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Voting, Opportunity Costs, and Property Taxes

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Abstract

Owners of real estate owe property taxes to local governments, but only permanent residents are granted the right to vote. The presence non-voting property owners reduces the share of total property tax revenue remitted by resident voters, thereby lowering residents' opportunity costs of public expenditure. Minnesota data suggest that spending on municipal services is higher as a result of the lower opportunity costs: communities with high concentrations of property value owned by non-voters spend more per resident than other communities. These results suggest that a one percent decrease in opportunity costs for voters is associated with at least a 0.50% increase in per capita property tax revenue. A policy innovation in 2001 affords the opportunity to further identify the effect on property taxes by comparing revenues before and after the change. These results suggest that a one percent increase in voter tax share is associated with a 1% decrease in per capita property tax revenue, a reduction of approximately $20 per capita at the mean.

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1 Introduction

In the United States local governments collect over $286.2 billion in property tax revenue, over $60 billion more than state governments collect in both individual income and corporate income taxes.[1] Property taxes are an ad valorem source-based tax; owners of property owe taxes in proportion to the value of their property. Local tax rates, tax revenues, and expenditures are determined by voters through elected representatives or popular referenda. Only property owners that are also permanent residents, however, are allowed to vote on tax rates, revenues, and expenditures. The presence of non-voting tax payers lowers the opportunity costs of property tax revenue for voters since resident voters remit a smaller share of the total tax burden.

Ignoring for the moment renters and questions of tax incidence, consider two relatively small cities in Minnesota with similar populations: Grand Rapids and Orono. In Grand Rapids, only 30% of the total property tax base is derived from local homeowners eligible to vote. In Orono, over 83% of the tax base is derived from local homeowners eligible to vote. A voter in Grand Rapids sacrifices less private income to finance the exact same increase in tax revenue. Consider the decision of voters in Grand Rapids to decrease property tax revenues by $100. By doing this they receive $30, which is 30 percent of the reduction in revenue. If voters in Orono elected to decrease property tax revenues by $100 they would receive $83. The opportunity cost of an extra $100 of property tax revenue is clearly lower for voters in Grand Rapids than it is for voters in Orono. As a result of the incentives thereby created, will voters in Grand Rapids collect more property tax revenue to finance local services?

[1] Source: U.S. Census Bureau. In 2002-03, local governments collected $286.2 billion in property taxes. State governments collected $182 billion in individual income taxes and $28.3 billion in corporate income taxes.

The difference in tax share between Grand Rapids and Orono illustrates how voter tax share might influence local property taxes. Although research concerning the importance of tax base composition has proved remarkably influential, especially with regard to state-aid formulas for education finance, it has proved difficult to identify any causal effects of voter tax share on local spending and taxation.[2] The main reason for the lack of causal findings is that while voter tax share may affect spending and taxation, spending and taxation may also affect voter tax share through their effects on the location and value of property. Indeed, there is an entire literature on the effects of local tax rates on business location.[3] Besides making it difficult to infer causality, the joint determination of local property tax revenues and voter tax shares also tends to bias estimates of the tax price elasticity towards zero. This simultaneity bias may explain the relatively low estimates of tax price elasticities found in the majority of studies concerning education and municipal expenditures.

Studies have also had difficultly controlling for unobservable differences in preferences across communities that are correlated with voter tax shares. Burdens placed on local services by non-residential property are also unobservable. Most studies have focused on education finance rather than municipal finance, reasoning that non-residential property does not place any burdens on educational finance.

Minnesota data demonstrate that in any given year communities with a lower voter tax share have higher property tax revenues and expenditures. Cross sectional estimates suggest that a one percent decrease in voter tax share is associated with as much as a 0.50% increase in local property tax revenues. The estimated association between voter tax share and local property tax revenue is biased toward zero by the joint determination of revenues and voter

[2]For example, findings on how the presence of commercial-industrial property is associated with higher educational spending (e.g., Ladd (1975)) have provided rational for state-aid formulas that redistribute tax revenues from places with relatively more commercial-industrial property to those with relatively less.

[3]See Dye, McGuire, and Merriman (2001) and Anderson (2005) for examples.

tax shares. A stronger association between voter tax share and local revenue is evident after accounting for differing local taste factors, public service costs across communities, and the possible joint determination of voter tax share and revenues. Using first differences, a one percent increase in voter tax share is associated with a 1% decrease in local property tax revenue.

In 2001, the Minnesota state government reduced the relative statutory property tax burden of non-residential property owners by reducing the assessment rate on non-residential properties (i.e., the percentage of their market value that is taxable). This produced unusually large and exogenous changes in voter tax shares and identifies further the effects of voter tax shares on local revenues. The results from the policy innovation reinforce the results from the first difference estimation and point to the economically significant causal effects of voter tax shares on local fiscal policy.

The reduction in voter tax share and thus the tax price of full-time residents is an example of tax exporting by local communities. Tax exporting refers to the ability of residents to impose a tax burden on non-residents, thus allowing residents to bear less than the full burden of local taxation. When non-residents shoulder a portion of the tax burden, the real costs of public spending are lower for residents. This paper suggests that full-time residents take advantage of the ability to export their taxes by collecting substantially more property tax revenues than they would if exporting were not available.

2 Model: Local Government Behavior

Local governments, especially school districts, generate a large portion of their revenue from property taxes. According to the U.S. Census Bureau, local governments in the United States collected over $238 billion in property taxes in 1999, making up 72% of their own-

source tax revenues and over 44% of their total revenues. Property taxes are remitted by owners of many different types of property including residential homes, vacation homes, commercial property, industrial property, and agricultural property.

Local governments collect property tax revenue to finance services such as health care, libraries, streets, parks, police, fire, transit, water, and sanitation services.[4] It is the demand for these services that necessitates the collection of the revenue and most likely the formation of the municipality itself.

The preferences of voters in a municipality determine the demand for services. By establishing a permanent residence in a city a taxpayer of voting age is given the right to vote in local referenda on taxation and spending. For this reason, voters in a community are referred to simply as the residents, or permanent residents, of a municipality. Taxpayers without the right to vote are non-residents and own non-residential property.[5] Following the standard models of local public service determination (e.g., Epple, Filimon, and Romer (1984), Westhoff (1977)) all residents of a community are assumed to have preferences over their consumption of a composite private good, b, property (land and housing), h, and the quality of a public service provided by their community, q. The location decisions made by taxpayers are taken as given; only the within-community component of a complete general equilibrium model is considered. A full general equilibrium model of these issues is beyond the scope of this paper.[6]

[4]This study focuses on spending and taxation by municipal and township governments. Educational services are provided by school districts, not municipalities and townships. Many of the issues discussed here, however, are also applicable to educational services and future work will focus on this issue.

[5]The residential vs non-residential distinction is useful as an expository tool, but residential status is not central to the basic concepts developed in this model. Indeed, as will be discussed below, the term tax exporting is simply a special case of a more general phenomenon. Residential status is important, however, for voting in this model. If a resident owned both residential and non-residential property they might vote differently than if they only owned residential. In this way, this model is not completely general. As long as these dual-owners are not dominant in the local political process this issue may not be important.

[6]This is not to imply that general equilibrium considerations are not important. Indeed, consideration of taxpayer mobility can alter the tax price term that describes optimal choices in this model. The consideration of mobility does not, however, invalidate any of what is discussed here. These issues will be discussed further

Assume that a resident-taxpayer in community j wishes to maximize her utility, $U(b, h, q_j)$ subject to her budget constraint and the community's budget constraint. All residents are assumed to have the same preferences and U is increasing, strictly quasi-concave, and twice continuously differentiable in all its arguments. Taxpayers differ in in their exogenously given income, Y. A resident's budget constraint is:

$$Y_k = b_k + p_h \cdot h_k + \tau \cdot p_h \cdot h_k \tag{1}$$

Providing a given quality of public service in a community requires, assuming a balanced budget, an amount of total expenditure sufficient to cover the costs of service provision. The total cost of a providing a given service quality is determined by the characteristics of the service being provided in conjunction with any characteristics of the population that influence the costs of providing that service. For example, if the service is a pure public good the total cost of providing a given service quality to all individuals does not depend on the total amount of individuals consuming that service. At the other extreme, if the service is a purely private good the total cost of providing a given service quality to all individuals depends on the total amount of individuals consuming that service.

A cost function $C(\cdot)$ describes the total cost of providing a given level of q to each taxpayer in a community. It is assumed q is not a pure public good, implying that the total cost of providing a given level of q is affected by congestion. The cost function, $C(\cdot)$, is assumed to be increasing in q and K, where K is the total population (i.e., total number of taxpayers) in a community. The production technology for q is assumed to exhibit constant returns to scale, so that the marginal cost of q is constant with respect to q and K.

later on in this section and in the discussion of the estimation of public service demand functions. For a summary of the details and problems of general equilibrium models of sorting and voting across communities see Ross and Yinger (1999).

The costs of providing service quality in a community are also affected by the composition of the tax base.[7] Define θ_j as the $K_j \times 1$ vector containing the marginal cost of providing quality to each taxpayer in community j and q_j the $K_j \times 1$ vector containing the quality of service enjoyed by each taxpayer (these could all be the same). The cost function takes the form

$$C(q, \theta_j) = q_j' \theta_j \tag{2}$$

where $C(\cdot)$ is linear, differentiable and increasing in all arguments.[8] The cost function indicates the total cost of delivering a particular service quality depends on the composition of the taxpayers.

The local government finances expenditures on service quality by levying a property tax on all property owners. Each taxpayer, $k = 1, 2, ..., K$ is a property owner and pays ad valorem property taxes (at rate τ) on the value of her real estate property, V_k, to fund local public services.[9] Property, h, is measured in units of property services with a gross-of-tax price of $p = p_h(1 + \tau)$. A taxpayer's property tax payment is defined as $T_k = \tau_j V_k = \tau_j \cdot p_h \cdot h_k$.[10] It is assumed that there are only two types of taxpayers: owners of non-residential property ($i = v$) and owners of residential property (i.e., residents) ($i = r$). Each taxpayer k is one and only one type and remits taxes to only one jurisdiction. The total number number of taxpayers in a jurisdiction j is $K_j \equiv n_{vj} + n_{rj}$, where n_{ij} is the

[7] Schwab and Oates (1991) consider the case of differing costs of public service across communities in a model featuring lump sum taxation. Gramlich and Rubinfeld (1982) consider the case where the consumption of a public service differs across residents according to their incomes.

[8] This follows Bradford, Malt, and Oates (1969) in that holding revenue and K constant the amount of the public service delivered depends on community characteristics, namely θ_j. The initial specification of the cost function, $C(\cdot)$ with C increasing in q and K still holds. See Ross and Yinger (1999) for more details on various specifications of the technology of public service production and how these specifications can affect the existence of equilibrium. These assumptions regarding the cost function are sufficient but not necessary for internal equilibrium.

[9] The use of the term taxpayers is deliberately vague and is also deliberately different from the term resident (see below).

[10] As Ross and Yinger (1999) note, $T = \tau V = \tau p_h \cdot h/r = \tilde{\tau} P_h \cdot h$. For ease of notation, τ rather than $\tilde{\tau}$ will be used throughout this paper.

number of taxpayers of type i in jurisdiction j.

The local government's budget must be balanced,

$$\tau \cdot p_h \cdot H = C_q \cdot q \tag{3}$$

where $H = \sum_{n=1}^{K} h_k$ is the total consumption of real estate services (land and capital) in a jurisdiction and C_q is the marginal cost of q.

By substituting the community budget constraint (3) into the individual's budget constraint (1) the voter chooses τ and h to maximize:

$$U(b, h, q) = U\left(y - \tau p_h h - p_h h, h, \frac{\tau p_h H}{C_q}\right) \tag{4}$$

The first order conditions for this problem imply:

$$\frac{U_q(\cdot)}{U_b(\cdot)} = C_q \frac{h}{H} \tag{5}$$

$$\frac{U_h(\cdot)}{U_b(\cdot)} = p_h(1 + \tau). \tag{6}$$

Let $h(p, y)$ denote the property demand function that results from this maximization problem. Following Epple, Filimon, and Romer (1984) it is assumed that individual demand for property does not depend on q.[11]

Voters are assumed to be myopic in that they do not consider any possible effects of their decisions concerning q and τ on property values in their jurisdiction through migration or the changes in real estate demand by current residents or owners of non-residential property.[12]

[11] See Crane (1990) for an example of the derivation of the tax price when housing demand depends on levels of the public service.

[12] Epple, Filimon, and Romer (1983) show that voter perceptions about h are not crucial, in that, any internal equilibrium that exists with voters anticipating varying their own housing consumption will also be an internal equilibrium if voters do not anticipate varying their own housing consumption. See their

This assumption implies that voters take p_h, H, K, n_i, and θ_j as given. A perfectly elastic aggregate supply of property, $H_s(p_h)$, is assumed implying that $p_h = \bar{p}_h > 0$.

Rearranging equation (5) and multiplying and dividing by $n_r \bar{h}_r$, where $\bar{h}_r$ is the average consumption of real estate services by permanent residents, produces:

$$\frac{U_q(\cdot)}{U_b(\cdot)} = C_q \cdot \frac{h}{n_r \cdot \bar{h}_r} \cdot \frac{n_r \cdot \bar{h}_r}{H} \tag{7}$$

Given a set of preferences, a resident's preferred choice regarding the quality of local services, and thus expenditure and tax rates, is influenced by the level of that voter's income or wealth and the real costs of providing a level of service quality, q. The expression on the right hand side of the equality is the tax price of the public service q. The last two terms represent the ratio of the tax base of the voter to the average tax base of all voters and the voter tax share (i.e., the share of tax base that is residential).[13]

The optimal tax rate, τ^*, sets the tax price of the public service equal to the marginal rate of substitution between the public service and private consumption. Through its effects on tax shares and marginal costs non-residential property influences taxing and spending policies in local jurisdictions. More non-residential tax base, in and of itself, is not beneficial unless its addition does not increase marginal costs. A voter in Grand Rapids does not benefit because Grand Rapids has a larger per capita property tax base. She only benefits

paper for a proof. As Crane (1990) and Wildasin (1989) emphasize, empirical estimates of the tax price may be biased if the effects of taxation on housing prices and housing demand (of both current and migrant residents) are not considered. Turnbull and Niho (1986) discuss the optimal property tax implications of mobile non-residential capital.

[13]Ladd and Yinger (1989) define the export ratio, ER, of local property taxes as

$$ER = \frac{1 - TS}{TS} \tag{8}$$

where TS is the residential tax share. The tax price terms above can then be expressed as

$$TS = \frac{1}{1 + ER} \tag{9}$$

where an increase in ER lowers the tax price.

from the reduction in opportunity costs if the reduction in voter tax share is not offset by increases in the costs of service provision.[14]

An increase in tax base derived from non-residential property increases C_q, increases total tax base, and reduces the tax share of all residential voters.[15] If internal equilibrium has been achieved a change in the taxable value of non-residential properties can be analyzed by differentiating the first order condition. After some algebra it can be shown that the total derivative of equation (7) is:

$$d\left(\frac{U_q(\cdot)}{U_c(\cdot)}\right) = \frac{h_k}{H}\left[\frac{\partial C_q}{\partial h_v} - \frac{C_q}{H}\right] dh_v \tag{11}$$

Given the assumptions on the form of the utility function, an increase in the tax base derived from non-residential property (denoted dh_{kv}) in a jurisdiction causes demand for q to increase if the increase in aggregate marginal cost is less than the decrease in that voter's

[14]Crane (1990) discusses the implications of voters considering the effects of public expenditure on housing prices and migration into and out of communities. Crane develops a theoretical model which suggests that the marginal price for publicly provided goods involves more than just the tax share and marginal costs faced by the median voter. He argues that differences arise for two reasons: taxes are distortionary and property values can be influenced by the value of local public services. Incorporation of these effects produces a tax price term that is the product of the original tax share component and the changes in costs, housing demand, and income potentially caused by changing the level of public expenditure. The voter considers that her tax share may change if she votes to increase or decrease or spending, while this model assumes that she views her tax share as fixed. Assuming that the price elasticity of housing demand is zero and denoting the tax share term in equation **??** as TS, the marginal cost of public services, M, becomes:

$$M = TS\left\{\frac{dC}{dq} - p_h\left[N\frac{\partial h}{\partial q}(1+\tau) + \tau h\frac{dN}{dq}\right]\right\} \tag{10}$$

The first term in brackets represents the increased costs of producing more of the service and the second term is the effect of migration and changes in q on tax share through changes in housing consumption caused by migrants. The cost term incorporates the congestion effect of new residents as well as scale effects of production. Regardless of the extent of myopia, what remains clear is that residential tax share, all else constant, will influence the demand for public expenditure.

[15]The amount of tax base derived from non-residentail property might change for a variety of reasons. Jurisdictions often offer tax breaks that attract commercial-industrial property and may act, despite the tax breaks to increase total tax base. Zoning policy could influence tax base composition as property was zoned as residential may be rezoned as commercial. The value of non-residential property might increase in a jurisdiction if the location becomes inherently more attractive for business. Increases in service quality (holding tax rates constant) or decreases in tax rates (holding quality constant) might also act to increase non-residential property values. Note that these last two examples illustrate how local fiscal policy and local tax shares are simultaneously determined which can cause problems for estimation.

tax share.

An increase in demand for service quality does not necessarily imply an increase in the tax rate. Since the tax base is larger a voter can consume more q with a tax rate that is actually lower than the previous rate. In fact, keeping the rate the same would increase revenues. A voter's demand for a higher tax rate would imply a desire to forgo private consumption in favor of increased public service consumption. When will these price effects be strong enough to increase the tax rate, τ, as the demand for the public service increases?

Using the budget constraint, the effect of changes in costs and total tax base on the local tax rate can be expressed as:

$$\frac{d\tau}{\tau} = (1 + \epsilon_q) \cdot \left[\frac{dC_q}{C_q} - \frac{dH}{H} \right]. \tag{12}$$

The direction of change in the tax rate will depend on the price elasticity of demand for q, ϵ_q, as well as the relative changes in total tax base and aggregate marginal cost. If non-residential tax base increased without an increase in the aggregate marginal cost the first order condition (eq. 7) implies an increase in demand for the public service.[16] The increase in demand will not, however, be large enough to call for an increase in the tax rate unless $\epsilon_q < -1$.

The reduced opportunity costs of property taxation arising from a lower voter tax share, equation 7, relies on the remittance of the tax being equivalent to the economic incidence. This is not necessarily true.[17] If for example, the tax on non-residential property results in lower wages for resident voters, this will have an income effect on voter demand for

[16]The policy innovation used in this paper is a decrease in non-residential home tax base that does not change aggregate marginal cost.

[17]For a discussion of tax incidence in open economies see McClure (1970) and Wildasin (1987b). For a discussion of the incidence of property taxes on non-residential property see McDonald (1993).

the public service. If local voters bear the entire economic burden of property taxes on non-residential property the voter tax share will equal one.

Assuming that voters do not bear the entire burden of the property tax on non-residential property results in an opportunity for resident voters to export their taxes. Tax exporting refers to the ability of voting residents to place tax burdens on non-residents. The most important distinctions between non-residents and residents in this depiction of tax exporting are the ability to vote and the costs and consumption of public services. Each of these distinctions is extremely important. Imagine that a locality can levy its uniform property tax rates on non-residents who could not vote on local policy. This is not beneficial if each of the non-residents consumes more value in local public services than they pay in taxes or if the costs of providing public services to them are prohibitive.

Now consider the case when non-residents pay taxes, do not consume or benefit from any services, but are allowed to vote on local policy. If the number of taxed non-residents is large enough, the community may be forced to lower taxes, despite the lower opportunity costs for residents, since a substantial portion of the electorate prefers to not be taxed at all. Thus, non-residents are only valuable to the extent that they do not yield political power.

Tax exporting is just a special case of the more general phenomena of the taxation of politically impotent groups that do not substantially contribute to the costs of providing local services. The fact that the taxpayers are non-residents only services to suggest that they are not politically powerful and don't consume many services.[18]

[18]See Wildasin (1987a) for a consideration of tax exporting with a pure public good. In the context of his model, a local community is able to tax a traded good and the burden of this taxation falls at least partially on those who live outside the jurisdiction (i.e., importers). Thus even without congestion affects, non-residential property may alter the real cost of raising local revenue, but only because *voters* do not pay. For other papers that discuss tax exporting see Braid (forthcoming) and Kim (1998). Tax exporting is an example of how the demographic structure of taxpayers influences the political economy of public expenditures. Poterba (1997) discusses how demographics influence the political economy of public

3 Voter Tax Share and Price Elasticity of Demand

Nearly all previous work estimating the price elasticity of demand for local public services has used cross sectional variation in residential tax shares and income to obtain parameter estimates (e.g., Ladd (1975)). The near exclusive reliance on cross-sectional data is due to both the limited availability of reliable panel data (especially for consecutive years), and a lack of variation in income and tax shares within communities from year to year. Thus, even when panel data were available, cross-sectional data has provided more variation in tax shares from which to generate more precise estimates of price elasticity. Furthermore, any changes in residential or voter tax shares within a community over time may be endogenously caused by migration or capitalization due to changes in tax rates, revenues, and expenditures. Given these issues, estimation with panel data usually offers few advantages over cross sectional data. Most cross-sectional studies use community level data while others use household and individual level data.[19] Cross sectional individual and community level studies generally find values for the price elasticity as small as zero and as large as -0.5.

The dependent variable in these studies is most often expenditure on a particular service or group of services. Examples of local services under study are education (Feldstein (1975) and Ladd (1975)), fire services (Duncombe (1991)), and general expenditures, police, and parks and recreation (Bergstrom and Goodman (1973)). Feldstein and Metcalf (1987) examine the effects of tax price on revenues, and Holtz-Eakin and Rosen (1990) examine

education.

[19]Inman (1979) reviews community level studies and Rubinfeld (1987) reviews studies using individual level data. For a review of studies outside of the United States and a discussion of various methods of identifying the decisive voter, see Ross and Yinger (1999). See the study of the composition of local Norwegian expenditure by Borge and Rattso (1995) for an example of a study using panel data. As the authors point out, however, their estimates of the price elasticity are not comparable to results from studies with endogenous local budget constraints (i.e., the United States). One panel study with U.S. data is Holtz-Eakin and Rosen (1990) who examine the effect of property tax deductibility on local tax rates.

the effects of tax price on local property tax rates. Most, if not all, previous studies focus on the estimation of both the income elasticity and price elasticity of demand for local services. The estimation of price elasticity requires the inclusion of a tax price variable in any regression. Tax price, as noted above, consists of the marginal cost of the public service, the median voter's share of residential tax base, and the tax share of residential property. Tax price also contains the price effects of matching grants from state governments and environmental variables that affect marginal cost(e.g., local poverty rates).[20]

The demand equation often estimated in community level cross-section studies uses a constant elasticity framework and has the general form (with all variables in log form):

$$E_j = \beta_o + \beta_1\, p_j + \beta_2\, y_j + \sum_{i=3}^{I} \beta_i x_j + v_j \tag{13}$$

where E is per capita expenditure, p is the measured tax price (e.g., tax share) of the median voter, y is the income of the median voter, the x_i's are community characteristics that affect the production costs of or preferences for local public services. The amount of lump sum aid is usually also included as an additional explanatory variable as are revenues from other sources (e.g., service charges, sales taxes). Since revenue is required for expenditure, expenditure is replaced with local tax revenue to estimate the price elasticity of local tax revenue.[21]

The problems with cross-sectional estimation of community level responses to differences in tax shares are well documented. Bergstrom and Goodman (1973) discuss the necessary

[20]The tax price terms becomes more complex when additional revenue sources such as income and sales taxes are considered. One of the advantages of the estimation procedure done here is that relatively few (24) of the localities in the sample levy income or sales taxes. Many other variables have been used to describe the tax prices of median voters. See Bergstrom, Rubinfeld, and Shapiro (1982) for an excellent summary of different specifications of the tax price variable.

[21]Because of saving and investment, current revenue does not always equal current expenditure of goods and services.

assumptions for the estimation of income and price elasticities from cross-sectional data using the median voter model. As Bergstrom, Rubinfeld, and Shapiro (1982) point out, median voter studies have the disadvantage that estimates of elasticities depend at least in part on the extent to which local decisions on expenditure approximate the median voter model.[22] Unbiased estimates of price and income elasticities require not only that the median voter model hold but also that the median voter be the resident with median income. If Tiebout sorting is not perfect, the use of individual level data will not eliminate bias and may actually cause additional bias.[23]

Another source of biased estimates of the price elasticity of demand is incorrect specification of the tax share. Wildasin (1989) demonstrates that failure to account for the endogeneity of tax share can cause price elasticity estimates to be biased downward (i.e., toward negative one) by as much as 25 percent while Crane (1990) discusses how migration effects tend to bias estimated price elasticities toward negative one and estimated income elasiticities away from positive one. The endogeneity often arises because spending and revenue decisions also affect location or housing decisions, which, in turn, affect voter tax shares and the identity of the median voter. These biases are present even if the constant elasticity specification is correct.

Some of these problems can be minimized through the use of community level panel data sets. In particular the use of panel data can more effectively control for across community variation in tastes for public services, prices for both factors and goods, and community characteristics that affect the production and costs of local public services. Studies using

[22]Other conditions discussed by Bergstrom and Goodman (1973) are constant unit costs with respect to output in each community, constant tax shares as local expenditure varies, and knowledge of the "tax price" by voters.

[23]See Ross and Yinger (1999) and the references therein. Tiebout bias and possible remedies were first discussed by Goldstein and Pauly (1981).Using data from Sweden Aronsson and Wikstrom (1996) test and reject the hypothesis that the median voter is the resident with median income. However, they find that elasticity estimates using the median voter are not significantly biased.

cross-sectional data are forced to use a long list of explanatory variables in attempts to control for these variables. While cross-sectional studies require the identification of a decisive voter to estimate the price elasticity, first difference and fixed effects estimation can allow the researcher to remain virtually agnostic as to the identity of the decisive voter. Since fixed effects controls for time invariant variables, if local preferences affecting public policy remain constant over the sample period the estimate of the price elasticity will not be biased because of incorrect identification of the median or decisive voter. In addition, if the relative prices of factors and private goods remain constant over the sample period fixed effects will control for their variation across jurisdictions.[24] If the incidence of the taxes on non-residential property differs across communities a panel study controls for these differences if the incidence of the tax is time-invariant within a community over the sample period.

As discussed above, however, the within community variation in tax shares and income is often too small for accurate identification of the price and income elasticities, and what little variation that exists is often endogenous. In 2001, a special feature of the Minnesota property tax system produced abnormally large and plausibly exogenous within community variation in tax price. The relatively large magnitudes of within community variation allows for precise estimates of the effects of voter tax shares and the exogenous changes in voter tax share plausibly reduce or eliminate the effects of endogeneity on estimates of price elasticity discussed by Crane (1990) and Wildasin (1989).[25] The policy innovation

[24]Successfully controlling for differences in costs across communities can have substantial effects on estimates. Several recent cross-sectional studies consider the effects that community characteristics have on the cost of public services. For example, studies by Ladd and Yinger (1989) and Duncombe (1991) have found that variables such as the poverty rate, building age, and the presence of commercial and industrial capital all influence the costs of providing local services and estimates of income and price elasticities.

[25]At least two other recent studies have used abnormally large and plausibly exogenous within community variation in tax price to identify price elasticities of demand for education. These studies find relatively small elasticites of greater than -0.1 but still statistically different from zero. Neither of these studies use information on the residential share of the tax base and both use the same property tax exemption program in New York state to generate within community variation in tax price. Eom, Duncombe, and Yinger (2005)

in Minnesota allows for the examination of changes in voter tax share that are not caused by the capitalization of differences in fiscal policies across communities or the migration of people and property. Both the magnitude and cause of the within community variation in voter tax share make these panel data especially valuable for estimating the effects of voter tax shares on the demand for local services and revenues.

The first order condition (eq. 7) guides the formation of the tax share term. Local choices of tax rates, revenues and expenditures should depend on local marginal costs, C_q, the median voter's share of residential tax base, and the share of tax base that is derived from voters. While information on median residential home value is available from the Census it does not necessarily equate with the median individual's home value for tax purposes and observations are not available for consecutive years. Information on the taxable value of individual homes is not yet available. Each community's marginal costs of local service provision are also not directly observable . Thus, the first two terms in the tax price are unobservable. Factors that affect production and costs, however, are not expected to vary much from year to year and the use of fixed effects should control for variation in these variables across communities. The fixed effects estimation also assumes that the median voter's share of total residential tax base remains constant from 2000 to 2001. Yet another amendment to the tax price may be important. Communities with relatively more non-residential property may have a superior amenity that attracts these types of properties. This heightened attraction to the community can create market power which may allow the community to raise tax rates without fear of out-migration. Failure to control for differences in this market power across communities may also bias results. Here again,

measure voter tax share as the median voter's tax share using census data on median home values. Rockoff (2003) assumes that the median voter's tax share is always one without the exemption program. Both of these measures of tax share likely suffer from measurement error (perhaps non-classical measurement error). The magnitude of the exemption's effect on tax price is also endogenous to local fiscal policies.

using fixed effects provides an advantage over cross section estimation if market power is time-invariant.[26]

Unfortunately, a direct measure of the income of residents is not available for the years under study. Income is unlikely to drastically change from 2000 to 2001 so using fixed effects may control for differences in income across communities. The inclusion of residential market value may partially control for this omission. Changes in residential property value may be related to changes in income and control for changes in permanent income through their effect on wealth. Within community changes in residential market value, however, may be the result of the capitalization of local fiscal policies into property values. This simultaneity should bias this coefficient towards one and may bias other coefficients as well. Fortunately, the inclusion of a residential wealth variable does not appear to affect any of the results regarding voter tax shares. Otherwise the regressions are as specified in equation 13 with both a pooled cross-section and fixed effects model estimated.

While it is likely that the assumptions outlined above are approximately true, there are sure to be deviations from them in at least several communities if not more. Fortunately, the possible effects of these biases can be examined through the use of an instrumental variable that is correlated with changes in the voter tax share but does not independently affect local decisions on property tax revenue and expenditure.

3.1 Exogenous Variation in Voter Tax Share

The exogenous changes in voter tax share were caused by institutional changes made at the state level. In Minnesota a jurisdiction's tax base is the Net Tax Capacity (NTC). The net tax capacity of an individual property is its estimated market value multiplied by its

[26]Controlling for the composition of the non-voter tax share has virtually no effect on any of the estimates discussed below. This is, however, an issue that should be explored further.

"class rate". Each property is assigned a class such as Residential Homestead, Commercial-Industrial, Non-Commercial Seasonal Recreational, or Agricultural Homestead. Each of these classes has its own class rate, α_c, where c denotes the property class.[27]

The total property tax payment for property k will depend on the tax rate its owner faces in jurisdiction j at time t, τ_{jt}, the class rate for its class of property, α_{ct}, and the taxable market value of the property M_{kt}.

$$\text{tax payment}_{kjt} = \tau_{jt} * \alpha_{ct} * M_{kt} = \tau_{jt} * NTC_{kt} \tag{14}$$

The only variable that a jurisdiction can control directly is the tax rate, τ.

In any year, the share of the total tax base derived from residential property, or the voter tax share, is a function of market value and class rates. Denoting the voter tax share as p_{jt},

$$p_{jt} = f(\alpha_t, m_t) \tag{15}$$

where α_t is a vector with an entry for each class rate at time t and m_t is a vector of the property values of all k properties within the jurisdiction at time t. The function f produces the ratio of the taxable value of property owned by voters to the total taxable value of all property. Table XII displays the various property classes and class rates prevailing in Minnesota around the sample period.

In 2001, the Minnesota state legislature, prompted by then governor Jesse Ventura, made legislative changes that produced exogenous and possibly unanticipated changes in the composition of the tax base in taxing jurisdictions. Specifically, class rates on many

[27]Local assessors are responsible for assigning each property a class according to criteria set by the state. Each year the Minnesota state legislature determines these class rates.

classes property fell by as much as 40%.[28] All else equal, the changes in class rates reduced the share of local property taxes remitted by owners of non-residential property in every jurisdiction and increases the share of local taxes remitted by voters. These exogenous changes are used as an instrumental variable in an effort to address possible problems with endogeneity of the voter tax share term.[29]

The instrument for the change in voter tax share is defined as

$$\Delta p_j^* = p_{j2001}^* - p_{j2000} \tag{16}$$

where the *implied* voter tax share in 2001 is defined as

$$p_{j2001}^* = f(\alpha_{2001}, m_{2000}), \tag{17}$$

as opposed to the *actual* voter tax share in 2001,

$$p_{j2001} = f(\alpha_{2001}, m_{2001}). \tag{18}$$

Since the class rate changes were decided at the state level and are uniform across the state, the fact that any change occurred is clearly exogenous to local tax and spending decisions. It is possible, however, that since class rates are lower non-residential property owners might choose to relocate, since at any given statutory tax rate, their effective tax rate is now lower. If owners of commercial-industrial property, for example, relocate their

[28] Minnesota employs a progressive property tax rate system where the average effective tax rate (tax payments as percent of market value) increases with market value.

[29] The magnitude of the exogenous change in non-residential tax base depends on the previous composition of tax base, which may be endogenous. However, the use of fixed effects to control for time-invariant omitted variables that affect the size of the non-residential tax base helps ameliorate this potential problem. This issue is discussed in detail below.

businesses because of the class rate reforms, changes in the distribution of tax base in 2001 would in part depend on the location decisions of households and firms. This would lead to endogenous measures of changes in tax base composition.

The same story applies to the possible capitalization of these reforms into property values. Since effective tax rates were immediately lowered on many types of property and, all else equal, voter tax shares were to increase, the class rate changes may have increased the market values of certain property classes and decreased the market values of others. It is also possible that any anticipated increased in voter tax shares might lead to expectation of reductions in public service provisions. If these reductions were capitalized into the values of residential homes their share of the tax base would have been affect by the class rate changes.

Migration and any capitalization would only affect the actual changes in voter tax share if the class rate changes were anticipated by assessors (and the housing market) by January 2nd, 2001. To protect against both of these potential problems, the instrument, as noted above, uses property value and location as of January 2nd, 2000, a full one and a half years before the policy reform was implemented. In fact, the property values used for the instrument were determined before Governor Ventura was even elected in a surprise victory that drew attention from the national media. It is unlikely that the housing market and, even more importantly, local assessors were able to anticipate the reduction in class rates back in January of 2000.

4 Data: Sources and Descriptions

Data on the taxable and market values of all properties within Minnesota from 1995 through 2002 were made available by the Minnesota Department of Revenue. These data detail

assessed property values by class of property for every county, township, city and school district in Minnesota.[30] The class of a property is determined by the property classification system in the state of Minnesota. There are 12 major classes of property in Minnesota with various subclasses within each class as well. Data on property tax revenue, tax rates, and state-aid were also made available for 1994 through 2002 at the city, township, school district and county levels by the Department of Revenue.[31]

Cities and townships in Minnesota with a population of greater than 500 and at least some non-residential property are included in the sample. The property tax is the only ad valorem tax available to townships in Minnesota and while cities can levy sales taxes, only twenty-four cities in the sample elect to do so. Tables VI and VII show the composition of total revenue for cities and townships in the sample. For cities, on average only 20% of all revenues are derived from property taxes. Property taxes are the third largest share of revenue behind intergovernmental aid and revenue from financial sources.[32] Townships depend much more heavily on the property tax with approximately 50% of their total revenues derived from property taxes. In terms of discretionary (non-aid) revenue, property taxes make up on average around 70% of this revenue in townships and 26% on average in cities(Tables $VIII$ and IX). The largest source of discretionary revenue for cities is financial revenue from bonds, sales of investments, and transfers from operating funds (i.e., savings). Interest earnings also make up a substantial portion of discretionary revenues for

[30]These data are technically based on a geography called a "unique taxing jurisdiction." This is an area in which all properties face the same statutory tax rates. For example, in Minnesota two homes can be in the same city but in different school districts. They would be located in two different unique taxing jurisdictions. It is possible to collapse these UTJ level data to the city, township or school district level, and that is what is done here.

[31]Total expenditure levels at the city and town level were obtained from the Office of the State Auditor in Minnesota. Total expenditures differ from local property tax revenue because of state-aid, revenue sharing programs, other local taxes, and saving.

[32]There are two explicit revenue sharing programs in Minnesota one in the Minneapolis-St. Paul metropolitan area and one in Northern Minnesota on the "Iron Range." These programs began in 1971 and 1997, respectively. Both programs share a portion of the growth in commercial-industrial tax base across cities/towns. Of the 762 cities and towns in the estimating sample, 188 receive this type of aid.

cities. Tables II and III show the summary statistics for the many of the relevant variables across cities and townships.

The dependent variable is the per capita (i.e., per permanent resident) local property tax revenue for the city or township in 2000 and 2001 for taxes payable in 2001 and 2002, respectively.[33] Independent variables include a measure of per-capita residential property wealth in a jurisdiction, the voter tax share variable, the per capita amounts of aid programs to cities and towns in Minnesota, and revenue derived from other sources(e.g., service charges, bond revenue, licenses).[34] The voter share variable is the share of total tax base that is classified as homestead property. All owners of homestead property can vote in a local jurisdiction. Classes of property that are non-homestead include commercial-industrial property, vacation homes, apartments, rental housing, agricultural land not connected to a permanent resident, and public utilities. People who live in apartments or rental housing can vote and do not directly remit property taxes, but could bear the burden of these taxes through higher rents. These properties make up, on average across the sample, well under 10% of the taxable value of all property. Given their small contribution to the tax base and other evidence that renters tend to participate less in local referenda than local homeowners, see Fischel (2001), they are not included in voter tax share. Of course, owners of commercial-industrial may also own homestead property within the same jurisdiction and thus would be able to vote. At the moment, there is no way of determining the extent of this cross-ownership. Since the issue of voter tax share becomes inherently trivial if it is assumed that all owners of non-homestead property also own homestead property, another extreme assumption is employed, that voters do not own any of the non-homestead property. If the

[33]Assessed values in 2000 multiplied by the 2001 tax rate determine tax payments remitted in 2001. Assessed values in 2001 multiplied by the 2002 tax rate determine tax payments remitted in 2002. All property is reassessed annually.

[34]The two largest programs are local government aid (lga) and homestead agricultural credit aid(haca) provided by the state of Minnesota.

extent of this measurement error is random the results concerning voter tax share will be biased towards zero.

State aid programs are distributed according to a state formula and their amounts are announced before cities and towns decide on their spending for the year. There were substantial reductions in state aid to townships in 2001 because of budgetary problems and general policy reforms at the state level. It appears these changes were not anticipated more than a few months in advance. Table III shows that these steep drop in state lump-sum aid resulting in 10% decrease in total aid on average for townships in the sample. Table II demonstrates that on average cities saw a modest increase in total aid. [35]

All amounts are expressed as 2000 U.S. dollars.[36] The majority of analysis is performed for the assessment years of 2000 and 2001, which corresponds to taxes payable (and expenditure) in 2001 and 2002. The analysis to follow is all performed at the city and township geography. All variables included in regressions are in natural logs.

5 Results

Analysis of these data suggests that non-residential properties, through their effect on the residential tax share and the opportunity costs of voters, influence local property tax revenues. An increase in the proportion of the tax base that is derived from non-residential property, causing the opportunity costs of voters to fall, is associated with substantial increases in local revenue. Instrumental variables estimation suggests that the endogeneity

[35] The state-aid formula in 2000 and 2001 was adopted in 1993 and consists of two parts: an amount determined by the formula and a "base" amount, also known as grandfathered aid. The base amount does not change unless specifically provided for in legislation. Each locality's formula aid is equal to a percentage of the difference between its "need" and "ability to pay". Ability to pay is the city's tax base and need is based on four factors: population, population decrease, percent of its housing built before 1940, and percent of its tax base that is classificed as commercial or industrial. The total amount of aid each year is capped. See Baker, Hinze, Dalton, Michael, and Massman (2003) for more details.

[36] Data on revenue, expenditure, and property values are adjusted for inflation using the CPI for all items from the Bureau of Labor Statistics.

of the tax share variable is not playing a large role in these panel data, and if anything, seems to be biasing the point estimates toward zero. Simultaneity and other omitted variables, however, cause cross-sectional estimates of price elasticity to be towards zero. The cross-sectional estimates are only half the size of the fixed effects estimates.

Columns (1) and (2) in Table XIV show the results of pooled cross-section regressions with per-capita local property tax revenue as the dependent variable. The relationship between the voter tax share and revenue is first examined without additional explanatory variables. The coefficient in column (1)represents an elasticity, suggesting that a one percent increase in voter tax share is associated with an 0.56% decrease in per-capita revenue. Including additional explanatory variables in column (2) changes the price elasticity to -0.495, with a similar standard error. Both coefficients are significantly different from zero. Residential market value is included in the regression because increases in residential tax share may also be caused by increases in residential home values which, by increasing the wealth of residents, may increase the demand for local services and local revenue. The coefficient on per-capita residential market value is statistically significant and positive at 0.504, indicating that localities with more per-capita residential wealth tend to have higher property tax revenue. To the extent that any changes in income are correlated with changes in residential market value, this coefficient reflects income elasticity as well as a wealth elasticity. Previous cross-sectional studies (e.g. Ladd (1975)) have found this coefficient to be positive and statistically significant.[37]

The coefficient on per-capita state aid is 0.188, and is also significantly different from zero and indicates that a one percent increase in per-capita state aid is associated with a 0.188% increase in local per-capita property tax revenue. Aside from any causal interpretation, the

[37]Ladd found a coefficient of 0.2392 on residential wealth where the dependent variable was per-pupil education expenditure. However, these studies also included a measure of median income which is not included here. The effects of omitted median income are discussed below.

sign of this coefficient is positive because more aid is distributed to localities with relatively high local property tax revenues (i.e., more need for aid). The estimated tax share coefficient is smaller upon the inclusion of this variable. Local non-property tax revenue is also seen to have a positive and significant effect on local revenue, again this is because cities and towns with higher property tax revenue usually have larger revenue needs and thus also have higher non-tax revenue. [38]

It is possible that the estimates reported above suffer from omitted variable and simultaneity bias. As discussed above, among the omitted variables are some measures of the local costs of public service provision and local preferences for public services. The omitted costs variable is positively correlated with aid received and also possibly with the availability of non-property tax revenue; cost has an expected positive association with property tax revenue itself. Not considering differences in costs across cities and towns will bias the coefficients on aid, and other local revenue upwards.

Correlation between omitted cost differences and voting tax share is less obvious. If non-residential property tends to increase the costs of service provision, the coefficient on tax share will be biased towards negative one. In this case cities and towns with a lower voting share will collect more property tax revenue because of their large costs not because of any reductions in opportunity costs. In contrast, if cities and towns with low voting shares face lower costs because non-residential property is less costly in terms of local services, the coefficient on voting tax share will be biased towards zero.

[38] When the natural log of population is also included in the regression estimated in column (2), its coefficient is estimated to be -0.06 and is significantly different from zero. Considering population as an environmental cost variable, following Ladd and Yinger (1989), the coefficient on population indicates that the revenue and expenditure in question are not pure public goods (i.e., are subject to congestion). Ladd and Yinger (1989) show that the coefficient on the log of population is equal to $(1 + \mu)(g - 1)$, where μ is the price elasticity and g indicates the extent to which the public service is subject to congestion. A pure public good has $g = 0$ while a pure private good has $g = 1$. The estimate of the coefficient on log population above actually indicates $g = 0.87$ The inclusion of population lowers to coefficient on residential tax share slightly to -0.52 while the standard error remains nearly identical.

Simultaneity between voting tax share and property tax revenue will also tend to bias estimates of the association between opportunity costs and revenue towards zero. All else equal, larger property tax revenues fund relatively high-quality services. When households demand these high-quality services relatively more than non-residential properties, the voting tax share will tend to be higher in places with higher property tax revenues because of capitalization of these quality services into residential property values. This will bias the voting share coefficient towards zero. Again, observing at any one point in time that places with larger voting tax shares also collect more property tax revenue does not suggest that higher opportunity costs cause more tax revenues to be collected.

Fortunately, these data present an opportunity to ameliorate concerns of omitted variable and simultaneity bias. Using first differences (i.e., fixed effects with two years of data) controls for any time-invariant variables that are correlated with the voter tax share and with local revenues. Columns (3)-(6) detail the results from first differences regressions with and without instrumental variables.[39] Column (3) is the simple regression of the first difference of property tax revenue on the first difference of voting tax share. The coefficient on voting tax share in column (3) is -1.079, indicating a one-for-one association between percentage increases in voter tax share and percentage decreases in property tax revenue. The point estimate is more negative because the effect of non-residential properties on marginal cost has been differenced out, time-invariant local preferences are differenced out, and the simultaneity issue has at least been partially addressed. As discussed earlier, non-residential property may reduce per capita marginal costs in communities. The coefficients on voting

[39]First difference regressions include a variable that controls for a common time trend in property tax revenue across all cities and townships. Allowing for different time trends in cities and townships does not substantially alter any results, although townships do exhibit a more positive trend than cities. This issue is specially addressed through the use of a random trends model that allows for each city and town to have its own linear time trend in property tax revenue. See column (7) for these results which are discussed in more detail below.

tax share in the pooled cross section regressions above are reflecting lower marginal costs in places with high concentrations of non-residential property as well as the effects of lower residential tax share.

Results in column (4) show that the coefficient on voting tax share is not substantially altered upon the inclusion of the residential wealth and aid variables. The tax share coefficient is now -0.991, again indicating that a one-percent decrease in voter tax share is associated with a one percent increase in local property tax revenue.

The coefficient on residential market value in column (4) is slightly higher than its estimate in column (2). This suggests that the omission of median income from the cross section has not significantly biased results. Again, the coefficient on market value may be biased upwards if within-community changes in spending are capitalized into the measured assessed property values. Given the lagged nature of the assessment system, within community changes in residential property wealth likely reflect changes in market value that occurred in years prior the assessment year. The changes in residential market value observed from 2000 to 2001 are, if correlated with revenues at all, correlated with changes in property revenues from (at the latest) 1999 to 2000. Regardless, inclusion of property wealth does not alter the coefficient on voter tax share in any meaningful way.

The coefficient on aid is still significantly different from zero but is now negative at -0.068, suggesting that a one percent increase in state aid is associated with a 0.068% decrease in local property tax revenues, which is more in line with previous findings on local government responses to aid. The coefficient on local non-property tax revenue is no longer significantly different from zero, reflecting the rather fixed and sometimes volatile nature of local non-property tax revenues in the sample.[40]

[40]Population is not included in these regressions. The reason for including population in the cross-section regression is to consider economies of scale and cost differences. The reasoning is less clear in first differences

Columns (5) and (6) use the instrumental variable to control for the endogeneity of tax base composition and thus residential or voter tax share. As discussed above, this endogeneity arises because of the effects of local fiscal variables on location choices and property values. Both Crane (1990) and Wildasin (1989) discuss how this endogeneity may cause estimates of the price elasticity to be biased towards negative one. They both show, using theoretical models, that simply using the tax share as proxy for tax price can produce biased estimates.[41] Thus, it is expected that if these omissions from from the model specification are important, that the instrumental variable estimates should be lower than the regular first differences estimates. Here the opposite effect is found, that is, instrumental variable estimates of the price elasticity tend to be more negative. The point estimates, however, are not significantly different from each other.

The instrument produces changes in residential tax share that are exogenous to each locality and highly correlated with the endogenous regressor. The instrument is defined as the change in a community's residential tax share that is implied only by the class rate change in Minnesota in 2001. As explained above, the implied or predicted change assumes that property values and property location (across communities) did not change. The first stage equation regresses actual changes of tax base composition on the predicted changes and has an R-squared of 82 percent. It is also clear that class rates do not independently affect spending, because they only affect spending through their affect on the tax base. See Table $XIII$ for the results of the first stage regression.

Every city and township in this sample was exposed to this policy innovation and received a treatment. The actual receipt of the treatment is exogenous to each locality and

across two years as the level of population changes being considered are not going to change costs in any significant way. Furthermore, these data only contain population figures for the year 2000, so there is no variation in population observed in these data.

[41] Crane's general result of downward bias does depend on the assumption that the net effect of migration on tax revenue and the net effect of capitalization on income are both zero.

is not directly caused by local fiscal policies. The strength of the treatment was determined by the composition of the tax base in a community prior to the policy change, and as discussed above, the composition of the tax base may be partially determined by local fiscal policy. Figure 4 demonstrates how the relative strength of the treatment depends on the voter tax share in place before the policy innovation. Cities and towns in the top quantile of voting tax share (the median voter share in the quantile is 81%) tended to receive weaker treatments, while cities and towns in the lowest quantile received substantially stronger treatments. Since every community received the treatment, it is this heterogeneity in strength that allows for identification. It is worth noting that the voter tax share prior to the policy change was not the sole determinant of the strength of the treatment. Many communities with the same initial voter tax share received different treatments because of other differences in the composition of their tax base.

If the strength of the treatment, however, is correlated with any omitted variables that affect local fiscal policy and voter tax share, the instrument will be endogenous. In the first-difference equation, to ensure consistency the voting share in each community in each year must be uncorrelated with deviations from the average error term.[42] Again, letting p_{jt} denote the voting tax share the requirement is that

$$E[p'_{jt}(v_{jt} - \bar{v}_j)] = 0,\ t = 1, 2, ..., T \tag{19}$$

The change in voting tax share caused by the policy innovation will only be exogenous if it is unrelated to deviations from the mean error term. Again, this says that only unobserved temporary changes to local property tax revenue that are also correlated with the initial

[42]See Wooldridge (2002) for a discussion of consistent estimation with panel data and the strict exogeneity assumption.

voter tax share will be correlated with the strength of the instrument. In other words, problems with endogeneity will remain if, for example, Orono received a smaller treatment than Grand Rapids because in the year prior to the treatment Orono used a one-time increase in revenue to finance a new hockey arena that increased voter tax share. If this were the case and if Grand Rapids only mildly increased revenue, the smaller treatment would be associated with a fall in revenue and the coefficient on voter tax share would be biased towards negative one.

Analyzing these data demonstrates that there is little correlation between deviations from the mean error and the strength of the instrument. Figure 5 demonstrates that for nearly all communities in the sample the share of market value derived from voting residents changes by only small amounts each year. For example, in 2001, only 22 out of 762 municipalities and townships had a change in the voting share of market values of five percent or greater in absolute value. Over half of the sample experienced changes less than one percent in absolute value. Table *I* also demonstrates that most of the variation in voter shares of market values is across communities not within communities over time.

Figure 5 also shows that property tax levies are much more likely to change by large amounts from year to year than are the voting shares of market values. If these changes were having any real effects on the distribution of market values, the small changes in voter market shares would not be observed. The figure also shows that, in non-reform years, the tax shares vary little from year-to-year within communities. In addition to the reform in 2001, relatively smaller tax reforms that changed class rates also occurred in 1996, 1997, and 1998. In the non-reform years of 1995, 1999, 2000, and 2002 most cities and towns in the sample saw only small changes in tax shares even when large changes in tax revenues were exhibited in much larger portion of the sample. Again, it is unlikely that year-to-year

changes in property taxes within communities have any real effects on observed voter shares of taxes or market value. The strength of the treatment is determined by persistent levels of service quality and tax revenues within a community not by one-time shocks that may have occurred during 2000-2001.

In other words, Grand Rapids with its 30% voter tax share, did not receive a larger treatment than Oronco, and its 80% voter tax share, because Grand Rapids had happened to spend a temporarily high amount in 2000 or voters anticipated temporary new expenditure in 2001. Rather, Grand Rapids received the larger treatment because the persistent determinants of its expenditure and voter tax shares are different than Orono's persistent determinants of expenditure and voter tax shares. When the strength of the treatment is only correlated with the persistent component of the error term first-difference estimation will produce consistent and unbiased results.[43]

Contrast the variation in voter tax shares caused by the policy innovation with the variation in voter tax shares that occurs in non-reform years. Again, one striking fact is that, as Table *I* demonstrates, there is little within community variation in tax shares in non-reform years. Column (6) demonstrates that over 21% of the overall variation in tax shares is within-communities during reform years. While it is known what causes the variation in voter tax shares in reform years it is unclear what causes the variation in non-reform years. There are at least two distinct causes, each of them presenting problems for the estimation of the effect of voter tax shares on property tax revenues.

The first possible cause of variation in non-reform years is the capitalization of new public service investments into the values of existing residential properties. This revenue

[43]Following the suggestion of Wooldridge (2002), a regression was also run to test for strict exogeneity using the F-test. In this case, the restricted model is the regression ran in column (4) or column (6) and the unrestricted model includes either p_{j2000} or p_{j2001}. This tests whether or not, for example, the initial voter tax share variable explains any of the deviations from the mean error term across communities. The F-statistic is 0.611 and thus the test does not allow for a rejection of strict exogeneity.

increase will cause residential tax share to increase and the coefficient on voter tax share will be biased towards zero since it will appear that communities experiencing increases in voter tax shares also increased tax revenues. The instrumental variable for the change in voter tax share avoid the capitalization problem since it uses changes in voter tax share based on property values determined before they could have been influenced by changes in revenues.

The second possible cause would be new properties moving into the jurisdiction and changing the composition of the tax base. Suppose several new commercial properties located within a town and decreased the voter tax share. The reduction in the voter tax share might cause property tax revenues to increase. The new properties, however, may also place new burdens on local infrastructure and additional revenues may need to be collected. Migration will bias the voter tax share coefficient towards negative one since revenue increases might appear especially large in places where voter tax share has fallen.

Without any additional explanatory variables, the I.V. estimate for tax price elasticity in column (5) of Table XIV is -1.172. The inclusion of the additional explanatory variables in column (6) increases the coefficient slightly to -1.041 and decreases the standard error slightly. The point estimates of the tax price elasticity for the I.V. regression are similar to those from the non-I.V. regressions, suggesting that any endogeneity in the tax price measure is not playing a large role for these panel data estimates. The fact that the use of the instrumental variable uncovers little bias is because most of the variation in local tax prices is caused by the policy innovation.

One possible problem with the estimation has yet to be discussed. It's possible that certain communities were experiencing, for example, a steady growth in the income of their residents that was causing property tax revenues to trend upwards. If places with high voter

tax shares were a experiencing the upward trends in property tax revenues their receipt of smaller treatments would be correlated with large observed increases in tax revenue. If communities with lower voter tax shares were experiencing little to no growth in revenues, these trends would bias the coefficient on voter tax share towards negative one in the instrumental variables regression. That is, changes in voter tax share would be negatively correlated with changes in property tax revenue but voter tax share changes would not be the causal factor.

This possibility is investigated through the use of a random trends model. See Wooldridge (2002) and the references therein for a description of random trends modeling. The random trends model allows each community to have its own linear trend in property tax revenues. Estimation of each city/town-specific trend requires three years of data, since an additional year of data is needed to difference out the community-specific trend that is in the error term of the first-differenced model. Column (7) in Table XIV illustrates that controlling for a time trend in each individual observation, using the years 1999-2001, does not significantly alter any results. The coefficient on voter tax share is -1.041 and is significantly different from zero.[44]

Another possibility is that voters might have anticipated the change in class rates that would change their opportunity costs. There would be two possible responses to this anticipation. One response would be for a locality to increase its revenue in the year prior to the change in order to take advantage of the relatively low price they would not enjoy in the following year. Places anticipating a larger increase in residential share in the future might exhibit relatively large increases in revenue prior to the policy change. If this occurred, the regressions in columns (4)-(6) would tend to overestimate the response of local governments

[44]Using years 2000-2002 instead of 1999-2001 does not alter the results.

to the change in tax price.

Yet another response might be that residential property owners realized that a large and permanent increase in their tax share might decrease the value of residential homes in their community. This would represent a decrease in the wealth of residents and communities facing large potential changes in tax share may have decreased revenues before the class rate change. If this occurred, the regressions above would tend to underestimate the the response of local governments to changes in tax price.

An examination of these data does not provide evidence that either of these potential anticipatory actions occurred to any substantial degree. To examine these issues a regression was run related lagged changes in spending to the change in residential tax share implied by the instrument. The results suggest that, if anything, the second effect was stronger, as the coefficient was small and negative, but not significantly different from zero. This suggests that communities facing large increases in tax prices did not substantially alter their revenue collections in the year prior to the policy change and, if anything, these places tended to decrease revenues in the year before the policy change. This indicates that the estimate of the price elasticity may be underestimated, in that the true parameter might be even more negative.

Finally, it is possible that cities and townships reacted too strongly to the class rate changes and returned to their equilibrium spending levels in 2002, a year after the policy innovation. This would imply that the regressions are only finding a temporary effect that should not be inferred as any actual response to changes in voter tax shares. That is, the coefficient on voter tax share would tend to be biased towards negative one; the effect of opportunity costs would be overestimated. This possibly was examined by using 2 and 3 year differences around the policy change. Regressions were run using the change in

voter tax shares and property tax revenues from 1999 to 2002 and from 2000 to 2002. The coefficient on voter tax share remains less than negative one in both sets of regressions and is still significantly different from zero at the 1% level.

For an idea of the magnitude of this effect, consider that the mean change in homestead tax share for cities from 2000 to 2001 was 11.75% (see Table II). According to the coefficients above, this would be associated with an almost 12% decrease in local per capita property tax revenue, which represents a decrease of over $20 per capita from the mean level of property tax revenue in 2000. Given the mean population of over $8,000$, this corresponds to a decrease in revenue of over $\$160,000$.

Consider differences in voting tax shares across communities. As Figure 1 demonstrates there is substantial variation in voting tax shares across communities in the sample. For two communities that have the same residential wealth and receive the same amounts in aid, a one standard deviation difference in voting tax shares of 16% would be associated with a 16% decrease in property tax revenues. This represents a $31 decrease in per capita property tax revenues at the mean. Clearly these are effects are economically significant.[45]

At least one last question remains however; Do localities simply replace their lost property tax revenue with other revenue and simply go on with their lives as if nothing happened? It is clear from Tables $VIII$ and IX that property taxes are not the only source of revenues in cities but are considerably more important in townships. To investigate this additional regressions were run using both per capita local expenditure and per capita local total rev-

[45]The regressions above were also estimated with separate intercept and slope terms for townships. Townships do exhibit a lower intercept but there is not enough power to reject the hypothesis that townships and cities have the same price elasticities. Accounting for the different township intercept lowers the price elasticity estimate slightly to approximately -0.90. The point estimates indicate that townships in this sample have a somewhat lower price elasticity than cities, suggesting that townships are less responsive than cities to voter tax share. This could be because townships rely more heavily on the property tax. Additional regressions also do not allow for the rejection of the hypothesis that the composition of non-voter tax base matters for price elasticities. There is little variation, however, in the within community composition of properties owned by non-residents.

enue as dependent variables. These results are presented in Tables XV and XVI. These findings corroborate the results from Table XIV in that the coefficients on voter tax share of around -0.4 and above demonstrate that these cities and towns actually decreased total revenue and total expenditure in response to increases in the voter tax share. The coefficients on voter tax share with total expenditure or total revenue as the dependent variable will be smaller than those with property tax revenue as the dependent variable because property taxes represent only a share of the total revenue that finances expenditures.

The regressions using local revenue and expenditure are the most common regressions used to estimate the demand for local public services. As others have pointed out, however, since the property tax is not the only source of local revenue the voter tax share variable of residential tax share is not entirely appropriate as a price variable unless the property tax is the only marginal revenue instrument. This is because not all local revenue and expenditure is financed by the property tax. When the property tax is the marginal revenue instrument, regressions using total revenue or total expenditure as the dependent variable are appropriate. With the dependent variable as local property tax revenue, however, the residential (i.e., voter tax share) is very much the appropriate price variable as it gives a direct measure of the residential share of that revenue. Future work should focus more on the different results obtained from using each of these dependent variables. Regardless of the dependent variable, however, the same qualitative and quantitative story remains, the composition of the tax base and the level of opportunity cost effects local demand for revenue and expenditure.

6 Conclusion

It was asked earlier if the voters in Grand Rapids would react to the incentives created from their relatively low opportunity costs of property tax revenue. The results above corroborate basic intuition as to how voters might respond to such incentives. In Grand Rapids, and other places with low voter tax shares, a reduction of property taxes by $100 dollars translates into relatively small increases in disposable income since this tax decrease must be spread across all taxpayers, not just voters. Places like Orono, MN, do not need to share tax decreases with non-voters and can increase disposable income by nearly the full amount of a tax decrease. These incentives are shown to be economically powerful, with a one percent increase in voter tax shares associated with a 1% decrease in property tax revenues.

The variation in voter share of tax base in these data offer an excellent opportunity to understand the implications of differing voter tax shares across communities. Differences in the real costs of raising revenue to fund public expenditure occur for many reasons and in a wide variety of communities. For example, Grand Rapids has a small voter tax share because Blandin Paper company decided to locate there over one-hundred years ago. Other historical accidents or even explicit government policies can create differences in voter tax shares across communities. The results above suggest that the distribution of voter tax shares across communities can have substantial effects on the distribution of property tax revenues across communities. The distribution of property tax revenues and thus total revenues and expenditures has important implications for the equity and efficiency of service provision by local governments.

While the implied effects discussed above are certainly powerful, it remains unclear how much actual variation there is voter tax shares across communities in the United States. In

Minnesota there is substantial variation, but much of this is created by the idiosyncratic class rate system. There is, however, still substantial variation across communities in the voter share of market value. Shares of market value would more directly correspond to property tax systems that do not allow differential assessments across property types. Unless the distribution of property types in MN is somehow drastically different that that of other states, substantial variation in the opportunity costs of local property tax revenue are likely to be common. Although these differences might be at least partially capitalized into the prices of homes, these differences in opportunity costs can still lead to inefficiently large expenditures on public services.

A preliminary examination of equity concerns demonstrates that voter tax shares are only very weakly positively correlated with median community income in Minnesota in 1999.[46] It might have been expected that cities with relatively low resident income would be the most likely to encourage the location of non-residential property and thus the reduction of voter tax share. If this were the case, the reduced voter tax share in relatively low income communities might increase equity in property tax revenues by encouraging low income communities to raise revenues similar to those collected in high income communities. These data, however, indicate that this is not the case in Minnesota indicating that many places with similar levels of resident income have drastically different voter tax shares which may contribute to equity concerns.

Most previous work on estimating both the possible effects of tax exporting and the magnitudes of tax price elascities has either focused on estimating demand functions for large cities in the United States or for the educational expenditures of school districts. Will these are certainly important areas on which to focus, attention to other cities and towns is

[46]Median income is at the town/city level as reported in the U.S. Census.

important as well. Furthermore, many of the education focus on narrow geographic regions as an inordinate amount of studies focus on only Michigan and Massachusetts.

It is important to note that previous studies on the price elasticity of educational expenditures may also suffer from the joint determination of expenditures and voter tax shares. This study demonstrates that, at least for municipal revenues and expenditures, that the bias from this joint determination can result in estimates of the price elasticity that are much too low. Of course, preferences regarding education funding may be very different from preferences concerning municipal services. Yet this research suggests that further work is needed to discover the true price effects of voter tax share and tax exporting on educational expenditures across communities.

To the extent that this study provides a particular example of a much broader phenomenon (i.e., tax exporting opportunities arising from tax base composition) these results are relevant not only to small and large communities in Minnesota but to all communities. Furthermore, given the difficultly in establishing any causal results of voter tax shares on local fiscal decisions, this study provides a starting point for estimates of the causal effects of differences in local tax prices and voter tax shares on fiscal policy. Future work on the effects of voter tax shares and tax exporting on fiscal variables must focus on finding variation in these variables that is not caused by variation in the fiscal variables under study.

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Table I:
Components of Variance For Tax Price and Outcomes
(Years With and Without Policy Change)

	Mean squared error in OLS regressions				Ratio	
Dependent variable:	(1)	(2)	(3)	(4)	(2)/(1)	(3)/(4)
tax share	161.97	3.47	181.283	38.556	.02	.21
market share	111.3	.75	113.29	1.49	.02	.01
expenditure	99,227.875	2,270.796	83,067.889	14,373.849	.02	.17
total revenue	101,702.692	2,262.86	84,846.63	14,208.108	.02	.17
tax revenue	5,963.878	195.638	7,856.558	1,120.479	.03	.14
Policy Change	No	No	Yes	Yes	No	Yes
Fixed Effects	No	Yes	No	Yes	-	-

Source: Author's tabulations based on data from the Minnesota Department of Revenue. Policy Change regressions use data from assessment years 2000-2001. Non-Policy Change regressions use data from 1999-2000. The policy changed the percentage of market value that is taxable across various classes of property. Columns (1)-(4) provide the mean squared error from OLS regressions that include no controls and city/town fixed effects. Columns (5)-(6) display the ratio of the mean squared error from the fixed effects regression to the mean squared error in the regression with no controls. These final columns represent the fraction of the overall variance in the dependent variable that is due to within-city/town differences rather than between-city/town differences. The samples in policy change and non-policy change years are identical and consist of 762 cities and towns in Minnesota with population of at least 500 during 1994 through 2002. See text for variable definitions.

Table II:
Local Revenues, Expenditures, and Tax Shares, 2000-2001
Cities
(Standard Deviations in Parentheses)

	Mean			Median
	2000	2001	% Change	% Change
total revenue	844.6	866.88	5.49	1.99
	(370.22)	(401.28)	(33.34)	
property tax revenue	196.39	225.32	16.69	12.92
	(115.04)	(121.44)	(26.31)	
% homestead	59.98	66.3	12.43	11.75
	(16.04)	(14.6)	(8.99)	
homestead market value	27,668.55	30,061.47	7.41	6.39
	(20,332.38)	(22,769.74)	(12.28)	
total aid	302.33	320.65	14.63	7.59
	(242.37)	(290.62)	(83.45)	
non-property local revenue	336.58	330.03	1.53	-5.3
	(212.66)	(218.22)	(33.36)	
tax credits	75.04	68.93	.88	6.49
	(33.8)	(26.14)	(28.2)	
population	8,348.45	8,348.45	0	
	(25,301.79)	(25,301.79)	(0)	
total expenditure	1,011.63	1,058.12	12.94	4.56
	(545.8)	(550.14)	(53.09)	
% residential hstd	59.14	65.37	12.41	11.74
	(15.81)	(14.43)	(8.99)	
residential mkt value	27,024.7	29,381.82	7.45	6.43
	(20,001.07)	(22,389.29)	(11.86)	
commercial-industrial mkt value	5,671.83	6,162.26	8.23	6.43
	(5,092.39)	(5,669.43)	(11.18)	
% commercial-industrial	31.32	24.62	-21.59	-22.91
	(17.17)	(14.29)	(9.34)	
# cities	459	459	459	459

Note: Tabulations based on Minnesota Department of Revenue and Minnesota Auditor's Data. Variables in levels are expressed in per capita terms. Sample is restricted to cities and townships with population not less than 500 in between 1994 and 2002. Standard deviations in parentheses. The columns represent the mean of each variable for 2000 and 2001 as well as the mean percentage change in each variable. Variables: population or number of permanent residents(Pop)in 2000, share of tax base that is derived from homestead properties (% homestead), per-capita market value of homestead properties (hstd mkt value), per capita local revenue, per capita property tax revenue, per capita total city/town expenditures, % residential homestead (subset of homestead property), per capita lump sum aid (Aid) from the two largest state aid programs (LGA and HACA) as well as federal aid, per capita tax credits, per capita other local revenue (e.g., service charges), % of property tax base that is derived from commercial-industrial property. Where appropriate, variables are in 2000 U.S. dollars. The year is the assessment year not the taxes payable year.

Table III:
Local Revenues, Expenditures, and Tax Shares, 2000-2001
Townships
(Standard Deviations in Parentheses)

	Mean			Median
	2000	2001	% Change	% Change
total revenue	235.3	237.62	8.57	-2.02
	(209.08)	(204.43)	(45.08)	
property tax revenue	93.97	122.09	37.81	30.67
	(52.53)	(56.48)	(36.3)	
% homestead	68.89	72.5	6.16	4.66
	(14.6)	(13.55)	(6.51)	
homestead market value	44,839.16	48,211.07	7.49	7.61
	(15,042.16)	(16,216.52)	(3.29)	
total aid	56.43	42.47	-10.16	-23.01
	(66.90)	(56.86)	(66.94)	
non-property local revenue	27.96	33.05	99.93	-9.20
	(45.92)	(82.04)	(812.73)	
tax credits	119.79	93.710	-18.24	-20.47
	(39.65)	(28.39)	(19.07)	
population	1,393.47	1,393.47	0	
	(1,117.78)	(1,117.78)	(0)	
total expenditure	227.88	220.47	8.43	-4.33
	(206.8)	(188.3)	(67.38)	
% residential hstd	46.62	47.85	3.4	1.81
	(17.24)	(17.17)	(7.28)	
residential mkt value	25,760.81	28,055.36	8.91	8.67
	(11,128.49)	(12,190.5)	(4.48)	
commercial-industrial mkt value	1,737.28	1,958.04	16.45	10.69
	(1,909.49)	(2,164.23)	(23.71)	
% commercial-industrial	6.66	5.4	-17.78	-21.44
	(6.25)	(5.29)	(17.38)	
# townships	303	303	303	303

Note: Tabulations based on Minnesota Department of Revenue and Minnesota Auditor's Data. Variables in levels are expressed in per capita terms. Sample is restricted to cities and townships with population not less than 500 in between 1994 and 2002. Standard deviations in parentheses. The columns represent the mean of each variable for 2000 and 2001 as well as the mean percentage change in each variable. Variables: population or number of permanent residents(Pop)in 2000, share of tax base that is derived from homestead properties (% homestead), per-capita market value of homestead properties (hstd mkt value), per capita local revenue, per capita property tax revenue, per capita total city/town expenditures, % residential homestead (subset of homestead property), per capita lump sum aid (Aid) from the two largest state aid programs (LGA and HACA) as well as federal aid, per capita tax credits, per capita other local revenue (e.g., service charges), % of property tax base that is derived from commercial-industrial property. Where appropriate, variables are in 2000 U.S. dollars. The year is the assessment year not the taxes payable year.

Table IV:
Policy Change and Heterogeneous Treatment
High and Low Concentrations of Commercial-Industrial Property, 2000

Name	Pop	Hstd %	implied $\%\Delta Hstd\%$	C-I %	HSTD MV	C-I MV	τ	Rev	Aid
OAK GROVE CITY OF	6903	88.11	.86	2.1	152065.78	516.16	28.02	185.55	59.16
ORONO CITY OF	7538	83.60	.3	5.02	370931.66	3744.02	13.33	309.22	222.67
SHOREWOOD CITY OF	7400	87.36	.4	5.66	277681.97	2752	18.68	280.05	407.42
BIG LAKE TOWN OF	6785	85.13	.86	6.08	162857.77	1383.71	11.98	77.41	28.55
ANDOVER CITY OF	26588	85.52	1.68	6.27	154885.56	1420.95	21.91	141.74	60.17
MARION TOWN OF	6159	85.39	2.24	6.59	119809.2	1202.57	12.41	62.68	22.11
OTSEGO CITY OF	6389	83.16	1.93	7.42	136029.66	1268.71	25.96	133.65	65.09
EAST BETHEL CITY OF	10941	82.01	2.08	7.48	131515.44	1557.53	21.95	122.18	54.3
MAHTOMEDI CITY OF	7563	83.3	.6	7.68	187965.84	2271.98	21.6	184.83	79
MOUND CITY OF	9435	80.3	1.23	8.1	150141.42	2311.4	17.21	141.16	153.35
MANKATO CITY OF	32427	28.19	22.4	51.6	98175.91	11940.32	32.27	222.58	393.91
FRIDLEY CITY OF	27449	34.18	18.78	51.77	113714.13	17092.79	15.96	126.72	142.29
BEMIDJI CITY OF	11917	25.64	29.83	51.99	60149.1	7942.08	31.64	137.44	520.64
MAPLEWOOD CITY OF	34947	37.61	16.01	52.72	128731.35	19100.08	19.43	193.87	87.63
ARDEN HILLS CITY OF	9652	40.66	12.18	53.98	171619.67	22749.96	16.74	185.4	36.42
ROSEVILLE CITY OF	33690	34.78	15.56	54.57	134773.84	24457.93	18.02	179.92	170.29
ALEXANDRIA CITY OF	8820	25.25	25.49	57.35	89093.39	16092.36	21.03	175.43	256.35
BLOOMINGTON CITY OF	85172	32.77	15.09	57.68	148797.56	31238.05	21.01	272.97	202.15
GRAND RAPIDS CITY OF	7764	28.94	27.7	59.3	74935.31	15153.95	54.83	383.44	437.2
INTL FALLS CITY OF	6703	26.85	36.45	60.23	49667.5	11493.75	38.19	230.76	703.86
WAITE PARK CITY OF	6568	15.61	31.94	64.27	86115.27	22397.45	37.1	341.85	224.28

Source: Author's tabulations based on Minnesota Department of Revenue and Minnesota Auditor's Data

Table contains the towns and cities in Minnesota with the lowest and highest concentrations of commercial-industrial property (minimum 1% concentration of C-I property) in years 1994-2002 with population at least 5,000. Variables: population or number of permanent residents(Pop), share of tax base that is derived from homestead properties (% homestead), the change in the share of the tax base derived from homestead properties implied by the policy change (implied $\%\Delta Hstd\%$, percent of tax base derived from commercial-industrial property (C-I %), per-capita market value of homestead properties (hstd mkt value), per-capita market value of commercial-industrial property, statutory city/town tax rate for the city or town, per capita local property tax revenue (Revenue), per capita lump sum aid (Aid) from the two largest state aid programs (LGA and HACA) as well as federal aid. Where appropriate, variables are in 2000 U.S. dollars. The year is the assessment year not the taxes payable year.

Table V:
Average Composition of Non-homestead Property in Tax Base, 2000-2001
(Standard Deviations in Parentheses)

Cities

	Means		
Revenue Source	2000	2001	% Change
commercial	45.81%	47.22%	4.02%
	(15.84)	(15.93)	(9.99)
industrial	14.54	14.25	-0.86
	(15.19)	(15.05)	(19.81)
commercial-industrial	60.35	61.47	2.35
	(16.55)	(16.78)	(8.96)
vacation homes	1.82	2.06	33.06
	(8.15)	(8.67)	(66.87)
apartments	11.26	15.02	37.09
	(7.55)	(9.58)	(26.54)
residential non-hstd	11.02	15.81	45.7
	(8.56)	(11.9)	(27.5)
public utilities	2.9	2.74	-3.5
	(8.57)	(8.38)	(48.7)
agricultural	1.29	1.72	77.04
	(2.98)	(3.85)	(478.45)
# cities	459	459	459

Townships

	Means		
	2000	2001	% Change
commercial	17.92%	19.15%	10.72%
	(13.25)	(14.15)	(32.79)
industrial	3.44	3.41	3.82
	(8.30)	(8.22)	(41.56)
commercial-industrial	21.36	22.55	7.24
	(15.23)	(16.24)	(23.84)
vacation homes	18.74	21.8	35.84
	(24.84)	(27.48)	(85.53)
apartments	0.75	1.06	47.82
	(1.53)	(2.23)	(50.92)
residential non-hstd	12.51	17.19	38.2
	(7.94)	(11.78)	(33.15)
public utilities	5.07	4.7	-6.07
	(10.49)	(9.91)	(52.07)
agricultural	22.76	29.2	33.12
	(21.79)	(26.54)	(30.33)
#townships	303	303	303

Source: Author's tabulations based on Minnesota Department of Revenue and Minnesota Auditor's Data

The year is the assessment year, which is the year prior to the year in which taxes are payable. The sample contains all communities (cities and townships) within Minnesota that have not had population below 500 since 1994 and have at least one percent of their tax base derived from commercial or industrial property. Each entry represents the percent of total non-homestead tax base derived from each type of property.

Table VI:
Average Composition of Revenue for Cities, 2000-2001
Sample Statistics
(Standard Deviations in Parentheses)

Cities			
	Means		
Revenue Source	2000	2001	% Change
Local Taxes	.3	.3	5.01
	(.14)	(.16)	(49.96)
-Property Taxes	.2	.2	7.43
	(.1)	(.12)	(53.35)
-Other Taxes	.06	.05	6.96
	(.06)	(.05)	(105.97)
-TIF	.03	.02	-4.41
	(.04)	(.03)	(105.54)
-Special Assessments	.04	.05	368.65
	(.05)	(.05)	(7,258.52)
-Licenses	.02	.02	22.08
	(.03)	(.03)	(99.01)
Total Aid	.27	.27	9.63
	(.15)	(.16)	(60.03)
Service Charges	.08	.08	17.95
	(.06)	(.06)	(103.61)
Miscellenous	.15	.14	26.32
	(.08)	(.08)	(487.85)
Financing Sources	.25	.26	155.37
	(.18)	(.18)	(1,128.25)
-Investment Revenue	.01	.01	126.27
	(.07)	(.06)	(2,741.96)
-Bond Sales	.12	.13	27.71
	(.16)	(.17)	(236.25)
#cities	459	459	459

Source: Author's tabulations based on Minnesota Department of Revenue and Minnesota Auditor's Data

Where appropriate, variables are in 2000 U.S. dollars. The year is the assessment year, which is the year prior to the year in which taxes are payable. The sample contains all communities (cities and townships) within Minnesota that have not had population below 500 since 1994 and have at least one percent of their tax base derived from commercial or industrial property. Variables that are indented indicate that these sources of revenue are a component of the non-indented revenue source directly above them. For example, investment revenue is a component of financing sources, as is bond sales. Each entry represents the average share (across cities and towns) of total revenue that is derived from each category. Numbers will not add to one because these are average shares across communities.

Table VII:
Average Composition of Revenue for Townships, 2000-2001
Sample Statistics
(Standard Deviations in Parentheses)

Townships			
	Means		
Revenue Source	2000	2001	% Change
Local Taxes	.49	.56	26.01
	(.18)	(.19)	(51.74)
-Property Taxes	.48	.55	26.03
	(.17)	(.19)	(52.27)
-Licenses and Permits	.01	.01	113.21
	(.03)	(.04)	(1,604.11)
Total Aid	.26	.2	-12.66
	(.14)	(.12)	(54.32)
Service Charges	.02	.02	472.1
	(.04)	(.05)	(3,587.08)
Miscellenous	.08	.07	101.31
	(.08)	(.09)	(779.67)
Financing Sources	.15	.14	29.34
	(.19)	(.19)	(349.32)
-Investment Revenue	.09	.09	13.36
	(.16)	(.16)	(310.87)
-Bond Sales	.03	.04	-6.56
	(.09)	(.11)	(36.14)
# townships	303	303	303

Source: Author's tabulations based on Minnesota Department of Revenue and Minnesota Auditor's Data

Where appropriate, variables are in 2000 U.S. dollars. The year is the assessment year, which is the year prior to the year in which taxes are payable. The sample contains all communities (cities and townships) within Minnesota that have not had population below 500 since 1994 and have at least one percent of their tax base derived from commercial or industrial property. Variables that are indented indicate that these sources of revenue are a component of the non-indented revenue source directly above them. For example, investment revenue is a component of financing sources, as is bond sales.

Table VIII:
Average Composition of Discretionary Revenue for Cities, 2000-2001
(Standard Deviations in Parentheses)

	Means			Medians		
Revenue Source	2000	2001	% Change	2000	2001	% Change
All local taxes	.39	.38	7.03	.39	.37	-3.5
	(.15)	(.17)	(57.17)			
-property taxes	.26	.26	9.94	.23	.23	.9
	(.13)	(.14)	(62.12)			
-other tax revenue	.08	.07	9.95	.06	.05	-13.57
	(.07)	(.06)	(113.53)			
Interest Earnings and Other (misc)	.2	.18	18.5	.18	.17	-9.73
	(.1)	(.1)	(296.34)			
Service Charges	.11	.1	21.03	.09	.08	-2.49
	(.08)	(.07)	(115.35)			
Financial revenue	.31	.33	127.09	.29	.31	3.15
	(.21)	(.21)	(704.88)			
-bond revenue	.14	.16	47	.03	.09	-42.04
	(.19)	(.19)	(319.65)			
-investment sales	.02	.02	2,125.35	0	0	-29.15
	(.09)	(.08)	(11,593.09)			
-fund transfers	.14	.15	87.77	.11	.12	-2.3
	(.12)	(.12)	(638.84)			
# cities	459	459	459	459	459	459

Source: Author's tabulations based on Minnesota Department of Revenue and Minnesota Auditor's Data

An entry represents the average share, across cities, of own-source revenue that is derived from a particular revenue source. The year is the assessment year, which is the year prior to the year in which taxes are payable. The sample contains all communities (cities and townships) within Minnesota that have not had population below 500 since 1994 and have at least one percent of their tax base derived from commercial or industrial property. Variables that are indented indicate that these sources of revenue are a component of the non-indented revenue source directly above them. For example, investment revenue is a component of financing sources, as is bond sales.

Table IX:
Average Composition of Discretionary Revenue for Townships, 2000-2001
(Standard Deviations in Parentheses)

	Means			Medians		
Revenue Source	2000	2001	% Change	2000	2001	% Change
All local taxes	.68	.72	15.67	.73	.79	4.69
	(.24)	(.24)	(48.98)			
-property taxes	.66	.70	15.73	.72	.77	4.99
	(.24)	(.24)	(49.68)			
-other tax revenue	.01	.01	181.84	0	0	-9.49
	(.04)	(.04)	(2,225.12)			
Int. Earnings, Spec. Assess (misc.)	.11	.09	74.64	.07	.05	-21.59
	(.1)	(.1)	(566.02)			
Service Charges	.02	.02	637.96	0	0	-21.61
	(.05)	(.06)	(3,875.01)			
Financial revenue	.19	.17	37.38	.08	.02	-39.91
	(.23)	(.22)	(410.04)			
-bond revenue	.04	.04	-52.04	0	0	-100
	(.11)	(.13)	(80.97)			
-investment sales	.12	.1	31.61	0	0	-66.35
	(.2)	(.19)	(508.84)			
-fund transfers	.03	.02	-35.13	0	0	-63.56
	(.1)	(.07)	(100.26)			
# townships	303	303	303	303	303	303

Source: Author's tabulations based on Minnesota Department of Revenue and Minnesota Auditor's Data

An entry represents the average share, across townships, of own-source revenue that is derived from a particular revenue source. Where appropriate, variables are in 2000 U.S. dollars. The year is the assessment year, which is the year prior to the year in which taxes are payable. The sample contains all communities (cities and townships) within Minnesota that have not had population below 500 since 1994 and have at least one percent of their tax base derived from commercial or industrial property. Variables that are indented indicate that these sources of revenue are a component of the non-indented revenue source directly above them. For example, investment revenue is a component of financing sources, as is bond sales.

Table X:
Average Composition of Expenditure for Cities, 2000-2001
(Standard Deviations in Parentheses)

	Means			Median
Expenditure Type	2000	2001	% Change	% Change
general government	.15	.15	8.81	-1.06
	(.09)	(.09)	(53.7)	
public safety	.2	.2	10.58	2.92
	(.09)	(.09)	(50.88)	
streets and highways	.24	.23	15.56	-2.86
	(.13)	(.12)	(85)	
sanitation (excludes sewer)	.01	.01	.42	0
	(.02)	(.02)	(54.82)	
health	0	0	11.55	0
	(.01)	(.02)	(221.65)	
culture	.09	.09	31.36	0
	(.07)	(.08)	(153.15)	
housing and econ development	.08	.07	829.22	0
	(.1)	(.1)	(13,238.13)	
miscellaneous expenditures	.07	.06	761.71	0
	(.11)	(.1)	(11,726.03)	
debt service	.16	.17	44.12	0
	(.12)	(.13)	(497.74)	
# cities	459	459	459	459

Source: Author's tabulations based on Minnesota Department of Revenue and Minnesota Auditor's Data

An entry represents the average share, across townships, of total expenditure that is derived from a particular type of expenditure. The year is the assessment year, which is the year prior to the year in which taxes are payable. The sample contains all communities (cities and townships) within Minnesota that have not had population below 500 since 1994 and have at least one percent of their tax base derived from commercial or industrial property.

Table XI:
Average Composition of Expenditure for Townships, 2000-2001
(Standard Deviations in Parentheses)

	Means			Median
Expenditure Type	2000	2001	% Change	% Change
general government	.18	.22	47.05	20.1
	(.11)	(.12)	(127.82)	
public safety (fire)	.13	.13	62.17	6.14
	(.09)	(.09)	(552.11)	
road and bridge	.55	.51	-1.21	-6.49
	(.19)	(.19)	(42)	
water and sewer	.01	.01	-4.4	0
	(.06)	(.04)	(19.03)	
miscellaneous expenditures	.05	.04	72.31	0
	(.09)	(.07)	(463.95)	
debt service	.04	.05	45.16	0
	(.1)	(.1)	(587.37)	
observations	303	303	303	303

Source: Author's tabulations based on Minnesota Department of Revenue and Minnesota Auditor's Data

An entry represents the average share, across townships, of total expenditure that is derived from a particular type of expenditure. The year is the assessment year, which is the year prior to the year in which taxes are payable. The sample contains all communities (cities and townships) within Minnesota that have not had population below 500 since 1994 and have at least one percent of their tax base derived from commercial or industrial property.

Table XII:
Minnesota Class Rate Changes
(share of market value that is taxable)

	Assessment Year			
Class of Property	1999	2000	2001	2002
Commercial-Industrial Land and Buildings				
to $150K	2.40%	2.40%	1.50%	1.50%
Over $150K	3.40%	3.40%	2.00%	2.00%
Residential Homestead*				
to $76K	1.00%	1.00%	1.00%	1.00%
$76K to $500K	1.65%	1.65%	1.00%	1.00%
Over $500K	1.65%	1.65%	1.25%	1.25%
Apartments (Non-Homestead)				
all values	2.40%	2.40%	1.80%	1.50%
Non-Commercial Seasonal Recreational				
to $76K	1.20%	1.00%	1.00%	1.00%
$76K to $500K	1.65%	1.65%	1.00%	1.00%
Over $500K	1.65%	1.65%	1.25%	1.25%
Agricultural Homestead (House, Garage, and 1 Acre)*				
To $76K	1.00%	1.00%	1.00%	1.00%
$76K to $500K	1.65%	1.65%	1.00%	1.00%
Over $500K	1.65%	1.65%	1.25%	1.25%
Agricultural Homestead Land*				
to $115K	0.35%	0.35%	0.55%	0.55%
$115K to $600K	0.80%	0.80%	0.55%	0.55%
Over $600K	1.20%	1.20%	1.00%	1.00%
Public Utility Land and Buildings				
To $150K	2.40%	2.40%	1.50%	1.50%
over $150K	3.40%	3.40%	2.00%	2.00%
Machinery				
all values	3.40%	3.40%	2.00%	2.00%
Timberlands				
all values	1.20%	1.20%	1.00%	1.00%
Commercial Seasonal Recreational (No Homestead)				
To $500K	1.65%	1.65%	1.00%	1.00%
Over $500K	1.65%	1.65%	1.25%	1.25%
Residential Non-Homestead (Single Unit)				
To $76K	1.20%	1.20%	1.00%	1.00%
$76K to $500K	1.65%	1.65%	1.00%	1.00%
Over $500K	1.65%	1.65%	1.25%	1.25%
Manufactured Home Park Land				
all values	1.65%	1.65%	1.50%	1.25%

Source: Minnesota Department of Revenue

Class rates increase with the market value of a property. The class rate applies only to that portion of the property's market value that is within the stated limit. For example, if a commercial property had a market value of $\$200,000$ in 2000, its taxable value would be $TV = .024 \cdot 150,000 + .034 \cdot 50,000$. The product of a property's class rate and market value is its taxable value. Class rates on the first $150K of commercial-industrial market value decreased by 37.5% in 2001 and the rate on the each additional dollar of market value fell by over 40%. Property tax payments equal the product of a property's taxable value and the local property tax rate. The Minnesota state legislature sets class rates each year. The class rate change occurred after market values, for tax purposes, were already fixed for 2001.

Table XIII:
First Stage Results: Actual vs. Implied Changes in Voter Tax Share
(Standard Errors in Parentheses)

dependent variable: actual %Δ Res Share	(1)	(2)
Implied %Δ Residential Share	.913	.936
	(.038)	(.041)
per capita hstd mkt value		.164
		(.024)
per capita total aid		0
		(.002)
per capita other local revenue		-.001
		(.001)
N	762	762
R^2	.80	.82

Note: Standard errors are in parentheses. The table shows results from a first differences regression of the actual percentage change in residential tax share on the percentage change in residential tax share implied by the policy innovation. The policy innovation altered the percentage of market value that is taxable for several classes of properties and thus altered the composition of the tax base in all communities. All coefficients represent elasticities. The instrument for homestead tax share is the change in homestead share caused only by a policy change in Minnesota that decreased the class rates of commercial-industrial properties.

Sample is restricted to cities and townships in Minnesota with the percent of total tax base derived from commercial and industrial property greater than one and with population greater than 500 during 1994-2002. Variables indicating percentages of total tax base (i.e. tax share) express the amount of tax base that is homestead property per $100 of total tax base. Where appropriate, variables are in 2000 U.S. dollars. All variables are first differenced.

Table XIV:

Effect of Voter Tax Shares on Local Property Tax Revenue, 2000-2001
(Standard Errors in Parentheses)

	OLS	OLS	FD	FD	FD IV	FD IV	2D RT
Dependent variable: per capita prop tax revenue	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Voter Tax Share	-.56	-.495	-1.079	-.991	-1.422	-1.172	-1.041
	(.055)	(.047)	(.165)	(.129)	(.143)	(.144)	(.137)
market value of homesteads		.504		.68		.69	.847
		(.033)		(.123)		(.148)	(.094)
total lump sum aid		.188		-.068		-.062	-.034
		(.021)		(.017)		(.017)	(.012)
local non-property revenue		.154		.005		.005	.018
		(.01)		(.016)		(.016)	(.011)
First difference	No	No	Yes	Yes	Yes	Yes	No
Instrument	No	No	No	No	Yes	Yes	No
City/Town specific trend	No	No	No	No	No	No	Yes
N	1524	1524	762	762	762	762	751
R^2	.09	.50	.11	.16	-	-	.16

Note: Standard errors are in parentheses. The table shows results from cross section and first difference regressions of per capita local property tax revenue on homestead tax share. All variables are in logs so that the coefficients represent elasticities. Columns (1) and (2) report results using OLS on the pooled cross section. Columns (3) and (4) use first differences and columns (5) and (6) use first differences with the instrumental variable. The instrument for homestead tax share is the change in homestead share caused only by a policy change in Minnesota that decreased the class rates of commercial-industrial properties. Column (7) allows for a city/town specific linear trend (random trends model).

Sample is restricted to cities and townships in Minnesota with the percent of total tax base derived from commercial and industrial property greater than one and population > 500 in all years 1994-2002. Variables indicating percentages of total tax base (i.e., tax share) express the amount of tax base that is homestead property per $100 of total tax base. Where appropriate, variables are in 2000 U.S. dollars.

Table XV:
Effect of Voter Tax Share on Total Local Revenue, 2000-2001
(Standard Errors in Parentheses)

	OLS	OLS	FD	FD	FD IV	FD IV	RT
Dependent variable: per capita local revenue	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Voter Tax Share	-.978	-.331	-.062	-.501	-.077	-.591	-.486
	.073	(.034)	.123	(.106)	.145	(.124)	(.166)
market value homesteads		.306		.262		.266	.733
		(.022)		(.092)		(.092)	(.166)
total aid		.367		.267		.27	.289
		(.016)		(.026)		(.026)	(.023)
other local revenue		.282		.133		.133	.148
		(.009)		(.019)		(.019)	(.023)
First difference	No	No	Yes	Yes	Yes	Yes	No
Instrument	No	No	No	No	Yes	Yes	No
City/Town specific trend	No	No	No	No	No	No	Yes
N	1524	1524	762	762	762	762	751
R^2	.13	.89	.01	.34	-	-	.36

Note: Standard errors are in parentheses. The table shows results from cross section and first difference regressions of per capita local revenue on homestead tax share. All variables are in logs so that the coefficients represent elasticities. Columns (1) and (2) report results using OLS on the pooled cross section. Columns (3) and (4) use first differences and columns (5) and (6) use first differences with the instrumental variable. The instrument for homestead tax share is the change in homestead share caused only by a policy change in Minnesota that decreased the class rates of commercial-industrial properties. Column seven uses three years of data (1999-2001) and includes a city/town specific linear trend (random trends model).

Sample is restricted to cities and townships in Minnesota with the percent of total tax base derived from commercial and industrial property greater than one in 2000 and 2001 and population $>$ 500 in the years 1994-2002. Variables indicating percentages of total tax base (i.e. tax share) express the amount of tax base that is homestead property per $100 of total tax base. Where appropriate, variables are in 2000 U.S. dollars.

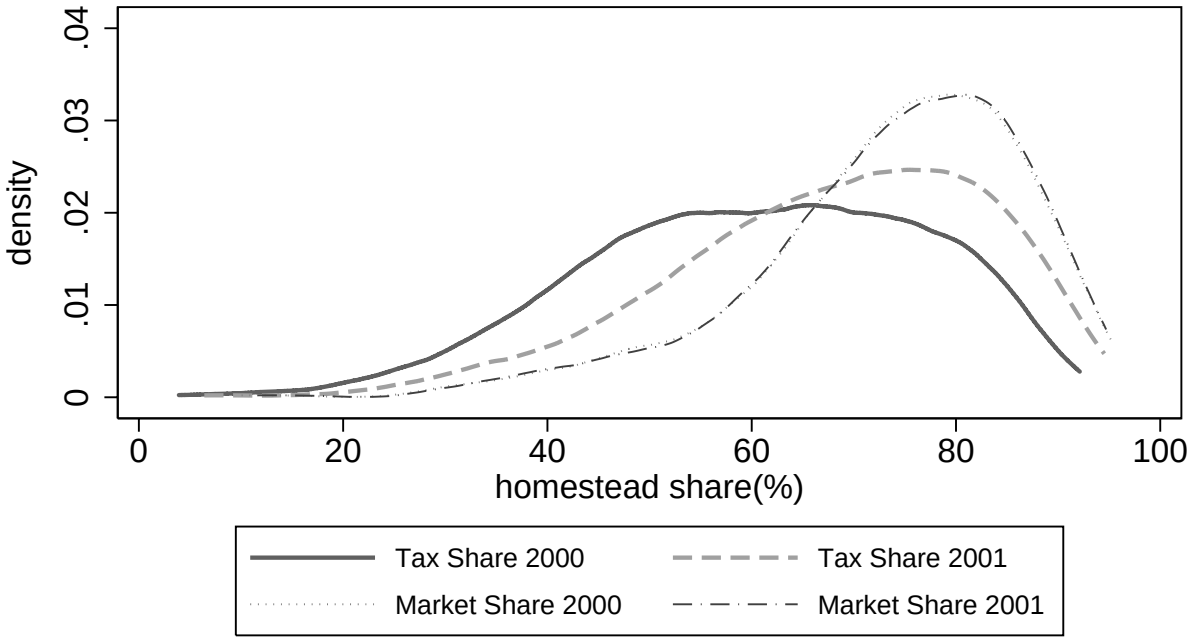
Table XVI:
Effect of Voter Tax Share on Local Expenditure, 2000-2001
(Standard Errors in Parentheses)

	OLS	OLS	FD	FD	FD IV	FD IV	RT
Dependent variable: per capita local expenditure	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Tax Share	-1.068	-.308	-.226	-.548	-.081	-.428	-.709
	(.086)	(.036)	(.176)	(.171)	(.203)	(.191)	(.282)
market value homestead		.282		.28		.274	.717
		(.027)		(.157)		(.157)	(.236)
total aid		.393		.195		.191	.237
		(.018)		(.033)		(.033)	(.037)
local non-property revenue		.319		.095		.095	.102
		(.01)		(.024)		(.023)	(.032)
First difference	No	No	Yes	Yes	Yes	Yes	No
Instrument	No	No	No	No	Yes	Yes	No
City/Town specific trend	No	No	No	No	No	No	Yes
N	1524	1524	762	762	762	762	751
R^2	.12	.86	.01	.095	-	-	.12

Note: Standard errors are in parentheses. The table shows results from cross section and first difference regressions of per capita local expenditure on homestead tax share. All variables are in logs so that the coefficients represent elasticities. Columns (1) and (2) report results using OLS on the pooled cross section. Columns (3) and (4) use first differences and columns (5) and (6) use first differences with the instrumental variable. The instrument for homestead tax share is the change in homestead share caused only by a policy change in Minnesota that decreased the class rates of commercial-industrial properties. Column (7) allows for a city/town specific linear trend (random trends model).

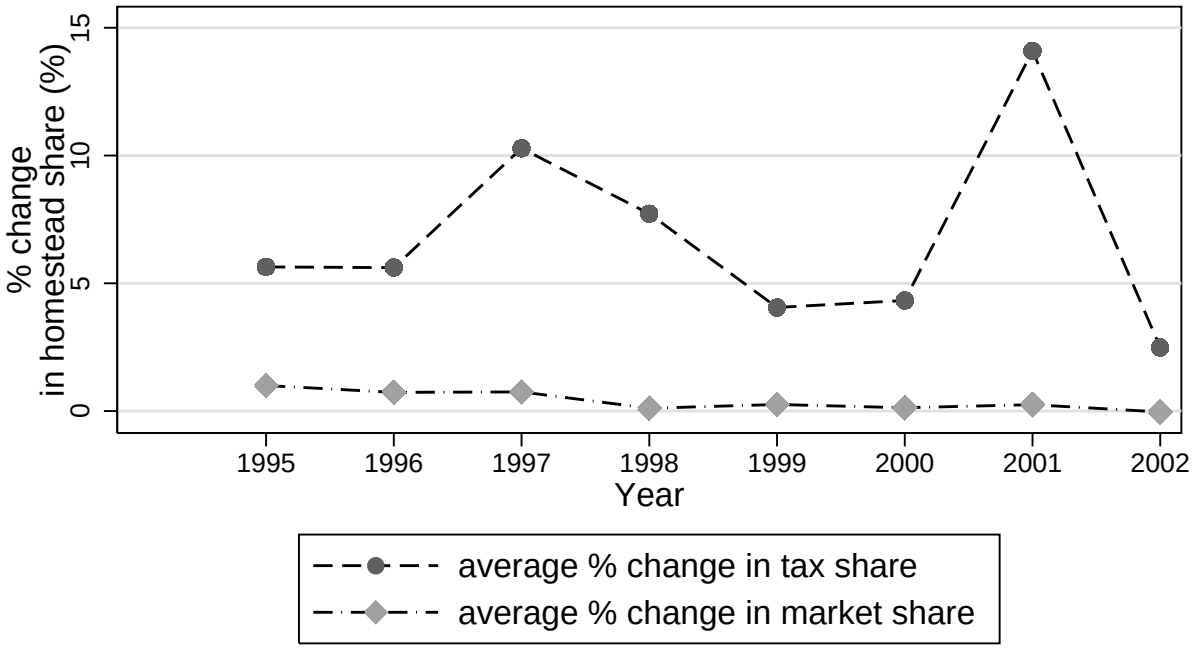
Sample is restricted to cities and townships in Minnesota with the percent of total tax base derived from commercial and industrial property greater than one and population always greater than 500 during 1994-2002. Variables indicating percentages of total tax base (i.e., tax share) express the amount of tax base that is homestead property per $100 of total tax base. Where appropriate, variables are in 2000 U.S. dollars.

Figure 1
Voter Tax Share vs. Voter Market Share
2000−2001



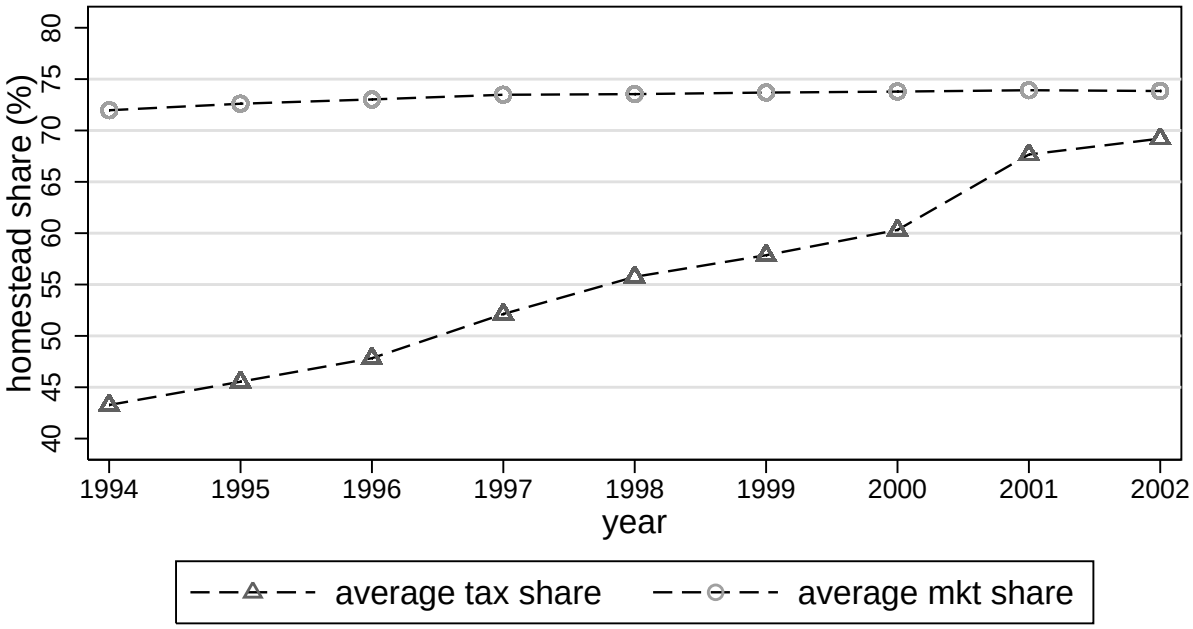
Note: Sample contains 762 cities and townships in Minnesota with a minimum population of 500 in the years 1994 through 2002.
Kernel: Epanechnikov, kernel half−width=4.
Source: Author's tabulations based on Minnesota Department of Revenue data.
Tax Share: percentage of tax base derived from homestead property.
Market Share: percentage of estimated market value derived from homestead property.
Market share differs from tax share only because of state−wide institutional factors

Figure 2
Average Changes in Voter Tax and Market Shares
1995−2002



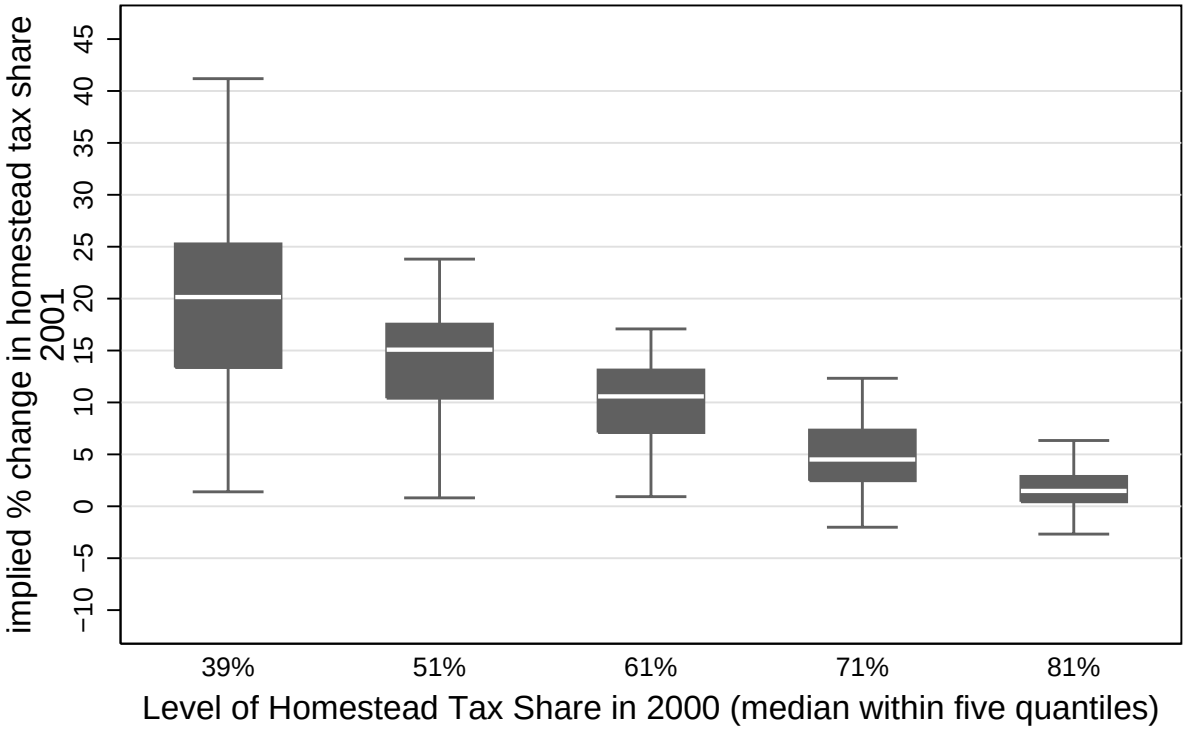
Source: Author's tabulations using Minnesota Department of Revenue data.
Homestead Tax Share: percentage of total tax base that is derived from homestead property.
Homestead Market Share: percentage of total market value in a city/town derived from homestead property.
Year is the year in which property are assessed to be used for taxes payable the following year.
Sample contains 762 cities and townships in Minnesota with a minimum population of 500 in the years 1994 through 2002.

Figure 3
Average Voter Tax Shares and Market Shares
1994−2002



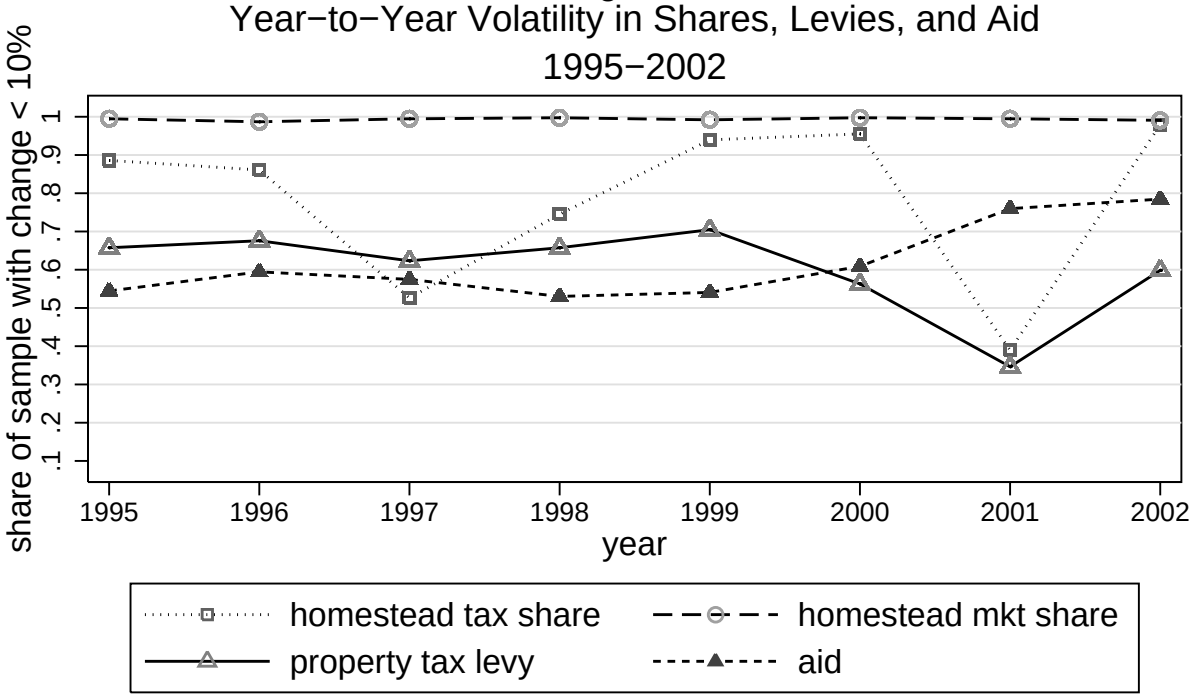
Source: Author's tabulations using Minnesota Department of Revenue data.
Homestead Tax Share: percentage of total tax base that is derived from homestead property.
Homestead Market Share: percentage of total market value in a city/town derived from homestead property.
Year is the year in which property are assessed to be used for taxes payable the following year.
Sample contains 762 cities and townships in Minnesota with a minimum population of 500 in the years 1994 through 2002.
Market share differs from tax share only because of state−wide institutional factors

Figure 4
Implied Magnitudes of Policy Change: Heterogeneous Treatment



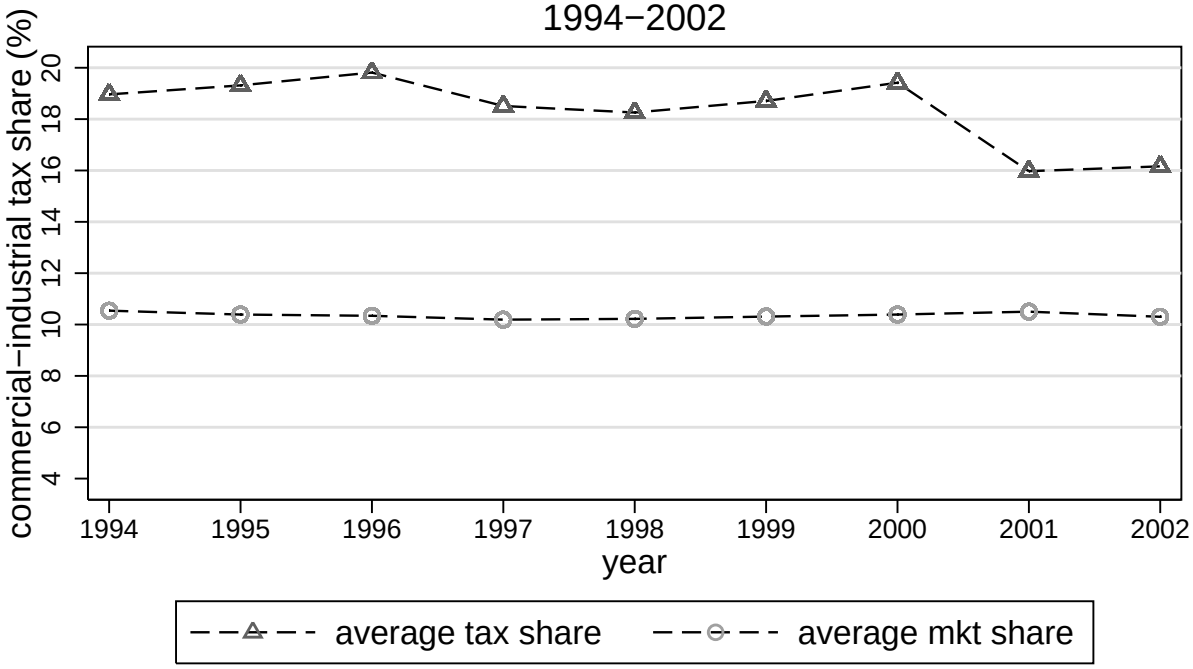
Sample contains 762 cities and townships in Minnesota with a minimum population of 500 in the years 1994 through 2002.
Homestead Tax Share: percentage of total tax base derived from homestead property.
Implied change is the effect of the 2001 class rate change, holding all market values constant.
Source: Author's tabulations using Minnesota Department of Revenue data.
Shaded area represents the inter−quartile range with the middle bar representing the median.

Figure 5
Year−to−Year Volatility in Shares, Levies, and Aid
1995−2002



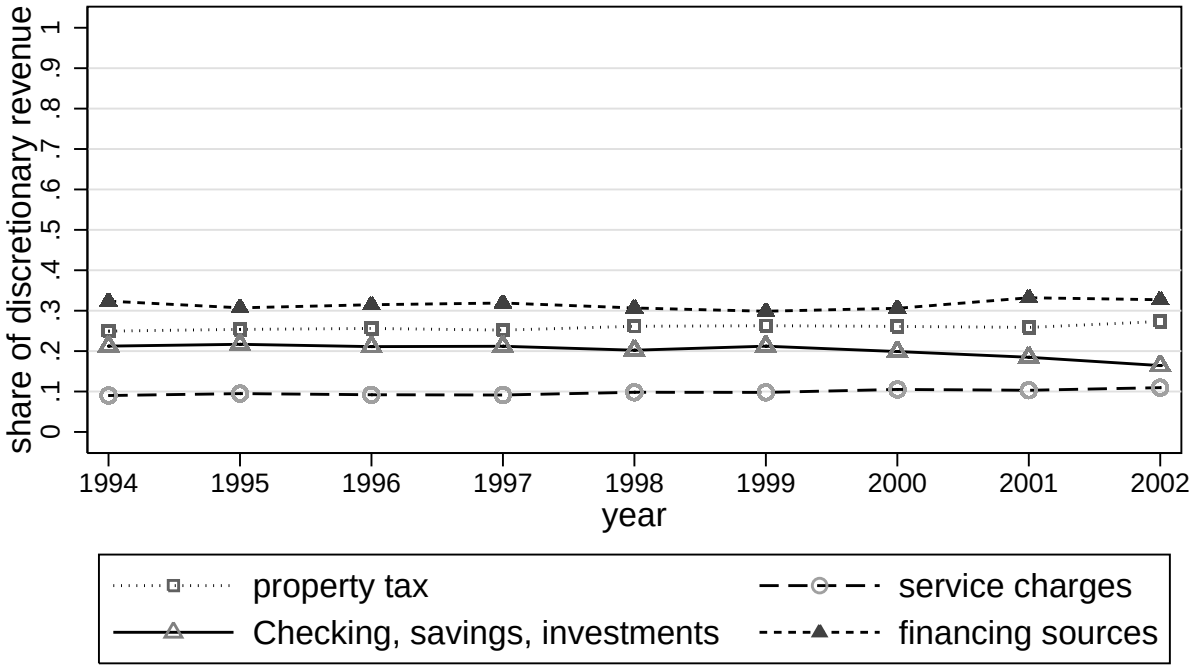
Sample contains 762 cities and townships in Minnesota with a minimum population of 500 in the years 1994 through 2002.
Year is the year in which property are assessed to be used for taxes payable the following year.
Source: Author's tabulations using Minnesota Department of Revenue data.
Homestead Tax Share: percentage of total tax base derived from homestead property.
Homestead Market Share: percentage of total market value derived from homestead property.
Property tax levy in (assessment year) 2000 is the declared revenue collections for (taxes payable year) 2001.
Changes less than 10% are changes in a variable that are less than 10% in absolute value.

Figure 6
Average Commercial−Industrial Tax Shares & Market Shares
1994−2002



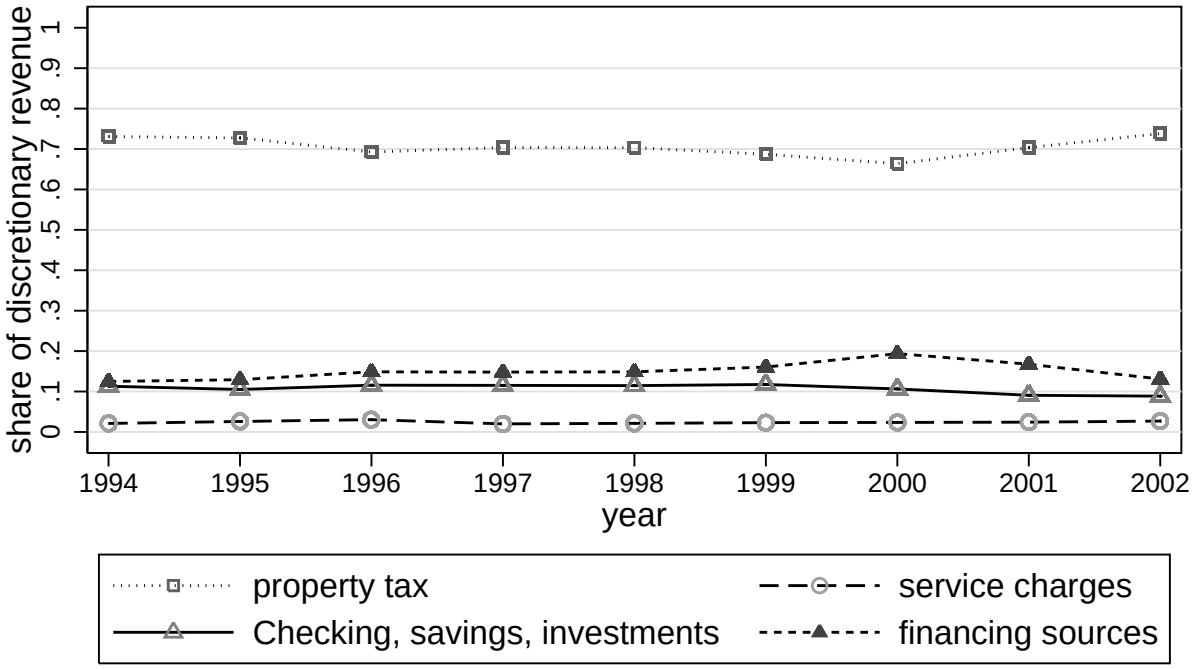
Source: Author's tabulations using Minnesota Department of Revenue data.
Commercial−Industrial Tax Share: percentage of total tax base that is derived from commercial−industrial property.
Commercial−Industrial Market Share: percentage of total market value derived from commercial−industrial property.
Year is the year in which property are assessed to be used for taxes payable the following year.
Sample contains 762 cities and townships in Minnesota with a minimum population of 500 in the years 1994 through 2002.
Market share differs from tax share only because of state−wide institutional factors

Figure 7
Average Discretionary Revenue Shares Across Cities
1994−2002



Sample contains 762 cities and townships in Minnesota with a minimum population of 500 in the years 1994 through 2002.
Year is the year in which property are assessed to be used for taxes payable the following year.
Source: Author's tabulations using Minnesota Department of Revenue data.
Shares represent the share of own−source revenue derived from each revenue source. Own−source revenue excludes aid.

Figure 8
Average Discretionary Revenue Shares Across Townships
1994−2002



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