Property Taxes and Commercial Real Estate Values in Urban Areas

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Great Cities Institute
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A Great Cities Institute Working Paper

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Introduction

The purpose of this paper is to present a summary of what is known about the effects of property taxation on the market rents and market values of commercial and industrial real estate in urban areas. More precisely, the paper concentrates on the impacts of *changes in* and *variations in* property tax rates on commercial and industrial property rents and values. The topic includes an examination of the effects of variations in property tax rates within an urban area. The paper does not examine the effects of public spending that might be funded by increasing the property tax rate on commercial and industrial property. It is taken as a given that commercial and industrial property usually pays far more in property taxes than the cost of the public goods and services directed at such property. Some 60 percent of all local government spending is on public schools, a public service that is assumed to benefit the owners of residential property.

The research reported in this paper indicates that local variations in property taxes have sizable effects on commercial and industrial property values and, in the long run, on the amount of commercial and industrial real estate located in a particular jurisdiction within the urban area. The studies discussed in this paper used recent data on commercial and industrial real estate in the Chicago metropolitan area.

Underlying the entire discussion is the idea that there exists a production function for commercial or industrial value added in an urban area that can be written

$$Q = Q(S, L, N, E, \quad (1)$$

where Q is output, S is capital embodied in structures, L is land, N is labor, and E is equipment. It is further assumed that the structure capital and land inputs can be grouped together and called real estate, or

$$q = q(S, L). \quad (2)$$

The intermediate input commodity real estate is assumed to be separable from the labor and equipment inputs; the marginal rate of substitution of S for L (σ) is not affected by the quantities of L and E in use, where σ is defined as $d\ln(S/L)/d\ln(p_L/p_s)$; p_L is the price of land and p_s is the price of structure capital. The elasticity of substitution measures the extent to which the ratio of structure capital to land increases as the price of land increases. Real estate is a commodity that is bought and sold in real estate markets. This means that the production function can be written

$$Q = Q(q, N, E). \quad (3)$$

No estimates of equations (1) or (3) exist, but some estimates of equation (2) can be found in the literature. One estimate [McDonald (1981)] of (3 in the commercial sector is .6, while the office building sector was estimated to have $\sigma = 1.2$, and σ in the manufacturing sector was found to be .7. Throughout it is assumed that the markets for the inputs into the production of real estate (i.e., land and structure capital) are perfectly competitive.

Individual Properties in the Short Run
This section of the paper is concerned with individual commercial or industrial properties in an urban area. What happens if the property tax rate imposed upon an individual property is higher than that prevailing elsewhere in the urban area? The analysis follows McDonald (1993b).

One's first reaction might be simply to say that the individual building faces a market demand of infinite elasticity, and therefore there will be no impact on the rent charged to tenants. The market value of the building will decline by the present discounted value of the increase in property taxes. The market value of a property of unit size (q = 1) with infinite life is

$$V = (R - tV)/I, \tag{4}$$

where R is the rent (after expenses) for one unit of q, t is the property tax rate as a percentage of the market value of the building, and I is the discount rate. The solution for V is

$$V = R/(I + t), \tag{5}$$

which leads to

$$dV/V = [-(1 + I)/(I + t)]\ dt. \tag{6}$$

If dt =.01 (i.e., a 1 percent increase in the property tax rate), I = .05, and t = .02, then dV/V =.15;

the market value of the building falls by 15 percent when the property tax rate is increased from 2 percent to 3 percent.

However, there are reasons to doubt that demand is infinitely elastic. Moving is costly for tenants. Suitable quarters must be found, and moving expenses must be paid. If suitable quarters cannot be found in the immediate vicinity, then the tenant's customers, suppliers, and employees must all make adjustments. Some customers may be lost, relationships with suppliers may change, and some valuable employees may be lost as well. In short, the owner of a commercial or industrial building very likely has some market power over the tenants. However, market power is limited by the fact that landlords do not wish to lose good tenants; landlords and tenants often form long-term relationships.
These arguments suggest that some increase in the property tax can be passed forward to tenants as higher rents; or that dR/dt > 0. Recall that rent R is rent after expenses, but before property taxes. With V = R/(I+t), we now have

$$dV/V = [(dR/R)/dt]dt - [(1+I)/(I+t)]dt. \tag{7}$$

The critical parameter is dR/dt, the effect of a change in the tax rate on rent. This question is examined empirically in McDonald (1993b). However, in that study the tax rate is assumed to be a specific tax on floor space (dollars per square foot) because this is how it is regarded by the participants in the market that was studied -- the market for office space in downtown Chicago. Indeed, it is fair to say that the participants in this market never think of the property tax as a percentage of the market value of an office building. Technically, the property tax liability of a building is, of course, a percentage of the assessed value of the building. However, the participants in the market do not regard the assessed value of the building as a sensible estimate of its market value.

Consider a simple model of pricing for a firm (i.e., an office building owner) with market power. Rent is determined according to

$$R = (1 + m)(C + T), \qquad (8)$$

where m is the markup over marginal cost, C is marginal cost excluding the property tax, and T is the tax per unit of real estate (i.e., floor space). The effect of changing the tax is

$$dR/dT = (1 + m) + T(dm/dT). \qquad (9)$$

In the standard Chamberlinian case the firm maximizes profits, or

$$(I + m) = e_d/(e_d - 1), \qquad (10)$$

where e_d is the elasticity of demand faced by the firm. Because a profit-maximizing firm with local monopoly power will have marginal revenue greater than 0, e_d must be greater than 1. If demand elasticity is constant, dm/dT = 0, and dR/dT must exceed 1; the firm with local monopoly power will increase rent by an amount greater than the increase in the tax. Such a result seems implausible on its face and is not consistent with the empirical results that have been obtained. However, if demand becomes more elastic as price increases, the dm/dT < 0, and it is possible that dR/dT < 1. For example, in the textbook case of a linear demand curve, exactly one-half of a tax increase is passed forward to tenants. To see this, assume a linear demand curve R = a - bq, where q is quantity. Setting marginal revenue equal to marginal cost (C + T) leads to the profit-maximizing price of R = (a + C + T)/2.

The study by McDonald (1993b) surveyed 259 private office buildings in downtown Chicago, and it showed that the property tax assessment per square foot strongly influences the building's average gross rent per square foot. This result implies that, in 1991, 45 percent of property tax differences across buildings were shifted forward to tenants. Of course, 55 percent of property tax differentials was absorbed by the owners of the building and land. The effect of the property tax on gross rent can be estimated with considerable precision because assessed value per square foot turns out to be an exogenous variable with respect to gross rent. The Hausman (1978) test was used to obtain this conclusion regarding exogeneity. The property tax is supposed to be determined by the market value of the building, which depends upon gross rent and expenses. However, the apparent difficulty of establishing accurate estimates of market value turns the property tax into an exogenous variable.

Studies by the Illinois Department of Revenue from 1991 show that the ratio of assessed value to market value of commercial properties in Cook County has a coefficient of dispersion of .62. The coefficient of dispersion is the average absolute deviation in this assessment ratio divided by the median assessment ratio. This is an extremely high coefficient of dispersion; the corresponding figure for small residential properties in Cook County is .24, which is itself not particularly low. The median assessment ratio for commercial properties was 23.41 percent. The first quartile for the assessment ratio was 16.40 percent, and the third quartile was 31.43 percent. In other words, 50 percent of the assessment ratios fell *outside* of this range. In short, a piece of commercial property could easily face a property tax bill that was double (or more) that faced by an equivalent property.

The mean gross rent per year for the sample of buildings was $19.06 per square foot, and the mean assessed value was $19.43 per square foot. Average rent and assessed value per square foot had mean values that were nearly equal, but the standard deviation of rent was $6.92, and the standard deviation of assessed value was $14.11. Average rent varied from a low of $3.90 to a high of $44 per square foot. Assessed value per square foot varied from $.20 to $114.90, extreme values that were double-checked with the Office of the Assessor of Cook County.

If about half of the variations in the local property tax bill are passed forward to tenants, we can estimate the effect on the market value of property. In this case, the value of a unit of real estate of infinite life is

$V = (R - T)/I$, and
$dV/dT = (dR/dT - 1)/I$.

In this case, $dR/dT = .5$, and $dV/dT = -.5/I = 10$ (for $I = .05$). In other words, an increase in the specific tax on floor space of $1 per square foot reduces the market value of that floor space by $10.

A Model of Property Taxes and Property Values

This section presents a basic model of commercial and industrial real estate demand and supply that can be used to determine the effects of a change in the property tax rate on the market value of real estate in a local jurisdiction, such as a county or a municipality. The model assumes that perfect competition prevails in input and output markets. As noted above, real estate is considered to be an input into commercial and industrial production processes, and is a function of stocks of land L and structure capital S. The real estate input is assumed to be weakly separable from other inputs, such as labor and equipment. Thus, the model considers a real estate development firm that produces an output called real estate q. All actual or potential real estate developers of a site have identical constant elasticity of substitution (CES) production functions with constant returns to scale, written

$$q = q(L, S). \qquad (11)$$

The elasticity of substitution for this production function is denoted σ.

The analysis of the introduction of the property tax is carried out in essentially the same way that was used by Mieszkowski (1972). As Mieszkowski pointed out, assuming that total capital and land are fixed in supply, the introduction of a uniform property tax across all jurisdictions and all classes of property will have no effect on the allocation of resources. (A uniform property tax will alter property values, of course.) Rather, property tax differentials alter local supplies and property values as well. The critical issue then is the effect on property values of variations in the property tax from the rate prevailing elsewhere. Mieszkowski and Zodrow (1989) have provided a comprehensive survey of models of this type.

The model presented in this section is quite different from the Tiebout-type models that have been applied to the commercial or industrial sectors. Fischel (1975) and White (1975) developed models with commercial and industrial zoning and perfect mobility of firms that generate equilibriums that are efficient. The value of the public services provided to firms just equals the property taxes paid. In such a model, changes in property tax rates in a single jurisdiction within the metropolitan area can be of two types. In the first type, any change in property taxes paid by firms is driven by a change in the value of public services provided to firms. In this case, an increase in the property tax is not associated with any change in the value of the industrial or commercial tax base. In the second type, the change in the property tax is not matched by a change in the value of public services provided to firms. If the property tax rate is increased in this case, firms in the jurisdiction will move to new jurisdictions, lower zoning constraints will be imposed, and a new Tiebout-type equilibrium will be established with a different group of firms in the jurisdiction. In this paper it is assumed that neither of these scenarios is of much importance.

The first task in establishing the links between the property tax and market value is once again to set out the relationship between the property tax as a percentage of market value and as a percentage of market rent. The market value of a unit of real property (one unit of q) of infinite life is

$$V = (R - tV)/I, \qquad (12)$$

where R is the constant annual rent paid after expenses per unit of q, t is the property tax rate as a percentage of market value, and I is the real discount rate. This equation implies that V/R 1/(I + t), or that I + t is the capitalization rate in this model. It is helpful to define • as the property tax as a percentage of annual rent, so

$$\bullet = tV/R = t/(I + t). \qquad (13)$$

As above, if t =.02 and 1 =.05, then • =.286. Further, define rent received as p= R - tV = R(1 - •).

The basic results of the model can be illustrated using a simple model of supply and demand for real estate in a local jurisdiction. Assume that the supply of real estate is expressed as a function of V, the market value per unit. The demand for real estate would usually be expressed as a function of R, rent paid (assuming other operating expenses are the same in all local jurisdictions), but at a given capitalization rate it can also be expressed as a function of V. An increase in the property tax rate increases the capitalization rate and reduces demand (as a function of V) because a given rent paid now translates into a lower market value per unit. Assuming the supply curve has a positive slope, this shift in demand results in reductions in the market value and the quantity of real estate in the local jurisdiction. Rent paid (R) will tend to adjust upward, of course. Since both V and q decline in response to an increase in the tax rate, the effect on the total value of property (qV) can be sizable. A mathematical model can be used to determine a rough estimate of the effect of variations in the tax rate on V, q, and qV.

Define the demand and supply elasticities in quantity-rent space as:

$dlnq/dlnR = E_d < 0$ and
$dlnq/dlnp = E_s > 0$.

A change in the property tax rate -r will change both R and p, and will cause a change in q, written

$$dlnq = E_d dlnR = E_s dlnp. \quad (14)$$

From the definition of p =_ R(1 - •),

$$dlnR = dlnp - dln(1 - •). \quad (15)$$

Equations (14) and (15) can be solved to produce
$$dlnR = -[1/(1 - E_d/E_s)]dln(1- •), \text{ and} \quad (16)$$

$$dlnq = -[E_d/(1 - E_d /E_s)]dln(1- •). \quad (17)$$

Since V = R/(I + t) is the market value per unit of q, the change in the market value of a unit of property in response to an increase in the property tax rate t in natural log form is:

$$dlnV = [dlnR/dln(1 - •)] [dln(1 - •)/d•] d•/dt - dln(I + t)/dt. \quad (18)$$

Note that this effect consists of two parts: the effect on rent paid R, and the effect on the capitalized value of rent paid. The effect on R will tend to be positive, but the effect on the capitalization rate (I + t) is obviously negative. Given that

$$d• /dt\ I/(I + t)^2,$$

substitution into equation (18) produces

$$dlnV/dt = [1 /(1 - E_d/E_s)][1/(1- •)] [I/(I + t)^2]-1 /(I + t) \quad (19)$$

Because • = t/(I + t), we know that I - • = I/(I + t). This means that

$$dlnV/dt = [1 /(I + t)] \{[1 /(1 - E_d/E_s)] – 1\}$$

$$= [1/(I + t)]E_d/(E_s-E_d) < 0 \quad (20)$$

The unsurprising result is that the effect of an increase in the property tax rate on the market value of a unit of property depends upon the elasticities of supply and demand.

Consider a numerical example. Suppose that I = .05 and t = .02 as before. Supply and demand elasticities in the long run are fairly large for an individual jurisdiction; suppose that $E_s = 4$ and $E_d = -2$. In this case, an increase in the property tax rate t of .01 causes the market value of a unit of property to fall by 4.76 percent. (The calculated value of dlnV/dt = 4.76, but the change in t is .01 rather than 1, so dlnV = 4.76dt = .0476.)

In the very short run (market period), $E_s = 0$ and

$$dlnV = -1/(I + t)dt = -14.28dt,$$

or a decrease of 14.28 percent for a tax increase of .01. Some response on the supply side to the increase in the tax rate will moderate this decline in the market value of a unit of property. Indeed, a permanent increase in the property tax rate will lead to a new long-run equilibrium that the real estate markets should be able to anticipate.

The response on the quantity side is found as

$$dlnq/dt = - [E_d/(1 - E_d/E_s)]\ [dln(1 - \bullet\ )/d\bullet\ ]\ d\bullet\ /dt$$
$$= [1/(I + t)][E_d/(1 - E_d/E_s)] < 0. \qquad (21)$$

The previous numerical example specified I = .05, t = .02, $E_d = -2$, and $E_s = 4$, so dlnq = -19.04dt. If dt =.01, the quantity will decline by 19.04 percent. This is a sharp decline in quantity, but the increase in the property tax rate from .02 to .03 is an increase of 50 percent. Further, in this numerical example, the total value of property in the local jurisdiction is the sum of the two effects, or

$$dln(qV) = (dlnq + dlnV)dt = -23.8dt,$$

which means a drop of 23.8 percent for a tax increase of .01. Local jurisdictions increase the property tax rate on commercial and industrial property at their peril!

Empirical Estimation of the Model

The McDonald (1993a) study is an attempt at empirical estimation of this model for the counties in metropolitan Chicago during the 1980s. Two dependent variables were of interest to this study: changes in property tax rates and changes in property values in the commercial and industrial sectors. It is clear that these two variables are jointly dependent. The theoretical discussion indicates the links from changes in property taxes to changes in property values. But it is also clear that changes in market values drive property tax rates. Unlike a sales tax or an income tax rate, the property tax rate is not set by law. The property tax is actually just the ratio of tax "extensions" by governments in a county divided by assessed value. Thus, if market values (and hence assessed values) rise (fall) sharply while tax extensions do not, then the tax rate falls (rises). A two-equation model with these two dependent variables was specified and estimated by McDonald (1993 a) by three-stage least squares.

It was hypothesized that the change in the property tax rate for commercial and industrial property, expressed as a deviation from the average change for the six counties of the metropolitan area, was a function of:

- percentage change in the real market value for that type of property (jointly dependent variable),
- percentage change in the real market value of residential property,

- percentage change in the real market value of other properties (industrial property for the commercial tax rate, and vice versa),
- the property tax rate at the beginning of the time period, expressed as deviation from the average for the counties in the metropolitan area,
- the lagged value of the change in the property tax rate from three years prior (expressed as a deviation from the average change for the counties),
- property class (commercial or industrial), and
- time period (1982-85 or 1985-88).

It was assumed that the changes in real market values for residential and other types of property are exogenous to the model. The property tax rate at the beginning of the time period and the lagged value of the change in the property tax rate were included to capture the notion that local governments moderate their demands for increases in tax revenue when tax rates are high or when tax rates have increased appreciably in the recent past.

The estimation in McDonald (1993 a) of this model of the change in the property tax rate for commercial and industrial property was quite successful. All but two of the variables have statistically significant coefficients with the hypothesized signs. Changes in the property tax rate (in deviation form) were lower the larger the growth in the residential tax base and the tax base of the sector in question (commercial or industrial). Also, tax rate changes were lower if the tax rate in deviation form was higher, or if the previous change in the tax rate in deviation form was larger. Only the percentage change in the "other" tax base and the sector dummy were not statistically significant. The estimated coefficients indicate that a 10 percent increase in the residential tax base reduced the tax rates on commercial and industrial property by .14 percent to .17 percent, and that a 10 percent increase in the commercial or industrial tax base lowered the tax rate on that type of property by .05 percent.

The empirical model for the change in the real market value of commercial or industrial property conformed to the theory discussed above. The change in the real market value was hypothesized to depend upon:

- the change in the property tax rate imposed on that type of property (jointly dependent),
- the property tax rate at the beginning of the time period, expressed as a deviation from the average for the counties in the metropolitan area,
- average distance of the county to the Central Business District,
- population density,
- property class (commercial or industrial), and
- time period (1982-85 or 1985-88).

The distance and population density variables were included to capture the general effects of suburbanization. Counties at the edge of the urban area and with low population densities might be expected to grow more rapidly in terms of real market values. However, the central county (Cook County) in the early 1980s contained substantial areas that were relatively undeveloped and at the edge of urban development. The property tax rate at the beginning of the period (expressed in deviation form) was included to test the hypothesis that commercial and industrial location choices depend upon existing tax differentials. The model above is an equilibrium model of the derived demand for and supply of real estate, which implies that growth in such real estate depends upon changes in demands for output, prices, etc. An alternative theory is that price differentials at the beginning of the time period influence locations and, therefore, the growth of the local economy. In this case the relevant price -- the property tax rate -- is determined by a political process rather than by pure market forces. It is reasonable to suppose that property tax rate differences are a permanent feature of a local economy and should therefore be included in an equilibrium model.

The basic empirical finding in McDonald (1993 a) of the model of property value changes was that both the property tax rate and its change expressed in deviation form are statistically significant determinants of market value change. However, the estimated effects seem to be implausibly large for a three-year time period. It was estimated that a I percent increase in the property tax rate in one county relative to the other counties was, holding everything constant, associated with a change in market value that was 46.5 percent lower than it would otherwise have been. Also, the results indicate that a property tax level than that was 1 percent higher than that of the other counties at the beginning of a three-year period was associated with growth in market value that was 36.5 percent lower than it otherwise would have been. It would appear that further efforts to test this type of model are needed.

Conclusion

The goal of this paper has been to convince the reader that variations in property tax rates within a metropolitan area have important effects for commercial and industrial property owners, tenants, and local taxing jurisdictions.

Variations in assessments within the same taxing jurisdiction are partly passed forward to tenants, but about half of the incidence of such variations are borne by the owners of the property. If this finding holds up to further empirical testing, the conclusion will be that an increase in the property tax (relative to other buildings) of $1 per square foot will reduce the value of a square foot by .511, where I is the real discount rate. If I = .05, then the decline in value is $ 10 per square foot for each increase in the tax of $1 per square foot.

Variations in the property tax rate across jurisdictions can have very large effects on the market value of a unit of real estate and on the quantity of real estate that exists in a jurisdiction in the long run. These effects depend critically on the long-run elasticities of supply and demand for real estate in a local jurisdiction. Little is known about these long-run elasticities, and empirical studies are needed. Much of the research in this general area has focused on the location decisions of firms within an urban area; Bartik (199 1) provides a nice summary of the empirical studies. Many of the studies reviewed by Bartik (1991) found that location decisions within an urban area are very sensitive to local tax rates. However, in the author’s view, more work is needed on the estimation of market supply and demand elasticities used in this paper.

In any event, local officials within a large urban area must be made cognizant of the powerful effects that local tax policy can have. For example, Cook County (the central county in the Chicago metropolitan area) taxes commercial and industrial property at rates that are more than double the rates in the other counties of the urban area. Cook County uses a classification system in which commercial and industrial properties are assessed at rates that are higher than that used for single-family homes. The other counties in the urban area do not have such a system. The strategy of taxing commercial and industrial properties at high rates in order to keep residential tax rates low may have made sense in the past when there was little or no alternative to locating in Cook County, but the emergence of the modem polycentric urban area has rendered this traditional policy harmful. Indeed, some of the decentralization of the urban area can be attributed to property tax policy.

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