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THE INCIDENCE OF THE LOCAL PROPERTY TAX: A RE-EVALUATION

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ABSTRACT

The article identifies the key assumptions that underlie competing theories of the incidence of the local property tax. We conclude that the "benefit view" which maintains that the property tax system is equivalent to a set of non-distortionary user changes is correct only under very restrictive assumptions. Only when communities adopt a set of exact, binding zoning requirements will a distortionary tax be transformed into a lump-sum tax.

We argue that within jurisdiction heterogeneity of house and firm type is very unlikely and that the burden of a property tax that is distortionary at the margin falls on the owners of capital.

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The Incidence of the Local Property Tax: A Re-evaluation

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I. Introduction

The objective of this article is to identify the key assumptions that form the basis of two competing theories of the incidence of the local property tax. These theories are (1) the "benefit view" which maintains that the property tax system is equivalent to a set of non-distortionary user charges that fall on the households and firms who benefit from local public goods; and (2) the "new view" of the property tax which concludes that the principal effect of the property tax system is to decrease the rturn to capital as the burden of a simultaneous increase in property taxes by all local governments falls on capital owners.

Our main conclusion is that the benefit or non-distortionary view of the property tax is correct only under very restrictive assumptions. Only homogeneous perfectly stratified communities can adopt a set of exact zoning requirements that transforms a distortionary property tax into a lump-sum tax. Indeed, we prove that homogeneous, utility maximizing communities will adopt a non-distortionary tax system. Consequently the accuracy of the benefit view is determined by the proportion of households and firms which are actually constrained by zoning requirements.

Note that the existence of zoning does not imply that most households located in the community are bound by the requirements. For example, a community might restrict housing to single family houses no smaller than 2000 square feet in size. But if most houses in the community are larger than the minimum, most residents are not strictly bound by the minimum floor space requirement and the imposition of a property tax will distort housing consumption -- to reduce their tax burdens, households will build smaller houses.

Once within-jurisdiction heterogeneity of house and firm type is

allowed, the strong form of the benefit view is vitiated. We shall argue heterogeneity makes exact zoning very unlikely, and that the burden of a property tax that is distortionary at the margin falls on the owners of capital.

This conclusion holds even at the level of a small community that raises its property tax in order to increase public spending. The community making the expenditure change will pay the tax as its cost of capital is increased by the amount of the tax. But the decrease in the demand for capital in the community incrementally increasing its tax will depress the return to caital throughout the economy by an amount approximately equal to the additional tax proceeds as the reallocation of capital in the econmy following the imposition of a distorting tax on mobile capital depresses the return to caital. Also, the capitalization into land values of a distortionary property tax is relative, not absolute. Land values fall in the taxing community, but increase by an equal amount in the non-taxing communities.

This result is an example of a proposition which dates back to Harry Gunison Brown (1924). Brown stressed that a distorting tax on capital in a small industry or region has a general equilibrium impact that should not be ignored however small the taxing sector, and that the general equilibrium incidence of a tax on a mobile factor was on that factor. This idea is fundamental in analyzing the effects of taxes on capital in a local public good economy and is developed in some detail in the fourth section of the paper. In the next section we analyze the benefit view of the property tax, and we do a benefit-related incidence analysis in Section III.

II. The Property Tax as a Perfect Benefit Tax

The benefit view for the case of homogeneous communities is summarized by the following proposition: If there exists a sufficiently large number of communities, public goods are publicly-provided private goods which are property tax financed, communities are perfectly homogeneous in that only one type of household and/or firm is located in a given community, and each community is precisely zoned in that the amount of housing capital per household or the amount of industrial capital per firm is predetermined and is independent of the property tax rate, then the

property tax system is non-distortionary and is equivalent to a set of lump-sum taxes or user changes. There is no intra-community reditribution of fiscal benefits and theproperty tax is a perfect benefit tax. This proposition was first developed for a model of residential housing by Bruce Hamilton (1975), and was extended to include industrial capital by William Fischel (1975) and Michelle White (1975).

The two key assumptions in the residential housing case are perfect zoning and the existance of a large number of communities. The latter assumption ensures that households can choose from a sufficiently large number of combinations of housing and public service levels so that all tastes are satisfied. The exact zoning assumption insures that the consumption of housing is precisely determined in every community so that housing consumption is not distorted by the property tax and there is no free rider problem. Together, these two assumptions ensure homogeneous communities.

As each community is homogeneous and housing consumption in each is predetermined by zoning, the property tax is converted to a user fee or a lump-sum tax. A one percent property tax on a $100,000 house is equivalent to a $1000 household tax. Also, as houses and lots are identical, a tax on house structure is equivalent to a tax on land values.

The generalization of this result to the inclusion of industrial capital is accomplished by adding the following assumptions: (1) The public services provided to industry are distinct from those provided to households, e.g., firms receive publicly provided water or police protection and households receive educational services. As for household consumption, it is assumed that <u>each</u> firm receives a given amount of essentially private goods, as public services, in the form of an intermediate producer's good, in exchange for the taxes that it pays; and (2) Competition between communities insures that in long term equilibrium each firm will receive public services equal in value to taxes paid. To avoid intra-jurisdictional redistribution firms will stratify themselves into "homogenous communities" and firms in a given community will receive the same amount of public services per unit of capital.

As in the analysis of household capital, the distortionary effect of the industrial property is eliminated by the assumption of perfect zoning. The amount of capital a firm must use in predetermined by zoning. So if a firm is to locate in a community it will know the tax rate t, its

capital K, and the level of public services. These three variables are simultaneously determined. As There exist an indefinitely large number of communities with varying zoning requirements, different K's, and different tax rates, the firm in making its location decision shops around and chooses the optimal (cost-minimizing) levels of labor, capital, and public services. In effect, the firm is free to buy public services at a fixed per-unit price.

Hamilton (1976) has attempted to generalize the benefit tax model by allowing for hetrogeneous residential communities whose houses vary according to value. But two essential features of the original model remain unchanged in this version of his work. First, households which reside in hetrogeneous communities and pay varying amounts of tax according to the house they live in are identical in terms of their demand for publicly provided goods and services. This implies that if the public goods could be purchased directly as a private good at a given unit price, the households that live in a particular assumption eliminates public choice problems and properties in a hetrogenous community are valued differently than identical properties in homogeneous communities solely because of taxes paid.

The other assumption which Hamilton in effect retains is that of exact, binding zoning. This is implied by his assumption that heterogeneous communities are fully developed -- since the house size on each lot is specified, this is equivalent to "heterogeneous zoning" where houses are no longer required to be identical, but it is impossible for households to change their housing consumption.

To see this, suppose that there is only residential capital, and that lots in all communities are identical and cost a given amount to transform from raw agricultural land, say $20,000 a lot. Also assume two income classes and two types of housing, H, valued at $100,000 a unit and L with a structure value of $50,000. Assume that the desired level of public services is $1000 per household and is the same across all communities. When communities are perfectly homogeneous and expenditures are constant across communities, the tax rate is 1 percent in community H and 2 percent in community L. An H house plus lot sells for $120,000 and a housing unit in L sells for $70,000.

Suppose that an existing heterogeneous community is "zoned" so that half the houses are H houses and half are L houses. In this case, Hamilton

was able to show that the property tax is not distortionary and also was able to derive the strong capitalization result that the total value of the lots in the heterogeneous community is exactly equal to the total value of the lots in homogeneous (stratified) communities the total value of the community is independent of its composition in terms of H and L housing.

The result can be demonstrated as follows. Assume there are two lots in the heterogeneous community. By assumption these two lots would sell for $40,000 in a homogeneous H or L community. The tax on H housing will be twice as large as the tax on L housing. In this community the tax on H housing is $1334 and $666 on L housing as expenditures are $1000 per households. As taxes per household in a perfectly homogeneous is $1000, the tax disadvantange (advantage) for H (L) housing of being lcoated in the heterogeneous community is $344 ($334) per year. The H (L) lot will sell at a discount (premium) in the heterogeneous community relative to the same lot in a homogeneous community.

But as the tax disadvantage to H housing is exactly equal to the tax advantage in the L housing, the capitalization effects will cancel. For example, if the discount rate is ten percent the H lot in the heterogeneous community will sell at a discount of $3340, or $16,660 and the L lot in this community will sell for $23,340. The two lots together are worth $40,000. This example verifies Hamilton's argument that heterogeneity in housing and tax liabilities combined with homogeneity of rates and zoning does not destroy the conclusion of perfect benefit taxation and the essential message of this theory -- you pay for what you get.

These are strong results and it appears that attempts to discredit the benefit theory of local taxes by questioning the assumptions of homogeneity of preferences, or perfect zoning is to quibble with a central tendency that is very powerful. To upset the theory one has to show that relaxation of the simplifying assumptions of the benefit theory yields results which are significantly different. This is what we shall do in the remaining sections of the paper.

It has been suggested by H. Aaron (1975) that the benefit theory of the property tax is more representative of a system of suburban communities than as a description of central cities which are quite heterogeneous. Aaron is correct in arguing that within community heterogeneity of housing and industrial taxpayers is the essential reason why the benefit theory of property tax is a partial theory at best. Heterogeneity does not preclude

the use of zoning as a means of separating various forms of economic activities within communities and in partially stratifying communities according to income level and house type. But, except in extreme cases, zoning will rarely be binding for a significant portion of households or firms. For example, consider a relatively homogeneous single-family community developed under zoning restrictions that limit construction to those homes no smaller than 2000 square feet, but where most houses actually constructed are substantially larger than the minimum level. Similarly, industrial zoning is not usually written so that the distortionary effects of the property tax are eliminated.

A property tax will be distortionary, except with exact zoning, as taxpayers will attempt to lower their tax burden by decreasing their demand for housing or industrial capital. For an individual household or firm, the perceived public services received in a given community will be taken to be independent of the capital put in place. This does not mean that communities do not use zoning to exclude low income residents or that residents will not locate in high tax rate jurisdictions so as to enjoy the benefits of superior education. The assumption we shall make in subsequent analysis is that zoning is insufficiently exact so that the property tax is distortionary. Households and firms in a given community will take the after tax rate of return on capital as predetermined, and as the property tax is increased will assume that their cost of capital is increased by the amount of the tax. This increase in capital cost will distort the use of capital in the community and will lead to a decrease in the demand for capital. This change will decrease the return to capital. A distortionary property tax is not a perfect benefit tax. Moreover, the capitalization effects associated with such a tax are relative, not absolute, where relative capitalization occurs when the decrease in land values in the community imposing the tax is offset (perhaps exactly) by an increase in land value in the communities that do not impose or increase the tax.

III. The Incidence of a Distorting Property Tax in a Tiebout Type Model

The weak or nonexistent specification of the benefit side in the work of Thompson (1965) Mieszkowski (1972) and Aaron (1975) on the incidence of the property tax has made their conclusion that the property tax is a tax on capital suspect and difficult to reconcile with the

opposing result that local property taxes are payments for benefits received. We shall demonstrate that the property tax is a tax on capital when the tax is distortionary at the margin and that this result does not depend on an explicit specification of the demand side of the model.

We retain the assumptio of a fixed number of communities, take the internal composition of communities as predetermined, and in the first instance, take the communities to be identical. These assumptions simplify the analysis without affecting the basic results. By taking the number of communities as fixed, we develop a model where a fixed national capital stock is combined with land to produce housing and a general purpose commodity. Land, the fixed factor, earns positive rents. In this sample formulation, we avoid the complications of introducing a third factor, labor.[1]

In the conventional approach to tax incidence, the determination of the level of expenditures is not explained. In this section we allow public expenditures to vary with respect to two tax regimes. In one regime, each homogeneous community is free to adopt a non-distorting head tax, which corresponds to a property tax with exact zoning. In the second regime, we adopt a methodology introduced by Atkinson and Stern (1974) which varies exongenously the level of non-distorting head taxes. A community restricted in its use of non-distorting head taxes must adopt a distorting property tax to raise additional tax revenues. The level of expenditures and the property tax rate are determined endogenously. The basic objective of the analysis is to study the incidence of a distortionary property tax.

The model which is described in detail in Zodrow and Mieszkowski (1984(a)) is quite simple. The economy consists of N identical jurisdictions. Each jurisdiction has an identical supply of land which is fixed. The national capital stock (K) is fixed and capital is perfectly mobile across jurisdictions. An identical general purpose good is produced and housing is not explicitly introduced.

Each community has a fixed number of identical residents. Each resident owns an equal share of jurisdiction's land and an equal share of the national capital stock, which is not necessarily invested in the jurisdiction of residence. There is no wage income. We normalize the population in each community to be equal to one.

Local public services (P) are public purchases of the general

purpose good. The public consumption good is financed by a per unit property tax on capital (T) or by a nondistortionary head tax (H): The budget balance condition is

$$P = TK + H \tag{1}$$

Each jurisdiction acts as a "Nash-competitor" and assumes that all other jurisdictions will not respond to changes in its property tax rate, and that its action cannot affect the national return to capital, r.

As each community is homogeneous, the local government maximizes the utility function U(C,P) where C is the consumption of the private good. The share of after-tax capital income of each community is

$$\frac{r\bar{K}}{N},$$

where N is the number of identical communities. Total output is a function of the input of capital

$$C+P=F(K). \tag{2}$$

Making use of (1), the optimization problem facing each government is to

$$\max_{T} U[F(K)-(r + T)K + r\bar{K}/N - H, TK + H], \tag{3}$$

where r and H are taken to be fixed. The first order condition for optimization requires that capital be used up to the point where the marginal product of capital $F_K(K)$ is equal to the cost of capital or

$$r + T = F_K(K) \tag{4}$$

Differentiation of (4) Yields the change in the capital stock resulting from an increase in the property tax rate:

$$\phi = -\frac{dK}{dT} = -\frac{1}{F_{KK}} > 0 \tag{5}$$

This term represents the distortionary effects of the property tax. Each community recognizes that by increasing its tax on capital it will increase the cost of capital, decrease the property tax base, and decrease income from land rents.

When the head tax, H, is a choice variable (along with T) the first order conditions for an optimum would be

(6) $$U_p/U_c = 1$$

(7) $$U_p/U_c = 1 /[1 - (T\phi/K)],$$

where the subscripts denote partial derivatives of the utility function. It follows immediately from (6) and (7) that when no constraint is imposed on the level of head taxes, the optimal property tax would be zero and the head tax financed public services will be provided up to the point where the marginal rate of substitution equals the marginal rate of transformation.

However, when the head tax is constrained to be less than the optimal level, the government sets T at a positive level where the first order condition for T is equation 7. Since ϕ is positive it follows that $U_p/U_c > 1$, which is an indication of the under provision of local services at the margin.

Another result which can be obtained for a changeover from a first best non-distortionary head tax to a "mixed system" where H is constrained and a distortionary property tax substituted, is that the after tax return to capital falls by the amount of the tax T. The assumption of a fixed national capital stock implies that

(9) $$N\, dK = 0$$

and from condition (4) it follows that

(10) $$dr = - dT.$$

Within the context of this simple model, this result confirms the conclusion reached earlier by Mieszkowski (1972) that the return to capital is decreased by the average rate of property tax in the economy. The point we stress here is that the exact binding zoning requirements specified by Hamilton, Fischel, and White are rarely observed, if at all, because individual communities are composed of diverse stocks of housing, and a wide variety of industrial and commercial firms.

However, without the assumption of homogeneous communities and exact zoning (equivalent to being able to use head taxes), the strict form of benefit view of the property tax collapses and the new view again applies.

In Zodrow and Mieszkowski (1984a) and Mieszkowski and Zodrow 1984b, we extend the simple model presented above. The first extension is the introduction of local public goods that enter as an input into the production process. The production function in a particular jurisdiction is F(K, B) where B is the level of-publicly-provided services to business. The

results for this model are very similar to those derived for the consumption good model. If unconstrained, a jurisdiction will use only head tax finance and will provide public services to industry to the point where the marginal benefit of these services is equal to the marginal cost of provision. When a distortionary property tax is used as a source of finance, publicly provided business services will be under provided and capital will bear the tax.

The second extension has an essential Tiebout type element in that two types of communites are allowed with one set of communities composed of "high demanders" for public services and another set composed exclusively of low demanders. As in the model presented above, the analysis is a special form of differential analysis. Initially, both types of communities are assumed to finance public consumption by a non-distortionary head tax. An exogenous constraint is imposed on head tax collections and both communities impose distortionary property taxes on housing and industrial capital as a partial source of finance. Our method of relaxing the perfect zoning assumption to assume that lcoal zoning ordinances are limited to fixing residential and non-residential land use and cannot precisely determine the amount of housing capital in each community. The distortionary tax discourages public good consumption in both communities and the property tax rate is higher in the high demander communities.

As the socially provided good is the composite good, the tax-induced increase in the cost of this good shifts demands towards housing in each community. Also the relative cost of housing is increased (decreased) in the high (low) tax communities and capital flows from (into) the high (low) tax communities. These capital flows lead to offsetting redistributions of income between fixed factors of production in the two sets of jurisdictions. Labor employed in the production of the composite good in the low tax jurisdictions gains at the expense of labor in the high tax jurisdiction. Similarly land used in the production of housing in the low (high) tax jurisdictions increases (decreases) in price after the introduction of a distorting property tax.

The effects resulting from interjurisdictional tax rate differences and the consumption distortion complicate the incidence result.

However, these effects are qualifications and extensions of the main result; the incidence expressions derived in Mieszkowski and Zodrow (1984b) all contain terms that reflect the "profit-tax effect" -- the depressing effect of a tax on capital on the after-tax return to capital.

IV The Brown-Harberger Proposition

The strongest theoretical case for the position that the incidence of distortionary property taxes falls on the owners of capital is the "Brown proposition developed by Harry Gunison Brown some sixty years ago. Brown's basic idea is that incidence analysis should not ignore the general equilibrium effects associated with the imposition of a distortionary tax in (on) a small jurisdiction (industry). In general, the assumption of constant factor prices in analysis of the effects of tax on a small sector of the economy is misleading.

Brown's idea has been formally demonstrated in a short, elegant paper by David Bradford (1978). But the idea is not well known and its full implications for incidence theory and the theory of capitalization have not been developed. In particular, we demonstrate here that there is no inconsistency in claiming that a tax in a small community depresses the rate of return to capital in the overall economy and that the immobile residents of the taxing community suffer from the imposition of the tax.

We demonstrate Brown's proposition in a strong form.[2] The model is the same used in the previous section. Although no explicit reference is made to expenditures and benefits, we offer the following differential incidence interpretation. Assume a "closed system" where the number of jurisdictions (industries) is fixed. The amount of land in each jurisdiction is fixed and there is a fixed amount of capital that is perfectly mobile between jurisdiction. Initially all jurisdictions use non-distortionary taxes to finance public expenditure. Then one jurisdiction is constrained in the level of neutral taxes it can utilize and to raise part of its revenues, imposes a small tax on property. The other jurisdictions continue to utilize non-distortionary taxation or user changes.

These assumptions are equivalent to assuming a zero tax initial equilibrium and we thus abstract from excess burden effects. Also we make the simplifying assumption that all N+1 jurisdictions produce a single community with the same two-factor technology, and that they have the same endowments of land.

Before the imposition of a tax on capital by jurisdiction A, the total capital stock K is distributed among the N+1 jurisdiction so that

$$K_A + NK_B = K \tag{11}$$

where $K_A = K_B$.

Jurisdiction A imposes a tax on capital, expressed as a per unit tax, T. In equilibrium the after tax rate of return (r) is equalized across jurisdictions. Thus, the change in the before tax rate of return in the taxing state, d_A is equal to the after tax return plus the tax

$$\bar{d}r_A = dr_B + T \tag{12}$$

As factor pricing reflects marginal productivity we can write (12) as

$$\bar{d}r_A = dK_A F''_A(\ ) = T + dK_B F''_B(\ ) \tag{12'}$$

where $F''_A(\ )$ and $F''_B(\ )$ is the second derivative of the production function in A and B respectively.

Since the marginal product of capital was equalized across jurisdictions in the initial non-distorted equilibrum, $F''_A(\ ) = F''_B$. Also, since the capital stock is fixed and regions are identical $dK_A = -\frac{dK_B}{N}$ and (12') simplifies to

$$dr_A = T\left(\frac{N}{N+1}\right) \tag{13}$$

From (13) it follows that when N=1, there are two jurisdictions, and the before tax rate of return increases by one-half of the tax rate. Also, as expected when the taxing region is small relative to the nation, (N becomes large) the change in before tax rate of return becomes negligibly small.

The change in the after tax rate of return is obtained by substituting (12) into (13) to obtain

$$dr = -\frac{T}{N+1} \tag{14}$$

Thus, as taxing regions become small relative to the nation, dr tends toward zero.

But even for large values of N, the change in the overall after-tax return to capital does not go to zero; rather it equals tax collection in A. Multiply (14) by the total capital stock $K_A(N+1)$ to obtain

$$K_A\left[-\frac{T}{N+1}\right] N+1 = -K_A T \tag{15}$$

where $K_A T$ are tax collections in A.

Thus, under our strong assumptions, the after-tax return to capital

throughout the nation falls by the taxes collected on capital in jurisdiction A, independently of the number of jurisdictions of type A.

As we ignore the effects of taxes on output, it follows that total output remains unchanged and the total return to land in the nation remains unchanged. The fall in land rents in A is exactly equal to the increase in land rents in the non-taxing jurisdictions. So as N becomes large the fall in land rents in the taxing state is approximately equal to tax collections. This last result supports our claim that in a model with a fixed number of jurisdictions, capitalization will be relative rather than absolute.

Essentially the same point can be made in a specialized form of the two-sector model developed by Arnold Harberger (1962). This example approximates the case discussed by Brown (1924) and is presented in order to reconcile the proposition that a property tax on housing is borne by consumers and the opposing claim that it is a tax on capital. In the example there exist two commodities X and Y. Good X is apartment services and is subject to tax and is consumed only by group A that does not own any capital. A second group (B) does not consume X and receives none of the income from capital. Group C owns all of the capital in the economy and spends none of its income on X. So group A is the only consumer ofX and group C receives all of the capital income.

To illustrate Brown's claim that taxes on capital in small sectors depress the return to capital, we assume tht only 1 percent of the nation's capital stock is used in providing housing services for group A. $K_X/Kx + Ky$ where Kx + Ky equals the nation's capital stock.

In Harberger's two-sector incidence model, labor is the other factor and both labor and capital are perfectly mobile between sectors. The effects of a tax on industry X are analysed and the change in the after-tax return to capital relative to labor is calculated.

As the model and its general result are well known we relegate this algebra to a footnote.[3] By making appropriate assumptions about the relevant parameters we can conclude that the return to capital will fall by one one hundredth of a tax on capital in X, i.e. dr=-.o1%. But if capital is the only input in the production of X, the change in the price of X is equal to T+dr = .99T. So the price of X increases by virtually the full amount of the tax, and it appears that consumers (group A) fully bear the burden of the capital tax on X. However, the return to capital has fallen by 1 percent of the tax and as the capital in X represents 1 percent of the nation's capital

it follows that the overall return to capital hs fallen by the amount of tax.

Paradoxically it appears that the real incomes of the consumers of the taxed product and the owners of capital both fall by the amount of the tax proceeds. To resolve this paradox, recognize that by depressing the return to capital, the tax increases the real income of group B, the group that neither consumes the taxed product, X, nor owns capital.

For example, suppose that group A earns 1 percent of total income and spends 25 percent of its income on X. Also, suppose that the shares of B and C in total income are 69 and 30 percent respectively. If tax proceeds are equal to 100, the balance sheet for the three groups is as follows:

Group	Use of Income Effect (Consumption)	Source of Income Effect	Net Change in Real Income
A	-99	0	-99
B	.69(100)	0	69
C	.30(100)	-100	-70
Government		+100	-100

The government and group B gain at the expense of the consumers of A and the owners of capital.

Brown's claim that a partial tax on real estate is not a consumption tax but a tax on capital as a whole is seen to be correct if different groups have the same average propensity to consume on housing, so that their losses as consumers of housing are exactly offset by their gains as the consumers of commodities not subject to tax.

The case is perfectly analogous to the situation where owners of land own equal amounts of land in different jurisdictions so that the capitalization effects of taxes on capital can be ignored as they cancel in the aggregate. But our claim is not that capitalization effects, or excise tax effects, should be ignored but that the effects of a partial tax on the return to capital must also be considered in any incidence analysis.

V. Conclusion

Our paper arrives at the following three conclusions. First, the benefit view of local property taxes depends on a very strong assumption about exact zoning. We do not argue with the logic of this theory, but

rather with its basis in fact. Since binding zoning constraints seldom occur, the assumption that taxes are non-distortionary at the margin seems counterfactual. Second, property taxes on capital depress the return to capital, even when each local community chooses its level of public services optimally under the constraints of perfect capital mobility and limitations on perfect zoning. Third, the use of distortionary property taxes, even by a small set of jurisdictions relative to the number of jurisdictions in the nation, reduces the income to capital owners by approximately the amount of revenue raised. Although returns to fixed factors fall in the taxing jurisdictions, these reductions are offset by increases in returns to fixed factors in the non-taxing jurisdictions; that is, capitalization is relative rather than absolute.

Footnotes

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1. An alternative specification for a two factor model is to allow community formation (agriculture land can be converted to urban use) and to allow variations in the quality of sites, according to location and amenity value such as climate. In such a model ladn rents and the marginal productivity of capital in a particular jurisdiction would vary with capital to land ratio. As capital migrates into (out of) a community land rents increase (decrease). This basic result is common to a model with a fixed number of jurisdictions and one with varying land quality. The former is much simpler to work with and the existence of a large number of communities insures that each community is a price taker.

2. The first example presented in this section was developed jointly with J. E. Stiglitz. It is somewhat more specialized than David Bradford's demonstration.

3. The expression for the change in the after tax return to capital relative to the wage rate, for the special where the elasticity of substitution between labor and capital in the taxed sector is zero and the share of capital in that sector is equal to 1

$$dr = \frac{E\left(\frac{K_x}{K_y}\right) T}{E(gk - 1)\frac{K_x}{K_y} - S_y}$$

where E is the elasticity of the demand for x, S_y is the elasticity of substitution between labor and capital in the production of y, and gk is the share of capital in the production of y. If we take $E = S_y = -.5$ and $gk = .25$ and $K_x/K_y = .01$ the change in the after tax return to capital, dr is calculated to be $\frac{-.005}{.50038}$ T, or approximately -.01T.

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