95	.065
100	2199.798	1100.40	.072
∞	--	--	.080

a. Based on the equation:
$(1+r)^x = (1+i)^x (1-t) + t = 1.08^x \cdot 1/2 + 1/2$ when r is after-tax rate-of-return to land owner for different holding periods, when the rate of appreciation before tax (i) is constant at 8%, tax rate (t) is 50%, and acquisition cost of $1 is deductible in year of sale (x).

4. DEFERRAL OF TAX BEYOND DATE OF SALE

a. Sale of Residence

If an owner sells a residence, the tax is deferred so long as he buys another residence within a year. Under large lot zoning, five or ten acres of grounds would probably qualify as part of the "residence," although local administrative practice varies.

b. Deferral of Tax by Barter

If the grounds qualify as a "farm" the owner can barter it, tax free, for a larger "like property" further out of town. The new owner has a higher basis--the appraised value at time of barter--and can subdivide and sell off without tax on the pre-barter increment. Or he can hold for further appreciation, the tax on which he too can defer in the same manner. Section 1031 of the Internal Revenue Code provides: "No gain or loss shall be recognized if property held for productive use in trade or business or for investment (not including stock, etc.) is exchanged solely for property of a like kind to be held either for productive use in trade or business or for investment." There is a good deal of "tailoring" of transactions to fit the letter of Section 1031. An investor whose intent is to buy a suburban farm for cash will first buy a rural farm, satisfactory to the prospective seller, and then barter farms with him. Or he might buy other suburban land for barter. The other land of "like kind" might also be a golf course, dump, drive-in, airport, nursery, etc. A network of brokers' clubs has developed to arrange such bartering. Thus a ready avenue is open to suburban land speculators to defer taxation of capital gains.

Section 1031 is not an unmixed evil for low-income housing. It unlocks some locked-in investors by letting them release their land to commerce without tax penalty on the transaction. On the other hand, it makes land speculating more attractive and so tends overall to inflate the level of land prices. The seller, too, is still locked into his "like property," which may be a rural farm--a big factor inflating farm land prices--but may also be another suburban farm.

c. Deferral by Installment Sale

The affluent seller who is in no hurry for cash, or whose strong credit enables him to obtain cash by borrowing, may defer tax on land sale by the installment device. He must be the mortgagee. He must not take a down payment of more than 30 percent of the selling price.

An important incidental benefit of this method of sale is that a large share of the interest on the deferred payments may be treated as part of the contract price and receive capital gains rates. Only a 4 percent rate must be treated as interest, at simple interest rates.

Mortgage interest rates today are about double that, at compound interest. So contract prices are inflated to reflect the buyer's benefit from borrowing at 4 percent simple interest from the seller; and the seller takes his interest above 4 percent at capital gains rates.

The longer the installment period, the greater the difference between simple and compound interest. So sellers who can wait a very long time for cash can get capital gains treatment on all compound interest above 2 percent or 3 percent, depending on the time involved.

A variant of installment sale is the "land contract." The seller instead of conveying title and taking a mortgage, retains title until payments are completed. If payments come in slowly this method is rather like rental, but with the tax benefit of capital gains treatment for all payments on principal representing taxable gains to the seller, and all interest payments above 4 percent simple. Thus a good deal of ordinary rent income receives capital gains rates.

d. Simple Prorating of Installment Payments between Interest and Principal

Whenever a debt is paid off in level installments, the true proportion which is interest is a maximum in the first year when the unpaid balance is a maximum, and falls nearly to zero in the last installment. The necessary sinking fund tables to find the true proportion are the common property of bankers, and no deep mystery. Simple prorating of level installments between interest and principal therefore constitutes a deferral of tax liability relative to an accurate accounting--another benefit from installment sales.

e. Contract Price Contingent on Buyer's Profits

If the contract price is contingent on the buyer's profits from the land, the seller need not prorate early payments between interest and recovery. He treats all payments as nontaxable recovery of principal until he has recovered his full basis; and only then does he begin to pay taxes on his cash receipts.

f. Condemnation

If land is condemned, as for highways or urban renewal, the tax on gains is deferred if the unwilling seller reinvests in like property within a year.

5. DEFERRAL OF INCOME FROM LAND USE

a. "Implicit Expensing" of Foregone Income

There is often an intertemporal dependence of land rents. Sacrificing early rents to get higher later ones is a form of investment, basically quite legitimate. However, the income tax biases landowners toward more of this kind of investment, because the foregone early rent is plowed back without ever having been received and taxed.

The effect is the same as though the early foregone rent were received in cash and then reinvested, and granted the valuable tax privilege of being expensed. This is "implicit expensing." Expensing of capital investments, we have seen, is tantamount to 100 percent exemption from income tax.

An example of how implicit expensing decreases the availability of land to builders is the following. As a district or neighborhood fills in, the early builders establish a pattern of use. The more of the land is developed, the more certain become the specifics of the highest use of the remaining undeveloped land. Thus certainty improves over time. This has always supplied a certain rationale for deferral of land development, even before income tax rates were significant. But now the early foregone rent--the investment in greater certainty--is expensible (implicitly, that is.) This encourages individuals to withhold land to achieve greater certainty. Since the individual's gain of certainty is achieved by imposing uncertainty on other landowners, there is no net social gain to justify a subsidy to this kind of withholding.

Another familiar example is the effort of large developers to attract the highest possible stratum of the market, at the expense of

some waiting. Early sales to wealthy buyers are thought to tone up a subdivision and enhance later sale prices, if not volume. Thus a bias toward high pricing and slow sales results. The income tax exaggerates it. The loss of potential income from idle land is "implicitly expensed." The same reasoning applies to apartment management which holds rents above the level that would fill the building quickly. Implicit expensing is involved not merely in the year-to-year management but in the original decision to put up a building whose units cater to higher tastes than the broadest and most frustrated stratum of the market can now afford.

A third example is the new towns movement. These have ideal tax shelter properties. Early operating losses are expensible; the final payout is the land value increment, taxed very lightly. Many towns have foundered by overestimating the increments and using too much leverage, but the point here is that the tax structure helps them divert land from meeting the most urgently felt current needs in order to prepare land for tomorrow's alleged needs as envisaged by the founders, their advisers, and the aesthetic taste dictators of the architectural haut monde. Too often they were rich men's hobbies and status symbols.

A fourth example is the California zoning device whereby large landowners can have their development density measured as a whole. They can raise density in parts of their land if they keep the average down to the required level. Their response is to begin at densities below the average, building up zoning "credits" to apply later to apartments after the integrated development has become established. The unreaped rents of the unused land, meantime, are implicitly expensed.

b. Explicit Expensing of Early Operating Losses

It is possible in several ways to appropriate control over territory by establishing an early position. An example is the effort of retailers to establish an early position in growing suburban territory. Here the bias is toward premature development--but not of housing, as a rule. How does this work?

Retailers establish new positions around every growing city. Where there is room for only one store, or shopping center, or only a few gas stations, to be there first is to establish a species of franchise over the trade area, at least for several years. The early losses are expensible; the taxable income is deferred, and might even be taken as capital gain by sale of land.

Thus, areas best suited for residential use are subject to premature invasion by commerce, a higher use. The "floating value" that results, diffused over wide areas, inflates values above the residential level, without, however, raising them enough to stop the commercial demand. This drives residential builders farther out, where high density residential use establishes a floating value over areas best suited for low density use.

While the homesite seeker is thus pressed from above by the higher use of commerce, he is pressed from below by the farming interests which also enjoy extraordinary privileges. "Farmers" may expense many capital investments in soil and water "conservation." The gentlemen farmers who sink money in farms have become a conspicuous case in point. A recent U.S.D.A. study, based on 1963 tax returns, shows that most wealthy taxpayers who own farms report farming losses. Of 3.2 million individuals who filed tax returns including farm income, 66,000 reported combined farm and non-farm incomes over $25,000.[12] Of this top group two-thirds reported farm losses. Their alleged tax losses are only current. They are expensed from ordinary income, usually urban, to be recouped later at capital gains rates by sale of a greatly improved farm. Soil and water conservation are likely to hold the land in agriculture until the tax-motivated farm improvements have been used for farming.

The cost of establishing orchards also is expensible, and the unrealized rent of the land used for an orchard's early nursery years

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12. Edward I. Reinsel, Farm and Off-Farm Income Reported on Federal Tax Returns (ERS-USDA, ERS-383), August, 1968, p. 25.

enjoys implicit expensing. The competitive strength of horticulture against housing is thus enhanced.

6. SUMMARY ON THE FEDERAL INCOME TAX

It seems reasonable to assert that the Federal income tax operates in such a way as to encourage land holdout and so increase urban land prices. It also stimulates consumption of owner occupied housing and land by income tax payers. It stimulates, through accelerated depreciation, construction of office buildings and rental apartments for moderate and high income renters. Each of these factors, by forcing up the price of land, impacts unfavorably upon housing costs for low-income individuals.

It is tempting to suggest changes in the Federal tax system that would "improve" this situation as it applies to housing. The present Federal tax system is exceedingly complex: changes in one part of the system usually create inequities or difficulties in other parts. To close one man's loophole makes the remaining ones stand out even more; and to eliminate one set of the loopholes or shelters while leaving others untouched may itself be a form of inequity. Nothing short of a sweeping reform of the entire system may suffice to restore some semblance of neutrality to the impact of the Federal tax system as it affects land use and housing, and a number of other elements of our economic system. It may be concluded, however, that land income receives unusually favorable tax treatment; that the favors are granted in such ways as to encourage land holdout and price inflation; and that there is probably scope for legitimate reduction of housing costs, without subsidy, via review and revision of the income tax features discussed in this paper.

II.

THE DEMAND FOR HOUSING AND THE DEMAND FOR LAND

by Richard F. Muth

A.

SUMMARY AND INTRODUCTION

Land and structures may be viewed as inputs into the production of housing. The demand for land and for structures is derived from the demand for housing and from technological conditions in the production of housing.

Estimates of the parameters which determine the demand function for land and for structures were made from data relating to the new FHA-financed housing in different parts of the country. The FHA publishes data on the attributes of new houses proposed for FHA mortgage insurance under Section 203, and the financial status of mortgages. The data are broken out for 51 metropolitan areas. Included in these data, by metropolitan area, are the average total value of the property, the market price of the site, and the value of the structure. Physical attributes of properties, particularly average square feet of the site and the dwelling are also published. Data are also provided on the average income, before and after taxes, of the families applying for mortgages.

These data permit determining, by geographic area, the average spending on structures versus land, as they are affected by the prices of land and structures and by the income of purchasers. Since construction costs differ between different regions in the country, the physical amount of structure per dollar of expenditure will also differ between regions, which in turn will influence the amount of structure purchased.

With a 10 percent increase in the ratio of site value per square foot to construction costs, the physical quantity of land relative to structures used to produce a given quantity of housing falls by about 5.4 percent. Total site value relative to construction expenditures rises, however, by 4.6 percent. With a 10 percent increase in site value per square foot, the quantity of land demanded by the housing industry declines about 6.2 percent, while expenditures in land increase by about 3.8 percent. Similarly, with a 10 percent increase in construction costs, expenditures in structures increase by about 1.6 percent. A 10 percent increase in income increases the quantities of land and structures demanded by about 9.5 percent.

The estimates are used to show how various housing policies might affect the housing market. Since it can be assumed that the quantity of land available to the housing industry is fixed in the short run, a 10 percent housing subsidy, by raising the demand for housing which in turn raises the demand for land, leads to a 15 percent increase in the price of land per square foot. Housing prices to consumers would decrease by 7 percent, and the quantity of housing consumed would increase by 6.4 percent. Similarly, a 10 percent decline in construction costs results in an increase of land prices of 3 percent, a decline of housing prices of 7.4 percent, and an increase in housing consumption of 6.8 percent.

These estimates constitute "upper bounds" of the impact of increased housing demand upon urban land prices insofar as the analytical method for making the analysis postulates that the supply of land available for urban housing is "fixed". To be sure, the supply of land available for housing sites can be increased by diverting urban land from other uses such as commercial and industrial employment; and by extending the urban area by means of building new roads, sewer systems, and so forth. These processes, however, are intertwined with private and, especially, public investment activities. Such increases in urban land supply are the result of complicated processes which in part derive their force from the increased land values (and costs) treated in this paper. However, to the extent that nonprice forces

which increase land supply (like zoning practices, tax policy, or the creation of social overhead facilities which permit transforming agricultural land into urban land) operate, the increased level prices resulting from increased housing demand will be dampened.

B.

THE THEORY AND THE MODEL

Assume that land, L, and structures, N, are used as inputs into the production of the commodity called housing, Q. The production function $Q = f(L,N)$ describes the maximum quantity of housing that can be produced with given inputs of land and structures. Let r and n be the unit prices of land and structures, respectively, and p the unit price of housing. Then the following conditions must hold if producers of housing are maximizing their incomes:

$$\frac{\partial Q}{\partial L} = r/p \quad \text{and} \quad \frac{\partial Q}{\partial N} = n/p$$

These equations are a way of saying that the commodity "housing" consists of both"structures" and "land". Housing is produced by combining the "land" and "structure" inputs, in ways that are importantly influenced by the relative prices of these inputs. Spending on housing is exhausted by payments for the land and the structure, and the "producers" of both elements seek to maximize their earnings or income. It is through price and supply adjustments, constrained and determined by substitution possibilities as between land and structure, that both producers and consumers mutually adjust their behavior. The sensitivity of these adjustments, or their elasticities, are the critical elements that describe that nature of the adjustment process.

To determine the impact of changes in underlying conditions in the housing market, the above three equations can be differentiated. Letting the superscript * designate the logarithmic differential of the variable so designated,[1]

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1. For a fuller discussion see Richard F. Muth, "The Derived Demand for a Productive Factor and the Industry Supply Curve", Oxford Economic Papers (July 1964).

$$Q^* - k_L L^* - k_N N^* = 0 \qquad (1)$$

$$- k_N L^* + k_N N^* + \sigma p^* = \sigma r^* \qquad (2)$$

$$k_L L^* - k_L N^* + \sigma p^* = \sigma n^*, \qquad (3)$$

where σ is the elasticity of substitution of land for structures in producing housing (see below), k_L is the share of payments to land in the total value of housing (or site value relative to property value), and k_N is the share of payments for structures to total value of house. (Here it is assumed that f (L,N) is homogeneous of degree one in L and N, so $k_L + k_N = 1$.)

A fourth condition for determining Q, L, N, and p in terms of r and n is the demand function for housing. Where η_p is the price elasticity of housing demand, η_y income elasticity, and y income,

$$Q^* - \eta_p P^* = \eta_y y^*. \qquad (4)$$

Solving the above set of four equations for site value (rL), structure value or construction expenditure (nN), property value (pQ) and housing price, one obtains:

$$(rL)^* = \left\{1-(k_N \sigma - k_L \eta_p)\right\} r^* + k_N(\sigma + \eta_p)\, n^* + \eta_y y^* \qquad (5)$$

$$(nN)^* = k_L\,(\sigma + \eta_p) r^* + \left\{1 - (k_L \sigma - k_N \eta_p)\right\} n^* + \eta_y y^* \qquad (6)$$

$$(pQ)^* = k_L\,(1 + \eta_p)\, r^* + k_N (1 + \eta_p)\, n^* + \eta_y y^* \qquad (7)$$

$$p^* = k_L r^* + k_N \eta^*. \qquad (8)$$

One sees that the effects of changes in land prices and construction costs depends upon shares of land and structures in property values, the price and income elasticities of housing demand, and the elasticity of substitution in production. FHA data used in Section C suggests k_L is almost exactly equal to .2 (so $k_N = .8$). Previous work of mine suggests the income and price elasticities of housing demand are both about unity numerically.[2] I have also inferred from

2. "The Demand for Non-Farm Housing", ed., Arnold C. Hargerger, The Demand for Durable Goods (Chicago: The Univ. of Chicago Press,1960).

changes over time that $\sigma \cong .75$.[3/]

One sees from Eq. 7 that the price elasticities of housing demand may be estimated from a regression of property value on land and structure costs (or, alternatively from Eq. 8, on an appropriately weighted average of them) and income. From the definition of the elasticity of substitution:

$$\frac{N}{L}^* = \sigma(\frac{r}{n})^*, \text{ so}$$

$$(\frac{rL}{nN})^* = (1-\sigma)\ (\frac{r}{n})^*. \tag{9}$$

Thus σ may be estimated from a regression analysis of the ratio of site value to structure value on the ratio of land to structure prices.

If f (L,N) had a constant elasticity of substitution, then it may be written as

$$Q = [aL^{-c} + bN^{-c}]^{-\frac{1}{c}}, \tag{10}$$

where a,b,c are constants and $\sigma = 1/(1+c)$. It can be shown that

$$\ln(\frac{rL}{nN}) = -\sigma \ln (\frac{b}{a}) + (1-\sigma) \ln (\frac{r}{n}). \tag{11}$$

With the constant elasticity of substitution production function then, Eq. 9 is not merely a first-order approximation but holds exactly, and the regression of the share ratio on the factor price ratio enables one to estimate the ratio of b to a from the constant term.

Now, it might be objected that, while land and structures are closely related commodities in consumption, separate consumer demand functions for them exist. In particular, many have argued that with increasing incomes people want to consume more land relative to structures. If the latter view is correct, then income should be

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3. "The Derived Demand for a Productive Factor and the Industry Supply Curve", op. cit.

included in Eq. 9, and the income elasticities of demand for land and structure in Eqs. 5 and 6, respectively, would differ. At the same time, the price elasticities of demand for land and for structures would bear no simple relationship to each other. A test of this alternative hypothesis is also presented in the next section.

C.

EMPIRICAL FINDINGS

For 22 of the metropolitan areas treated in the FHA data source, the Boeckh city index of construction costs for residential structures is published.[4] Hence it is possible to apply the model formulated in the previous section to 22 selected metropolitan areas. Appendix B describes the variables used in the regression analysis.

TABLE 1

FHA HOUSING AREAS USED

Anaheim - Santa Ana - Garden Grove, Calif.
Atlanta, Georgia
Baltimore, Md.
Birmingham, Ala.
Chicago, Ill.

Cincinnati, Ohio
Dallas, Tex.
Denver, Colo.
Detroit, Mich.
Gary - Hammond - E. Chicago, Ind.

Kansas City, Mo. - Kan.
Los Angeles - Long Beach, Calif.
Minneapolis - St. Paul, Minn.
New Orleans, La.
New York, N. Y.

Philadelphia, Pa. - N. J.
Pittsburg, Pa.
St. Louis, Mo. - Ill.
San Francisco - Oakland, Calif.
Seattle, Wash.

Vallejo - Napa, Calif.
Washington, D. C. - Md. - Va.

4. Boeckh Division, The American Appraisal Co., Milwaukee, Wisconsin.

Estimates of the elasticity of substitution of land for structures are given in Table 2. The coefficient of the ratio of site value per square foot to the construction cost index in Eq. A implies an elasticity of substitution of about .54. This value implies that with a rise in the ratio of site value per square foot to construction costs, less land in physical units is used relative to structures, but expenditure on land rises relative to expenditure on structures. Note that almost four-fifths of the variation in the relationship between expenditures on land and expenditures on structures is explained by the variation in the land/construction cost ratio.

In Eq. B, the income of home buyers was included as a determinate of the relative demand for structures and land. One sees that its coefficient is truly negligable and, indeed, negative. These results are contrary to the alternative hypothesis that there is an "independent" demand for land on the part of homeowners.

Equation C shows the results when the number of occupant purchase cases in the FHA sample in each area for 1966 is used to weight the regression observation. Not surprisingly, the standard error of estimate for the regression is smaller, but the coefficients in Eq. C are essentially the same as those in Eq. B. Finally, for Eq. D the coefficients are estimated using the method of instrumental variables. This last comparison was made to examine the possibility of least-squares bias due to simultaneous determination of land prices and the land/structure expenditure ratio. Nineteen-sixty population, 1960 population relative to 1950 population, and net family income were used as instrumental variables. One sees that the coefficients of the land/construction cost ratio and net family income are not very different from those in Eq. B.

The FHA data was also used to explore the relation between housing value, factor prices, and income, with the results shown in Table 3. In the first row (Eq. E), site value per square foot and construction costs were entered as separate variables, while in row two (Eq. F) these two variables were combined into a single index of

housing prices in the manner indicated by Eq. 8. All three of the price coefficients are consistent with a price elasticity of housing demand of -1, since none are significantly different from zero. The standard error of the estimate is only a little larger in Eq. F than in Eq. E, and the F-ratio for testing the significance of square foot land price and the construction cost index separately, with 1 and 18 degrees of freedom, is only 1.5. In addition, neither of the income coefficients in Eqs. E and F is significantly different from +1.

The third row of Table 3 shows the result when Eq. F is estimated using a weighted rather than standard regression. While the elasticities of housing demand with respect to price and net family income are not significantly different from one by usual standards, both agree less well with my previous estimates than those shown in Eq. F. When the coefficients are estimated by the method of instrumental variables, in the same way as in Eq. D of Table 2, however, values of housing demand elasticities slightly larger than one, numerically, are implied.

In Table 4, standard regression estimates of separate demand functions for land and structures are presented in Eq. I and Eq. K, respectively. In contrast, Eqs. J and L show the elasticities of land price and the construction cost index implied by Eqs. 5 and 6 and estimates made from the FHA data of the elasticities of demand and substitution and input shares. The estimated factor price elasticities are quite close to the expected ones; that of the construction cost index in the construction-expenditure-per house regression differs from its anticipated value by about one and a half standard errors, the other three by less than one standard error. The difference between the income elasticities of the demand for land and for structures is small relative to either's standard error. Indeed, land's estimated income elasticity is actually smaller than that for structures, contrary to the alternate hypothesis mentioned in Section B. These results are all consistent with the hypothesis that the demands for land and for structures are derived from a demand for housing in the manner suggested in the preceeding section.

TABLE 2

RELATION OF RELATIVE INPUT SHARES[a] TO INPUT PRICE RATIO

Regression Equation	Constant	Explanatory Variables		St. Error of Est.	R^2
		Land/Construction Cost Ratio	Net Income of Home Buyers		
Standard Regression Eq. A	-1.05 (.05)	.460 (.054)	-	.128	.782
Eq. B	-1.04 (2.40)	.460 (.069)	-.0013 (.261)	.131	.782
Weighted Regression Eq. C[b]	-1.14 (2.68)	.480 (.073)	.0088 (.292)	.125	.834
Instrumental Variables Eq. D[c]	-	.536	-.172	-	-

a. Dependent variable is the land/structure expenditure ratio.
b. Using number of occupant purchase cases in sample to weight the observations.
c. Using 1960 SMSA population and 1960 population relative to 1950 population as instrumental variables in place of land price (i.e., site value per square foot).

TABLE 3

RELATION OF AVERAGE SALES PRICE[a] TO NET FAMILY INCOME AND HOUSING COSTS

Regression Equations	Constant	Explanatory Variables				Standard Error of Est.	R^2
		Land Price	Construction Cost Index	Housing Price	Net Family Income		
Standard Regressions Eq. E	1.73 (1.65)	.0537 (.0461)	-.176 (.236)	-	.901 (.181)	.0880	.739
Eq. F	1.24 (1.62)	-	-	.0755 (.167)	.952 (.178)	.0890	.718
Weighted Regression[b] Eq. G	2.55 (1.57)	-	-	.227 (.156)	.810 (.171)	.0780	.790
Instrumental Variables[c] Eq. H	-	-	-	-.0621	1.04	-	-

a. Dependent variable is average sales price of 1-family owner occupant proposed (new) homes.
b. Same as Table 2.
c. Same as Table 2.

TABLE 4

RELATION OF LAND AND STRUCTURE OUTLAYS TO INPUT PRICES AND INCOME

Regression Equations	Constant	Explanatory Variables			Standard Error of Est.	R^2
		Land Price	Construction Cost Index	Net Family Income		
Actual[a,c] Eq. I	1.37 (2.97)	.414 (.083)	-.0432 (.425)	.790 (.325)	.158	.804
Expected[a,d] Eq. J	-	.38	-.30	-	-	-
Actual[b,c] Eq. K	1.44 (1.51)	-.0485 (.0423)	-.170 (.217)	.899 (.166)	.0807	.664
Expected[b,d] Eq. L	-	-.076	.16	-	-	-

a. Dependent variable is average market price of site of 1-family proposed (new) homes.
b. Dependent variable is average construction expenditure per house (i.e., average sales price of 1-family, owner occupant proposed (new) homes less market price of the site).
c. Estimated using standard regression.
d. Assuming $\eta = .92, \sigma = .54, k_L = .20$.

D.

SOME IMPLICATIONS

The system of Eqs. 5 through 8 can be used in a variety of ways, only a few of which will be suggested here. Of course, to complete the model one would need a supply of schedules of land and of structures to the housing industry. In two important special cases, however, the factor supply schedules may be neglected. First, for studying the immediate impact of changes, the elasticities of supply of land and of structures can be assumed to equal zero. In this case, $L^* = N^* = 0$ (hence by Eq. 1, $Q^* = 0$), so Eqs. 5 through 8 yield r^*, n^*, and p^* as functions of exogenous changes. Second, and of much greater interest, in the long run it would appear that the resources move freely into the construction industry, even for the nation as a whole,[5] so that the elasticity of supply of structures is infinite, or n is fixed. While the supply of land to the housing industry undoubtedly has a positive elasticity, bounds on other variables may be obtained by assuming the supply elasticity of land to be zero. In this case, the model determines r^*, N^*, Q^*, and p^*.

For working through some of the implications of the preceeding analysis, it is useful to substitute approximate numerical estimates of the parameters. Using the estimates obtained in Section C,

$$L^* = -.62r^* - .30n^* + .95y^* \qquad (13)$$

$$N^* = -.076r^* - .84n^* + .95y^* \qquad (14)$$

$$p^* = .2r^* + .8n^* \qquad (15)$$

$$Q^* = -.92p^* + .95y^*. \qquad (16)$$

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5. "The Demand for Non-Farm Housing", op. cit.

The first point to be considered is the long run impact of housing subsidies. Many persons have argued that the impact of housing subsidies would be largely dissipated on higher site values, with no change in consumption of housing per family. This is, of course, the case in a very short run, since the resources devoted to housing are fixed. In the long run, however, with a highly elastic supply of structures, the result is quite different because land's share in the production of housing is relatively small. With, say, a 10 percent housing subsidy, the quantity of housing demanded increases by 9.2 percent, as seen from Eq. 16. Because the production function for housing is assumed to be homogeneous of degree one, the quantity of land demanded at unchanged factor prices likewise rises by 9.2 percent. If the quantity of land available to the housing industry were fixed, then according to Eq. 13, $.092 - .62\, r^* = 0$ or $r^* = .15$. The 15 percent increase in land prices, in turn, by Eq. 15 leads to a housing price increase of 3 percent. On balance then, combining a 10 percent housing subsidy and a housing price increase of 3 percent leads to a net decrease in the price of housing to consumers of 7 percent and an increase in housing consumption of 6.4 percent in the long run, even if the supply of land to the housing industry has zero elasticity.

As a second example, consider the effects of a 10 percent decrease in construction costs, $\underline{n}$, due, perhaps, to a technological improvement. By Eq. 15, the price of housing falls by 7.4 percent, while by Eq. 16 housing consumption increases by 6.8 percent. Of course, the greater the elasticity of supply of land to the housing industry, the smaller the increase in site values and the greater the fall in housing price and increase in housing consumption.

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Appendix A

THE MATHEMATICS OF LAND COSTS

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Appendix A

THE MATHEMATICS OF LAND COSTS

There are two basic methods for making land costs commensurable with other costs. The present value method discounts all costs and incomes to time zero. The annuity method converts all to a constant or level yearly sum over a specified life. Each method has its expository value, so both will be used.

Viewing all costs as present values, the net cost (NC) of land is the present price less the discounted salvage value. If salvage value equals present price (P_o), then:

$$NC = P_o[1 - (1+i)^{-L}] \qquad (A1)$$

where i is interest rate and L is Life (in years). The expression in brackets is a coefficient less than one that tells us what fraction of the present observed price is the net cost. At high i and long L the coefficient approaches unity i.e, the present value of land salvage is near zero. For lower values of i and L, the coefficient is easily evaluated from standard tables of compound interest, or from the rule of thumb that money at compound interest doubles every $\frac{.72}{i}$ years.[1] Table A1 presents a number of values, for different Lives (L) and interest rates (i). Note the sensitivity of the coefficient to these variables:

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1. If $(1+i)^L = 2$; $L\ell n(1+i) = \ell n2$
But $\ell n(1+i) = p$, the continuous rate of interest; and $\ell n2 = .69$.
A small adjustment to convert continuous to annual interest yields the rough rule that $L \cdot i = .72$.

Table A1

VALUES OF LAND SALVAGE COEFFICIENT $[1 - (1+i)^{-L}]$
(For Range of Values of i and L)

i \ L	10	20	30	40	50	60	70
.03	.26	.45	.58	.69	.77	.83	.87
.05	.39	.62	.77	.86	.91	.95	.97
.07	.49	.74	.87	.93	.97	.99	.99
.10	.62	.86	.95	.98	.99	.99	.99
.15	.74	.94	.98	.99	.99	.99	.99

Anticipated land appreciation can lower net land cost in the eyes of the buyer. The proper weight of this factor is shown by raising the salvage value of land in the coefficient. In Table A1 we assumed salvage value (S_L) equalled initial cost (P_o). If $S_L > P_o$, the net cost of land becomes

$$NC = P_o\left[1 - \frac{S_L}{P_o}(1+i)^{-L}\right] \qquad (A2)$$

In the extreme, if land appreciates as fast as money in the bank, $\frac{S_L}{P_o} = (1+i)^L$ and NC = 0. More generally, land appreciates slower than that, but still appreciates enough to lower net cost materially.

The matter is best clarified if we express land appreciation in the familiar form of a yearly percentage, comparable to the interest rate. If land price rises from P_o to S_L over L years, that is the same as an annual percentage growth rate, g, that satisfies

$$(1 + g)^L = \frac{S_L}{P_o} \qquad (A3)$$

Substituting Eq. A3 into A2, we have a modified land salvage coefficient expressed in terms of the annual appreciation of land:

$$NC = P_o\left[1 - \left\{\frac{1+g}{1+i}\right\}^L\right] \qquad (A2a)$$

Now within the relevant range of values of $\underline{i}$ and $\underline{g}$ and $\underline{L}$,

$$\left[\frac{1+g}{1+i}\right]^{L} \simeq (1+i-g)^{-L} \qquad \text{(A4)}$$

We can therefore gauge the effect of any growth rate simply by subtracting it from the interest rate, and referring to Table A1. For example, if land appreciates at 3 percent a year, the land salvage coefficient for an interest rate of 8 percent is that which appears in the row headed 5 percent. For higher values of $\underline{g}$ and $\underline{i}$ and $\underline{L}$, approximation Eq. A4 may be materially inaccurate so that it would be well to construct another table.

Property tax rates (t) are handled in the reverse manner; they are added to interest rates (i).

The second method of putting commensurable values on costs of different time-characteristics is to reduce them all to level yearly sums or annuities. This is another common way of perceiving land costs: they are the yearly holding or carrying costs of the land value, less yearly appreciation. Comparing land costs and building costs, the former are smaller, per $1000 of cost at time zero, because from land holding costs we can deduct appreciation, if any; while to building holding costs we always add depreciation and obsolescence, which are unavoidable facts of life.

The level annuity that covers interest plus depreciation over the life of a building is known as the "capital recovery factor" (c), or annuity whose present value equals one. It is simply the reciprocal of the present value formula for a level annuity.

$$c = C_o \frac{i}{1-(1+i)^{-L}} \qquad \text{(A5)}$$

where C_o = capital cost of building at time zero. The comparable annuity for unappreciating land is simply $P_o \cdot i$, which is really Eq. A5 when L = oo, and of course C_o is replaced by P_o. The yearly land cost per $1000 of initial investment is lower than the corresponding yearly building cost, since it covers no depreciation. As with the present value method, the difference between land and building becomes negligible for high values of $\underline{i}$ and $\underline{L}$, unless the land appreciates.

A more complete statement of holding costs of land (HC) includes property taxes levied as a small percentage of market value, and subtracts appreciation.

$$HC_x = P_x(i+t-g) \qquad \text{(A6)}$$

where x is any given year, t the ad valorem property tax rate, and g the current appreciation expressed as a percent. If g is large, and t is small, HC may approach zero.

In evaluating the effect of appreciation on holding costs, one should avoid a misconception that might easily but erroneously be inferred from the discussion thus far, which stresses how appreciation reduces effective land cost below its apparent relative value. It would be easy to conclude that appreciation, as opposed to none, simply lowers land cost, but that is wrong: for the expectation of appreciation raises apparent land cost, that is, the initial land price, P_o. Thus it raises the basic holding costs, $P_x(i+t)$, for all years: and later appreciation (in a perfect market with perfect foresight, etc.) simply offsets this added burden.

The value of land (P), neither taxed nor appreciating, is:

$$P = \frac{a}{i} \qquad \text{(A7)}$$

where a is annual rent.[2] The holding cost (HC) of the land is interest on the value; but that equals the rent (a):

$$HC = V \cdot i = \frac{a}{i} \cdot i = a \qquad \text{(A9)}$$

That holding cost equals current rent also holds true when land is appreciating, so long as we assume a perfect market. If land

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2. In practice, a must be derived by annualizing an irregular stream of costs and revenues, so:

$$a = \sum_{o}^{L} [(R_x - C_x)(1+i)^{-x}] \frac{i}{1-(1+i)^{-L}} \qquad \text{(A8)}$$

appreciates at g percent yearly:

$$P_o = \frac{a}{i-g} \quad 3/ \qquad \text{(A10)}$$

But

$$HC = P_o(i-g) = \frac{a}{i-g}(i-g) = a \qquad \text{(A11)}$$

Thus the overall effect of appreciation is to leave holding costs equal to rent. The higher land price on which interest is charged just balances off the yearly increment of value.

The same principle appears when the ad valorem property tax on land is added. If land yields a steady rent, a, and is taxed at rate t, then

$$P_o = \frac{a}{i+t} \qquad \text{(A12)}$$

But

$$HC = P_o(i+t) = a \qquad \text{(A13)}$$

Finally, everything is consolidated in one expression for taxed, appreciating land:

$$HC = P_o(i+t-g) = \frac{a}{i+t-g}(i+t-g) = a \qquad \text{(A14)}$$

From Eq. A14, as well as from Eqs. A7-A13, one can see that the holding cost of land is unavoidable, and in a perfect market equals the rent, a.

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3. $P = a\left[\frac{1}{1+i} + \frac{1+g}{(1+i)^2} + \ldots r\frac{1+g}{1+i}^{\infty}\right] =$

$$a\frac{1}{1+i}\frac{1}{1-\frac{1+g}{1+i}} = \frac{a}{i-g}$$

Pages 62, 63 and 64 omitted
no information deleted

Appendix B

DESCRIPTION OF VARIABLES

Appendix B

DESCRIPTION OF VARIABLES[1]

1. Construction Cost Index

Boeckh city index of residential (frame) construction costs for the metropolitan area, relative to the 1966 U.S. average. Boeckh Div., The American Appraisal Co., Milwaukee, Wis., (From Engineering News-Record March 21, 1968, pp. 88-89).

2. Construction Expenditure Per House

Average sales price of one-family, owner-occupant proposed (new) homes less average market price of the site.

3. Housing Price

Average of site value per square foot and construction costs (both in logs), weighted by average shares of land and structures, respectively.

4. Land/Construction Cost Ratio

Ratio of site value per square foot to construction cost index.

5. Land Price

Site value per square foot of land.

6. Land/Structure Expenditure Ratio

Ratio of average market price of site of one-family proposed homes to average sales price of one-family owner-occupant proposed homes less average market price of site.

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1. Unless otherwise noted all variables were calculated from data in U.S. Federal Housing Administration, FHA Homes, 1966 (Washington, D.C.: Department of Housing and Urban Development, 1967), all variables are in natural logs, and all are for the year 1966.

7. Net Family Income

FHA estimated average family effective income less income taxes of the mortgagee.

8. Sales Price

Average sales price of one-family owner-occupant proposed (new) homes.

9. Site Value

Average market price of site of one-family proposed homes.

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13. ABSTRACT

This Study comprises two separate papers addressing the general problem of the cost of land for low-income housing. The first, by Mason Gaffney, discusses how public policy affects land costs and the second, by Richard Muth, presents a quantitative model that shows the impact of the demand for housing and the demand for land on the price of land.

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