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CITY TAXES AND PROPERTY TAX BASES

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ABSTRACT

This paper investigates the simultaneous relationship between tax rates and city property tax bases using data for 86 large U.S. cities in 1967, 1972, 1977, and 1982. We find that a 10 percent increase in the city's property tax rate decreases the city's tax base by about 1.5 percent. In addition, local income taxes and taxes levied by overlying jurisidictions (such as county and state governments) also have negative impacts on the city's property tax base. Local sales taxes, in contrast, appear to have little impact. We conclude that taxes affect local property values more than is typically implied by previous studies that have investigated the impacts of state and local taxes on firms' location decisions.

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City Taxes and Property Tax Bases

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The property tax has traditionally been and continues to be the major revenue source of U.S. cities. Although cities have increasingly turned to other local revenue sources such as sales and income taxes, they still rely heavily on the local property tax to finance their local public expenditures. Despite this, surprisingly little is known about the impact of a city's property tax rate on its tax base.

Many local public officials apparently believe that property taxes have significant adverse effects on city economic activity. Witness, for example, their frequent willingness to grant tax abatements to encourage economic investment in the city. Applied economists, in contrast, are nearly unanimous in their skepticism both about the wisdom of such tax breaks and, more fundamentally, about the magnitude of the adverse behavioral effects of state and local taxes. Many empirical studies appear to support the contention that differentials in state and local tax burdens are simply too small to offset differences in the more basic determinants of firm location such as labor costs and accessibility to markets. (See surveys by Case, Papke, and Koenigsberg (1983); Kieschnik (1981); and Wasylenko (1981).)

Recent econometric investigations of the link between state and local taxes and the location of economic activity fall into two categories. First are those that focus on particular types of location decisions, typically the branch plant decision which, one might argue, is the most likely to be affected by taxes. (See, for example, Carlton (1979), Bartik (1985, 1986), and Schmenner (1982).) This approach has the advantage of allowing the researcher to ground the empirical analysis in the microeconomic theory of firm behavior. The second approach takes a much broader definition of economic activity such as the level or change in employment or capital investment either for all industries or certain industrial sectors. (See for example, Papke (1986) who focuses on investment and Bradbury, Downs, and Small (1982) who focus on changes in employment.) These more aggregate variables are harder to model precisely because they reflect a variety of economic decisions including, for example, the decision to expand, to shut down, to set up a new branch plant, or to start a new firm.

Even if economists better understood the links between local taxes and the location and expansion decisions of firms, they would still not be able to answer the central question of this study, namely, what impact do local property taxes have on the size of a city's property tax base? The difficulty arises because the city tax base includes residential as well as business property and because the market value of such property reflects not only the intensity of economic development (the quantity of capital) but also location rents, that is, the prices that firms and households are willing to pay to invest in the central city rather than elsewhere. High property taxes may reduce the size of the tax base either by reducing the level of business or residential economic activity in the city or by being capitalized into lower property values, or by some combination of both. Whatever the mechanism, city officials and economists ought to care about the responsiveness of the city's property tax base to the property tax rate. To the extent that the current tax rate reduces the size of the base, the additional tax rate needed to finance a given increase in public expenditures will be higher.

Other state and local taxes such as income or sales taxes may also affect local property values despite their initial incidence on non-property factors of production or on other economic transactions. Hence, a secondary goal of this paper is to provide quantitative estimates of the effects of other state and local taxes on the size of a city's property tax base. This aspect of the study can be viewed as the first step in a larger and more ambitious study that would examine the effects of all major city taxes on each of the city's tax bases.

I. The Data and the Role of the Property Tax

Our empirical work focuses on the relationship between city property taxes and the market value of potentially taxable property in U.S. central cities. City governments, however, are often not alone in having the power to levy property taxes on the property located within city boundaries. In many metropolitan areas, independent school districts, county governments, and special districts are also authorized to tax city property if it falls within their jurisdictional boundaries. Moreover, the economic activity generated by the city's property may be subject to state or local sales and income taxes. Regardless of whether they apply specifically to property or are levied by overlying governments, all of these taxes (and the corresponding public services they finance) could affect the size of a city's tax base. Hence, all must be taken into account.

Our primary perspective, however, is the city government itself. As an independent decision-making entity, its decisions about local taxes can be modeled more easily than could those of an aggregated set of governmental units. Hence, our goal is to measure the impact of city property taxes on city property tax bases, controlling for all other taxes that may affect the amount of taxable property in the city.

The basic data are for 86 U.S. central cities for four years -- 1967, 1972, 1977, and 1982. The 86 comprise all those American cities with population over 300,000 in 1970 or 1980 plus all the central cities of the 50 largest SMSAs in either 1970 or 1980. Thus, the analysis includes all major central cities in the United States. The combined 1980 population of the 86 cities constitutes 21 percent of the 1980 U.S. population and 94 percent of the U.S. population in central cities containing 50,000 or more people.

Property taxes are less important for city governments than for such other types of local governments as counties and school districts, but they still accounted for over half of the 1982 tax revenues of the average city in our sample. Table 1, which provides information for the 79 cities with complete revenue data for all four years, shows that reliance on the property tax varies across cities of different sizes and across regions and that it declined over time in all groups. Comparing cities grouped by size, cities with population over 1 million relied least heavily on the property tax in 1967 and experienced the greatest decline in dependence in the succeeding 15 years. Of the six cities in this group, only Houston derived more than half of its tax revenue from the property tax by 1982.

Cities in the Northeast began the period relying more heavily on the property tax than cities in other parts of the country. Even in 1982, the five New England cities still received 98-99 percent of their tax revenue from the property tax. In contrast, cities in other parts of the country began the period with more access to alternative taxes and increased their use of such taxes during the period. Nationwide by 1982, 18 of the 86 cities derived some revenue from local income or payroll taxes and all but nine cities relied on general or selectives sales taxes to some degree.

Effective property tax rates, like dependence on the property tax, also vary substantially across cities and generally declined over the 15-year period. We define an effective tax rate as

$$t = T/B,$$

where T is the city's total revenues from the property tax, and B is the market value of all potentially taxable property in the city. The tax base in

Table 1
Property Taxes as Percent of All City Tax Revenues

Cities by Group	Number Of Cities	1967	1972	1977	1982
All	79	69%	62%	59%	53%
Population Size:					
Less than 100,000	6	95	91	89	91
100,000 - 250,000	19	67	64	63	60
250,000 - 500,000	30	65	57	52	46
500,000 - 1,000,000	18	70	61	59	52
Greater than 1,000,000	6	63	53	49	40
Region:					
Northeast	16	87	84	83	82
North Central	15	63	53	46	40
South	28	69	61	59	54
West	20	58	51	48	40

Note: Data are averages for the 79 cities in the sample that had complete revenue data for all four years.

Source: U.S. Bureau of the Census, Census of Governments and City Government Finances.

this measure is intended to be independent of how each city defines its tax base in practice and to include all property other than that universally exempt from the property tax such as churches and government buildings. Data on property tax revenues are readily available from the Census of Governments, but the market value of each city's potential tax base had to be estimated from data on assessed values and assessment/sales ratios.[1]

To estimate tax bases, information from the Census of Governments was supplemented with data gathered directly from cities. Nonetheless, some missing values remain, especially for the earlier years. As a result, information on tax bases is available for only 56 of the 86 cities for all four years, but a total of about 280 city-year observations are available for the pooled regression analysis reported below.

Table 2 shows the level and variation in effective tax rates for the 56 cities with complete information. The average rate decreased from 0.8 percent in 1967 to 0.6 percent in 1982. (These rates may appear low, but they are averages of city tax rates alone. The inclusion of property taxes levied by overlying governments would raise the rates substantially in some cases.) The table shows that tax rates are generally highest for the smallest and the largest cities in the sample. This reflects heavy dependence on the property tax relative to other revenue sources in the small cities and heavy overall taxation in the large cities.

Among regions, rates in northeastern cities, especially those in New England, are strikingly higher than those elsewhere. For the New England cities, the high rates reflect a combination of heavy dependence on the property tax and a concentration of revenue-raising responsibility (including for schools and counties) at the municipal government level. In the West, rates were low in 1967 and declined by one-half, on average, over the ensuing fifteen years. This largely reflects the 1978 passage of Proposition 13,

Table 2
Average Effective Property Tax Rates
(percent)

Cities by Group	Number Of Cities	1967	1972	1977	1982
All	56	.83%	.85%	.80%	.63%
<u>Population Size</u>:					
Less than 100,000	0	n.a.	n.a.	n.a.	n.a.
100,000 - 250,000	13	.95	.91	.85	.80
250,000 - 500,000	22	.68	.66	.57	.44
500,000 - 1,000,000	16	.92	1.00	1.01	.68
Greater than 1,000,000	5	.94	1.00	1.05	.85
<u>Region</u>:					
Northeast	8	1.85	1.80	2.07	1.62
North Central	15	.54	.63	.57	.47
South	18	.94	.93	.78	.66
West	15	.45	.46	.39	.22

Notes: Averages shown for cities with data available in all four years. Thirty of the 86 cities did not have complete property data for all four years. The missing cities include all 11 in the sample with population under 100,000. Also left out of this table are 7 with population 100,000-250,000, 9 with population 250,000-500,000, and 2 and 1 in the two largest population categories. Nine of the cities not reported in this table were located in the Northeast, 12 in the South, and 9 in the West.

These effective property tax rates refer to city government property taxes alone; see text for definition of effective property tax rate and sources. Economic activity in these cities may also be subject to property taxes imposed by independent school districts or county governments.

which rolled back local property taxes in California and strengthened the tax limitation movement in other states.

This wide variation in effective tax rates provides a natural experiment for examining the hypothesis that city tax rates affect the attractiveness of a city to households and firms and thereby directly influence the size of the city's potential property tax base. Correspondingly wide variation in city use of alternative revenue sources and in tax burdens imposed on city residents by overlying jurisdictions also provide the information needed to determine the effects of other taxes on city property tax bases.

II. Conceptual Framework

The relationship between the market value of a city's property per capita (PBASE) and the city's property tax rate (t) is given by the expression

$$PBASE = f(t, X)$$

where X is a vector of exogenous variables, including public service levels, that influence the size of the tax base. Estimating a relationship of this form using ordinary least squares would not be a problem if the tax rate were truly exogenous. This would be the case, for example, if state law mandated a binding limit on the city's property tax rate. Perusal of the laws affecting city property taxes, however, suggests that in most cases the property tax rate, expressed as a fraction of full market value, is not exogenous. While many cities are subject to tax limitations of some form, only rarely do these limitations determine the effective tax rate. The clearest exceptions are California cities in 1982 and Boston in 1982, each of which is subject to a binding limit expressed in terms of an effective tax rate.[2]

More commonly, the local property tax rate is determined in part by the size of the tax base. Consider, for example the following model of city behavior. City government officials choose a level of expenditures in response to the demand of citizen voters for public services. They then levy sufficient property taxes to pay for whatever portion of total expenditures that they are unable to finance from other revenue sources. According to this model, a higher tax base would lead to a lower tax rate for any given property tax levy.

Assuming a log-linear specification of the tax base equation, we can eliminate the resulting simultaneity by substituting the definitional relationship t = PTAX/PBASE, where PTAX is per capita property tax revenues, for t in the equation explaining the size of the base. Before the substitution we have

$$\text{(1)} \quad \ln PBASE = a + b \ln t + c \ln X + e,$$

where ln denotes natural logarithm and e is a random error term. After substituting for t and solving for PBASE, the equation becomes

$$\text{(2)} \quad \ln PBASE = a/(1+b) + b/(1+b) \ln PTAX + c/(1+b) \ln X + e/(1+b).$$

Thus, treating property tax revenue, rather than the tax rate, as the explanatory variable removes one source of the simultaneity problem, yet still makes it possible to solve for b, the elasticity of the base with respect to the tax rate.

Even per capita tax revenue, however, may not be exogenous. A larger base means that the same amount of revenues can be raised with a lower tax rate, reducing the pain of raising taxes and thereby increasing the willingness of voters to vote for higher taxes. (See later sections of the paper for further discussion.) This endogeneity leads to the following two-equation model:

$$\text{(3a)} \quad PBASE = g(PTAX, X) \qquad \text{with } \partial g/\partial PTAX < 0$$

$$\text{(3b)} \quad PTAX = h(PBASE, Z) \qquad \text{with } \partial h/\partial PBASE > 0$$

where Z is a vector of exogenous variables that influence tax revenues. The key to identifying the crucial coefficient of PTAX in equation 3a is that there be good identifying variables, that is, that the vector Z include variables that clearly belong in the revenue equation but not in the base equation. One distinguishing characteristic of this study is the availability of such variables.

The Tax Base Equation

The tax base equation includes tax revenues and three sets of exogenous control variables in addition to year dummies. First are those that emerge from a simple monocentric model of an urban economy. Second are those that control for taxes other than municipal property taxes levied on economic activity generated in the city and third are measures of public services. The variables and reasons for including them are explained in the subsections that follow. Table 3 reports their mnemonic variable names, definitions, means, and standard deviations.

Variables Derived From an Urban Model. The starting point for the tax base equation is a monocentric model of an urban economy. This strategy of building on the descriptive implications of an urban model dramatically simplifies what is in fact an enormously complicated and not-very-well-understood problem, the behavioral modeling of economic activity in an urban area.[3] The following log-linear specification captures the essential implications of the standard urban model for the total value of property (B) per unit of land (LAND) in the portion of the metropolitan area designated as the central city:

(4) (B/LAND) = f(SMPOP, LAND).

Controlling for the amount of land in the city, more activity in the

Table 3
Variable Definitions and Means

(L denotes the natural logarithm)

Variable	Definition	Mean	Standard Deviation
Endogenous Variables			
LPBASE	Market value of potential property tax base per capita in thousands of 1972 dollars.	2.51	.40
LPTAX	Property tax revenues per capita in 1972 dollars.	4.20	.76
Variables in Both Equations			
LPCY	Per capita income of city residents in 1972 dollars.	8.28	.13
YR82	Dummy variable that takes on the value 1 for 1982 and 0 otherwise.	--	--
YR77	Dummy variable that takes the value 1 for 1977 and 0 otherwise.	--	--
YR72	Dummy variable that takes the value 1 for 1972 and 0 otherwise.	--	--
Other Variables in the Base Equation			
LSMPOP	Population in the city's Standard Metropolitan Statistical Area - in thousands (1970, 1972, 1977, 1980)	7.10	.69
LLAND	City land area in square miles.	4.22	1.07
KEYCC	Dummy variable that takes the value 1 for dominant central cities and 0 otherwise.	.70	.46
TRINC	Statutory tax rate for city income, earnings or payroll tax.	.0035	.0086
TRSAL	Statutory tax rate for city general sales tax.	.0060	.0086
LOVTAX	Overlying tax burden per capita in 1972 dollars.	5.86	.70
LGEMP	Government (all levels) employment per capita.	2.56	.44

Table 3 - continued

Variable	Definition	Mean	Standard Deviation
LCRIME	Total crimes (both property and violent as reported in Uniform Crime Reports) divided by private sector employees in the city.	-1.78	.42
LFIRESER	Total per capita state and local spending on fire protection in the city's state in 1972 dollars deflated by FCOST.	2.41	.54
LMISCSER	Total per capita state and local spending in the city's state on schools, health and hospitals, and sewers and sanitation in 1972 dollars deflated by MCOST.	5.70	.25
<u>Other Variables in Tax Equation</u>			
LTSRI	Total service responsibilities per capita in 1972 dollars.	4.74	.59
AVINC	Dummy variable that takes the value 1 if the city uses a local income, earnings, or payroll tax and zero otherwise.	.18	.39
AVGSAL	Dummy variable that takes the value 1 if the city uses a general sales tax and zero otherwise.	.47	.50
AVSSAL	Dummy variable that takes the value 1 if the city uses a selective sales tax and zero otherwise.	.87	.34
ERPROP	Export ratio for the property tax.	.37	.11
ERINC	Export ratio for the local income tax (0 if the tax is not used).	.073	.18
ERSAL	Export ratio for the general sales tax (0 if the tax is not used).	.106	.15
MCOST	Cost index for miscellaneous services (Relative to 1972 average)	102.	23.
PCOST	Cost index for police services (Relative to 1972 average)	118.	79.
FCOST	Cost index for fire services (Relative to 1972 average)	120.	52.
LFAID	Federal aid per capita in 1972 dollars.	3.04	1.55
LSTAID	State aid per capita in 1972 dollars.	3.27	1.56

metropolitan area as measured by metropolitan population (SMPOP) leads to a higher value of property in the city per unit of city land. According to the monocentric model, this occurs both because larger metropolitan areas have higher land prices at the center and also because the higher price of land induces more intensive economic development in the city in the form of business and residential structures.

More city land, controlling for metropolitan population, is predicted to reduce the value of property per unit of land; more land means that the city extends further down the rent and density gradients of the metropolitan area.

Expressing the dependent variable in per capita terms rather than per unit of land is more natural for the current empirical investigation. Hence, the dependent variable in equation 4 must be multiplied by the inverse of the population density (that is, by LAND/POP, where POP is the population of the city). One approach at this point would be to add density (with a predicted coefficient of -1 in a log-linear specification) to the right hand side of the equation. The difficulty here is that population density is endogenous in that it, too, is determined by the exogenous determinants of land prices in the city, namely SMPOP and LAND. Hence, including population density as an exogenous variable in the estimating equation would not make sense. Instead, we specify the reduced form of the model in log-linear form as

$$(5) \quad \ln PBASE = a + c_1 \ln SMPOP + c_2 \ln LAND + e$$

where PBASE is the property tax base per capita and the coefficients c_1 and c_2 represent the combined effects of the exogenous variables on the base per unit of land and on population density. Provided the population density gradient is less affected by the exogenous variables than are the rent and business density gradients, a positive sign for SMPOP and a negative sign for LAND are still predicted.[4]

The sample cities, and the metropolitan areas in which they are located, vary in how well they fit the simple monocentric model. Of most concern is that some of the central cities in the sample are not the primary centers of economic activity in their respective SMSAs. Thus, for example, Everett WA, with its 1982 population of 57,000, has far less claim to being the center of the Seattle-Everett metropolitan area than does Seattle with 490,000 residents. To help control for such variations, an additional variable (KEYCC) takes on the value one for those cities that dominate their SMSAs and zero otherwise. Dominant cities are defined as the central city in SMSAs with one central city and, somewhat arbitrarily, as those that have 60 percent or more of either population or employment in SMSAs with two central cities or 50 percent or more in SMSAs with three central cities. Dominant central cities are predicted to have larger tax bases per capita than do nondominant central cities because of their positions as centers of urban economic activity.

Per capita income of city residents (PCY) completes the specification of this part of the equation. This variable is expected to have a positive sign because higher income increases the demand for housing.[5]

The property tax rate (t) is simply added to equation 5 in logarithmic form with a coefficient of b, hypothesized to be negative. A higher property tax rate is expected to reduce the value of the city's property tax base in part because the land component of the tax will be capitalized into lower property values. In addition, the improvements component of the tax is expected to induce producers to shift away from capital toward labor and to reduce the attractiveness of the city as a place for investing capital. The reduced attractiveness of the city may manifest itself either in a change in land prices or in reduced economic activity or, most likely, in some combination of both. Following the logic of equation 2, the equation is then respecified as a function of per capita property tax revenues (PTAX) to yield:

$$\ln PBASE = a + b/(1+b) \ln PTAX + c_1/(1+b) \ln SMPOP + c_2/(1+b) \ln LAND + c_3/(1+b) \ln KEYCC + c_4/(1+b) \ln PCY + \sum_{i=5}^{n} c_i/(1+b) X_i + e, \quad (6)$$

where $X_5 \ldots X_n$ are the other control variables in the tax base equation discussed in the next two sections.

Nonproperty Tax Variables. Three additional tax variables control for the other taxes imposed on economic activity in central cities. Alternative taxes levied by the city itself are represented in the tax base equation by statutory city tax rates for income taxes (TRINC) and for general sales taxes (TRSAL). Close to half the sample cities make no use of local general sales taxes. In these cities the tax rate is zero.[6] Only 18 of the 86 sample cities had some form of a city income or payroll tax in 1982. Negative signs are expected on both tax rate variables. A higher income tax rate lowers the net-of-tax income of city residents, and may induce firms to pay higher wages than they otherwise would, thereby reducing net profits and discouraging investment in the city. This is predicted to reduce the demand for property in the city except to the extent that the higher cost of labor induces firms to substitute in favor of land and capital. A higher sales tax rate may reduce the demand for taxed goods, and, similarly, lead to less investment in the city.

The tremendous complexity and variation in the division of taxing responsibilities among city and non-city governments across states makes it impossible to control separately for each of the non-city taxes imposed on city economic activity. Instead, we constructed a single variable (OVTAX), based on statewide data, as a proxy for the burden of overlying taxes. The variable is calculated as the average state and local per capita tax burden in the city's state multiplied by the "non-city" share of taxes in the state, and is based on the following logic. If the city itself imposed no taxes, all residents (including residents of the city) could be viewed as being subject to the average state and local tax burden in the state. But since each city's major taxes (property, income, and sales) are modeled separately, city taxes must be removed from the total state and local burden. This is accomplished by using statewide data to subtract the average per capita taxes collected by all those jurisdictions in the state that perform the same functions as the city in question. Thus, for example, in constructing the overlying tax variable for a city such as San Francisco which has responsibility for county functions as well as municipal functions and hence has no overlying county, care is taken to make sure that the calculated overlying burden does not include county taxes.[7] The expected sign of this variable is negative; higher overlying tax burdens are likely to depress economic activity in the city.

Measures of Public Services. Public services are an important component of any study of the effects of state or local taxes. Since public services are valued and taxes are used to pay for them, failure to control for services could lead to incorrect estimates of the effects of taxes alone. In principle, we need to control for all services available to city firms and households regardless of whether the services are provided by the city government itself or by some overlying government such as a state or county government or an independent school district.

Public expenditures typically serve as the standard measure of public services in studies of tax capitalization (e.g. Oates, 1969), but, as shown by Rosen and Fullerton (1977), output measures such as educational test scores are far superior. Hence, we have constructed three public service measures that are intended to measure public sector outputs rather than simply public inputs. The first is the number of crimes in the city expressed as a fraction of the city's total private sector employment (CRIME). Vocal public concern about crime makes it plausible that the decision to invest in a particular city might be influenced by the perceived risk of being assaulted or robbed. Higher crime rates per worker in the city are predicted to lead to lower property values.[8] The second and third variables (FIRESER and MISCSER) are proxies for fire protection and miscellaneous services (consisting of local schools, sewers, sanitation, and health and hospitals) constructed from per capita state and local expenditure data by state deflated by the estimated costs of providing the respective service or sets of services in each city. The cost indexes are designed to measure the effects of city-specific environmental and demographic factors on the costs of providing a given package of public services and are described in more detail below. To the extent that the indexes correctly measure the costs per unit of final output, deflating expenditures by them should lead to reasonable proxies for the level of services actually available to city residents. We expect both variables to enter the base equation with positive signs since higher service levels should increase the size of a city's property tax base, ceteris paribus.

Year Dummies. The final three variables are year dummies (YR82, YR77, and YR72). These dummies are needed in the pooled regression to control for cyclical trends in the aggregate economy and for secular trends such as the fall in transportation costs that tend to decentralize business activity.

The Property Tax Revenue Equation

Derivation of the property tax equation proceeds in two steps. First comes the derivation of the demand for public services and second comes the city's choice among revenue sources. This approach is consistent with the view that the equilibrium amount of property taxes collected depends on explicit choices by city officials. The basic structure of the estimating equation follows from the identity

$$(7) \quad PTAX = (\sum_{i=1}^{I} E_i - OR)\ (PTAX/TTAX)$$

where PTAX is property tax revenues, $\sum_{i=1}^{I} E_i$ is all city operating expenditures summed over I individual spending categories, OR is nontax exogenous revenues such as lump sum intergovernmental aid, and TTAX is total revenues from all local tax sources. For estimation, the variables derived from the two steps are combined in a logarithmic equation with year dummies. The variables are summarized in table 3.

Demand for Local Public Expenditures. The literature on local public expenditures is well developed and needs only brief review here.[9] The typical starting point is that quantity demanded is a function of resident income, per unit costs, and tax prices. Desired expenditure on the ith expenditure category (E_i) is the product of costs and quantity demanded. Hence,

$$(8) \quad E_i = C_i Q_i = f\ (Y, C_i, TS),$$

where Y is the income of the decisive voter, C_i is per unit cost of the ith expenditure category, and TS is the decisive voter's share of the local tax burden. The cost and tax share variables are entered separately because they have different predicted impacts on total expenditures. Assuming a constant price elasticity of b_i in the equation for quantity demanded, the coefficient of the tax share variable in the expenditure equation is predicted to be b_i and consequently negative. The coefficient of the cost variable, however, is predicted to be $(1+b_i)$, which will be positive unless the price elasticity is larger (in the negative direction) than minus one.

Appropriately measured cost variables would reflect not only the costs of inputs, but, following the logic of Bradford, Malt and Oates (1969), would also incorporate the amount of intermediate goods such as police patrols that are needed to produce a given level of protection from crime. The idea here is that environmental conditions in the city such as city density and the incidence of poverty may affect the costs to the city of providing a given level of the output, such as police protection, ultimately valued by city residents. To reflect such cost variations, we have included three cost indices for miscellaneous public services (MCOST), police protection services (PCOST), and fire protection services (FCOST). The cost indices are derived from a regression model that estimates the average impact on city expenditures of each cost factor, controlling for other determinants of city spending such as resident income and preferences.[10]

Given the purpose of this study, there is little need to be precise about the identity of the decisive voter. The goal is simply to capture the essentials of a basic expenditure model in order to think clearly about which variables appropriately belong in the tax equation and can serve to identify the coefficient of the property tax variable in the base equation. In the estimated equations, per capita income (PCY) serves as a reasonable proxy of the relevant income measure and is expected to have a positive effect on taxes. The decisive voter's tax share is inversely proxied with a measure of property tax exporting, which is also expected to influence the choice among revenue sources, described in the next subsection of the paper.

As specified so far, desired expenditures are not explicitly dependent on the size of the property tax base. This primarily reflects the simplicity of the decisive voter model, particularly in its median voter form, rather than economic reality. In more realistic models, the tax base or its components might enter the expenditure equation for a variety of reasons. The value of residential property, for example, might better proxy residents' permanent income and, consequently, residents' willingness to pay for public services than does current income. Or higher-valued property (whether residential or business) may require greater services in the form of protection from crime. Or large amounts of business property relative to residential property in a city may give business interests political power that can be used to convince public officials to provide more services specifically for business or to keep expenditures low to stabilize tax rates. Hence, using the simple model presented in equation 8 to justify excluding the size of the property tax base as an explanatory variable would be a mistake. Moreover, as discussed below, the choice among revenue sources (the second stage of the derivation of the tax equation) provides an additional justification for expecting the property tax base to positively influence the level of property taxes.

The analysis to this point argues for including in the tax equation standard determinants of the demand for spending on individual public services: resident income, a tax share variable, service-specific measures of costs, and the property tax base. One additional variable related to expenditures dominates all the others in terms of its relevance to this study, namely a measure of the services for which each city government in the sample is responsible. Given the cross-sectional nature of the data set, variation in service responsibilities is likely to be a primary determinant of the variation in total expenditure. Stated differently, the number of expenditure categories over which the summation applies in equation 7 varies substantially among cities.

The variable measuring the total service responsibilities assigned to each city (TSRI) indicates the per capita spending net of user charges that would be required in each city to achieve national average per capita state-local spending on each of 17 designated services, given the particular allocation of spending responsibilities in each city's state. Constructed from statewide rather than city-specific expenditure data, the measure avoids the potential problem of attributing high service responsibilities to cities who choose to provide high service levels. The measure varies substantially across cities. The most obvious variation relates to services such as elementary and secondary education and municipal hospitals for which a city has either complete spending responsibility or none. Some cities are also responsible for services provided by counties elsewhere in their state. Variation across states in the role of state government also accounts for a substantial portion of the variation in service responsibilities across states. The greater the state role in welfare, health, and corrections, the lower, in general, is the city role.[11]

Choice among Revenue Sources. Subtracting nontax exogenous revenues (OR in equation 7) from total desired expenditures yields the amount of revenue that must be raised from local tax sources. Nontax revenue is primarily intergovernmental aid, but in principle, only the aid that is truly exogenous. As measured, however, some of the per capita federal aid (FAID) and per capita state aid (STAID) may be matching aid.

How the remaining revenue requirements are allocated among local tax sources has received much less attention from economists than has the expenditure decision.[12] Consistent with the decisive voter approach, one might hypothesize the following model of the city decision regarding how much to rely on local property taxes:

(9) PTAX/TTAX= f(PBASE, AV, ER)

where PBASE, as before is the per capita property tax base, AV is a vector of dummy variables indicating the legal availability of alternative local taxes, and ER is a vector of export ratios for alternative taxes.

The larger is the property tax base per person, the easier it should be for the city to raise revenue through the property tax. A larger tax base allows the city to raise a given amount of revenue with a lower tax rate and thereby to avoid the potentially distorting effects and heavy tax burdens of high tax rates.

The legal availability of alternative revenue sources plays a key role in the city tax decision given the stringent restrictions often placed on city revenue-raising authority. As already noted, only 18 of the 86 sample cities are currently allowed to use some form of local income or payroll tax, and 47 cities a general sales tax. A higher proportion of cities are permitted to impose some form of selective sales tax. Availability of alternative tax sources is likely to decrease a city's reliance on the local property tax. Availability is indicated with dummy variables: AVINC refers to local income, earnings, or payroll taxes; AVGSAL refers to the general sales tax; AVSSAL refers to selective sales taxes.

Not all taxing instruments impose equal burdens on resident voters. A portion of the burden of a local sales tax, for example, might be shifted onto nonresident tourists and commuters in the form of higher prices. Or a payroll tax may fall partially on nonresident commuters. Similarly, part of the property tax burden may ultimately be borne by nonresidents in the form of lower profits, higher prices, or lower wages. The export ratios (ER), defined as the proportion of the tax burden associated with each of the major local taxes that can be shifted to nonresidents, are included in the equation to account for this burden shifting. The hypothesis is that local voters choose taxes in such a way as to minimize burdens on themselves. Hence, a higher export ratio for the property tax (ERPROP) is expected to lead to greater reliance on property taxes, but higher export ratios for sales (ERSAL) or income taxes (ERINC) are expected to reduce city reliance on property taxes.

The calculation of each export ratio relies first on assumptions about which groups -- consumers, workers, or owners of property -- bear the burden of each tax and second on estimates of the proportion of each group that lives outside the city. The incidence assumptions are straightforward for the income and sales taxes; local income taxes are assumed to be borne fully by workers in the form of lower wages and local sales taxes by consumers in the form of higher prices. The incidence assumptions used for the property tax are much more complex and are spelled out elsewhere.[13] Calculated export ratios for all three taxes vary substantially across cities because of differences in how cities define their tax bases, the diversity of city roles in metropolitan areas, and variations in the mix of shoppers, job-holders, or property types across cities.

III. Estimation and Results

Table 4 shows the coefficients estimated using two-stage least squares for three equations: the tax base equation and two versions of the tax equation. The results correspond quite closely to expectations.

The Tax Base Equation - Results

The coefficient of primary interest, that of the property tax variable in the base equation, is -0.13 and significantly different from zero. Recalling from equation 6 that this estimated coefficient is equal to (b/(1+b)), we estimate the elasticity of the per capita property tax base with respect to the property tax rate (b) to be approximately -0.11. Thus, if the property tax rate in one city were twice that of another city, per capita property values would be expected to be 11 percent lower in the higher tax city.

The three additional tax variables provide some interesting new insights about the effects of alternative revenue sources on the size of a city's property tax base. The results imply that city income taxes and non-city taxes both reduce the size of a city's tax base but, somewhat surprisingly, that city sales taxes do not. The finding that sales taxes have no effect on

Table 4
Regression Results – Basic Model

Independent Variables:	Dependent Variable: LPBASE
LPTAX	-.13*
	(.035)
LPCY	1.6*
	(.15)
LSMPOP	.16*
	(.034)
LLAND	-.066*
	(.023)
KEYCC	.11*
	(.050)
TRINC	-14*
	(2.9)
TRSAL	1.7
	(2.3)
LOVTAX	-.093*
	(.034)
LCRIME	-.065
	(.059)
LFIRESER	.052
	(.049)
LMISCSER	-.19*
	(.10)
YR82	.20*
	(.057)
YR77	.12*
	(.062)
YR72	.0095
	(.057)
Constant	-9.6*
	(1.4)
Adjusted R-squared =	.50
Standard error =	.27

Independent Variables:	Dependent Variable: LPTAX	
LPBASE	.57*	.28
	(.12)	(.44)
LPCY	--	.58
		(.86)
LTSRI	.71*	.71*
	(.055)	(.053)
LMCOST	.32*	.33*
	(.18)	(.17)
LPCOST	.063	.12
	(.096)	(.13)
LFCOST	.66*	.63*
	(.15)	(.15)
AVGSAL	-.29*	-.27*
	(.076)	(.076)
AVSSAL	-.26*	-.27*
	(.083)	(.080)
AVINC	-.31*	-.37*
	(.10)	(.13)
ERINC	-.92*	-.82*
	(.20)	(.24)
ERSAL	-.46*	-.41*
	(.25)	(.25)
ERPROP	.027	.17
	(.28)	(.35)
LFAID	.0082	.0074
	(.025)	(.024)
LSTAID	.081*	.071*
	(.024)	(.028)
YR82	-.40*	-.35*
	(.10)	(.13)
YR77	.099	.13
	(.12)	(.12)
YR72	.21*	.22*
	(.10)	(.097)
Constant	-5.3*	-9.5
	(.76)	(6.4)
Adjusted R-squared =	.73	.75
Standard error =	.40	.38

* Coefficient significantly different from zero at 5% level, one-tailed test.

Notes: N=282; pooled time series and cross-section.
Estimated with two-stage least squares; LPBASE and LPTAX treated as endogenous.
Asymptotic standard errors in parentheses below coefficients.

the size of the base may not be surprising to business owners, many of whom seem to prefer sales taxes over other state and local taxes on the grounds that forward shifting of tax burdens to consumers keeps business firms from bearing the burden of such taxes. To economists, however, the finding is still somewhat surprising; reduced consumption in response to higher prices would generally be expected to lead to some reduction in economic activity in the city.

The coefficient of the overlying tax burden variable (LOVTAX) can be interpreted directly as an elasticity once it has been multiplied by (1+b). The coefficient of the income tax rate variable (TRINC) can be converted to an elasticity evaluated at the mean income tax rate in the sample after multiplying by (1+b). These calculations imply the following elasticities: -.083 for overlying taxes and -.044 for income taxes, both of which are the same order of magnitude but, not surprisingly, smaller than the elasticity of -.11 estimated for the property tax rate. The policy significance of the relative sizes of these magnitudes is discussed later in the paper.

In contrast to the tax variables, the performance of the service variables is somewhat disappointing. The crime rate and fire protection services enter with the expected signs, but neither is statistically significant. Of more concern is the negative sign on miscellaneous services. Why the quantity or quality of services such as schools, health services, and sanitation should lower property values is not clear. Measurement problems may be part of the answer. Like the fire protection services variable, this measure is based on statewide spending deflated by a local cost index. In the partial adjustment model discussed later, the coefficient of miscellaneous services becomes positive.

Each of the other estimated coefficients in the base equation must also be multiplied by (1+b) = 0.89 to determine the value of the relevant elasticities. However, since the precise magnitudes of elasticities of per capita property values with respect to the other variables are not the focus of this paper, the reader should simply keep in mind that they are somewhat smaller (in absolute value) than the coefficients shown in Table 4.

The variables derived from the urban monocentric model all perform as expected. Cities in larger SMSAs have higher property values than those in smaller SMSAs and cities with greater land areas have lower property values. Moreover, because the dependent variable is expressed per capita rather than per unit of land, the estimated coefficients imply that the impacts of SMSA population and city land area on rent and business density gradients are greater than on population density gradients. For example, the negative coefficient of the land variable suggests not only that the market value of property per unit of land is lower for larger cities (presumably because in such cities the city extends further down the area's rent and density gradients), but also that the lower property value per unit of land is not offset by a sufficiently lower population density to produce a higher value of property per resident.[14]

Also consistent with the predictions of the model are the findings that dominant central cities have higher property values than secondary cities in multi-centered SMSAs and that the per capita income of city residents is strongly positively associated with city property values.

The Property Tax Revenue Equation - Results

The explanatory power of the tax equation as a whole is remarkably strong; many variables not only show the expected signs, but also exhibit coefficients significantly different from zero. The two versions of this equation shown in Table 4 differ only in the exclusion of the per capita income of city residents from the first equation.

As discussed earlier, theoretical considerations argue for including both per capita income and per capita property values in the estimating equation. In practice, however, they are highly correlated, especially after controlling for other variables in the equations. Hence, identifying the independent effect of the size of the property tax base on property tax revenues in this pooled time-series cross-section is difficult. When income is included, the coefficient of the base is indistinguishable from zero; when income is excluded, the coefficient reflects the effects on property tax revenues of both the property tax base and of the portion of resident income that is correlated with property values across cities. No matter how it is measured, however, ability-to-pay has a positive effect on revenue, which differs significantly from zero. If one city has 10 percent more property per capita than another city, the "combined" coefficient estimate implies that it will raise 5.7 percent more tax revenues, other things (not including income) equal, and that its property tax <u>rate</u> will be 4.3 percent lower.

A city's measured index of service responsibilities has a strongly positive effect on tax revenues, as expected, and serves as a critical variable identifying the tax variable in the base equation. Where the "required bundle" of city services involves 10 percent more per capita spending (at average costs), per capita property tax revenues are about 7 percent higher, on average, other things equal. Presumably the difference is made up in service quality reductions or in additional revenues from other sources. The three cost indexes are also positively associated with tax revenues, indicating that in cities with higher production costs for local public services, property taxes are also higher, other things equal.

The variables relating to taxes other than the property tax used by city governments all exhibit statistically significant negative signs, as expected. The negative coefficients on the dummy variables representing availability of specific nonproperty taxes indicate that cities tend to substitute these other taxes for property taxes when they are allowed to use them. Moreover, where the burdens of these nonproperty taxes fall less upon local residents, cities depend upon them more heavily, as shown by the negative signs on the income and sales tax export ratios. Also as predicted, the coefficient of the property tax export ratio is positive, but it is not significantly different from zero.

Intergovernmental aid from the federal government appears to have no effect, while that from state government appears to exert a positive effect on property tax revenues. This positive impact runs counter to the expectation that intergovernmental transfers substitute for property tax revenues, but might reflect reverse causation due either to matching requirements or to distribution formulae that direct more aid to cities with high property tax burdens. We attempted to purge the state and federal aid variables of their possible endogeneity by using federal and state aid five years earlier as instrumental variables, but the results were similar to those reported in Table 4.

The coefficients on year dummy variables suggest that, controlling for changes over time in the other included variables, per capita property tax revenues (in constant dollars) expanded from 1967 to 1972 and then declined to 1982.

<u>Cross-Section by Year</u>

The basic structural model is generally robust over time. Estimating the same tax base equation as shown in Table 4 (minus the year dummies) separately for each of the four years yields signs and general patterns that are similar across years, although some of the coefficients are estimated less precisely, partly because the samples are smaller and partly because the quality of the data probably improved over time. An F-test of the complete equation does not allow us to reject the hypothesis that the coefficients jointly are the same over all four years and, hence, justifies pooling the four years of data into one large sample.

Table 5 reports the estimated coefficients by year of all the tax variables in the base equation. The patterns are remarkably consistent across years with the exception of 1972, for which year the coefficients of the property tax variable and the overlying tax variable are surprisingly low. Multicollinearity in this sample may be part of the problem; excluding the miscellaneous service variable from the equation, for example, more than doubles the absolute value of the coefficient of the property tax variable. Overall, however, the results by year confirm the patterns from the pooled data: negative effects on the property tax base of property taxes, income taxes, and overlying taxes and positive (but insignificant) effects of sales taxes.

Partial Adjustment Model

Researchers generally view coefficients from a cross-section regression as estimates of long-run responses or elasticities, on the assumption that differences between cities reflect equilibrium responses to differences in underlying city characteristics. But over time, the land rents and intensity of economic activity that determine city property values may not adjust immediately to changing conditions. The availability of four years of data for our cities, five years apart, allows us to incorporate this dynamic behavior into the estimating equation and thereby provides an alternative way to estimate long-run elasticities.

Partial adjustment models start from the premise that economic actors in any one period move only part way toward a long-run equilibrium. Thus, if

Table 5
Single-Year Regression Results

Coefficients of Tax Variables in Base Equation

	1967	1972	1977	1982
LPTAX	-.13*	-.033	-.12*	-.22*
	(.073)	(.059)	(.068)	(.074)
TRINC	-8.6	-7.8	-16*	-18*
	(5.8)	(6.0)	(6.2)	(5.2)
TRSAL	4.6	-1.5	3.1	2.9
	(4.8)	(4.7)	(5.8)	(4.7)
LOVTAX	-.067	-.039	-.076	-.14*
	(.056)	(.067)	(.075)	(.081)
N =	57	72	76	77

*Coefficient significantly different from zero at 5% level, one-tailed test.
Notes: Estimated with two-stage least squares; LPTAX treated as endogenous.
Other variables in system as shown in Table 4, excluding year dummies.
Asymptotic standard errors in parentheses below coefficients.

$PBASE^*_t$ is the long-run equilibrium tax base per capita in period t and $PBASE_t$ and $PBASE_{t-1}$ the actual bases per capita in periods t and t-1, then in multiplicative form

$$(11)\quad PBASE_t/PBASE_{t-1} = (PBASE^*_t/PBASE_{t-1})^{\lambda},$$

where λ is the proportional adjustment occurring in one (five-year) period. Taking natural logarithms yields:

$$(12)\quad \ln PBASE_t = \lambda \ln PBASE^*_t + (1-\lambda) \ln PBASE_{t-1}.$$

Hence, the variables needed in the estimating equation are simply the determinants of the equilibrium base $PBASE^*_t$, as before, plus the lagged base, $PBASE_{t-1}$.

Estimates of the partial adjustment model are shown in Table 6. The second column reports coefficients estimated for the base equation including the lagged base, and the two final columns report estimated coefficients from the corresponding tax equations. Lack of data on property tax bases in 1962 limits these equations to the later three years of the study - 1972, 1977, and 1982. The first column reports estimates with no lags - the same model as shown in Table 4 but for the same three years as the partial adjustment model - to provide a consistent comparison of the two estimates of long-run responses.

The estimated coefficient on the lagged base variable, 0.54, implies that λ is 0.46 and that slightly less than half of the adjustment to long run equilibrium occurs during a five-year period. In the partial adjustment framework, a long-run elasticity (that is, an elasticity of the equilibrium base) with respect to any right-hand-side variable is equal to the estimated coefficient shown in Table 6 divided by the estimate of λ. Correcting also for the substitution of tax revenues for tax rates, the long run elasticity of

Table 6
Regression Results - Partial Adjustment Model

Dependent Variables: LPBASE

Independent Variables:	Full Model No Lags	Partial Adjustment
LPBASE-1	--	.54* (.056)
LPTAX	-.14* (.040)	-.083* (.032)
LPCY	1.5* (.17)	0.95* (.16)
LSMPOP	.17* (.040)	.062* (.033)
LLAND	-.052* (.026)	-.026 (.022)
KEYCC	.12* (.057)	.016 (.047)
TRINC	-16* (3.3)	-8.4* (2.7)
TRSAL	1.8 (2.8)	.58 (2.4)
LOVTAX	-.096* (.043)	-.055 (.034)
LCRIME	-.099 (.070)	-.042 (.060)
LFIRESER	.061 (.058)	-.0024 (.046)
LMISCSER	-.12 (.12)	.098 (.097)
YR82	.21* (.051)	.064 (.043)
YR77	.11* (.049)	.025 (.041)
Constant	-9.5* (1.6)	-7.0* (1.4)
Adjusted R-squared =	.48	.67
Standard error =	.29	.22

Dependent Variable: LPTAX

Independent Variables:	Partial Adjustment	
LPBASE	.43* (.13)	.27 (.21)
LPCY	--	.47 (.50)
LTSRI	.73* (.064)	.72* (.064)
LMCOST	.52* (.20)	.45* (.21)
LPCOST	.12 (.11)	.17 (.12)
LFCOST	.57* (.17)	.56* (.17)
AVGSAL	-.27* (.090)	-.27* (.088)
AVSSAL	-.45* (.10)	-.44* (.10)
AVINC	-.31* (.12)	-.34* (.12)
ERINC	-.99* (.25)	-.91* (.26)
ERSAL	-.52 (.36)	-.46 (.36)
ERPROP	-.064 (.35)	.042 (.36)
LFAID	.0063 (.037)	.0034 (.036)
LSTAID	.081* (.030)	.080* (.029)
YR82	-.54* (.082)	-.53* (.081)
YR77	-.075 (.081)	-.070 (.080)
Constant	-5.4* (.96)	-8.7* (3.7)
Adjusted R-squared =	.74	.75
Standard error =	.40	.39

* Coefficient significantly different from zero at 5% level, one-tailed test.

Notes: Pooled time series and cross-section using data for 1972, 1977, and 1982; N = 202 except in "no lags" model where N = 225.
Estimated with two-stage least squares; LPTAX and LPBASE treated as endogenous.
Asymptotic standard errors in parentheses below coefficients.
LPBASE-1 is LPBASE lagged one period (five years).

the base with respect to the property tax rate is approximately equal to -0.15, somewhat higher than the -0.12 estimate implied by the equation with no lags. Both of these estimates are greater (in absolute value) than the -.11 derived from the comparable equation shown in table 4, presumably because the year 1982, when the elasticity was more negative, is given more weight.

Although the reported coefficients of many of the other variables are smaller in the partial adjustment equation than in the equation with no lags, dividing by λ (=0.46) to derive estimates of long-run elasticities restores most to comparable or larger size. Including the lagged base has the advantage that it nets out a variety of inter-city differences not captured in the other included variables and thereby controls for special factors in each city that might otherwise lead to biased estimates of long-run elasticities. One not very surprising result of this is that the roles of some of the descriptive variables such as KEYCC and LSMPOP are reduced. These variables do not change much over time and their predicted effects on the tax base may operate through the lagged base variable in the partial adjustment equation.

The coefficients of variables representing public services available to city residents appear to be quite sensitive to the inclusion of the lagged base term. The measures of crime and of miscellaneous services now both enter with the predicted signs, although with relatively large standard errors. This provides some support, albeit weak, for the conclusion that higher crime rates reduce property values and that higher miscellaneous services such as education and sanitation increase property values in the city. Our proxy for fire protection services enters with an unexpected negative sign but its coefficient is virtually zero.

The results for the tax equation are similar to those reported in Table 4. Even with lagged base as an additional instrument, we still cannot identify separate effects for base and income. The elasticity of tax revenues with respect to the tax base (when income is excluded) is smaller than the earlier results suggested - closer to 0.4 than to 0.6, indicating that a city with a per capita tax base 10 percent above average would probably enjoy a tax rate 6 percent below average.

IV. Interpretation: The Effects of Taxes on City Property Tax Bases

Our best estimate of the long-run elasticity of a city's property tax base with respect to its tax rate is -0.15. We prefer this estimate from the partial adjustment model because it explicitly allows for the dynamics of property market adjustments over time and controls for city-specific effects that might otherwise bias the coefficients. The estimated response appears to be well identified in a statistical sense thanks to the nature of the data base and the attention devoted to the specification of the revenue equation as well as to the base equation. Moreover, the elasticity emerges from a set of two equations that yield reasonable coefficients for almost all the other variables suggested by economic theory.

How reasonable is the preferred estimate? In the absence of comparable studies, one approach is to evaluate it with reference to the theory of capitalization. Consider, for example, what would happen if property tax rates were fully capitalized into property values. By way of illustration, consider a parcel of property worth $100,000 and subject to a 0.8 percent tax rate, the average city's rate in the sample. Then consider the change in value predicted to occur with a 10 percent increase in the tax rate, to 0.88 percent. Assuming the resulting $80 tax increase were expected to continue indefinitely, full capitalization would lead to a 1.5 percent reduction in the value of the property (as our equation predicts) provided the relevant interest rate were 5.3 percent (since $80/0.053 = $1500 = 1.5 percent of $100,000). Thus, at an interest rate of 5.3 percent, the estimated long run elasticity of −0.15 would be fully consistent with 100 percent capitalization. For higher interest rates, the estimated elasticity indicates a larger impact than would be implied by capitalization alone and for lower rates, it indicates a smaller impact.

Even if one were sure that the relevant interest rate were exactly 5.3 percent, it would be incorrect to interpret our results as evidence that property taxes are fully capitalized into values. In contrast to previous studies that explicitly measure capitalization (e.g. Oates, 1969), we purposely do not control for the amount of capital in the city. Hence the estimated response of property values probably represents the combined effects of some capitalization (price change) and some physical disinvestment in the city (change in the quantity of capital). That is, part of the reduction in the base probably represents the decision of some potential residents (households and firms) not to move into the city, the decision of some firms to let their city property depreciate as they invest elsewhere, and the decision of some city residents to disinvest in their residential structures by reducing maintenance. This decrease in investment occurs simultaneously with a fall in the price of city land and stops once the after-tax rate of return to investment is again equalized across jurisdictions.

As noted earlier, this study provides new evidence that taxes other than city property taxes also affect the size of a city's property tax base. The one exception is local sales taxes which appear to have essentially no effect on the property tax base. Table 7 compares the effects of the various taxes, using the coefficients from the partial adjustment equation. The entries in the first column show the impact on the logarithm of the property tax base of a 10 percent increase in a particular tax rate or, equivalently for nonproperty taxes, in tax revenues. As changes in logarithms, the entries (multiplied by 100) can be interpreted as percentage changes in the base.

Table 7
Impacts on the Property Tax Base
(By Type of Tax)

	10 Percent Increase in Tax Rate or Tax Revenues	$10 Per Capita[a] Increase in Taxes
Property Tax	-.015	-.014 or -.020[b]
City Income Tax	-.0054	-.026
City Sales Tax	0	0
Taxes Imposed by Overlying Governments	-.010	-.0026

Notes: Entries are predicted impacts on the natural logarithm of the per capita property tax base. When multiplied by 100 they can be interpreted as percentage changes in the tax base. Calculated from estimated coefficients from the partial adjustment equation shown in Table 6.

[a]1972 dollars.
[b]The first entry was evaluated at the average tax base and tax rate in the sample. The second entry was evaluated for average tax revenues.

Thus, a 10 percent increase in the property tax rate is predicted to reduce the base by 1.5 percent, while a 10 percent increase in the local income tax rate is predicted to reduce the base by only 0.5 percent. The estimated impact of a 10 percent increase in overlying taxes is a 1.0 percent decline in the base, halfway between the impacts of local income and property taxes. These findings have two clear implications. First, a 10 percent increase in a city's property tax rate will produce only an 8.5 percent increase in property tax revenues on average in the long run. Second, increases in city income tax rates or in taxes levied by overlying jurisdictions such as state and county governments will reduce the property tax revenues collected with a given property tax rate.

Policymakers should also be interested in the second column of Table 7 which shows the impact on the (logarithm of the) property tax base of a $10 increase in per capita tax revenues from each source. The two entries for the property tax reflect evaluation at different averages. The 1.4 percent decline was evaluated at the average property tax rate and tax base in the sample, while the 2.0 percent decline was evaluated at the average per capita tax revenues in the sample.

Surprisingly, the calculations indicate that a $10 increase in local income taxes reduces the size of the property tax base by more than does a comparable per capita increase in property taxes on average. This finding is easily reconcilable with the apparently contradictory results in column 1: a $10 per capita increase in revenue from income taxes requires a much larger percentage increase in income tax rates than does a $10 increase in property tax revenues, at current average rates in the sample. The larger impact of raising revenue through the income tax has important implications for policymakers trying to reduce property tax burdens by substituting income taxes for property taxes. Assuming constant total tax revenue and after allowing time for all adjustments, we find that the net effect of shifting away from property taxes toward income taxes is to reduce the size of the property tax base. Shifting away from property taxes in favor of local sales taxes, in contrast, is estimated to increase the size of the local property tax base.

An alternative way for local officials to reduce property taxes is to induce higher levels of government to take over some of the city's service responsibilities and to finance them by higher noncity taxes. Our estimates suggest that this shift would increase the size of the city's property tax base. Reducing property taxes by $10 per capita would increase the tax base by 1.4 to 2.0 percent, an increase that more than offsets the much smaller decrease of 0.3 percent associated with the $10 increase in the overlying tax burden on city residents and firms.[15]

IV. Conclusion

We began this paper with reference to the many studies that conclude that state and local taxes do not matter in determining levels of economic activity in cities. The results of this study indicate, quite to the contrary, that taxes do matter. We find not only that cities with higher property tax rates have lower property tax bases, but in addition that cities whose taxpayers are subject to other taxes such as local income taxes and taxes levied by overlying jurisdictions have lower property tax bases. These effects are important because lower property tax bases require higher local property tax rates to finance a given package of public services.

Footnotes

[1]Values of locally-assessed taxable and exempt real and personal property, and state-assessed property, were combined. Because personal property is partially or completely exempt from property taxation in many states, the reported "exempt" values for personalty were generally incomplete. Personal property values were imputed for most cities based on their commercial and industrial real property values and the relationship between personal property values and commercial and industrial real property values in those cities fully taxing personal property.

[2]This means that the equation modeling tax revenues (discussed below) is less appropriate for Boston and the California cities in 1982 than for other cities. But deleting these observations does not affect the coefficient estimates.

[3]See Bradbury, Downs, and Small (1982) for an attempt to model the simultaneous determination of city population, employment, and per capita income.

[4]More precisely, we have

$$\ln (B/LAND) = b_0 + b_1 \ln SMPOP + b_2 \ln LAND + e \text{ and}$$

$$\ln (POP/LAND) = d_0 + d_1 \ln SMPOP + d_2 \ln LAND + u,$$

so that

$$\ln (B/POP) = (b_0-d_0) + (b_1-d_1) \ln SMPOP + (b_2-d_2) \ln LAND + (e-u).$$

Hence, c_1 should be interpreted as b_1-d_1 and c_2 as b_2-d_2.

[5]This prediction should not be confused with the more ambiguous effects of income that typically emerge from an urban model. According to that model, household income of the residents of a metropolitan area exerts two opposing forces on the slope of the price gradient. On the one hand, higher income increases the demand for space, which tends to flatten the gradient. On the other, higher income increases the value of travel time and thereby raises the cost of transportation which leads to steeper gradients. With the relevant variable specified as the per capita income of city residents alone, the effects of income on city vs. suburban location are already accounted for and the issue becomes solely one of the demand for housing services.

[6]Statutory rates for cities imposing a sales tax were pieced together from a variety of sources. The four main sources are the Commerce Clearing House, State Tax Guide; John Due and John Mikesell, (1983); John Due (197?) and Advisory Commission on Intergovernmental Relations, Significant Features of Fiscal Federalism, various years.

[7]The estimated overlying tax burden for all other California cities in the sample exceeds that for San Francisco, because they all have overlying counties. See Helen F. Ladd, John Yinger et al. (1986), ch. 8, for a complete discussion of the complexities of calculating measures of overlying tax burdens in a slightly different context.

[8]Previous studies have shown that higher crime rates reduce housing values. See, for example, Rizzo (1979) and Gray and Joelson (1979). We have normalized the number of crimes (both property and violent crimes as reported in The Uniform Crime Reports) by employees rather than by city population because crimes rates per resident appear to be strongly correlated with the amount of a city's nonresidential activity, especially commercial activity. Hence, normalizing by resident population rather than by employees would lead to a severe reverse causation problem; higher tax bases per capita would be associated with higher crime rates per capita.

[9]See, for example, T. Bergstrom and R. Goodman (1973); and T. Borcherding and R. Deacon (1972).

[10]For a complete description of the basic methodology, see Ladd, Yinger et al. (1986). A similar methodology based on Massachusetts communities is described in K. Bradbury et al. (1984).

[11]For a complete derivation and discussion of this measure, see chapter 9 in H.F. Ladd, J. Yinger et al. (1986).

[12]One notable exception is Robert P. Inman (1982).

[13]See Bradbury and Ladd (1985).

[14]That is, (b_1-d_1) and (b_2-d_2) from footnote 4 are positive.

[15]Furthermore, if it typically costs the city more on a per capita basis to provide the shifted service than it costs other municipalities within the jurisdiction assuming the responsibility, overlying taxes may rise by less than $10 per capita; hence, the net increase in the property tax base may be slightly greater.

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