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How Decisive Is the Decisive Voter?

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Abstract

This paper provides a new test of the political economy "as if" proposition that underlies nearly all empirical studies that utilize the median voter model. Specifically, we employ a unique dataset to examine whether the voter with the median income is decisive in local spending referenda. Previous tests of the median voter model have typically relied on aggregate cross sectional data to examine whether the voter with the median income is pivotal. These studies are likely biased because communities differ across a variety of unobservable dimensions that are likely correlated with both the cost of providing public services and with the distribution of income in each community. In contrast to previous studies we make use of a unique pair of California referendums to estimate a first difference specification that controls for jurisdiction unobservables. The first referendum proposed to lower the required vote share for passing local educational bonding initiatives from 67 to 50 percent, and the second referendum, which was held only six months later, proposed lowering the vote requirement from 67 to 55 percent. This pair of votes allows us to precisely test whether voters vote on each referendum "as if" future public service provision under the rules of that referendum would be determined by the income of the proposed decisive voter. This approach avoids the need to assume that public spending accurately captures public service levels and eliminates potential bias from time invariant district attributes that are likely correlated with median income. Our empirical results suggest that jurisdiction median income accurately captures the expected outcomes of majority votes on public service spending and that voters understand the impact of small changes in the identity of the decisive voter. The estimated effect of median income on voting are not present in counterfactuals estimated at the census tract and state assembly district level.

Journal of Economic Literature Classification: H4, H7, I2

Keywords: Median Voter Hypothesis, Voting, School Spending

1. Introduction

The median voter hypothesis has a long theoretical and empirical history within public economics. Since the pioneering work of Bergstrom and Goodman (1973), which established the conditions under which the median voter is also the voter with the median income, hundreds of studies have used the median voter framework to estimate demands for publicly provided goods and services. The enduring popularity of the median voter model stems both from its simplicity and its analytic tractability. As noted by Inman (1978), if governments act "as if" to maximize the preferences of the median income voter, the median voter hypothesis provides "a powerful starting point for predictive and normative analysis of government behavior."

Despite the wide spread popularity of the median voter model, a number of the key assumptions that make the model so tractable have been repeatedly challenged.[1] In particular, empirical application of the median voter model typically requires three strong assumptions. First, one must assume the political process leads to public services being delivered that satisfy the preferences of the median voter (the key implication of the model itself). That assumption is unlikely to hold when preferences are not single peaked (e.g. Stiglitz 1972; Mckelvey 1976) or when elected officials seek to maximize their budgets (e.g. Niskanen 1975; Romer and Rosenthal 1979b, 1982) or when elected officials act strategically due to differential voter turnout (e.g. Hastings, Kain, Staiger, and Weinstein 2007). Second, one must assume that median income in a community provides a reasonable proxy for the identity of the median voter. That assumption may not hold when there are private alternatives to public goods (e.g. Epple and Romano 1996) or in the presence of Tiebout sorting (e.g. Goldstein and Pauly 1981; Ross and Yinger 1999). Finally, one must assume public spending is a reasonable proxy for the level of publicly provided services; an assumption that has been challenged by Behrman and Craig (1987) and Schwab and Zampelli (1987). If any of these three assumptions fail to hold, the key proposition that governments act "as if" to maximize the preferences of the median income voter is unlikely to hold.

Consequently, numerous studies have attempted to test whether the voter with the median income is truly pivotal including Pommerehne and Frey (1976), Pommerehne (1978), Inman (1978), Deno and Mehay (1987), Turnbull and Djoundourian (1994), Aronsson and Magnus (1996), Turnbull and Mitias (1998), and Turnbull and Chang (1998). While these studies employ different datasets and different methodologies, they nevertheless share a common feature: they all attempt to test the median voter hypothesis using the same framework that is typically used to estimate demands for publicly provided goods and services. As a result, these studies are subject to the same criticisms and concerns that surround studies that utilize the median voter framework to estimate demands for publicly provided goods and services. Specifically, all the aforementioned studies utilize aggregate cross-sectional data to identify

[1] See Holcombe (1989) for a review of the criticisms and concerns surrounding the median voter model.

a relationship between public service expenditure levels and a community's median income. Because, these studies utilize public expenditures as a proxy for the level of publicly provided services, they are subject to the same criticisms that surround studies that utilize public expenditures to estimate demands for public goods; namely, that public expenditures may be a poor proxy for the actual services demanded by residents. Furthermore, these studies are likely biased because communities differ across a variety of dimensions including unobserved preferences for public services, the cost of providing public services, voter turnout, etc; and these differences are likely correlated with the distribution of income in each community.

In this paper, we propose an entirely new approach for testing the median voter hypothesis. We examine vote returns from a unique pair of California referenda that proposed changing the rules under which public spending decisions are determined. Specifically, the first referendum proposed to lower the required vote share for passing local educational bonding initiatives from 67 to 50 percent, and the second referendum, which was held only six months later, proposed lowering the vote requirement from 67 to 55 percent. Thus, the first referenda would have changed the identity of the decisive voter from the voter in the 33rd percentile of the income distribution to the 50th percentile while the second referenda would have changed the identity of the decisive voter from the voter in the 33rd percentile to the voter in the 45th percentile. Using the results from these two referenda, we test whether people vote "as if" future spending decisions will be based upon the preferences of the newly proposed decisive voter by examining whether the change in the fraction of 'yes' votes cast in the two elections can be explained by the implied change in the newly proposed decisive voter's income (i.e. the difference between the income of the 45th and 50th percentile voter in a jurisdiction).

Unlike previous tests of the median voter hypothesis, where public service spending is used to infer a relationship between the median voter's preferences and outcomes of the political process, our test infers that a median voter relationship holds because voters act as if the relationship holds when they cast their ballots to determine voting rules for choosing the level of public services provided. Consequently, our test avoids the fundamental problem of measuring the actual services demanded by voters within a jurisdiction which may be poorly proxied by the measures used in previous studies, such as expenditures per capita. Furthermore, by regressing changes in the fraction of 'yes' votes between the referendums on changes in the income associated with the decisive voter (45th and 50th percentile) in each district, we are able to difference out school district unobservables that are likely to create a correlation between the decisive voter's income and the political leaning of residents. We are also able to control for a variety of other factors that might have influenced voting changes between the referendum including changes in the tax price of the decisive voter, changes in the size and composition of voter turnout, and district size.

We find a strong negative relationship between the difference between the 45th and 50th percentile incomes and the vote share supporting the referendum in a school district. A larger income difference implies a larger decline in the amount of new education spending that voters can expect with the lower vote share requirement by moving the vote share from 50 to 55, and accordingly more voters are willing to support the second referendum when it implies a smaller increase in spending (as compared to no increase if the referendum fails). We also examine whether alternative measures of income dispersion can explain any variation in vote share changes after controlling for the income difference between the 45th and 50th percentile. After considering a variety of alternative measures of income dispersion, our results suggest the income difference between the 45th and 50th percentiles explains the vast majority of the variation in vote share differences. These findings are consistent with a world where jurisdiction median income accurately captures the expected outcomes of majority votes on public service spending and voters understand the impact of small changes in the identity of the decisive voter. Finally, this relationship between the income of the jurisdiction's decisive voter and the likelihood of supporting a referendum does not hold for two counterfactuals estimated by replacing school districts with alternative definitions of jurisdiction based on census tracts and state assembly districts.

2. Literature Review

Over the last several decades hundreds of studies have used the median voter model, developed by Bowen (1943) and Bergstrom and Goodman (1973), to estimate demand for public goods and services.[2] The vast majority of those studies use aggregate cross sectional data on the observed level of spending within a community and a community's median income to identify demand functions for publicly provided goods and services.[3] Consequently, these studies either implicitly or explicitly rely on the results of Bergstrom and Goodman (1973) that show that, "subject to certain strong assumptions, majority rule implies that one can treat an observation of expenditure levels in a given jurisdiction as a point on the demand curve of a citizen of that community with median income for the community" (Bergstrom Rubinfeld and Shapiro, 1982, p. 1184).

Despite (or possibly because of) the wide spread popularity of the median voter model, the assumptions required for the median voter model to hold have been repeatedly questioned. Preferences

[2] A review of older studies that use the median voter framework to estimate demand can be found in Inman (1979). A few of the more recent studies include, Rothstein (1992), Silva and Sonstelie (1995), Stevens and Mason (1996), and de Bartolome (1997) for school spending, Schwab and Zampelli (1987) for police, Duncombe (1991) for fire, Balsdon, Brunner and Rueben (2003) for local general obligation bond issues, and Husted and Kenny (1997) for expansion of the voting franchise.

[3] A smaller set of studies, including Bergstrom, Rubinfeld and Shapiro (1982), Gramlich and Rubinfeld (1982) and Rubinfeld, Shapiro and Roberts (1987), use individual-level survey data to estimate demand for publicly provided goods and services. See Rubinfeld (1987) for a review of these types of studies.

may not be single peaked when voters have preferences over multiple issues (McKelvey 1976) or when private alternatives exist (Stiglitz 1972; Epple and Romano 1996). Politicians and bureaucrats may use their ability to set the political agenda in order to maximize their budget (Niskanen 1975; Romer and Rosenthal 1979a, 1979b, 1982; Romer Rosenthal, and Munley 1992; Balsdon, Brunner, and Ruben 2003), or they may make decisions based on their party's or their own personal ideology (Levitt 1996; Reed 2006; Washington 2006). Similarly, politicians may have an incentive to act strategically (and in ways that deviate from the preferences of the median voter) because voter turnout may be influenced by differential voter reactions to their past actions (Hasting, Kain, Staiger, and Weinstein 2007) or by the media (Gentzkow 2006; DellaVigna and Kaplan 2007).

Further, the standard empirical assumption that the median voter is also the voter with the median income has been repeatedly questioned in the literature. For example, as pointed out by Goldstein and Pauly (1981) most of the studies that estimate demand for local public goods and services have ignored the issue of Tiebout sorting, in which households choose communities based in part upon their demand for public services. Such sorting induces well-known biases on estimated public service demand parameters in cross sectional studies and also calls into question whether median voter is also the voter with the median income. In particular, as noted by Ross and Yinger (1999), with Tiebout sorting communities may contain both higher income households with weak preferences for public services and lower income households with strong tastes for public services. Consequently, the median preference voter may not be the voter with the median income.[4] Similarly, Epple and Romano (1996) show that when there are private alternatives to public services (e.g. private schools), an equilibrium exists where the median income voter is not pivotal. Instead, the pivotal voter has an income that lies below the median.

Finally, nearly all studies that utilize the median voter framework to estimate demand for publicly provided services suffer from the fundamental problem of measuring the actual services demanded by voters. The vast majority of studies use community-level expenditures to infer a relationship between the median voter's preferences for publicly provided services and outcomes of the political process. However, as noted by Behrman and Craig (1987), "… people pay taxes based on the city-wide amount of purchased inputs, but base their demand and voting behavior on the perceived level of neighborhood service output" (Behrman and Craig, 1987, p. 47). To the extent that the services produced differ substantially across jurisdictions given the same public inputs, public spending will provide a poor proxy for public service provision. Furthermore, unobserved community characteristics that influence the cost of providing public services are likely to be correlated with other community characteristics like median

[4] Epple and Sieg (1999) estimate a structural model that allows for preference heterogeneity and enables them to estimate income and price elasticities in a model that explicitly identifies the median preference voter.

income.[5] As a result, studies that fail to properly control for the costs associated with providing public services are likely to be biased. That fact is highlighted by Schwab and Zampelli (1987) who find that studies of public service demand that fail to take into account the impact of community characteristics on the cost of public service provision can yield very misleading results.

Given all of the aforementioned caveats and concerns, it is not surprising that since the mid-1970's numerous studies have attempted to test whether the voter with the median income is truly pivotal. Pommerehne and Frey (1976), Pommerehne (1978), Inman (1978), Deno and Mehay (1987), Turnbull and Djoundourian (1994) and Turnbull and Mitias (1998) evaluate the performance of the median voter model by examining whether the use of median income in local public service demand regressions outperforms other specifications (such as replacing median income with mean income). The results of those studies generally support the hypothesis that the median income voter is decisive. Similarly, using a revealed preference approach, Turnbull and Chang (1998) find that local governments act "as if" to maximize the utility of the median income voter. On the other hand, Romer and Rosenthal (1979) argue that most studies that utilize the median voter framework, "fail to identify whether the median voter is pivotal or a voter at some other fractile is pivotal." That conclusion is supported by Aronsson and Magnus (1996) who test the predictive power of a model where the median income voter is assumed to be decisive against a more general statistical alternative. Their results lead them to reject the hypothesis that the voter with the median income is decisive.

While the majority of the studies listed above provide support for the median voter model, substantial skepticism remains about the model's empirical relevance primarily due to concerns about the validity of the aggregate analyses that support it. In particular, a common feature of all of the studies listed in the preceding paragraph is that they rely on aggregate cross-sectional data to identify the relationship between public service outcomes and a community's median income. As noted in the introduction, these studies are likely biased because communities differ across a variety of dimensions including unobserved preferences for public services, the cost of providing public services, voter turnout, etc; and these differences are likely correlated with the distribution of income in each community. Furthermore, all of the studies listed in the preceding paragraph attempt to test the median voter hypothesis using the same framework that is used to estimate demands for publicly provided goods and services; namely, by examining the relationship between community expenditures and some measure of community income. Consequently, these studies suffer from the same fundamental problem of measuring actual service demands that plagues most studies that utilize the median voter model to estimate demands for publicly provided goods. As a result, it remains unclear whether these studies can accurately identify

[5] See Ross and Yinger (1999) for a survey of studies that document cost heterogeneity across jurisdictions, as well as recent additional studies by Duncombe and Yinger (2005) and Reschovsky and Imazeki (2003).

whether or not the voter with the median income is truly decisive and therefore provide confirmation that the median voter model accurately describes the public service provision decisions of local jurisdictions.

3. Conceptual Framework

Prior to 2000, local school bond measures in California required a two-thirds supermajority to pass. If voters approved a bond issue, the bonds were then repaid with local property tax increases that remained in effect until the bonds were fully repaid. In 2000 Californians voted on two statewide initiatives designed to ease this supermajority vote requirement. In March of 2000 Californians voted on Proposition 26, an initiative that would have reduced the vote requirement on school bond measures to a simple majority. The proposition garnered the support of only 47 percent of voters and thus failed. In November of 2000 Californians voted on Proposition 39, an initiative that was nearly identical to Proposition 26 except it called for reducing the vote requirement on local school bond measures to 55%. This time California voters approved the measure with 53 percent of voters voting in favor of Proposition 39.

In this section we develop a simple voting model based on Rothstein (1994) in order to illustrate the relationship between support for a change in required vote share and the income of the decisive voter. Let S_{ij}^{*} denote the desired level of school spending of individual i located in school district j. The individual votes in favor of a decrease in the vote share required to pass spending referenda to P if and only if S^{P}, the spending level under the new vote share, is preferred to S^{0}, the spending level under the current, higher vote share requirement.

Following Rothstein (1994), we parameterized individual preferences for school spending using the desired spending level S_{ij}^{*} so that an individual's indirect utility function $V(S_j \mid S_{ij}^{*})$ is maximized when district spending level $S_j = S_{ij}^{*}$. Next, we assume that the distribution of preferences in district j is distributed around a district mean preference S_j^{*} or

$$S_{ij}^{*} = S_j^{*} + \mu_{ij} \qquad (1)$$

where μ_{ij} is a random disturbance. Assuming preferences over public service levels are single peaked, a unique α_j^{P} exists so that $V(S_j^{0} \mid a_j^{P}) = V(S_j^{P} \mid \alpha_j^{P})$ where V is a voter's indirect utility function conditional on their preferences for the public service.[6] A voter supports the referendum to lower the vote share requirement presumably increasing public service levels if and only if $S_{ij}^{*} > \alpha_j^P$. Parameterizing α_j^P as

$$a_j^P = \alpha(S_j^0, S_j^P) + \nu_j = (1-\delta)S_j^0 + \delta S_j^P + \upsilon_j \tag{2}$$

where δ is between zero and one and substituting equations (1) and (2) into the inequality above, we find that a voter supports the reduction in the vote share requirement if and only if

$$S_j^* - [(1-\delta)S_j^0 + \delta S_j^P] > \upsilon_j - \mu_{ij} \tag{3}$$

Let $pyes_j$ denote the fraction of voters in district j that prefer S^P to S^0. As demonstrated by Rothstein (1994), if υ_j and μ_{ij} follow independent type 1 extreme value distributions, then the log-odds can by expressed as:

$$\ln\left(\frac{pyes_j}{1-pyes_j}\right) = c_0 + c_1 S_j^* - c_2 S_j^0 - c_3 S_j^P \tag{4}$$

where c_1, c_2, and c_3 are all non-negative.[7] If the first initiative imposed a required vote share of 50% for spending referenda and the second initiative imposed a 55% vote share, the difference in the log-odds of the fraction of voters that support the two initiatives in district j is:

[6] Specifically, we assume that indifference curves are convex over public service levels and property tax rates so that given a well-behaved community budget constraint an individual has a unique preferred level of public service and utility declines as the public service level is increased above or decreased below that preferred level, see Epple and Romano (1996a, 1996b) as well as many other earlier papers that impose such assumptions. This implies that $V(S_j \mid S_{ij}^*)$ is a concave function of S_j see Rothstein (1994) and Balsdon and Brunner (2005).

[7] Equation (4) involves aggregate vote shares. The aggregation from Equation (3), which is based on individual preferences, is accomplished via the assumption of an extreme value distribution for the unobservable associated with the distribution of individual preferences within a jurisdiction and for the unobservable associated with parameterizing α_j^P, the preference level in a community that is indifferent between the referendum passing or failing. This assumption leads to jurisdiction vote shares that depend upon the standard logistic distribution.

$$\ln\left(\frac{pyes_j^2}{1-pyes_j^2}\right)-\ln\left(\frac{pyes_j^1}{1-pyes_j^1}\right)=-c_3(S_j^{55}-S_j^{50}) \quad (5)$$

where both the unique district mean preference for public service levels, the default level of public service provision, and any idiosyncratic district attributes that are captured by the intercept drop out of the model.

4. Empirical Methodology

In order to operationalize equation (5), we assume that for referendum k the implied future level of public service is a function of the income and tax price percentile associated with the vote share required under the referendum. For a 50 percent vote share, the standard median voter assumption applies where the future level of public service is a function of the median income and median tax price in the school district. The tax price p_j is the median percentile assessed value divided by the property tax based per service recipient, or

$$p_j \equiv \left(\frac{E_j}{G_j}\right)h_j^{50}$$

where the first term is the number of service recipients E_j, in this case number of school district students divided by the jurisdiction grand list of property assessments G_j, and the second term is 50th percentile assessed value of owner-occupied homes.

For a 55 percent vote share, which is the share associated with the second referendum, the future level of public service is a function of the district's 45th percentile income and tax price. Specifically, a higher vote share for passage decreases the level of public service that will be acceptable to voters and thus shifts the decisive income and tax prices further down the distribution. Assuming a linear form for public service demand yields

$$S_j^{P_k}=S(y_j^{100-P_k},p_j^{100-P_k})=b_k+b_y y_j^{100-P_k}+b_p p_j^{100-P_k}+\varepsilon_{jk} \quad (6)$$

where P_k is the required vote share for referendum k, $y_j^{100-P_k}$ or y_{jk} for short is the income at the decisive percentile, $p_j^{100-P_k}$ or p_{jk} for short is the tax price at the decisive percentile, b_y and b_p are parameters describing the responsiveness of demand to income and price, b_k is a referendum specific intercept, and ε_{jk} is a random error term. Substituting equation (6) into equation (5) for the two referenda yields

$$\ln\left(\frac{pyes_j^2}{1-pyes_j^2}\right)-\ln\left(\frac{pyes_j^1}{1-pyes_j^1}\right)=(d_2-d_1)+d_y(y_{j2}-y_{j1})+d_p(p_{j2}-p_{j1})+(\varepsilon_{j2}-\varepsilon_{j1}) \qquad (7)$$

where the d parameters are just the b parameters from equation (6) multiplied by the negative term $-c_3$. The median or decisive voter model predicts that d_y should be negative since public service demand increases with income as captured by a positive value for b_y and so vote shares should fall as the public service level implied by the referendum rises. Similarly, d_p should be positive since public service demand falls with tax price a reflected by a negative value for b_p.

This difference specification eliminates unobserved differences across districts in preferences for public services, political leaning, time invariant differences in turnout rates, as well as a host of other idiosyncratic differences. Consequently, it eliminates any time invariant factors that might be correlated with the income distribution and thus bias a cross-sectional aggregate test of the median or decisive voter model. Nonetheless, one might worry that changes in the decisive percentile income between the referenda may be correlated with unobservables that affect the change in vote share between referenda. In order to control for these factors, additional models of change in vote share are estimated including controls for voter turnout and other time varying jurisdiction attributes, as well as district size.

Further, an additional specification test is conducted to test whether other measures of heterogeneity in the income distribution can explain any variation in vote share changes after controlling for the income difference between the 45th and 50th percentile. Specifically, the predicted residual from equation (7), $(\hat{\varepsilon}_{j2}-\hat{\varepsilon}_{j1})$, is regressed upon the income differences between selected income percentiles, or

$$(\hat{\varepsilon}_{j2}-\hat{\varepsilon}_{j1})=\gamma_1(y_j^{40}-y_j^{60})+\gamma_2(y_j^{30}-y_j^{70})+\gamma_3(y_j^{20}-y_j^{80}) \qquad (8)$$

If these measures of the variance in income across a jurisdiction can explain the residual in vote share, the influence of the income change between the 45th and 50th percentile on vote share might also be attributed a correlation between vote share and jurisdiction income heterogeneity or omitted variables that are correlated with jurisdiction income heterogeneity. On the other hand, if these variables cannot explain the residual, the findings will support the notion that the income of the decisive percentile voter is sufficient for explaining the relationship between public service voting outcomes and jurisdiction income distribution.

Finally, the specification test described in equation (8) is repeated with alternative, entropy based measures of income heterogeneity. The generalized entropy measure for a distribution is calculated as follows

$$GE(\gamma) = \frac{1}{\gamma^2 - \gamma}\left[\frac{1}{N}\sum_{i=1}^{N}\left(\frac{y_i}{\bar{y}}\right)^{\gamma} - 1\right] \tag{9}$$

where γ captures the relative weight placed on different regions of the distribution. As γ increases from low levels, emphasis is shifted from the lower tail of the distribution to the middle of the distribution and eventually as γ continues to increase to the upper tail of the distribution. For a basis of comparison, values of γ between –0.5 and 0.0 closely resemble the Gini coefficient, while a γ of 1.0 and 2.0 yield the Theil index and coefficient of variation, respectively. We will examine values of γ between –2.5 and 2.5.

5. Data

We obtained data on vote outcomes for Propositions 26 and 39 from the Statewide Database, maintained by the Institute of Governmental Studies at the University of California, Berkeley. The database contains aggregate vote outcomes and voter registration information, for all statewide primary and general elections held in California since 1990. The primary unit of analysis in the statewide database is the Census block. We aggregated the block level vote tallies and voter registration information up to the school district level. Thus, our primary unit of observation is the school district.

In the empirical framework developed in Section 4, the difference in vote shares between Proposition 39 and 26 is a function of the difference between the 45^{th} and 50^{th} percentile income and the difference between the 45^{th} and 50^{th} percentile tax price in a school district. To construct estimates of the income percentiles, we used district-level data from the 2000 Census on the distribution of household income. Specifically, the 2000 Census contains information on household income grouped into 17 income categories. We used this grouped income data and linear interpolation to estimate the 50^{th} and 45^{th} percentile level of income in each district. We used a similar approach to construct measures of the 50^{th} and 45^{th} percentile tax prices.

As noted in Section 4, the 50th percentile tax price in district j is $\left(\frac{E_j}{G_j}\right)h_j^{50}$, where E_j denotes the total enrollment in district j, G_j denotes the total assessed value of property in district j and h_j^{50} denotes the 50th percentile assessed value of owner-occupied homes in district j. Similarly, the 45th percentile tax price is $\left(\frac{E_j}{G_j}\right)h_j^{45}$, where h_j^{45} denotes the 45th percentile assessed value of owner-occupied homes in district j. District-level data on student enrollment in 2000 was obtained from the California Department of Education while data on the total assessed value of property in each school district in 2000 was obtained from the Coalition for Adequate School Housing, a California school advocacy organization. Unfortunately, district-level data on the assessed value of owner-occupied homes in California is unavailable. Consequently, we used data from the 2000 census on the distribution of house values (which are grouped into 25 categories) to estimate the 50th and 45th percentile level of home values and used these home value percentiles as proxies for h_j^{50} and h_j^{45} when constructing our tax price variables.

The use of actual home values as a proxy for assessed values may be particularly problematic in the case of California due to Proposition 13 which was passed by California voters in 1978. Specifically, Proposition 13 capped property tax rates at one percent of assessed valuation throughout the state. In addition, it changed when and how property was assessed for tax purposes in California. After the passage of Proposition 13, property could only be reassessed upon a change in ownership, at which point the property was assessed at full market value. As a result, the assessed value and market value of homes in California can differ substantially depending on when a home was purchased. In general, the longer a resident has lived in their home, the larger the gap between market value and assessed value. In light of that fact, we also constructed two additional variables to control for the difference in the tax price between the 50th and 45th percentile voter. Those variables are the 50th and 45th percentiles of homeowner tenure in current residence which we constructed using grouped data from the 2000 census on the number of years a homeowner has lived in their current residence. These variables are designed to control for systematic differences across districts in the market value and assessed value of homes.

We also include a number of additional variables in several of our empirical specifications. The first variable is the difference in voter turnout between Proposition 39 and Proposition 26. We used data on voter registration from the Statewide Database to construct our measure of voter turnout. Specifically, we measure the difference in voter turnout between Propositions 39 and 26 as:

$$Turnout_j = \frac{(tvote39_j - tvote26_j)}{Total\ Registered\ Voters_j},$$

where $tvote39_j$ is the total number of voters who cast a vote on Proposition 39 in district j, $tvote26_j$ is the total number of voters who cast a vote on Proposition 26 in district j and *Total Registered Voters*$_j$ is the total number of registered voters in district j. We include this variable to account for the potential impact changes in voter turnout may have on vote outcomes between the two elections. The second variable is the difference in the fraction of registered Republicans between Proposition 39 and Proposition 26 and the third variable if the difference in the fraction of registered Democrats between the two propositions. We include these two variables to further control for systematic changes in the composition of voter turnout between elections.

The remaining variables are a set of district size fixed effects. Districts that are larger and more heterogeneous may have responded differently than smaller, more homogenous districts to events that occurred between the votes on Propositions 39 and 26, and the difference between 50th and 45th percentile income is likely to be correlated with both district size and the general level of income heterogeneity in the district. The strong positive correlation between district size, the change in decisive voter's income, and the change in the share of 'yes' votes is illustrated in Table 1 for our data. Consequently we used data on the number of registered voters in each district to construct four indicator variables that take the value of unity if the total number of registered voters in a district is in the first, second, third or fourth quantile of district size respectively. In our empirical work, we use districts in the first quantile as a reference group and include the second, third and fourth quantile indicator variables as controls. Note that the inclusion of these size category fixed effects in the vote share difference model allows the vote share to vary systematically across the two referenda by size category.

{Insert Table 1 Here}

Our data have a number of limitations. The first limitation concerns school districts with overlapping boundaries. Specifically, California contains three types of school districts: unified districts, elementary districts and high school districts. The boundaries of the latter two types of districts overlap: one high school district typically contains two or more elementary districts. Thus, in non-unified districts there are really two decisive voters: the decisive voter for the elementary school district and the decisive voter for the high school district into which the elementary district feeds. That fact has ramifications for our empirical work since in non-unified districts it becomes unclear how one should measure the income and tax price of the proposed decisive voter. Consequently, in the empirical analysis that follows, we restrict our sample to unified school districts. The second limitation concerns missing data. Data on the fraction of voters supporting Proposition 26 is unavailable for 15 of the 323 school districts operating in California in 1999-2000.[8] We exclude these 15 districts from our analysis leaving a final sample of 308 unified school districts.

Table 2 provides means and standard deviations for the variables used in the analysis. These summary statistics are reported separately for Propositions 26 and 39 respectively. As expected the increase in the vote requirement from 50 to 45 percent is associated with a greater percentage of votes supporting the referendum, lower decisive voter income, and lower decisive voter tax share. The change from a summer election (Prop 26) to a November election (Prop 39) also increases turnout from 45.9 to 66.4 percent of registered voters.

{Insert Table 2 Here}

6. Core Results

The core regression results for change in vote share are presented in Table 3. The first column presents the basic model that controls only for the change in the decisive voter's income and tax price. The second and third columns contain results from models that include additional controls for turnout and household tenure in residence, and the fourth column presents results after controlling for jurisdiction size category fixed effects. As expected, all four regressions imply a strong negative relationship between the income of the decisive voter and support for the referendum. The estimates from the first three models suggest that a one percent decrease in the income of the decisive voter should lead to approximately a 0.2 percent increase in vote share, based on average vote share in the first referendum this is consistent with a 0.4 percentage point increase in the share voting yes. The effect size is cut by about half after controlling for district size, and a one percent decrease in decisive voter income is consistent with a 0.2 percentage increase in share yes. Using Table 2, the average change in the income of the decisive voter is 9.7 percent, which is consistent with between a 2 and 4 percent increase in share voting yes between the two referenda, while the actual statewide increase in vote share was approximately 3 percent. We do not find any evidence to suggest that voters in the referenda considered the tax price of the decisive voter.

{Insert Table 3 Here}

[8] The counties of Monterey, Humboldt and San Luis Obispo did not report vote tallies to the Statewide Database for Proposition 26.

Table 4 presents the results of our first specification test for each of the four models in Table 3. The first three panels present the relationship between the predicted residual from the models in Table 3 and the three individual income percentile differences: $(y_j^{40} - y_j^{60})$, $(y_j^{30} - y_j^{70})$, and $(y_j^{20} - y_j^{80})$. The last panel regresses the residual on all three income difference variables. None of the models identify a statistically significant relationship between the residual and the income difference variables.

{Insert Table 4 Here}

One potential problem with the specification tests reported in Table 4 is that the change in the decisive voter's income $(y_j^{45} - y_j^{50})$, is highly correlated with all three of the other income difference variables $(y_j^{40} - y_j^{60})$, $(y_j^{30} - y_j^{70})$, and $(y_j^{20} - y_j^{80})$. In fact, that correlation is always above 0.95. Consequently, our specification test may have limited power to distinguish between the effect of changes in the income of the decisive voter and other measures that capture income heterogeneity. Table 5 presents the correlation between the decisive voter income variable and a variety of generalized entropy measures of income dispersion. These correlations are much lower than the correlation with the income difference variables used in Table 4, suggesting that a specification test based on these variables should have power to distinguish between the decisive voter effect and a more general effect of income heterogeneity. Table 6 presents the results of regressing the residuals from the models in Table 3 on the individual values of γ. Once again, none of the models identify a statistically significant relationship between the residual and the generalized entropy measures of income dispersion.

{Insert Tables 5 and 6 Here}

7. Measurement Error and Instrumental Variables Estimation

The results of the specification tests reported in Tables 4 and 5 suggest that the income difference between the 45^{th} and 50^{th} percentiles sufficiently explains the majority of vote share differences. Thus, our results are consistent with a world where jurisdiction median income accurately captures the expected outcomes of majority votes on public service spending and voters understand the impact of small changes in the identity of the decisive voter. In other words, our results are consistent with the proposition that the median voter is the voter with the median income. Nevertheless, the results reported in Table 3 may still suffer from specification bias if our decisive voter income variable suffers from measurement error. Concerns about measurement error seem warranted given that the 50^{th} and 45^{th} income percentiles for each jurisdiction must be imputed based on census tabulations that divide the population into 17 income categories. While these imputations may accurately represent across district differences in income, the difference between the imputed 50th and 45th percentile incomes may be far less accurate in capturing across district differences in the change in the decisive voter's income. Measurement error should attenuate the coefficient estimate on the decisive voter income variable and thus the estimates reported in Table 3 should provide a lower bound on the relationship between vote share and the decisive voter's income.

The standard approach for addressing measurement error is instrumental variables. The generalized entropy measures of income dispersion used in the previous sections provide reasonable candidates for instruments given the ability of these variables to explain changes in the decisive voter's income between the two referenda. Further, the standard overidentification test for instrumental variables estimation also tests our proposition that the change in decisive voter income is sufficient to explain the entire empirical relationship between jurisdiction vote share and the jurisdiction's income distribution. Overidentification tests explicitly ask the following question: Do the instruments enter into the second stage equation in a way that is not captured by the linear combination of those variables that was estimated in the first stage? If our instruments enter into the second stage in a form that differs from how they enter the first stage, one or more of those variables could not have entered the second stage solely through the first stage variable, a violation of the exclusion restriction assumption. In our case, a rejection of the exclusion restrictions suggests that other measures of income heterogeneity belong in the voter share model, while a failure to reject the exclusion restrictions supports our initial hypothesis that information on decisive voter income is sufficient to explain changes in vote share.

Table 7 presents the results of these specification tests where each model includes three generalized entropy measures where the values of γ are chosen to reduce the correlation between the three measures being used in the same specification.[9] Specifically, the three panels in Table 7 present the residual regression results using entropy measures based on the following values of γ: (-2.5, -0.5, 2.5), (-2.0, 0, 2.0), and (-1.5, 0.5, 1.5). The parameter estimates on the decisive voter income variable increase moderately by between 25 and 70 percent, and therefore are consistent with measurement error in the explanatory variable. The largest changes occur in the specification that includes jurisdiction size category fixed effects, and the effect of a one percent decrease in the income of the decisive voter increases from a 0.2 percentage point increase in share voting yes to more than a 0.3 percent increase for the size fixed effect model.

[9] The estimates of all first stage models are presented in an appendix that is available upon request along with F-tests that establish that the instruments have substantial explanatory power in the first stage, suggesting that our instrumental variable estimates are not biased by weak instruments.

{Insert Table 7 Here}

Finally, measurement error may also be present in the tax price variable and the resulting attenuation bias may be substantially larger. The 50th percentile owner-occupied house value is likely to be a seriously flawed indicator of the median tax burden. In addition to measurement error based on imputations from the distribution of house values in a jurisdiction, self reported house values in the census are likely to vary dramatically from tax assessments because proposition 13 in California prohibits the reassessment of owner-occupied houses for property tax purposes except for when the house is sold. The change in tax price arising in Equation (7) is the difference between the 45th and 50th percentile house value divided by the property tax based per service recipient, or

$$\left(p_{j2} - p_{j1}\right) \equiv \left(\frac{E_j}{G_j}\right)\left(h_j^{45} - h_j^{50}\right)$$

The ratio of number of service recipients or students (E_j) to the jurisdiction grand list of assessments (G_j) provides an instrument that will be correlated with changes in decisive percentile tax price and yet uncorrelated with measurement error that arises because the census distribution of house values does not accurately represent the actual distribution of assessed values.

Instrumenting for tax price using the ratio of the number of service recipients to the jurisdiction grand list has no meaningful impact on any previously estimated coefficients. The effect of decisive voter income is robust in terms of both significance and magnitude, and the estimated effect of tax price remains small and statistically insignificant.[10]

8. Counterfactuals

The results reported in sections 6 and 7 consistently support the hypothesis that the income difference between the 45th and 50th percentile voter adequately and sufficiently explains changes in vote outcomes between Proposition 26 and Proposition 39. Thus, our results provide strong support for the hypothesis that the median voter is also the voter with the median income. However, before we accept that conclusion, it would be helpful to know whether we have truly identified a relationship between changes in the school district's decisive voter's income and changes in vote shares or whether we are

[10] All income and tax price instruments are included in the first stage models for both decisive voter income and tax price. As before, overidentification tests fail to reject the exclusion restrictions. Finally, F-tests confirm that the instruments have power to explain the decisive voter income and tax price variables both as a complete set of instruments, as well as when focusing on the instruments created for one decisive voter variable conditioning on the instruments created for the second variable. These estimates and the IV specification tests are available upon request.

simply picking up a spurious relationship caused by some other unobserved factor that might persist at a variety of levels of spatial aggregation. To address this concern, we conduct two counterfactuals. The logic behind our counterfactuals is simple: if the relationship we have identified is truly causal, then it should hold for school districts (which would have been directly affected by the outcomes of Propositions 26 and 39) but it should not hold for other political or geographic entities. For example, while we expect the income difference between the 45^{th} and 50^{th} percentile voter in a *school district* to explain differences in vote shares within school districts we would not expect the income difference between the 45^{th} and 50^{th} percentile voter in a *census tract* or an *state assembly district* to explain differences in vote shares within those geographic/political entities. That is, for political/geographic entities other than school districts, the income difference between the 45^{th} and 50^{th} voter should be uncorrelated with changes in vote shares.

Our rationale for choosing census tracts and state assembly districts is based on their size and their lack of relevance for the provision of any local public services. Census tracts tend to be much smaller than school districts while state assembly districts tend to be much large than school districts (California contains 80 state assembly districts). Thus, our counterfactuals cover geographic/political entities that are both smaller and larger than school districts. Further, since the neither of these geographic regions represents a level of local governments, the median income and tax price variables could not be related to any unexpected fiscal implications of Propositions 26 and 39.

To implement our counterfactuals we estimate models identical to those reported in Table 3 using data on vote shares, income differences, tax price differences, etc, that are calculated for either census tracts or state assembly districts. For example, our counterfactual involving census tracts utilizes information for 6,796 census tracts on vote share differences in a census tract, income differences between the 45^{th} and 50^{th} percentile voter in a census tract, etc. Similarly, our counterfactual involving state assembly districts (SAB) utilizes information for the 80 SAB's in California on vote share differences within SAB's, income differences within SAB's, etc.

Results based on these counterfactuals are reported in Table 8.[11] The results reported in Table 8 are quite striking. The estimated coefficients on the income difference between the 45^{th} and 50^{th} percentile voter are statistically insignificant in all our counterfactuals, and the magnitude of the estimates are substantially smaller than the estimates for school districts. For example, in model 4 involving census tracts the estimated coefficient on the income difference variable is -0.019. The corresponding estimate

[11] In the interest of brevity, we report only the estimated coefficients on the income difference and tax price difference variables. The complete set of estimated coefficients for model 4, the model that includes our complete set of control variables, is included in an appendix that is available upon request.

for school districts reported in Table 3 and the top panel of Table 8 is -0.127 or 6 times larger than the estimate based on census tracts.[12]

{Insert Table 8 Here}

9. Conclusion

This paper provides a direct test of the political economy “as if” proposition that underlies nearly all empirical studies that utilize the median voter model. Specifically, we employ a unique dataset to examine whether the voter with the median income is decisive in local spending referenda. Previous tests of the median voter model have typically relied on aggregate cross sectional data to examine whether the voter with the median income is pivotal. These studies are likely biased because communities differ across a variety of unobservable dimensions that are likely correlated with the distribution of income in each community. In contrast to previous studies we make use of a pair of California referendums to estimate a first difference specification that controls for jurisdiction unobservables. The first referendum proposed to lower the required vote share for passing local educational bonding initiatives from 67 to 50 percent, and the second referendum, which was held only six months later, proposed lowering the vote requirement from 67 to 55 percent. This pair of votes allows us to precisely test whether the income and tax price of the decisive voter affects the willingness of voters to support the referendum.

Our empirical results suggest that jurisdiction median income accurately captures the expected outcomes of majority votes on public service spending and that voters understand the impact of small changes in the identity of the decisive voter. The estimates from most models suggest that a one percent decrease in the income of the decisive voter should lead to approximately a 0.2 percent increase in vote share, based on average vote share in the first referendum this is consistent with a 0.4 percentage point increase in the share voting yes. This effect size is cut by about half after controlling for district size, and a one percent decrease in decisive voter income is consistent with a 0.2 percentage point increase in share yes. These effects are consistent with between a 2 and 4 percentage point increase in the statewide share voting yes between the two referenda, while the actual statewide increase in vote share was approximately 3 percent. Instrumental variable estimation for measurement error increases the associated change between the two referenda to between a 3 and 6 percentage point increase in the share voting yes. Finally, the estimated effect of median income on voting is not present in counterfactuals estimated at the census tract and state assembly district level.

[12] The census tract model includes district fixed effects so that all estimates are based on within school district comparisons. The estimates from this fixed effect model are insulated against the systematic across district variation that drives the estimates in the school district sample. Standard errors for this model are also clustered at the school district level because heteroscedasticity can bias the estimation of standard errors in fixed effect models.

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Table 1

Voter Turnout and Differences in Vote Shares and Income by Quantiles of District Size

Quantiles Based on Number of Registered Voters	Vote Share Difference (Prop 39-Prop26)	Income Difference (45th - 50th)	Voter Turnout Difference
First Quantile	0.015	-3,463	0.21
(Less than 3,704)	(0.041)	(1,246)	(0.09)
Second Quantile	0.018	-4,529	0.22
(3,704 - 14,242)	(0.031)	(1,884)	(0.08)
Third Quantile	0.038	-5,055	0.25
(14,243 - 36,928)	(0.026)	(1,293)	(0.07)
Fourth Quantile	0.042	-5,242	0.25
(greater than 36,928)	(0.026)	(1,438)	(0.06)

Table 2
Summary Statistics

	Proposition 26		Proposition 39	
Variable	Mean	Std. Dev.	Mean	Std. Dev.
Fraction Yes	0.477	0.085	0.505	0.084
Income	47,297	17,299	42,724	15,815
Tax Price	0.530	0.292	0.503	0.278
Years in Current Residence	10.14	2.77	8.57	2.32
Turnout	0.459	0.094	0.664	0.069
Fraction Republican	0.373	0.114	0.374	0.114
Fraction Democrat	0.441	0.108	0.436	0.106

Table 3
Baseline Coefficient Estimates

	(1)	(2)	(3)	(4)
Income	-0.156**	-0.207**	-0.227**	-0.127**
	[0.053]	[0.060]	[0.063]	[0.056]
Tax Price	-0.287	0.080	0.278	0.171
	[0.410]	[0.410]	[0.419]	[0.355]
Years in Current Residence		-0.047*	-0.046*	-0.034
		[0.024]	[0.024]	[0.023]
Turnout			-0.108	-0.118
			[0.116]	[0.118]
Fraction Democrat			0.779*	0.403
			[0.424]	[0.374]
Fraction Republican			-0.010	0.114
			[0.476]	[0.449]
Second Quantile of Size				0.003
				[0.024]
Third Quantile of Size				0.077**
				[0.023]
Fourth Quantile of Size				0.090**
				[0.024]
Constant	0.036	-0.001	0.003	0.019
	[0.029]	[0.036]	[0.045]	[0.044]
R-Square	0.04	0.05	0.07	0.15
Observations	308	308	308	308

Notes: (1) Robust standard errors in brackets, (2) * significant at 10%; ** significant at 5%

Table 4
Coefficient Estimates from Regressions of Residual on Alternative Income Differences

	(1)	(2)	(3)	(4)
y^{40} - y^{60}	-0.001	-0.002	-0.001	-0.001
	[0.013]	[0.013]	[0.013]	[0.012]
F-statistic	0.00	0.01	0.01	0.01
y^{30} - y^{70}	-0.002	-0.002	-0.002	-0.002
	[0.006]	[0.006]	[0.006]	[0.006]
F-statistic	0.07	0.10	0.08	0.10
y^{20} - y^{80}	-0.001	-0.002	-0.002	-0.001
	[0.004]	[0.004]	[0.004]	[0.003]
F-statistic	0.15	0.22	0.19	0.13
y^{40} - y^{60}	0.105	0.100	0.101	0.091
	[0.064]	[0.062]	[0.062]	[0.061]
y^{30} - y^{70}	-0.024	-0.019	-0.017	-0.040
	[0.054]	[0.055]	[0.055]	[0.050]
y^{20} - y^{80}	-0.016	-0.019	-0.020	-0.003
	[0.025]	[0.025]	[0.025]	[0.022]
F-statistic	1.23	1.32	1.36	0.81

Notes: Robust standard errors in brackets

Table 5
Correlation Matrix for Various Inequality Measures

Variable	(y^{45} - y^{50})	GE(-2.5)	GE(-2.0)	GE(-1.5)	GE(-1.0)	GE(-0.5)	GE(0)	GE(0.5)	GE(1.0)	GE(1.5)	GE(2.0)	GE(2.5)
(y^{45} - y^{50})	1											
GE(-2.5)	-0.7231	1										
GE(-2.0)	-0.6841	0.9859	1									
GE(-1.5)	-0.5685	0.919	0.9709	1								
GE(-1.0)	-0.396	0.7983	0.8803	0.9644	1							
GE(-0.5)	-0.1963	0.6337	0.7349	0.8623	0.9645	1						
GE(0)	-0.0418	0.4878	0.5939	0.741	0.8864	0.9755	1					
GE(0.5)	0.0729	0.3625	0.4663	0.6182	0.788	0.9141	0.9795	1				
GE(1.0)	0.1726	0.2335	0.3303	0.4787	0.6613	0.8136	0.9137	0.9754	1			
GE(1.5)	0.2495	0.1003	0.1835	0.3186	0.5003	0.6652	0.7897	0.8873	0.9647	1		
GE(2.0)	0.2663	-0.0043	0.0588	0.1683	0.3282	0.4828	0.6105	0.7259	0.8442	0.9523	1	
GE(2.5)	0.2147	-0.0501	-0.0077	0.0706	0.1934	0.3171	0.4258	0.5354	0.6683	0.8242	0.9552	1

Table 6
Coefficient Estimates from Regressions of Residual on Alternative Income Inequality Measures

	(1)	(2)	(3)	(4)
GE(-2.5)	-0.001	-0.001	-0.001	-0.000
	[0.002]	[0.002]	[0.002]	[0.001]
F-statistic	0.12	0.10	0.19	0.02
GE(-2.0)	-0.002	-0.001	-0.002	-0.002
	[0.006]	[0.006]	[0.006]	[0.005]
F-statistic	0.09	0.06	0.15	0.08
GE(-1.5)	-0.008	-0.006	-0.009	-0.010
	[0.018]	[0.018]	[0.019]	[0.017]
F-statistic	0.19	0.12	0.26	0.31
GE(-1.0)	-0.035	-0.031	-0.038	-0.035
	[0.043]	[0.043]	[0.043]	[0.042]
F-statistic	0.66	0.52	0.75	0.72
GE(-0.5)	-0.094	-0.088	-0.095	-0.081
	[0.079]	[0.080]	[0.079]	[0.077]
F-statistic	1.38	1.20	1.46	1.13
GE(0)	-0.151	-0.144	-0.150	-0.117
	[0.115]	[0.115]	[0.114]	[0.112]
F-statistic	1.74	1.56	1.74	1.10
GE(0.5)	-0.163	-0.156	-0.159	-0.114
	[0.133]	[0.134]	[0.133]	[0.131]
F-statistic	1.49	1.34	1.44	0.75
GE(1.0)	-0.121	-0.117	-0.120	-0.076
	[0.121]	[0.122]	[0.121]	[0.120]
F-statistic	1.00	0.92	0.98	0.40
GE(1.5)	-0.062	-0.062	-0.065	-0.031
	[0.079]	[0.080]	[0.079]	[0.078]
F-statistic	0.61	0.60	0.66	0.16
GE(2.0)	-0.021	-0.022	-0.024	-0.007
	[0.033]	[0.033]	[0.033]	[0.032]
F-statistic	0.40	0.44	0.53	0.04
GE(2.5)	-0.005	-0.005	-0.006	-0.000
	[0.008]	[0.008]	[0.008]	[0.008]
F-statistic	0.35	0.43	0.59	0.00

Notes: Robust standard errors in brackets

Table 7
Instrument Variables Estimation

	(1)		(2)		(3)		(4)	
	O.L.S.	2SLS	O.L.S.	2SLS	O.L.S.	2SLS	O.L.S.	2SLS
Income	-0.156**	-0.172**	-0.207**	-0.224**	-0.227**	-0.240**	-0.125**	-0.167**
	[0.053]	[0.055]	[0.060]	[0.065]	[0.063]	[0.072]	[0.058]	[0.068]
Tax Price	-0.287	-0.261	0.080	0.126	0.278	0.308	-0.109	0.256
	[0.410]	[0.400]	[0.410]	[0.407]	[0.419]	[0.413]	[0.361]	[0.349]
Hansen J Statistic		1.54		1.34		1.68		2.10
Income	-0.156**	-0.194**	-0.207**	-0.254**	-0.227**	-0.270**	-0.125**	-0.176**
	[0.053]	[0.058]	[0.060]	[0.069]	[0.063]	[0.075]	[0.058]	[0.071]
Tax Price	-0.287	-0.224	0.080	0.205	0.278	0.381	-0.109	0.275
	[0.410]	[0.394]	[0.410]	[0.402]	[0.419]	[0.414]	[0.361]	[0.352]
Hansen J Statistic		2.34		1.99		2.18		2.58
Income	-0.156**	-0.213**	-0.207**	-0.280**	-0.227**	-0.295**	-0.125**	-0.179**
	[0.053]	[0.066]	[0.060]	[0.079]	[0.063]	[0.087]	[0.058]	[0.083]
Tax Price	-0.287	-0.191	0.080	0.276	0.278	0.442	-0.109	0.282
	[0.410]	[0.393]	[0.410]	[0.409]	[0.419]	[0.426]	[0.361]	[0.364]
Hansen J Statistic		3.08		2.60		2.62		2.94

Notes: (1) Robust standard errors in brackets, (2) Panel 1 instruments using GE(-2.5), GE(-0.5), GE(2.5), (3) panel 2 instruments using GE(-2.0), GE(0), GE(2.0), (4) panel 3 instruments using GE(-1.5), GE(0.5), GE(1.5).

Table 8
Counterfactuals

	(1)	(2)	(3)	(4)
		School Districts		
Income	-0.156**	-0.207**	-0.227**	-0.127**
	[0.053]	[0.060]	[0.063]	[0.056]
Tax Price	-0.287	0.080	0.278	0.171
	[0.410]	[0.410]	[0.419]	[0.355]
Observations	308	308	308	308
		Census Tracts		
Income	0.001	0.002	-0.020	-0.019
	[0.018]	[0.018]	[0.013]	[0.012]
Tax Price	0.061	0.043	0.028	0.026
	[0.077]	[0.087]	[0.092]	[0.092]
Observations	6796	6796	6796	6796
		State Assembly Districts		
Income	0.025	-0.114	-0.141	-0.026
	[0.081]	[0.117]	[0.119]	[0.120]
Tax Price	-0.808	-0.255	-0.143	-0.293
	[0.705]	[0.755]	[0.671]	[0.663]
Observations	80	80	80	80

Notes: (1) Robust standard errors in brackets, (2) * significant at 10%; ** significant at 5%