2014

The Parcel Tax as a Local Revenue Source for California Public Schools

Bree J. Lang
Xavier University - Cincinnati

The Parcel Tax as a Source of Local Revenue for California Public Schools

Bree Lang[a] and Jon Sonstelie[b]

February 2014

[a]Williams College of Business
Xavier University
3800 Victory Parkway
Cincinnati, Ohio 45207
USA
langb1@xavier.edu

[b]Department of Economics
University of California, Santa Barbara
Santa Barbara, CA 93106-9210
USA\
jon@econ.ucsb.edu
1-805-893-2242

1. Introduction

California's school finance system is an experiment in fiscal federalism. Due to court rulings and a voter initiative, the financing of California public schools has shifted from mainly a local responsibility to almost entirely a state responsibility. The last vestige of local finance is the parcel tax, which is typically a fixed amount per parcel of land. To levy this tax, school districts must secure support from at least two-thirds of their voters. About 10% of California districts have passed that threshold.

This paper explores the use of the parcel tax by California school districts. To do so, we employ a standard model of local demand for school spending to estimate the probability that a district levies a parcel tax. This approach yields estimates of price and income elasticities that are similar to estimates from other studies. The parcel tax appears to be a logical reaction to differences across districts in the demand for school spending. The system of state finance does not recognize those differences, and the parcel tax fills the void between the spending desired by local residents and the revenues provided by the state.

We also find that, holding tax-price, income, and other characteristics constant, school districts in the San Francisco Bay Area are much more likely to levy a parcel tax than other districts. Sixty-two percent of Bay Area districts levy a parcel tax, compared to four percent of districts in the rest of the state. This difference is partly explained by variables included in our model. Bay Area households have higher income on average, and household income is positively correlated with support for the parcel tax. However, differences in observed variables can explain only about half of the difference between the Bay Area and other districts in the likelihood of a parcel tax. One explanation for this remaining difference is that our model is missing an important variable. Another possibility is that we are observing the parcel tax at an early stage of its adoption. Bay Area districts may be the early adopters, with other districts likely to follow. To examine the potential for further adoption of the parcel tax, we estimate the likelihood that districts outside the Bay Area adopt a parcel tax using a version of our model fitted only to data from Bay Area districts. With that version, we estimate that 33 percent of districts outside the Bay Area levy a parcel tax. An adoption rate of this magnitude would represent a substantial unraveling of California's current system of state finance.

2. Origins of the Parcel Tax

The parcel tax is a by-product of California's complex history of school finance reform. In 1970, California's school finance system was similar to the systems in most other states. Each school district levied its own property tax rate, and the property tax was the primary source of school district revenue. The state offset some differences in tax base among districts by allocating more revenue to districts with lower bases. Despite this effort, revenue per pupil varied widely across districts, leading to the landmark decision of the California Supreme Court in Serrano vs. Priest (1972). In that decision, the Court ruled that variations in revenue per pupil related to variations in tax bases violated the equal protection clauses of the state and federal constitutions.

The state legislature responded to this decision by creating revenue limits for each school district. Each district's limit capped the sum of its revenue from the property tax and state aid. Because state aid was determined by formula, the revenue limit essentially capped the property tax rate a district could levy. Limits were initially set equal to the revenue a district received in 1973-74 and then increased over time. The increases were smaller for high revenue districts than for low revenue districts, tending to equalize revenue per pupil over time.

The revenue limit system had a large loophole, however. By majority vote of their residents, school districts could exceed their limits. This loophole made a district's revenue limit meaningless because, before the revenue limit system was put in place, property tax rates had to be approved by a majority of voters. The loophole was closed by the passage of Proposition 13 in 1978, a statewide initiative limiting the property tax rate to one percent, a rate less than half of the statewide average at the time.[1] The limit applied to the sum of all rates levied by cities, counties, school districts, and special districts. The legislature was left with the task of determining how the revenue from this lower rate would be allocated among local governments.

The legislature responded by giving each government the same share of the revenue from each property that it had received before Proposition 13. Because school districts depended heavily on the property tax, they suffered a very large reduction of revenue. The legislature made up this reduction by increasing state aid to bring each district's revenue up to its revenue limit. The revenue limit essentially became each district's revenue allocation.

The legislature has slowly equalized revenue limits over time. In about 10 percent of districts, property tax revenue exceeds revenue limits, leading to significantly higher revenue in these districts. In addition, over the last 20 years, the state has added a large number of categorical programs to address specific needs.[2] The federal government has also increased categorical aid to school districts.

[1] Fischel (1989) argues that Serrano caused Proposition 13.
[2] See Sonstelie (2008).

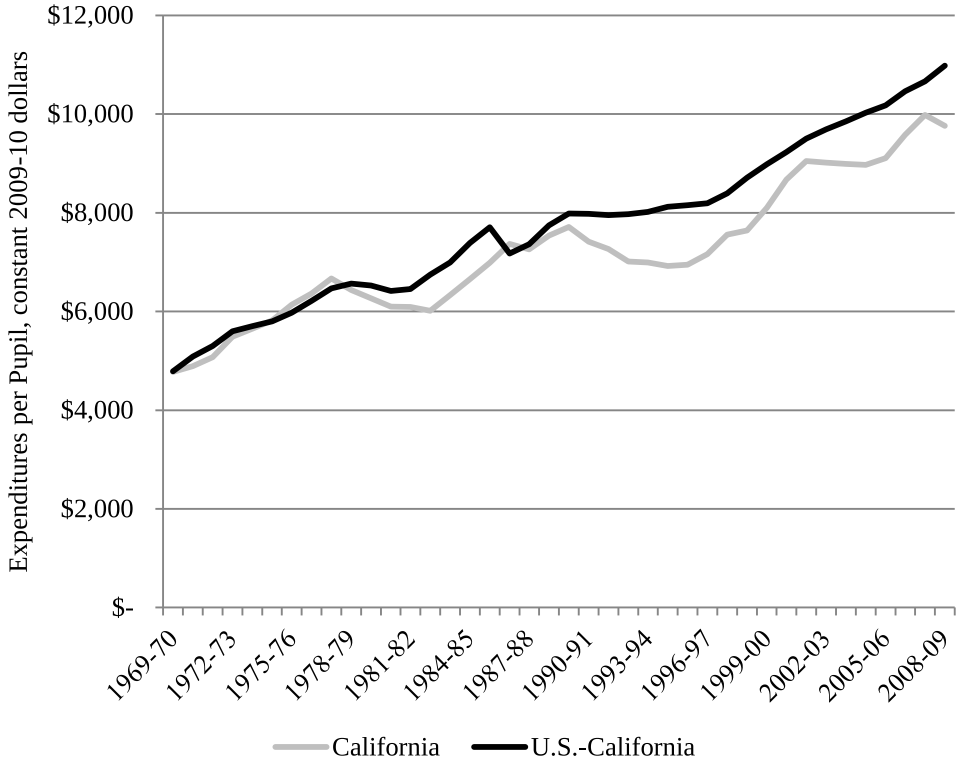


Figure 1
Current Expenditures per Pupil in California versus All Other States[3]

Because of the centralization of school finance in California, revenue is certainly higher in some districts than it would have been under the previous system of local finance. However, since Proposition 13 in 1978, current expenditures per pupil have fallen in California relative to other states (Figure 1). In 2008-2009, spending per pupil was 11 percent lower in California than in the average of all other states. Because teacher salaries in California are higher than in other states (27 percent higher in 2008-2009), lower spending per pupil translates into lower resource levels. In 2008-2009, the ratio of teachers per pupil in California was 70 percent of the ratio for

[3] Sources: For 1986-2009, Common Core of Data, National Center for Education Statistics. For 1969-1985, Historical Trends: State Education Facts, 1969-1989, National Center of Education Statistics, August 1992.

all other states.[4] For the average California school district, the limits on local revenue have not been fully offset by state revenue.

Districts can circumvent these limits by levying a parcel tax. Ironically, the parcel tax stems from Proposition 13 itself. The Proposition limited the ad valorem tax on property to one percent and further required that any "special taxes" levied by local governments must be approved by two-thirds of a jurisdiction's voters. The Proposition was not specific about what taxes would require this two-thirds vote. A common interpretation was that special taxes were taxes earmarked for special purposes and that any tax without earmarks was a general tax, which does not require a two-thirds vote. Under this interpretation, taxes levied by school districts were special taxes because school districts, unlike cities and counties, provide a narrowly defined public service. This interpretation was reinforced and clarified by Proposition 218 in 1996, which explicitly stated that any tax levied by a school district is a special tax and thus requires a two-thirds vote.

Neither Proposition 13 nor Proposition 218, or any other legislation, specifically requires that the taxes levied by school districts must be a tax on parcels of land. A tax on parcels is a natural option for school districts, however. It is merely an additional item on the property tax bill for each parcel's owner. It is essentially an avenue for school districts to evade the cap on property taxes imposed by Proposition 13. Because parcel tax revenue does not count as local revenue for the state's revenue limits, it is also a way for school districts to exceed the revenue caps imposed by the state. It is truly a local revenue source.

[4] Salary data is from Rankings and Estimates: 2008-2009, National Education Association. Enrollments and number of teachers are from the Common Core of Data, National Center for Education Statistics.

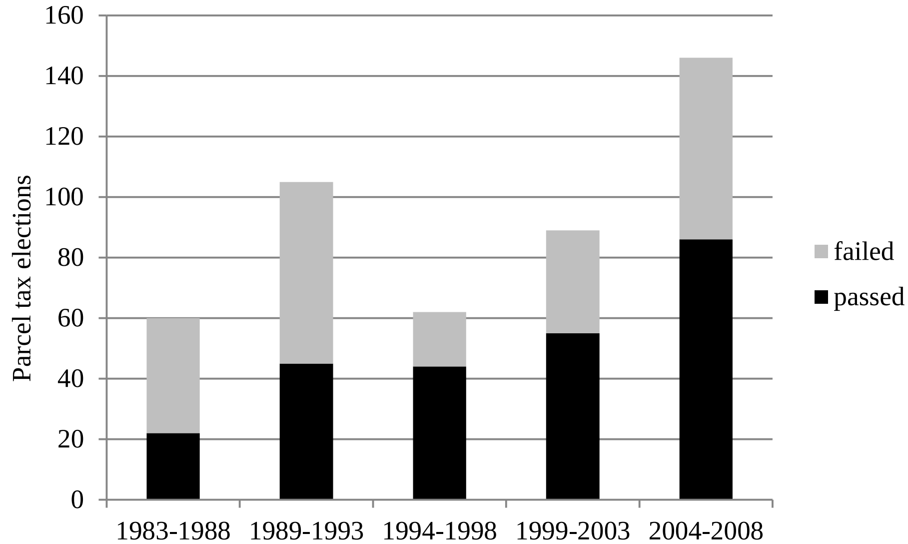


Figure 2
Parcel Tax Elections by California School Districts

School districts can levy parcel taxes to support capital investments or to finance current operating expenditures. We focus on parcel taxes for current operating expenditures, the first of which was levied in 1983. Five school districts proposed a tax in that year, and one was successful in securing the necessary support from voters. The success rate of districts has increased substantially since then (Figure 2). Between 2004 and 2008, California school districts held 146 parcel tax elections. In 86 of those elections, at least two-thirds of voter supported the proposed tax. Almost all proposals specify a time period for the tax, usually between 4 and 10 years. In 2009-2010, the year we focus on in our analysis, 90 of California's 963 school districts received parcel tax revenue.[5] For these districts, revenue averaged $799 per pupil. Twenty districts raised more than $1,000 per pupil.

Parcel tax proposals are usually quite simple. Most propose the same rate for every parcel. Of the 146 elections in 2004-2008, 128 proposed a flat rate, and the average rate was

[5] Three more districts reported some parcel tax revenue, but had no record of a successful parcel tax election in the Ed-Data website maintained by the California Department of Education.

$127 per parcel. The remaining 18 proposals involved either a different flat rate for different classes of property or a tax based on square footage.   Property owners in one of these districts have challenged the legality of these more complicated rate structures, arguing that structures of this sort violate the uniformity principle.[6] A Superior Court ruling in favor of the district was overturned by the California Court of Appeals in December of 2012, and the California Supreme Court has declined to review that appeal. This outcome casts doubt on the legality of parcel taxes other than a flat rate applied to all parcels.

To date, research on the parcel tax has been limited. Brunner (2001) compared the tax-price of school spending when the parcel tax is the source of discretionary revenue with the tax-price where the property tax is the source. The ratio of students to parcels, the tax-price of school spending under the parcel tax, also plays a prominent role in Duncombe and Yinger (2011). They estimate the demand for school quality, as measured by standardized test scores, as a function of demand variables including students per parcel. In their model, the relationship between the quality districts chose and the spending that choice requires also depends on students per parcel. However, Duncombe and Yinger do not estimate how this tax-price affects the parcel tax revenue districts raise or the probability that a district levies a parcel tax.

[6] Borikas v. Alameda Unified School Districts, 2012.

3. A Model of Local Demand for Public School Spending

Is the parcel tax the resurrection of the local finance in California's highly centralized system? To address this question, we use a standard public choice model to analyze the decision of school districts to levy a parcel tax. If the parameter estimates from that analysis are reasonably consistent with estimates from other studies of local demand for school spending, the parcel tax can be viewed as a natural response to the limitation imposed by state finance.

The standard model we employ dates back to the median voter model first implemented by Barr and Davis (1966), Borcherding and Deacon (1972), and Bergstrom and Goodman (1973). In those models, voters have demand functions for public goods, much like private good demand function. In this particular case, the public good is the resources for local public schools. These resources include personnel of various types, materials, extra-curricular activities, and so on. In short, resources are a vector of goods and services. The abundance of any school's resources also depends on the number of students it serves. To capture these ideas, we assume that there is an index of resources per pupil, which we denote by q. The cost per pupil of one unit of that measure is denoted by c, a parameter which may vary from district to district. Expenditures per pupil is cq.

Local property taxes and state and federal funds finance a level of school resources denoted by q^0. The school district can provide a higher level of resources, q, by levying a parcel tax. The revenue per pupil necessary for that increase is $c(q-q^0)$. This requires a parcel tax rate of $pc(q-q^0)$, where p is students per parcel in the school district.

The voter has income of w and pays a tax of t^0 for the resources the school district currently employs. Letting x denote all other expenditures, the voter's budget constraint is

$$x+pc(q-q^0)=w-t^0. \quad (1)$$

In standard form, this constraint is

$$x+pcq=w+(pcq^0-t^0). \quad (2)$$

A voter's demand is the value of q that maximizes his or her utility. The voter's tax-price is pc, and his or her *full fiscal income* is $y=w+(pcq^0-t^0)$.[7]

The terms in parentheses in the expression for full fiscal income arise because the parcel tax is only used for increments in school funding. The base level of funding for each district comes from local property taxes, state taxes, and federal taxes. The difference between the two terms in parentheses result from the difference between the share of parcel taxes a voter would pay relative to the share of local, state, and federal taxes he pays.

As in most previous studies, we assume that the demand for school resources is log-linear in tax-price and income. This function is

$$\ln(q)=\alpha+\varepsilon\ln(pc)+\eta\ln(y), \quad (3)$$

where α, ε, and η are parameters to be estimated. The parameter ε is the price elasticity of demand, and the parameter η is the income elasticity. We do not observe the level of resources directly so we focus on spending per pupil, which is $e=cq$. Rewriting the demand for resources in terms of the demand for spending per pupil yields

$$\ln(e)=\alpha+\varepsilon\ln(p)+\eta\ln(y)+(\varepsilon+1)\ln(c). \quad (4)$$

School districts in California fall into three main types: elementary districts, high school districts, and unified districts, which serve all grades. Seventy percent of California students attend a unified district, twenty percent attend elementary districts, and ten percent attend high school districts. Most elementary districts cover kindergarten through grade 8, and most high

[7]The term full fiscal income comes from Craig and Inman (1986).

school districts cover grades 9 through 12. However, about ten percent of elementary districts do not include grades 7 and 8, and a similar percentage of high school districts include those grades.

The number of grades in a district affects its tax-price. To illustrate, consider an area served by an elementary district for kindergarten through grade 8 and a high school district for grades 9 through 12. Suppose the elementary district has two students per parcel and the high school district has one student per parcel. Now suppose the two districts merge and form a unified district serving all grades from kindergarten through grade 12. The unified district has three students per parcel and thus a higher tax-price than either of the two districts from which it formed. But, should demand be less? It seems reasonable to assume that the spending a voter would demand in the unified district equals the sum of his or her spending demands for the elementary and secondary districts. In the appendix, we demonstrate that this assumption implies three restrictions on the demand function. First, the price and income elasticities (ε and η) are the same for elementary, secondary, and unified districts. Second, to deal with the issues raised by the measurement of tax-price in different types of school districts, the demand function must be augmented to include the log of the number of grades in the district. Third, the coefficient on the log of grades is the negative of the price elasticity of demand. With these three restrictions, the demand function is

$$\ln(e)=\alpha+\varepsilon\ln(p)+\eta\ln(y)+(\varepsilon+1)\ln(c)-\varepsilon\ln(g), \quad (5)$$

where g is the number of grades served by the district.

The parcel tax is a tax on land, which is a fixed factor. Economic theory predicts that the burden of the tax should fall entirely on landowners. Because renters do not bear any of the burden of the parcel tax, we assume that all renters favor any proposal to enact a parcel tax.[8]

[8] Oates(2005) takes a similar approach.

Homeowners will bear the full burden of the tax, however. Depending on their demand and the tax rate proposed, some will favor the tax, and some will be opposed. The larger the fraction of renters in a district, the smaller the fraction of homeowners who must support a parcel tax for it to be enacted. Voting turnout also matters, and renters tend to be less likely to vote in local elections than homeowners.[9] To represent the threshold for homeowner support, let λ be the percentage of renters who vote, r be the percentage of residents who are renters, and κ be the percentage of homeowners who vote. For a parcel tax proposal to pass, two-thirds of voters must support it. The percentage of homeowners in favor must exceed the threshold θ, implicitly defined by the equation

$$\lambda r + \kappa(1-r)\theta = (2/3)(\lambda r + \kappa(1-r)). \qquad (6)$$

Support for the parcel tax among homeowners is positively related to income. Above some critical level, all homeowners will support the tax proposal, and below that level none will support it. Alternatively, we can focus on the top θ percent of the income distribution. If all homeowners with incomes in this range support a parcel tax proposal, it will pass. In particular, if the homeowner in the $(1-\theta)$ percentile of the income distribution supports the proposal, it will pass. Assuming the log of income is normally distributed, the log of the critical homeowner's income, denoted $\ln(y^*)$, is implicitly defined by the following equality

$$1-\theta = \Phi\{(\ln(y^*)-\mu)/s\} \qquad (7)$$

where Φ is the standard normal distribution, μ is the mean of log income, and s is the standard deviation of log income. Let f be the inverse of Φ. Then, this critical income is explicitly defined as

$$\ln(y^*) = \mu + sf(1-\theta). \qquad (8)$$

[9] See DiPasquale and Glaeser(1999).

A first order approximation to that expression around the point r=0 is

$$\mu - 0.43s + 0.93(\lambda/\kappa)sr. \quad (9)$$

Substituting this approximation in equation (5) yields the following demand function for the critical homeowner:

$$\ln(e^*)=\alpha+\varepsilon\ln(p)+\eta\mu+\eta(-0.43)s+\eta(0.93(\lambda/\kappa))sr+(\varepsilon+1)\ln(c)-\varepsilon\ln(g). \quad (10)$$

If the critical homeowner's demand exceeds current expenditures, $\ln(e^*)>\ln(e^0)$, a district could secure the necessary voter support to levy a parcel tax. It could propose the tax rate $p(e^*-e^0)$, which would secure support from at least two-thirds of voters. If $\ln(e^*)$ is significantly higher than $\ln(e^0)$, it has other viable options. It could secure a higher plurality than two-thirds by proposing a lower tax rate. It could also propose a higher tax rate and still secure support from two-thirds of voters, an outcome predicted by the agenda setting model proposed by Romer and Rosenthal (1979). In what follows, we assume districts propose the tax rate preferred by the critical voter.

With that assumption, we follow the usual latent variable approach to derive the specification of a probit model. We assume that the demand of the critical voter is measured with a normally distributed error with mean zero and standard deviation σ. The probability that district i levies a parcel tax is then

$$\pi_i= N[\beta_0+\beta_1\ln(p)_i+\beta_2\mu_i+\beta_3 s_i+\beta_4 s_i r_i+\beta_5\ln(c)_i+\beta_6\ln(g)_i+\beta_7\ln(e^0)_i] \quad (11)$$

Though price and income elasticities are not directly estimated, they can be derived as ratios of estimated coefficients. In particular, $\varepsilon=-\beta_1/\beta_7$ and $\eta=-\beta_2/\beta_7$.

4. Data and Results

We apply this econometric model to a cross-section of California school districts in 2009-2010. In that year, there were 963 public school districts in California. Ninety districts received parcel tax revenue from an election held before 2009, and eight more districts approved a new parcel tax levy in either 2009 or 2010. Our model seeks to explain why these 98 districts levied a parcel tax and why the remaining 865 did not.

The tax-price of school resources is the product of pupils per parcel and the cost of a unit of school resources. We obtained data on the number of parcels from the private firm, DataQuick. For each county, the company acquires data on every parcel from the county's assessor. The resulting database lists the tax rate area for each parcel. A tax rate area is a collection of parcels that pay property tax revenue to the same collection of local governments. Geographically, it is an intersection of local government boundaries. Using data from the California State Board of Equalization, we determined the school district of every tax rate area in California and thus the total number of parcels in each school district in 2009-2010. We obtained enrollment in each district from the California Department of Education.

For the cost of resources, we estimate the cost to each district of the statewide average for resources per student. In 2009-2010, 85.5 percent of current operating expenditures of California public schools were spent on the salaries and benefits of school employees. The salary and benefits of school employees reflect local labor market conditions, which vary substantially from the lower wage areas of northern and interior California to the higher wage areas of the San Francisco Bay Area and Southern California (Rose and Sengupta, 2007). It is also possible that the salaries paid by a district reflect the district's fiscal condition. Districts with relatively high revenue might pay their employees relatively high salaries, a possibility that would make a district's salaries endogenous in our probit regression. Because of this possibility, we represent the salaries that a district pays its employees by the average salary paid by neighboring districts. In particular, we first calculate a salary for each district by averaging the highest salary in the district's salary schedule for certified teachers with the lowest salary in that schedule. We then use these salaries to calculate an average salary for all districts with an adjoining or overlapping boundary.[10] The result is a salary number for each district that reflects local labor market conditions, but does not reflect fiscal conditions in the district itself. This neighborhood average was then divided by the statewide average to form a labor cost index with a mean value of unity. We assume that other resources, such as books, computers and supplies, have the same price throughout the state. Our measure of the cost of resources for district i is

$$c_i=0.145+0.855u_i, \tag{12}$$

where u_i is standardized average neighborhood salary for district i. The value c_i is the cost to district i of the statewide vector of resources per pupil as a percentage of the statewide cost of that vector.

We derived the income variables from the school district aggregation of the 2010 American Community Survey (ACS). The ACS reports the number of homeowners in each district that fall into each of ten income categories. We set the income of each homeowner equal to the average of the upper and lower limits defining its category. To estimate an average income for homeowners in the top category, we used the aggregate income of all homeowners and the number and average income in each of the other nine categories. To convert these measures of income into full fiscal income, we used the expression in equation (6): $y=w+(pcq^0-$

[10] The salary data comes from the J90 form districts file with the California Department of Education. Districts are not required to report their salary schedules. In 2009-2010, 821 districts reported. For those districts not reporting in 2009-2010, we used salaries reported in the previous year adjusted for inflation. For districts not reporting in either year, we used salaries reported in 2010-2011, adjusted for inflation. This left 87 districts without salary data. However, all 963 districts have at least one neighboring district with salary data.

t^0). For w, we used income reported in the ACS. For pcq^0, we used the product of parcels per student and current expenditures per pupil in the district's schools. The parameter t^0 is the taxes a voter pays to support the existing level of spending in his or her school district. This value will vary with the circumstances of individual voters, and we do not have a good way of accounting for these circumstances. We therefore use a proxy: the average household tax burden for public education in California, which we estimate by total expenditures of California public schools in 2009-2010 divided by the number of households in that year. This average is $3,895. These calculations gave us an average of full fiscal income for each income category. We converted these averages to natural logarithms and used those values to calculate the mean and the standard deviation of log income for the homeowners in each school district. The ACS also reports the fraction of households that rent in each district.

The revenue attributed to each district comes from the financial reports districts filed with the California Department of Education for 2009-10.[11] Most revenue sources flow directly to school districts. Special education revenue is an exception, however. Most California school districts cooperate with other districts to provide special education services. This cooperation is coordinated through a consortium, which often involves a county office of education. Some districts in a consortium may provide few special education services themselves, depending on other districts or the county office to provide those services. To represent the special education resources available to every district, we totaled all special education revenue in a district's consortium and prorated that total among all districts in the consortium in proportion to their enrollments. We used the same approach for the 58 California school districts that belong to one of the eight consortiums that provide common transportation services to students. Finally, we excluded revenue for a number of programs not directly related to the core educational services

[11] 2009–10 SACS Unaudited Actual Data, http://www.cde.ca.gov/ds/fd/fd/.

of students in kindergarten through high school. We excluded revenue for adult education, child care and pre-school, vocational education, and nutrition. We also excluded revenue for school facilities and the temporary federal aid to school districts under the American Recovery and Reinvestment Act. And, of course, because we are attempting to explain whether a district imposes a parcel tax, we excluded parcel tax revenue.

Parcel taxes are geographically concentrated. Of the 98 districts that levied a parcel tax, 68 were located in the six counties of the San Francisco Bay Area.[12] These counties contain only 110 school districts, 12 percent of California's total. In each county, 50 percent or more of districts had a parcel tax. Only one other county, Mono, reached this 50 percent threshold, with one of its two districts levying a parcel tax. The district is home to one of California's largest ski areas and has many vacation rentals. Three counties had between 20 percent and 33 percent of districts with a parcel tax; all three are relatively close to the Bay Area. Three counties in Southern California also had districts with parcel taxes, but none had more 10 percent of districts with a tax. No district in either Orange or San Diego Counties, two of California's largest urban counties, had a parcel tax. In fact, 43 of California 58 counties did not have a district with parcel tax revenue.

[12] Alameda, Contra Costa, Marin, San Francisco, San Mateo, and Santa Clara Counties.

Table 1

Sample Means for Explanatory Variables,
Sample Standard Deviations in Parenthesis

Variable	All districts		Bay Area districts	
	With tax	Without tax	With tax	Without tax
Student per parcel	0.32	0.38	0.32	0.34
	(0.23)	(0.52)	(0.16)	(0.16)
Number of grades	10.22	10.16	9.96	9.86
	(2.53)	(2.65)	(2.45)	(3.04)
Mean household income	$150,375	$86,394	$159,681	$124,797
	($55,095)	($32,378)	($57,617)	($37,158)
St. dev. household income	$85,984	$51,628	$90,107	$69,590
	($37,461)	($25,350)	($39,096)	($29,720)
Percent renters	0.34	0.35	0.33	0.38
	(0.14)	(0.14)	(0.14)	(0.14)
Revenue per pupil	$8,414	$9,231	$8,528	$8,624
	($2,794)	($6,864)	($3,049)	($2,708)
Cost index	1.01	0.94	1.04	1.02
	(0.07)	(0.07)	(0.06)	(0.06)
Number of districts	98	865	68	42

The prevalence of the parcel tax in the Bay Area may be partly explained by household income. The demand for school resources should be positively related to income, and incomes are higher in Bay Area districts, as Table 1 demonstrates.

Table 2 reports parameter estimates of our probit model. The table reports four sets of coefficient estimates , each set from a different treatment of Bay Area districts. The first column presents estimates of the probit model in which Bay Area districts are not distinguished from

Table 2
Coefficient Estimates for Baseline Model, Standard Errors in Parenthesis
Probit Model: Districts with Parcel Tax Revenue in 2009-2010

Explanatory Variables	All districts	All districts	Bay Area districts	Districts not in Bay Area
Log students per parcel (β_1)	-0.70***	-0.56***	-0.84**	-0.53***
	(0.15)	(0.17)	(0.40)	(0.20)
Mean log income (β_2)	2.64***	2.13***	1.57**	2.36***
	(0.28)	(0.31)	(0.64)	(0.39)
Std. dev. log income (β_3)	0.17	1.00*	1.06	1.21*
	(0.58)	(0.60)	(1.38)	(0.69)
Std. dev. log income * % renters (β_4)	1.51**	0.99	-0.27	1.44*
	(0.61)	(0.65)	(1.26)	(0.76)
Log cost index (β_5)	2.38**	-1.75	1.82	-3.25*
	(1.15)	(1.38)	(2.45)	(1.72)
Log grades (β_6)	0.65**	0.84***	1.22**	0.64*
	(0.27)	(0.30)	(0.54)	(0.38)
Log revenue per pupil (β_7)	-1.09***	-0.95***	-1.42*	-0.91**
	(0.28)	(0.32)	(0.74)	(0.36)
Constant (β_0)	-23.91***	-21.00***	-9.59	-23.69***
	(3.54)	(4.01)	(8.99)	(4.75)
Bay Area dummy variable		1.68***		
		(0.19)		
Observations	963	963	110	853
Log likelihood	-202.79	-161.67	-61.82	-97.04

*p<0.10, ** p<0.05, *** p<0.01.

other districts. In the second column, Bay Area districts are distinguished from other districts by a shift in the constant term, a Bay Area dummy variable. The coefficient on that dummy variable is statistically different from zero at the 1 percent level, indicating that a district in the Bay Area is more likely to enact a parcel tax than a district in a different part of that state with the same values for all explanatory variables. Holding tax-prices, incomes, and other variables constant, Bay Area districts are more likely to enact a parcel tax.

Columns 3 and 4 provide a test of a different proposition. Are price and income elasticities (and other coefficients) different for Bay Area voters than for other voters throughout the state? Column 3 presents coefficient estimates when the sample is restricted to Bay Area districts. Column 4 presents estimates when the sample is restricted to districts outside the Bay Area. Except for the constant term, which is much larger in the Bay Area sample, the coefficient estimates are similar for the two subsamples. To formalize this comparison, we test the null hypothesis that all coefficients except the constant term are equal in the two subsamples. This test comes down to a comparison of the log likelihood from the model in column 2, which imposes the restriction that all coefficients except the constant term are equal, to the sum of the log likelihoods of the models in columns 3 and 4, which permit all coefficients to differ between the two sub-samples. The log-likelihood ratio statistic for this test is chi-square with seven degrees of freedom. The value of this statistic is 5.66, which implies that the null hypothesis cannot be rejected at any reasonable significance level.

In most cases, the coefficient estimates in Table 2 have the signs predicted by the model developed in the previous section. The tax-price and revenue coefficients are negative and significantly different from zero. The income and grade coefficients are positive, as predicted. Not all coefficient estimates are consistent with the model, however. The model predicts a negative coefficient for the standard deviation of log income, but the estimated coefficients of this variable are positive in all four specifications. The model also predicts a positive coefficient for the interaction between that variable and the percentage of renters. The estimate of this coefficient is positive when the model is estimated with all districts and the non-Bay Area districts, but not significantly different from zero in the other two specifications.

To explore this issue further, we estimated the model including the percentage of renters as a separate variable and excluding the interaction term. For the specification represented by the second and fourth columns, the coefficients for the standard deviation of log income are positive and significant at the 5 percent level, but the coefficient for percent renters is not significant. For the specification in the first column, the coefficient on the standard deviation of log income is not significant, but the coefficient on percent renters is positive and significant. Based on our empirical results, our predictions for the percent renters and for the variation of income can be clearly rejected.

The coefficient estimates in Table 2 yield estimates of the price and income elasticity of demand for public school resources. The price elasticity is the coefficient on the log of students per parcel divided by the coefficient on the log of revenue per pupil. The income elasticity is the coefficient on mean log income divided by the coefficient on the log of revenue per pupil. Income and price elasticities are presented in Table 3.

Table 3
Elasticity Estimates, Standard Errors in Parenthesis
Estimates Derived from Probit Model in Table 2

	All districts w/o Bay Area dummy	All districts with Bay Area dummy	Bay Area districts	Districts not in Bay Area
Price elasticity (β_1/β_7)	-0.64***	-0.59***	-0.59**	-0.58***
	(0.14)	(0.16)	(0.26)	(0.18)
Income elasticity (β_2/β_7)	2.41***	2.25***	1.11	2.58***
	(0.61)	(0.73)	(0.70)	(0.96)

*p<0.10, ** p<0.05, *** p<0.01. Standard errors estimated by delta method.

The price elasticity estimates are consistent across the four different ways in which we have represented Bay Area districts. However, the income elasticity estimate is much lower, when the baseline model is estimated with Bay Area districts only. Among districts outside the Bay Area, income is very important in predicting the likelihood of a parcel tax. Within the Bay Area, however, income is a much less important predictor.

Appendix B presents linear probability estimates of the baseline model. For the Bay Area subsample, those estimates are quite similar to the probit estimates. For the other three specifications, however, the estimates differ considerably. Furthermore, in all the linear probability estimates, the estimated probability of a parcel tax is less than zero in more than 20 percent of school districts. Consequently, we believe that the probit results are generally more reliable.

Our price elasticity estimates are somewhat higher in absolute value than estimates from other studies. Bergstrom, Rubinfeld, and Shapiro (1982) summarize estimates from a number of studies in which school district expenditures are regressed on measures of tax-price and income, following the median voter model of Borcherding and Deacon (1972) and Bergstrom and Goodman (1973). Two-thirds of the estimates are less than 0.5 in absolute value. Using data from their survey of Michigan voters in 1978, Bergstrom and co-authors estimate a price elasticity of -0.39. Applying a different method to the same data, Rubinfeld, Shapiro and Roberts (1987) estimate a price elasticity of -0.32. Brasington (2002) implemented a third approach for estimating price elasticity. Using method based on the implicit price for quality revealed in a hedonic model of housing prices, he estimates an elasticity of -0.11. The panel data study by Rockoff (2010) also yields a relatively low price-elasticity, -0.22. The most direct comparison comes from Duncombe and Yinger (2011). Applying a simultaneous equation model of the demand for school quality, the cost of quality, and the efficiency of school spending to California public schools in 2003 through 2005, they estimate a price elasticity of -0.01.

Our income elasticity estimates differ considerably across the four specifications. When the sample is restricted to the Bay Area, the estimate is 1.11. For the three other specifications, estimates exceed 2.0. Estimates from other studies are invariably less than unity. The income elasticity we estimate implies that differences in income across school districts have significant effects on the likelihood that a school district has a parcel tax. In 2009-2010, 10 percent of California districts had a parcel tax. Coefficient estimates from the probit model with all districts and a Bay Area dummy implies that a one standard deviation increase in the mean of log income would increase that probability to 33 percent. In the Bay Area sub-sample, 62 percent of districts have a parcel tax. Using coefficient estimates from that sub-sample, a one standard deviation increase in the mean of log income would increase that probability to 82 percent.

Variations in students per parcel have a similar effect on the probability of a parcel tax. Using coefficient estimates from the probit model with all districts and a Bay Area dummy, a decrease of one standard deviation in the log of students per parcel increases the estimated probability of a parcel tax from 10 percent to 23 percent. For the Bay Area sub-sample, that probability would increase from 62 percent to 87 percent.

The likelihood of a parcel tax differs between the Bay Area and the rest of the state partly because of differences in the variables included in our model and partly because a Bay Area district is more likely to impose a parcel tax than a district with the same characteristics outside the Bay Area. To decompose the difference into these two parts, we used our model estimated from the Bay Area sample to predict the likelihood that districts outside the Bay Area would levy a parcel tax. For those districts outside the Bay Area, the likelihood of a parcel tax increased from 4 percent to 33 percent. For Bay Area districts, the likelihood was 62 percent. Thus, 50 percent of the 58 percentage point difference between Bay Area districts and other districts can be explained by differences in observable characteristics.

The remainder of the difference may be explained by characteristics that are not included in our baseline model. Two obvious candidates are the percentage of households with children beyond school age or with children in private school.[13] A community with a high percentage of these households would be less likely to support a parcel tax. To examine this possibility, we augment our baseline model with two variables. The first is the percentage of the population over 65 years of age, and the second is the percentage of students enrolled in private schools. Table 4 present results for all districts with a Bay Area dummy variable and for the Bay Area sub-sample.

---

[13] Studies of the support of elderly voters for school spending include Poterba (1997), Ladd and Murray (2001), Harris, Evans, and Schwab (2001), and Fletcher and Kenny (2008). Sonstelie (1982) estimates that the percentage of parents with children in private school has a negative, though not statistically significant, effect on the public school spending per pupil. Using a hedonic measure of the price of private school quality, Brasington (2000) finds that the price of private school quality has a positive effect on the demand for public school quality.

Table 4
Coefficient Estimates for Baseline and Augmented Model, Standard Errors in Parenthesis
Probit Model: Districts with Parcel Tax Revenue in 2009-2010

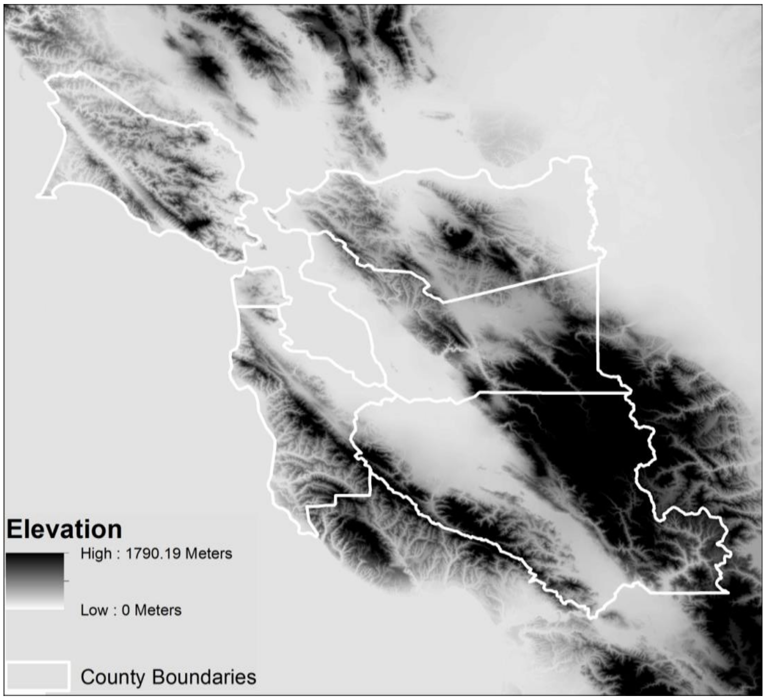
Explanatory Variables	All districts	All districts	Bay Area districts	Bay Area districts
Log students per parcel (β_1)	-0.56***	-0.55***	-0.84**	-0.65
	(0.17)	(0.17)	(0.40)	(0.42)
Mean log income (β_2)	2.13***	1.93***	1.57**	0.99
	(0.31)	(0.33)	(0.64)	(0.73)
Std. dev. log income (β_3)	1.00*	0.63	1.06	1.33
	(0.60)	(0.67)	(1.38)	(1.97)
Std. dev. log income * % renters (β_4)	0.99	1.41**	-0.27	-0.15
	(0.65)	(0.69)	(1.26)	(1.38)
Log cost index (β_5)	-1.75	-1.95	1.82	0.68
	(1.38)	(1.39)	(2.45)	(2.59)
Log grades (β_6)	0.84***	0.85***	1.22**	1.14**
	(0.30)	(0.31)	(0.54)	(0.54)
Log revenue per pupil (β_7)	-0.95***	-0.91***	-1.42*	-0.97
	(0.32)	(0.31)	(0.74)	(0.79)
Constant (β_0)	-21.00***	-19.34***	-9.59	-7.45
	(4.01)	(4.14)	(8.99)	(9.31)
Bay Area dummy variable	1.68***	1.68***		
	(0.19)	(0.20)		
Percentage 65 years of age		1.29		-1.41
		(1.23)		(3.38)
Percentage in private school		8.85*		21.71*
		(4.49)		(12.92)

*p<0.10, ** p<0.05, *** p<0.01.

In the model with all districts, the addition of these two variables has little effect on parameter estimates. In particular, the coefficient of the Bay Area dummy doesn't change, suggesting that the addition of these two variables does not account for much of the difference in the likelihood of a parcel tax between Bay Area districts and other districts. This suggestion is confirmed by a decomposition similar to that employed above. When the parameters in the third column of Table 4 are used the estimate the likelihood of a parcel tax, 34 percent of districts outside the Bay are predicted to have a parcel tax. Again, differences in observed characteristics explain only about half of the difference in parcel tax adoption between Bay Area districts and other districts.

Because household income is an important predictor of adopting a parcel tax, "Tiebout" bias is a concern.[14] School districts that pass a parcel tax will attract high-income families, making household income an endogenous variable in our model. This endogeneity could bias our parameter estimates, particularly the coefficient on average income. To investigate this issue, we use elevation as an instrument for household income. In the Bay Area, many parcels in the hills overlooking the Bay provide outstanding views, which make them a desirable residential location. The competition for these locations drives up housing prices in these areas, and the willingness to pay for a view rises with income. The result is that the average income of a neighborhood tends to be correlated with its elevation. This relationship is demonstrated by the two maps in Figure 3. The top map shows elevation in the six Bay Area counties. The bottom map displays the mean household income of each census tract in those counties.

[14] See Goldstein and Pauly (1982), Reid (1990), and Rubinfeld, Shapiro and Roberts (1982).



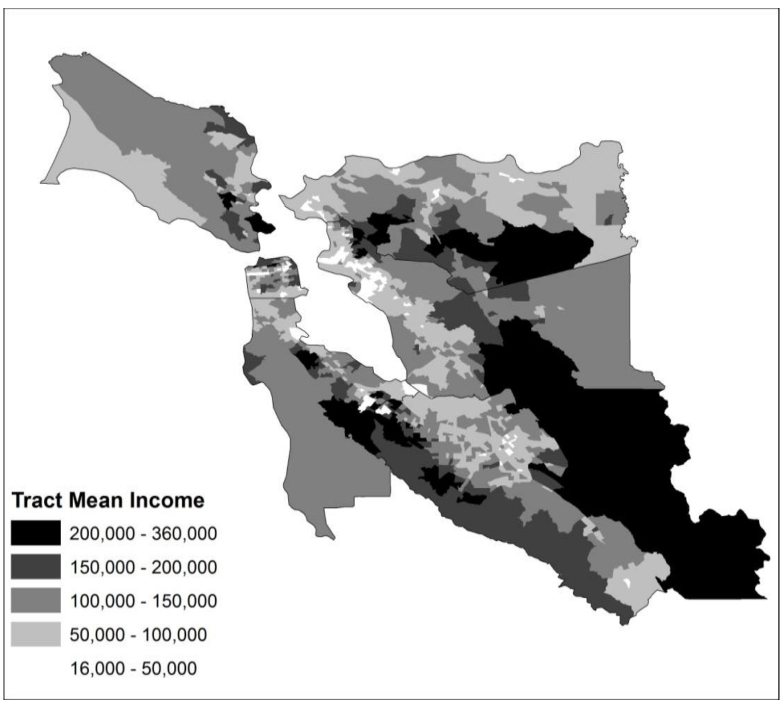


Figure 3
Income and Elevation

To construct an instrument for our analysis, we used ArcGIS to overlay school district boundaries on a topographical map. Using a standard tool in that program, we then calculated the average elevation of each school district. A simple regression of the mean log income of a school district on its average elevation has an F-statistic of 15, making elevation a plausible instrument for income. Elevation also had a significant coefficient in a first-stage regression of mean log income on elevation and other baseline variables. The coefficient on elevation had a t-statistic of 3.20. It also seems reasonable to us that elevation satisfies the other condition for a valid instrument: it should not be related to the demand for education resources other than through its association with the income of households.

Results from applying this instrument are reported in Table 5. The first column repeats the estimates from the ordinary probit model applied to Bay Area districts. The second column presents those estimates when elevation is used as an instrumental variable for the mean of log income in a district. With the instrument for income, the income coefficient is similar to previous estimates. However, the standard error of that coefficient is more than three times higher, and we could not reject the hypothesis that the income coefficients are the same in the two models. When the coefficients in the second column are used to estimate the likelihood that districts levy a parcel tax, we predict that only 29 percent of districts outside the Bay Area have a parcel tax. Thus, 57 percent of the 58 percentage point difference between Bay Area districts and other districts is due to observable characteristics.

Table 5
Coefficient Estimates for Baseline Model, Standard Errors in Parenthesis
Probit Model: Districts with Parcel Tax Revenue in 2009-2010
Instrumental Variable Estimates, Bay Area districts

	Instruments	
Explanatory Variables	None	Elevation
Log students per parcel (β_1)	-0.84**	-0.71
	(0.40)	(0.47)
Mean log income (β_2)	1.57**	1.55
	(0.64)	(2.26)
Std. dev. log income (β_3)	1.06	0.99
	(1.38)	(2.40)
Std. dev. log income * % renters (β_4)	-0.27	0.25
	(1.26)	(2.08)
Log cost index (β_5)	1.82	0.11
	(2.45)	(3.42)
Log grades (β_6)	1.22**	1.16**
	(0.54)	(0.54)
Log revenue per pupil (β_7)	-1.42*	-1.06
	(0.74)	(0.86)
Constant (β_0)	-9.59	-12.67
	(8.99)	(22.30)

*p<0.10, ** p<0.05, *** p<0.01.

6. Conclusion

We reach two main conclusions from our analysis of the use of the parcel tax by California school districts. The first is that the likelihood of levying a parcel tax is significantly related to the standard demand characteristics of price and income. Districts turn to the parcel tax because the demands of local residents are not met through the revenue allocations provided by the state.

Our second conclusion is that, holding standard demand characteristics constant, Bay Area districts are much more likely to levy a parcel tax than other districts. Bay Area households have higher income on average than households in the rest of the state, and income is an important predictor of the likelihood of a parcel tax. But, differences in observed characteristics explains about half of the difference between Bay Area districts and other districts in the likelihood of levying a parcel tax.

Our model undoubtedly excludes some important variables, and these variables may explain part of the difference between Bay Area districts and other districts. Another possibility is that the parcel tax is a fiscal innovation that is slowly spreading throughout the state. The Bay Area is a likely starting place because of the relatively higher incomes there, but other areas of California are also affluent and seem likely adopters of the parcel tax. If the model used to predict a parcel tax among Bay Area districts is applied to all districts in the state, about 30 percent of districts outside the Bay Area would have a parcel tax.

While we do not know how likely this outcome is, the recent reform of California school finance system will certainly increase the popularity of the parcel tax. This reform would channel most of new state revenue for California schools to districts with high percentages of low-income students. The reform is a logical consequence of the state's high academic achievement standards for all students, standards much less likely to be met by students from low-income families. It is a logical consequence of state finance, where goals for academic achievement do not different according to family income. But, it will certainly leave public schools in many high-income areas well short of the resources families in those areas demand and are willing to pay for. The parcel tax is an obvious reaction.

If the parcel tax does become more widespread, it is unlikely that the legislature can ignore it, as it has done to this point. One obvious response is to include parcel tax revenue along with property tax revenue in the state's revenue limit system. In that case, every dollar of parcel tax revenue would reduce state aid dollar for dollar. The parcel tax would disappear and the state would reassume complete control of public school resources. It seems to us that California may soon confront another important decision in its ongoing experiment with fiscal federalism.

7. References

Anderson, Nathan B., “No Relief: Tax Prices and Property Tax Burdens,” *Regional Science and Urban Economics*, Volume 41, 2011, pages 537-549.

Baldassare, Mark, Dean Bonner, Sonja Petek, and Jui Shrestha, “Californians and Education,” Public Policy Institute of California, San Francisco, California, April 2012.

Bergstrom, Theodore C., and Robert P. Goodman, “Private Demands for Public Goods,” *The American Economic Review*, Volume 63, Number 3, June 1973, pages 280-296.

Bergstrom, Theodore C, Daniel L. Rubinfeld, and Perry Shapiro, “Micro-based Estimates of Demand Functions for Local School Expenditures,” *Econometrica*, Vol. 50, 1982, pp. 1183-1205.

Borcherding, Thomas E., and Robert T. Deacon, “The Demand for the Services of Non-Federal Governments,” *The American Economic Review*, Vol. 62, 1972, pages 891-901.

Brasington, David M., “Demand and Supply of Public School Quality in Metropolitan Areas: The Role of Private Schools,” *Journal of Regional Science*, Vol. 40, 2000, pp. 583-605.

Brasington, David M., “The Demand for Local Public Goods: The Case of Public School Quality,” *Public Finance Review*, Vol. 30, 2002, pp. 163-187.

Brunner, Eric J, “The Parcel Tax,” in J. Sonstelie & P. Richardson, *School Finance and California’s Master Plan for Education*. San Francisco, CA: The Public Policy Institute of California, 2001, pages 89-112.

Craig, Steven, and Robert P. Inman, “Education, Welfare and the “New” Federalism: State Budgeting in a Federal Public Economy,” in Harvey S. Rosen (ed), *Studies in State and Local Public Finance*, Chicago, IL: University of Chicago Press, 1986, pp. 187-228.

DiPasquale, Denise, and Edward L. Glaeser, “Incentives and Social Capital: Are Homeowners Better Citizens?,” *Journal of Urban Economics*, Vol. 45, 1999, pp. 354-384.

Duncombe, William, and John Yinger, “Making Do: State Constraints and Local Responses in California’s Education Finance System,” *International Tax and Public Finance*, Vol. 18, 2011, pp. 337-368.

Fischel, William A., “Did *Serrano* Cause Proposition 13?,” *National Tax Journal*, Vol. 42, pp. 465-474.

Flectcher, Deborah, and Lawrence W. Kenny, “The Influence of the Elderly on School Spending in a Median Voter Framework,” *Education Finance and Policy*, Vol. 3, 2008, pp. 283-315.

Goldstein, Gerald S., and Mark V. Pauly, "Tiebout Bias on the Demand for Local Public Goods," *Journal of Public Economics,* Vol. 16, 1981, pp. 131-144.

Harris, Amy Rehder, William N. Evans, and Robert M. Schwab, "Education Spending in an Aging America," *Journal of Public Economics,* Vol. 18, 2001, pp. 449-472.

Ladd, Helen F., and Shelia E. Murray, "Intergenerational Conflict Reconsidered: County Demographic Structure, and the Demand for Public Education," *Economics of Education Review,* Volume 20, Issue 4 (August 2001), pages 307-416.

Netzer, Dick, editor, *Land Value Taxation: Can It and Will It Work Today?,* Lincoln Institute of Land Policy, 1998.

Oates, Wallace E., "Property Taxation and Local Public Spending: The Renter Effect," *Journal of Urban Economics,* Volume 57, 2005, pages 419-431.

Poterba, James M., "Demographic Structure and the Political Economy of Public Education," *Journal of Policy Analysis and Management*, Volume 16, Number 1, Winter 1997, pages 48-66.

Rockoff, Jonah E., "Local Responses to Fiscal Incentives in Heterogeneous Communities," *Journal of Urban Economics,* Volume 68, 2010, pages 138-147.

Romer, Thomas, and Howard Rosenthal, "Bureaucrats Versus Voters: On the Political Economy of Resource Allocation by Direct Democracy," *Quarterly Journal of Economics,* Volume 93, Number 4, November 1979, pages 563-587.

Rose, Heather and Ria Sengupta, *Teacher Compensation and Local Labor Market Conditions in California: Implications for School Funding,* Public Policy Institute of California, 2007.

Rubinfeld, Daniel L., Perry Shapiro, and Judith Roberts, "Tiebout Bias and the Demand for Local Public Schools," *The Review of Economics and Statistics,* Vol. 69, 1987, pp. 426-437.

Sonstelie, Jon, "The Welfare Cost of Free Public Schools," *Journal of Political Economy,* Vol. 90, 1982, pp. 794-808.

Sonstelie, Jon, "Financing California's Public Schools," *Conditions of Education in California 2009,* Policy Analysis for California Education, 2008.

Vickrey, William S., "Defining Land Value for Taxation Purposes," in *The Assessment of Land Value,* Daniel M. Holland, editor, University of Wisconsin Press, 1970.

8. Appendix A. Tax-price and Grades

California school districts may serve elementary grades, secondary grades, or all grades. To account for grade span in our specification of demand, we make the following assumption: If an elementary and secondary district unify to form one district serving all grades, the typical voter would demand the same spending in the unified district as the sum of spending the voter demanded for the separate elementary and secondary district.

To see the implication of that assumption, consider a special case. An area is served by an elementary district and a secondary district. The elementary district has g_1 grades, and the high school district has g_2 grades. Each grade has exactly m students. The cost of educational resources, c, is the same for both districts. The area contains n parcels.

The demand function for school spending is log-linear as in equation (). For the elementary district that demand function is

$$\ln(e_1) = \alpha_1+(\varepsilon_1+1)\ln(c)+\varepsilon_1\ln(g_1m/n)+\eta_1\ln(y). \qquad \text{(A1)}$$

For the secondary district, the demand for school spending is

$$\ln(e_2) = \alpha_2+(\varepsilon_2+1)\ln(c)+\varepsilon_2\ln(g_2m/n)+\eta_2\ln(y). \qquad \text{(A2)}$$

For the unified district, the demand is

$$\ln(e_3) = \alpha_3+(\varepsilon_3+1)\ln(c)+\varepsilon_3\ln(g_3m/n)+\eta_3\ln(y). \qquad \text{(A3)}$$

The assumption that demand for spending in the unified district is the same as the sum of demands for the elementary and secondary district implies that

$$\begin{aligned}\alpha_3+(\varepsilon_3+1)\ln(c)+\varepsilon_3\ln(g_3m/n)+\eta_3\ln(y) = \\ &(g_1/g_3)\{\alpha_1+(\varepsilon_1+1)\ln(c)+\varepsilon_1\ln(g_1m/n)+\eta_1\ln(y)\} \\ &+(g_2/g_3)\{\alpha_2+(\varepsilon_2+1)\ln(c)+\varepsilon_2\ln(g_2m/n)+\eta_1\ln(y)\}. \qquad \text{(A4)}\end{aligned}$$

Equation A4 holds for all values of c and y, which implies that $\varepsilon_1=\varepsilon_2=\varepsilon_3=\varepsilon$ and $\eta_1=\eta_2=\eta_3=\eta$. The equalities of these coefficients reduces Equation A4 to

$$\alpha_3+\varepsilon\ln(g_3)=(g_1/g_3)\{\alpha_1+\varepsilon\ln(g_1)\}+(g_2/g_3)\{\alpha_2+\varepsilon_2\ln(g_2)\}. \qquad \text{(A5)}$$

For equation (A5) to hold for all values of g_1 and g_2, the following equality must hold:

$$\alpha_3+\varepsilon\ln(g_3)=\alpha_1+\varepsilon\ln(g_1)=\alpha_2+\varepsilon_2\ln(g_2). \qquad \text{(A6)}$$

This implies that there exists a parameter value α such that

$$\alpha_i=\alpha-\varepsilon\ln(g_i). \qquad \text{(A7)}$$

Accordingly the demand for school spending in a district (elementary, secondary, or unified) can be written as

$$\ln(e) = \alpha+(\varepsilon+1)\ln(c)+\varepsilon\ln(p)+\eta\ln(y)-\varepsilon\ln(g), \qquad \text{(A8)}$$

where g is the number of grades in the district.

9. Appendix B. Linear Probability Models

Table B2
Coefficient Estimates for Baseline Model, Standard Errors in Parenthesis
Linear Probability Model: Districts with Parcel Tax Revenue in 2009-2010

Explanatory Variables	All districts	All districts	Bay Area districts	Districts not in Bay Area
Log students per parcel (β_1)	-0.07***	-0.03***	-0.30**	-0.02**
	(0.01)	(0.01)	(0.13)	(0.01)
Mean log income (β_2)	0.37***	0.21***	0.51***	0.17***
	(0.04)	(0.03)	(0.19)	(0.03)
Std. dev. log income (β_3)	0.20***	0.17***	0.22	0.12**
	(0.06)	(0.05)	(0.36)	(0.05)
Std. dev. log income * % renters (β_4)	0.22**	0.11	-0.05	0.15*
	(0.09)	(0.09)	(0.40)	(0.08)
Log cost index (β_5)	0.31**	-0.14	0.55	-0.19**
	(0.14)	(0.11)	(0.78)	(0.09)
Log grades (β_6)	0.07**	0.07**	0.41**	0.05**
	(0.03)	(0.03)	(0.19)	(0.02)
Log revenue per pupil (β_7)	-0.04	-0.03	-0.44**	-0.02
	(0.03)	(0.02)	(0.19)	(0.02)
Constant (β_0)	-4.08***	-2.38***	-2.74	-1.96***
	(0.54)	(0.47)	(2.32)	(0.45)
Bay Area dummy variable		0.48***		
		(0.05)		
Observations	963	963	110	853
Sum of squared residuals	67.18	50.40	21.17	26.50
Percent with predicted probability>1	0.00	0.00	2.73	0.00
Percent with predicted probability<0	24.20	25.96	72.73	24.26

*p<0.10, ** p<0.05, *** p<0.01.

Table B3
Elasticity Estimates, Standard Errors in Parenthesis
Estimates Derived from Linear Probability Model in Table B2

	All districts w/o Bay Area dummy	All districts with Bay Area dummy	Bay Area districts	Districts not in Bay Area
Price elasticity (β_1/β_7)	-1.46*	-1.04*	-0.68**	-1.10
	(0.78)	(0.61)	(0.27)	(0.82)
Income elasticity (β_2/β_7)	8.36	7.02	1.15**	8.69
	(5.40)	(5.19)	(0.56)	(7.96)

*p<0.10, ** p<0.05, *** p<0.01. Standard errors estimated by delta method.

Table B4
Coefficient Estimates for Baseline and Augmented Model, Standard Errors in Parenthesis
Linear Probability Model: Districts with Parcel Tax Revenue in 2009-2010

Explanatory Variables	All districts	All districts	Bay Area districts	Bay Area districts
Log students per parcel (β_1)	-0.03***	-0.03**	-0.30**	-0.27**
	(0.01)	(0.01)	(0.13)	(0.13)
Mean log income (β_2)	0.21***	0.18***	0.51***	0.37*
	(0.03)	(0.04)	(0.19)	(0.20)
Std. dev. log income (β_3)	0.17***	0.12**	0.22	0.16
	(0.05)	(0.05)	(0.36)	(0.46)
Std. dev. log income * % renters (β_4)	0.11	0.16*	-0.05	0.08
	(0.09)	(0.09)	(0.40)	(0.41)
Log cost index (β_5)	-0.14	-0.15	0.55	0.26
	(0.11)	(0.11)	(0.78)	(0.81)
Log grades (β_6)	0.07***	0.06**	0.41**	0.39**
	(0.03)	(0.03)	(0.19)	(0.19)
Log revenue per pupil (β_7)	-0.03	-0.03	-0.44**	-0.37*
	(0.02)	(0.02)	(0.19)	(0.19)
Constant (β_0)	-2.38***	-2.11***	-2.74	-1.90
	(0.47)	(0.48)	(2.32)	(2.51)
Bay Area dummy variable	0.48***	0.48***		
	(0.05)	(0.05)		
Percentage 65 years of age		0.16		-0.23
		(0.17)		(0.81)
Percentage in private school		1.19**		5.26*
		(0.56)		(2.69)
Percent with predicted probability>1	0.00	0.00	2.73	7.27
Percent with predicted probability<0	25.96	27.73	72.73	70.91

*p<0.10, ** p<0.05, *** p<0.01.

Table B5

Coefficient Estimates for Baseline Model, Standard Errors in Parenthesis

Linear Probability Model: Districts with Parcel Tax Revenue in 2009-2010

Instrumental Variable Estimates, Bay Area districts

Explanatory Variables	Instruments: None	Instruments: Elevation
Log students per parcel (β_1)	-0.30**	-0.30**
	(0.13)	(0.14)
Mean log income (β_2)	0.51***	0.68
	(0.19)	(0.74)
Std. dev. log income (β_3)	0.22	0.01
	(0.36)	(0.66)
Std. dev. log income * % renters (β_4)	-0.05	0.28
	(0.40)	(0.64)
Log cost index (β_5)	0.55	-0.06
	(0.78)	(1.09)
Log grades (β_6)	0.41**	0.40**
	(0.18)	(0.18)
Log revenue per pupil (β_7)	-0.44**	0.42*
	(0.19)	(0.25)
Constant (β_0)	-2.74	-4.81
	(2.32)	(7.30)
Percent with predicted probability>1	2.73	4.55
Percent with predicted probability<0	72.73	0.91

*p<0.10, ** p<0.05, *** p<0.01.