# LAND TAXATION AND EFFICIENT LAND SPECULATION

T. NICOLAUS TIDEMAN*

## ABSTRACT

The optimal timing of development is an important allocative function that can be either enhanced or degraded by the impact of land taxes on land speculation. This paper discusses four types of taxes on land:

- taxes on the rental value of land,
- taxes on the sale value of land,
- taxes on realized income from land, and
- taxes on realized gains from the sale of land.

All four taxes reduce incentives for speculation in land, which is generally beneficial. The third and fourth produce distortions with respect to incentives to develop land, while the first and second do not. All four taxes have some beneficial effect of mitigating imperfections in capital markets. All permit reduction or elimination of taxes with significant dead-weight losses, such as those on improvements.

## I. Introduction

As formerly centralized economies move to adopt market practices, it will be very important for them to develop markets for land. People with good ideas for new businesses cannot implement their ideas unless there is some place where they can do so. It will not work to require every potential entrepreneur to convince a government official that his or her idea deserves an allocation of land. People who want to use land must be able to buy the right to use land from those who have that right. Land rights must be transferable to achieve a well-functioning market economy.

Of course, land will not be transferred by those who have the right to use it unless some payment is made. The possibility of payments for transferring the right to use land raises the specter of land speculators receiving large undeserved profits while holding economic development hostage. Is land speculation an unavoidable concomitant of a market economy?

It is important to understand first that withholding land from development can be a productive activity. Land that is developed prematurely will not be improved to the extent that is efficient when the land is ripe for development, because that later development would require the sacrifice of the earlier, inefficient improvements.

To insure that resources are not wasted on premature development of land, it must be possible for those who make development decisions to profit from making them well. This perspective on land speculation was developed by Richard T. Ely (1920).

While there is thus social value in the activity of identifying the optimal time for land to be developed, it is possible for a society's institutions of land possession and transfer to reward land speculation in excess of its social value, leading to a waste of resources as people compete to acquire speculative gains. This paper discusses the distinction between productive and unproductive withholding of land from development and the ways that various taxes can be used to inhibit unproductive withholding of land.

Section II develops the theory of productive and unproductive reasons for leaving land unused and for spending effort to determine the future value of land. Section III discusses the effects on incentives for land speculation of four kinds of taxes: taxes on the rental value of land, taxes on the sale value of land, taxes on realized income from land, and taxes on gains from the sale of land. Section IV discusses some effects of these taxes on matters other than land speculation. Section V offers concluding comments.

**II. The Private and Social Returns from Land Speculation**

To see how land speculation can lead to a waste of resources, it is useful to develop a somewhat formal model of land management and land speculation. Abstract from the continuous divisibility of land and suppose that land comes in "sites." At each moment in time, each site is in one of three states:

1. Suitable for agriculture.

2. Suitable for housing.

3. Suitable for commercial activity.

While each site can be used for any activity, the net return will be greatest if it is used for the activity for which it is suited, provided that it remains in that activity long enough to fully amortize the associated capital that is state-specific, durable and immobile. What could keep a site from remaining in an activity long enough to amortize the associated capital is that from time to time a site makes a transition from state 1 to state 2 or from state 2 to state 3. These transitions are imperfectly predictable. When a transition from state 2 to state 3 occurs unexpectedly, the course of action that maximizes the net return to the site may entail scrapping prematurely the residential structure built there and building a commercial structure. In such an instance, one may be able to look backward and say that it would have been better not to have built the residential structure at all, but rather to have left the site in agricultural use until the transition to state 3

occurred. However, such reckoning can affect investment decisions only to the extent that transitions can be foreseen.

The transitions are assumed to be costly to foresee, and to be more costly to foresee when they will be occurring further in the future. Like signs of spring, symptoms of a possible transition are at first faint and unreliable, becoming more and more obvious and certain as the time of the transition approaches.

In addition to the land management motive for seeking to foresee transitions, there is a speculative motive, which differs in form and magnitude. While the land management motive is concerned with the possibility that capital will be wasted on a site that is soon to undergo a transition in state, the speculative motive arises from the gains to be made from owning title to land at the time that its better future prospects become generally known.

People differ in the costs they incur in ascertaining whether the signs present at a particular site herald a pending transition, and how soon it will occur. Therefore those who have a comparative advantage in foreseeing the transitions tend to do the speculating. A speculator will incur the cost of ascertaining the significance of the signs at a particular site if, based on that speculator's experience, the probability of a transition given the signs, multiplied by the increase in the current value of the property if there is a transition, is greater than the sum of the cost of making the determination, the transactions costs of acquiring the site and the net cost of holding the site until its future prospects become generally known. The activity of speculation yields a normal expected private return to the funds spent on speculation, with particularly skillful speculators also obtaining unusual returns to their unique talents.

The speculative return from foreseeing future transitions arises from holding title to land when pending transitions become generally known. This return is a purely private return, with no corresponding social return, since the land will increase in value whether or not any given speculator holds it. The land-management return from foreseeing future transitions, on the other hand, arises from knowing not to employ capital on sites where future transitions will cause the capital to depreciate prematurely. This is a social return, since it involves improving the allocation of scarce resources. There is no necessary connection between the private return and the social return.

The phenomenon of a lack of any necessary relation between the private and social returns to knowledge has previously been noted by Jack Hirshleifer, in connection with inventive activity. He wrote (1972, p. 572):

Do we have reason to believe that the potential speculative profits to the inventor, from the pecuniary effects that will follow release of the information at his unique disposal, will be so great that society need take no care to reserve for him any portion of the technological benefit of his innovation? The answer here is

indeterminate. There is no logically necessary tie between the size of the technological benefit on the one hand, and the amplitude of the price shifts that create speculative opportunities on the other.

While there are no logically necessary ties between social benefits and required incentives, there are systematic differences in the social returns from different kinds of knowledge. For transitions from state 2 to state 3, there are both land management and speculative reasons for wanting to foresee the transitions. If there were no expenditures on predicting the transitions, there could be significant social costs from the inefficient construction of residences on sites that were soon to undergo a transition. It is valuable for a society's land possession institutions to provide an incentive for efficient use of resources in predicting these transitions.

For transitions from state 1 to state 2, on the other hand, there may be only a speculative reason and not a land-management reason for wanting to foresee the transition. If agriculture is conducted without improvements to the land that are durable, immobile and state-specific, then there is no land-management reason for wishing to foresee the transition from state 1 to state 2. When the transition occurs, the use can be changed. The ability to foresee the change confers no added benefit. Thus there is only a private return and no social return from being able to foresee transitions from state 1 to state 2. Any resources that are spent on predicting transitions from state 1 to state 2 for the sake of the speculative gains that can thereby be obtained are, from a social perspective, purely a waste of resources.

The possibility that there could be no social gain from an activity that produced private speculative gains was recognized by Paul Samuelson (1957, p. 209), in a discussion of the effects of uncertainty on intertemporal price equilibrium:

Suppose my reactions are not better than those of other speculators but rather just one second quicker. (This may be because of the flying pigeons I own or quickness of my neurones.) In a world of uncertainty I note the consequences of each changing event one second faster than any one else. I make my fortune--not once, but every day that important events happen. Would anyone be foolish enough to argue that in my absence the equilibrium pattern would fail to be reestablished? By hypothesis, my sole contribution is to have it established one second sooner than otherwise.

An additional social cost of land speculation was elucidated by Harry Gunnison Brown (1927). He pointed out that when it is possible to profit from land speculation, land will tend to be acquired by those who have the most extreme beliefs about how much it will rise in value, and that such beliefs will generally be more optimistic than is warranted. Economists have given the name "winner's curse" (Milgrom & Weber, 1982) to the phenomenon that those who bid the most tend to bid too much. The winner's curse can cause the whole land market to become dominated by persons with extreme beliefs about future rises in value,

creating an artificial scarcity of land for current use, as those who have land wait for illusory future opportunities. The winner's curse is thereby shifted to society.

The next section discusses the features of various taxes on land, and in particular their capacity to remove the incentive for inefficient land speculation.

## III. Effects of Land Taxes on Speculation

### A. Taxes on the Rental Value of Land

The rental value of land is sometimes defined as the net return from possessing land, after paying the costs of other factors. Such a definition suffices if land has unchanging opportunities. However, when the use to which land can best be put varies with the time when the use begins, such a definition leads to ambiguity regarding the rent of land at any specified time. This ambiguity can be resolved by defining the rent of a site as the opportunity cost of leaving it unused. That is, the rent of a site for the span of time from a to b is the present value of net returns from use of the site beginning at a, minus the present value, discounted to time a, from use of the site beginning at time b (Tideman, 1990). Another way of expressing this is that the rental value of a site for the year beginning now is the amount of money that a person would be willing to pay for the use of the site for one year beginning now, if use carried with it an option to use the site into the indefinite future, upon payment of future rent, which would be defined in the same way. To implement such a recursive definition of rent, there would need to be similar recurring transactions involving similar land, so that amounts due in the future could be specified.

The initial effect on the sale value of land of a tax on the rental value of land (disregarding general equilibrium effects and the value of any services financed by the tax), is to reduce the value of all land by the same percentage as the tax rate. That is, the tax is capitalized into the purchase price of land. It is borne by those who hold land at the time the tax is announced. Feldstein (1977) has shown that in a closed economy, a tax on rent can generate income effects that produce a new equilibrium with higher saving and lower interest rates, which have an upward effect on land prices, thereby shifting at least part of the tax. These effects do not arise in a small open economy, as when a single urban area taxes land. Furthermore, if the proceeds of the tax are used to finance public services that add to the value of land, it is possible for those who hold land to be better off with the combination of taxes and public expenditures than they would be with neither. In any case, income effects do not constitute economic distortions. A tax on the rental value of land has no distorting effects as long as it is assessed in such a way that there is no action that possessors of land can take that will increase or decrease their taxes.

The effect on land speculation of a tax on the rental value of land is to reduce the return from being the one who possesses land when its improved prospects

become known. Less effort will be spent in seeking to discover what land will rise in value and in seeking to acquire land in advance of when the rise in value becomes generally known. Because the winner's curse will be less prominent, less land will be withheld from development.

With the incentive to speculate in land reduced by taxes on land, it might be expected that there will be a tendency for land to be developed prematurely out of ignorance of its future prospects. However, the land management motive for anticipating transitions remains. With taxes on the rental value of land, those who contemplate developing land will have an incentive to discover whether the land they plan to develop will rise in value, because if they do not take account of such prospects, they will find themselves with tax bills higher than they anticipated, and possibly with no additional revenue with which to pay them. In addition, as long as a tax on the rental value of land takes only part of the rental value, potential developers of land will also be motivated to perceive future opportunities because of the greater profit that can then be attained from improved development decisions.

The consideration that could lead to premature land development is that, with a tax on the rental value of land, it will be harder for those with a special talent for perceiving future opportunities to profit from that talent. When it is possible to profit from land speculation, the high price of land informs potential developers of the future opportunities that other market participants anticipate. However, if land were taxed so heavily that no one bothered to speculate, the same information might be conveyed by the development of a "land value insurance" market, where those with the talent to perceive future opportunities sold insurance to land developers, against the possibility that land would rise in value, with a resulting rise in taxes. But such a market would involve a different set of transactions costs than the market through which land speculation provides information about perceived future opportunities. Information might therefore be transmitted less efficiently. On the other hand, with land speculation affected by the winner's curse, there may be significant inefficiency entailed in the signals that are provided when the land speculation market functions.

Gaffney (1961, 1973) has suggested an additional reason why taxing land will improve the efficiency of land development decisions: It mitigates friction in the lending market. Land, he says, is an investment that commends itself to investors with low discount rates and high opportunity costs of their time. It requires little attention; unlike investments in on-going enterprises, land is unlikely to fall greatly in value as a consequence of neglect. Potential users of land, on the other hand, tend to be people who have above-average discount rates. Because of the combination of differing capacities of borrowers to offer collateral and the difficulties in identifying borrowers who will be good risks, an equilibrium can persist in which competing bidders for land have quite divergent discount rates. In such circumstances, the taxation of land ameliorates the variation in discount rates. The capitalization of land taxes into lower purchase prices constitutes a

substitution of a recurring annual charge for a one-time charge. This makes land relatively more attractive to people with high discount rates, and relatively less attractive to people with low discount rates, shifting land out of the hands of people who will tend to leave it idle and into the hands of people who will tend to develop it. Since this circumvents friction in the lending market, the consequent earlier development of land is more efficient.

**B. Taxes on the Sale Value of Land**

**A tax on the sale value of land, or "*ad valorem*" tax, is a recurring (e.g., annual or monthly) tax proportional to the price at which the land would sell.** *Ad valorem* taxes on land have been praised by many economists for the fact that they do not impair incentives to use land productively. The characteristic of an ad valorem tax that keeps it from impairing incentives to produce is that, when such a tax is properly administered, the amount of the tax is independent of any action taken by the taxpayer. Whatever course of action maximizes the wealth of a taxpayer before a tax is levied also maximizes his or her wealth after the tax is levied (apart from income effects, which do not entail allocative distortions). A taxpayer can reduce the taxes he or she pays by selling the land, but the new purchaser will acquire a tax burden of the same magnitude. The total of taxes to be paid is independent of any reshuffling of land titles among taxpayers. For this reason, ad valorem taxes on land, like taxes on the rental value of land, are capitalized into the purchase price of land and entail no economic distortions.

**A tax on the sale value of land is very much like a tax on the rental value of land, but with a somewhat different incidence.** If land is not taxed, its sale value in a market in which the participants foresee the same opportunities can be described as the present value of future net returns, discounted at the market interest rate, ***r***, when the land is used in such a way as to maximize those returns. The effect of an ad valorem tax at an annual rate of ***t*** is to increase the annual holding cost of a dollar's worth of land from r to r + t. Thus the value of a site in the presence of a tax at a rate of t is computed by discounting future returns at a rate of r + t. The sale price of a site with a net return of x per year falls from x/r to x/(r + t), so the tax takes the fraction t/(r + t) of the pre-tax value. Thus for land that is not changing in value, an ad valorem tax at a rate of t is equivalent to a tax at a rate of t/(r + t) on the rental value of the land.

If the net return from the use of a site is not constant but rather grows from an initial value of x at a rate of g, then the sale value of the site in the absence of a tax is x/(r - g). When the tax raises the annual holding cost to r + t, the sale price becomes x/(r + t - g). The fraction of value that is taken by the tax is t/(r + t - g). For example, if the tax rate is 4% and the interest rate is 8%, then the tax takes 1/3 of the value of a site that is not growing, but 40% of the value of a site whose return is growing at 2% per year. When paths of returns through time cannot be expressed as simple growth rates, it continues to be true that, other things being equal, a site with relatively more attractive future prospects will bear a higher

proportion of current taxes under a tax on the sale value of land than under a tax on the rental value of land. Thus an ad valorem tax falls more heavily on land that might be the object of speculation than on other land. It thus tends to discourage speculation more than a tax on the rental value of land does. Otherwise, its effects are the same as those of a tax on the rental value of land. There is an upper limit of 100% on the feasible rate of a tax on the rental value of land. There is no such upper limit on the feasible rate of an ad valorem tax on land. The tax could be 10% per year or 10% per day or 10% per hour, with the sale value falling as the rate rose. In the limit as the tax rate of an ad valorem tax approaches infinity, the tax approaches a tax that takes 100% of the rental value of the land.

An ad valorem tax is administered by having assessors who estimate the sale value of land. When tax rates are modest, it is easy enough for assessors to do this by monitoring sales of land that is vacant or has only structures that are about to be demolished. However, if the rate of an ad valorem tax is very high, then the influence of inherent value of land will be overwhelmed in prices by idiosyncratic features of transactions between particular buyers and sellers. Assessors would need to rely on processes in which sale prices were linked directly to taxes. These could be either **auctions**, where participants knew that the auction result would be used to set the tax for a specified period, or **options**, where potential uses of land offered specified payments for any site meeting certain standards. Because ad valorem taxes on land have no distorting effects, they neither retard nor advance the timing of land development in a world of perfect information. This has been denied by Shoup (1970, p. 38-39), Bentick (1979, pp. 861-63; 1982) and a variety of other writers who have followed them. The tax that Shoup and Bentick analyze, however, is not an ad valorem tax, but rather a tax whose base is the present value of the future net income that is expected to result from the plans for a site. Thus a change in the plan produces a change in the tax bill, generating an incentive for inefficient changes in plans (Tideman, 1982).

**An element of truth in the analyses of Shoup and Bentick is that it is possible that while the tax base will be called "land," the size of the tax bill will in fact vary with land development actions of the holders of land. If assessors assign a different value to land if it is developed than if it is not developed, then a tax on land is not neutral.** This may occur in particular if assessors use a "land as residual" method of assessing sites with old improvements, estimating the selling price of land as the difference between the selling price of the improved site and the undepreciated value of the improvements. For a tax on the assessed selling price of land to be neutral, assessors must assess land according to what its sale value would be if it were bare.

### C. Taxes on Realized Income from Land

Land can also be taxed according to the income realized from it. This also reduces the gain from land speculation relative to the gain from using land. However, a tax on realized income from land does less to discourage land speculation than

taxes on the sale value or rental value of land, because it imposes no explicit cost on holding land idle.

Bentick (1979) has argued that a tax on realized income from land would be neutral because whatever actions would maximize the wealth of a landholder who received all of the rent would also maximize the wealth of a landholder who received any specified fraction of the rent. However, Wildasin (1982) has pointed out that if the rate of a tax on realized income from land is expected to vary, then there will be an inefficient incentive to choose development plans that concentrate income in periods when the tax is low. In addition, there are significant practical difficulties with a tax on realized income from land. First, there are problems with taxing land that is used for consumption purposes by the person who holds title to it. There will be no transaction incorporating the rent, so the tax either leaves owner-occupiers untaxed or else requires the services of an assessor to specify the implicit income. If land is used for production by those who hold title to it, a different set of problems arises. It would be necessary to find a way to separate the return to land from the returns to all other factors that were used. Even if returns to all other factors were excluded from the tax base, in the way that labor costs and interest expenses are excluded from the corporation income tax, there would be virtually no way to exclude the entrepreneurship of the landholder from the tax base, which could be expected to induce landholders to economize on the use of entrepreneurship, to put less effort into securing the greatest possible net return.

Whether economizing on entrepreneurship results in more rapid or less rapid land development is not clear. If the choice that a landholder faced were simply one of when to undertake a given level of development, then at a time of indifference between developing the land and postponing development, a tax on entrepreneurship would have a lower present value if development were postponed. On the other hand, if the choice were between modest development now and extensive development later, it is possible that the present value of the tax on entrepreneurship would be greater with the later development, and that therefore the tax on entrepreneurship would tilt the decision toward earlier, less extensive development. In any case, the inclusion of entrepreneurship in the base of a tax on realized rental income from land will tend to have adverse effect on the timing of development, whether it causes earlier or later development.

**D. Taxes on Realized Gains from the Sale of Land**

A tax on realized gains from the sale of land shares with a tax on realized income from land the characteristics of imposing no explicit cost on holding land idle and falling on entrepreneurship as well as land. It has the additional unfortunate feature of being avoidable by continuation of ownership. If there were no improvements in the efficiency of land use that depended on transferring land title, a tax on gains from the sale of land would have no distorting effects and would also raise no revenue. To avoid the tax, people would simply lease land

rather than sell it, and no tax would be collected. The general principle involved here is that if a tax is levied on a good for which there is an untaxed perfect substitute, everyone will use the substitute, there will be no welfare losses, and there will be no tax revenue.

Another set of conditions under which a tax on realized gains from the sale of land would have no distorting effects is if landholders were able to obtain a return from land only by selling it, and if there were no entrepreneurship involved in obtaining the best possible sale price. A person indifferent between two options involving different timing of development would be indifferent between the two when what was received was a constant fraction of the returns from the two. However, because it is possible to obtain a return from land not only by selling it but also by using it oneself, and because entrepreneurship is involved in the sale of land, a tax on gains from the sale of land will have the effect of reducing sales and therefore, typically, postponing development. It is also possible that the prospect of paying the tax would induce a landholder to undertake a modest, premature development under on his or her own, when in the absence of the tax the landholder would wait and sell the land to specialists in development. Whether the development is advanced or postponed, however, the effect of the tax is to reduce the efficiency of development.

In the U.S., a further consideration that causes development to be postponed is the possibility of avoiding Federal income taxes on increases in land value by including the land in one's estate. Estate taxes are paid according to the actual value of the land (as they would be paid on the proceeds if the land were sold), but one's heirs pay taxes only on the increase in value after it leaves the estate, so that taxes on the increase in value during one's lifetime can be avoided.

**IV. Indirect Effects of Taxing Land**

One consequence of levying additional taxes on land is that it becomes possible to lower taxes on other things. One of the things most likely to be taxed less when land is taxed more is improvements. Lowering taxes on improvements makes the present value of land development very much less costly, and hence is likely to accelerate development although it would be possible to construct cases in which the effect of lowering taxes on improvements would be to postpone development. Whether it retards or accelerates development, the lowering of taxes on improvements results in more intensive development when development occurs. The possibility of promoting more intensive development by reducing or eliminating taxes on improvements is an important beneficial effect of an increase in taxes on land.

A second consequence of levying additional taxes on land is that it becomes possible to price public services more efficiently. Services to land such as sewers, water and electricity are used most effectively when they are priced at marginal cost. The costs of these services, however, are generally such that the sum of

marginal costs will not cover total costs. Land taxes have the potential to provide a fund to cover the difference between total costs and the sum of marginal costs. If land taxes are so used, the reductions in the costs of using services that complement development will promote more efficient development.

## V. Summary

There are both speculative and land-management reasons for spending resources on foreseeing changes in the opportunities to use land. The speculative reason is purely private, while the land-management reason is both private and social. Taxation of land reduces (in the limit, eliminates) the speculative reason for foreseeing land use opportunities, and thereby eliminates the waste of resources in seeking to be first to perceive such opportunities. In the absence of a speculative reason for foreseeing changes in land-use opportunities, a market might develop in insurance against changes that would generate land-management losses.

All four taxes analyzed have the beneficial effect of reducing the waste of resources involved when people seek to be the ones who own land when its improved prospects become known. Taxes on land also have the beneficial effect of reducing the extent to which society suffers from an artificial scarcity of land induced by the winner's curse. In addition, taxes on land ameliorate the consequences of capital market imperfections.

The least beneficial taxes on land are taxes on the realized income from land and on realized gains from the sale of land. They impose no explicit costs on those who hold land idle, and they tax entrepreneurship as well as land. A tax on realized income from land also has conceptual difficulties when applied to those who own the land they use. A tax on the realized gain from the sale of land has the unfortunate characteristic of being avoidable by refraining from transferring land.

Taxes on the sale value and rental of land have no such unfortunate consequences. Taxes on the sale value of land do the most to discourage speculation. However, if assessors treat developed land as if it is more valuable than similar land that is not developed, there will be an inefficient incentive to postpone development.

A very important effect of taxing land is the opportunity it provides for removing non-neutral taxes such as those on improvements. This is highly stimulative of development. A related stimulative opportunity that is created by taxing land is the opportunity to provide services such as water, sewerage and electricity at marginal cost.

If nations that are setting up systems of private possession of land are concerned about land speculation, the best course of action is not to seek to regulate or prohibit speculation, but rather to tax land enough to make speculation not worthwhile.

**References**


Bentick, Brian L. "The Impact of Taxation and Valuation Practices on the Timing and Efficiency and of Land Use," Journal of Political Economy 87 (1979), pp. 859-68.

Bentick, Brian L. "A Tax on Land May Not be Neutral," National Tax Journal 35 (1982), p. 113.

Brown, Harry G. "Land Speculation and Land-Value Taxation," Journal of Political Economy 35 (1927), pp. 390-402.

Ely, Richard T. "Land Speculation," Journal of Farm Economics 2 (1920), pp. 121-35.

Feldstein, Martin. "The Surprising Incidence of a Tax on Pure Rent: A New Answer to an Old Question," Journal of Political Economy 85 (1977), pp. 349-60.

Gaffney, M. Mason. "Ground rent and the allocation of land among firms," in Frank Miller (ed.), Rent Theory: Problems and Practices, North Central Regional Research Publication 139 (1961), University of Missouri Research Bulletin 810, pages 30-49 and 74-82.

Gaffney, M. Mason. "Tax Reform to Release Land," in Marion Clawson (ed.), Modernizing Urban Land Policy, Baltimore: Johns Hopkins, 1973, pp. 115-52.

Hirshleifer, Jack. "The Private and Social Value of Information and the Reward to Inventive Activity," American Economic Review 62 (1972), pp. 561-74.

Milgrom, Paul and Robert J. Weber. "A Theory of Auctions and Competitive Bidding," Econometrica 50 (1982), pp. 1089-1122.

Samuelson, Paul A. "Intertemporal Price Equilibrium: A Prologue to the Theory of Speculation," Weltwirtschaftliches Archiv 79 (1957), pp. 181-219, reprinted in Joseph E. Stiglitz (ed.), The Collected Scientific Papers of Paul A. Samuelson, Cambridge, Mass.: MIT Press, 1966, Vol. 2, pp. 946-84.

Shoup, Donald C. "The Optimal Timing of Urban Development," Papers of the Regional Science Association 25 (1970), pp. 33-44.

Tideman, Nicolaus. "A Tax on Land is Neutral," National Tax Journal 35 (1982), pp. 109-11.

Tideman, Nicolaus. "Integrating Land-Value Taxation with the Internalization of Spatial Externalities," Land Economics 66 (1990), pp. 341-55.

Wildasin, David E. "More on the Neutrality of Land Taxes," National Tax Journal 35 (1982), pp. 105-08.