Rational Choice in the Voting Booth:
Are Voters Influenced by the Composition of the Electorate?

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Abstract: Do people simply vote based on their a priori view of the best outcome, or do they sometimes consider the signal associated with the aggregate count of other people's votes? Recent models of voter behavior incorporate the idea that, given imperfect information, a rational voter should condition his or her voting decision on the event that he or she casts the pivotal (or swing) vote. However, some researchers question whether there is a real world example where people vote differently due to conditioning their choice on the event that their vote is pivotal. This paper explains why the local property tax referendum setting meets the necessary conditions for this type of behavior to occur. Next, this paper conducts the first empirical test for whether people at the voting booth behave as if they will be the pivotal voter. The results are consistent with the idea that voters are influenced by the composition of the electorate and that voters behave as if they are pivotal.

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I. Introduction

Individuals may consider that their vote only affects the outcome of an election or referendum if it is the pivotal (or swing) vote. A pivotal vote is one in which the outcome would be different if not for that vote.[1] With imperfect information, an individual's optimal voting behavior should depend on his or her *conditional* belief about the issue given the event that she is the pivotal voter. Consider the case of an individual who, prior to the election, is slightly opposed to the referendum and anticipates that ninety percent of all other voters will vote against the referendum. Suppose this individual would actually be slightly in favor of the referendum if she learned that the other votes are equally split, because this would send a more positive signal concerning the referendum's merits. If there is a majority-rule referendum in which all other voters will vote based on their a priori beliefs concerning the merits of the referendum, then this individual should actually choose to vote in favor of the referendum, because the event that this voter is pivotal would imply that she favors the referendum. In general, an individual's optimal voting behavior should not simply be based on his or her a priori beliefs, but rather on his or her a priori beliefs conditional on being the pivotal voter (Feddersen & Pesendorfer, 1996, 1997; Austin-Smith & Banks, 1996).

"Pivotal voting" is a term used by Feddersen & Pesendorfer and others to describe the act of conditioning both one's decision to vote and the direction of this vote on the event that one's vote is pivotal. Within the context of this paper, I define the latter part of this behavior as "strategic voting." Given that an individual has already decided to participate in the election, strategic voting is the act of conditioning the voting choice on the event that this individual is the pivotal voter. This type of strategic voting might just as well be called "rational" or "sophisticated" voting, because this behavior is the only regret-free voting strategy. A strategic voter will never regret his or her voting choice upon reading the election outcome and

[1] For example, suppose a measure passes if more than 50% of the voters vote in favor of this measure. A voter who votes in favor of the measure is pivotal if, excluding this voter, the votes are split exactly in half. A voter who votes against the measure is pivotal if, including this voter, the votes are split exactly in half.

See Mulligan & Hunter (2001) for a discussion of the frequencies of pivotal votes in U.S. Congressional and state legislature elections. As these authors discuss, in some elections, a vote could potentially be pivotal even if the votes are not split; if vote tallies are not entirely accurate and if a vote recount occurs when the election is sufficiently close, then a vote may also be pivotal if it marginally leads to a recount that changes the election outcome.

aggregate vote count in the following morning's newspaper. If this vote decided the election outcome, then the individual feels that he or she made the right choice.

Despite the rationality of this type of behavior, researchers have rightfully questioned whether there is a real world example where someone would actually vote differently than her a priori expectation of her preferred outcome. For this to occur, a voter must be unable to easily gather information from other people prior to the election, yet be able to meaningfully process the signal revealed by being the pivotal vote. Feddersen and Pesendorfer (1996; 1999a) apply the idea of pivotal voting to the large, two candidate election, whereas a number of studies apply this idea to jury voting.[2] The criticism against the applicability of pivotal voting to large elections is that, since preferences and tastes are diverse and difficult to quantify, it would be very difficult for the voter to interpret the aggregate signal revealed in the event that this voter is pivotal. The criticism against the applicability of pivotal voting to small settings, such as juries, is that these voters will be willing and able to reveal information to each other prior to the vote. These arguments have been raised by critics such as Margolis (2001), who concludes that there is no real world example of a two-alternative election in which an individual would not vote simply based on his or her a priori information.

The theoretical section of this paper discusses a promising example of strategic voting applied to the local public finance setting. In this setting, individuals cannot fully share asymmetric information through simple communication *and* the aggregate information revealed when a voter is pivotal has readily interpretable implications. In addition, the presence of imperfect information is likely to be particularly important. Residents would like to update their information about the productivity of local government. Home-owning residents would also like to update their information concerning how changes in spending levels might affect the market values of their homes. While exit poll studies examining major political elections do not reveal people voting differently than they would based on their a priori beliefs, less is known

[2] See Feddersen & Pesendorfer (1999b) for an insightful summary of some of these jury studies. More recently, Guarnaschelli, McKelvey, and Palfrey (2000) provide experimental results and Coughlan (2000) provides theoretical results for cases where juries may communicate prior to the vote.

about voter attitudes during local referenda, and what the local referenda literature does suggest is that many referenda participants are uncertain whether expenditures would be beneficial.[3]

Given that "strategic voting" might occur during local referenda, how can one empirically test for its existence? The usefulness of survey data in addressing this issue is highly suspect. Even if voters reliably described what factors led them to vote one way or the other, it would be nearly impossible to determine whether their voting choice was actually altered due to strategic considerations. This paper empirically tests for strategic voting by exploiting variation in the nature of the signal implied when votes on a majority-rule referendum are split in half. One may capture variation in the nature of this signal by measuring variation in the fraction of partisans, voters who unconditionally vote in a certain direction.[4]

In this paper's central example, I define a "partisan-o" as a partisan who opposes the referendum regardless of her private information, a "partisan-f" as a partisan who favors the referendum regardless of her private information, and a "non-partisan" as an individual whose vote is affected by her private information. Assume that all non-partisans have similar preferences but possess imperfect information, so that the expected net benefit to a non-partisan from a referendum passing is an increasing function of the fraction of other non-partisans who favor the referendum, (i.e., a greater fraction of non-partisan's voting Yes provides a more favorable signal concerning the merits of the referendum). Suppose that the vote on a majority-rule referendum is split in half. Given this split, a greater fraction of partisan-o's implies a more favorable signal concerning the merits of the proposed referendum, ceteris paribus, because a greater fraction of non-partisan

[3] Though there is a large empirical literature on the demand for local spending, (e.g., Romer & Rosenthal, 1982; Gramlich & Rubinfeld, 1982; Romer, Rosenthal, & Munley, 1992), there are few studies that survey voter attitudes during local referenda. Using data from one local referendum, Lankford (1985) examines voters' perceptions concerning the benefits of local spending. He found that 37% of voters were "Not Sure" whether school quality would be affected by moderate expenditure changes, (24% responded "Not affected" and 39% responded "Is Affected). In addition, 31% of voters responded that they were "Not Sure" whether the school district's authorities spend its budget wisely, (29% responded that money is "Wasted" and 40% responded that it is "Spent Wisely").

[4] Another potential way to capture variation in the nature of the signal implied when a voter is pivotal is to capture exogenous variation in the required pass rate for a measure. For example, suppose that two referenda occur and they are identical except that one requires a 50% approval rate to pass and the other requires a two-thirds approval rate. If one's expected net benefit from approving the referendum is a positive function of others' support for the referendum, then the event that a voter is pivotal in the two-thirds requirement case sends a signal more favorable to approving the referendum. Thus, a strategic voter would be just as likely or more likely to vote in favor of the referendum given a higher required approval rate. Using this type of logic, Feddersen & Pesendorfer (1998) show that, under certain conditions, a jury may be less likely to wrongfully convict a defendant under a simple majority voting rule than under a unanimous voting rule.

voters must have voted in favor of the referendum. If a non-partisan behaves strategically, conditioning her voting choice on the event that the vote is split, then, (holding the fraction of partisan-f's constant), she will be more likely to vote in favor of the referendum when a greater fraction of voters are partisan-o's. Even if she does not know the exact breakdown of voter types, her estimate of the fraction of voters who are partisans, along with her knowledge of the required approval rate to pass the referendum, will affect her vote.

Thus, in this example, a greater presence of partisan-o's can have two effects on the likelihood of a referendum's success. First, there is a direct, negative effect caused by these additional partisan-o's voting against the referendum. Second, there may be an indirect, positive effect caused by some voters strategically voting 'yes' due to the greater number of partisan-o's. In order to test for the presence of this second effect due to strategic voting, I exploit differences in the likely composition of voters when the marginal cost of voter participation is low versus high. The underlying assumption used to motivate the theory of voter participation is that people only participate in high marginal participation cost elections if they derive a non-pecuniary benefit from helping a side that they are certain they favor. If the marginal cost of voting is high, one would not expect participation from individuals whose strategic vote differs from their naïve vote, (a vote based simply on a priori expectations), because these individuals do not gain as much pleasure from the act of voting.

By applying the concept of pivotal voting to the local public finance setting and by empirically testing for this type of strategic voting, this paper makes several new contributions to both the voting literature and the local public finance literature. First, asymmetric information may be important in the local public expenditures setting. The previous literature on preferred spending for local public services has generally ignored the idea that an individual would want to know about other people's preferences for the local public good.[5] Second, this paper offers an explanation for the inconsistent results found in the empirical literature on local school spending referenda, particularly in terms of the impact of the elderly.[6]

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[5] See Ross & Yinger (1999) for an excellent survey of this literature.

[6] Studies have found mixed results concerning the correlation of the composition of elderly in a district and local expenditures. Mullins and Rosentraub (1992) and Simonsen (1994) found that a greater composition of elderly adults appears to have a negative effect on local expenditures, but not at statistically significant levels. Using panel data on

Finally, this paper provides the first empirical test of whether people strategically condition their behavior on the event that their vote is pivotal. The results are consistent with the idea that voters are influenced by the composition of the electorate and that voters behave as if they are pivotal.

Section II presents a theoretical framework for voting behavior in high and low marginal cost referenda, Section III discusses how data from Minnesota school district property tax referenda are used to test for strategic voting, and Section IV describes the results.

II. Theoretical Framework

This section adapts the theoretical model of Feddersen & Pesendorfer (1996) to the case of local property tax referenda and extends this model to consider cases in which these referenda are held either independently or jointly with political elections. In order to motivate the main theoretical analysis below, I will first briefly discuss why imperfect information is important when individuals vote for local tax rates.

Yinger (1982) models a residents' preferred local property tax rate given perfect information. The first order conditions for a resident's maximization problem implies that residents are influenced not only by their own preferences for the local public service, but also by the slope of the cost function for the production of the local public service and by the distribution of other residents' preferences for the local public service. Other residents' preferences are important, because changes in the tax-expenditure mix may be capitalized into housing and thus affect the property tax base used to finance the local public service.

It is likely that residents possess asymmetric information concerning the cost function for the local public service and concerning each others' preferences. If property tax revenue were used for local public school spending, then residents would want to know how much a spending increase would improve the

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state level expenditures, Poterba (1997) did find a significant, negative effect. Earlier studies that included, but did not focus on, the composition of elderly as a predictor of local expenditures found both negative effects (Inman, 1978; Romer, Ronsenthal, & Munley, 1992) and positive effects (Brazer & McCarty, 1987; Cutler, et. al, 1992). These mixed findings may result from the presence of strategic voters, whose behavior during certain types of local referenda effectively cancels out the true negative impact of the elderly on local school expenditures.

quality of the local schools. Given asymmetric information, a rational individual may draw inferences concerning other residents' information based on their voting behavior.[7]

The remainder of this section will present a model of voting behavior during referenda that are either held independently or concurrently with political elections. I refer to the independently-held referenda as "high marginal participation cost" referenda, because the marginal cost of participating in these types of referenda includes the total cost of going to the polls. Referenda held concurrently with political elections are called "low marginal participation cost" referenda, since many residents would have gone to the polls even if these referenda were not taking place. In order to motivate this paper's empirical tests, I will derive the following results:

(i) Strategic voting causes the fraction of residents who unconditionally oppose higher spending to have *no effect* on the probability that a local tax referendum passes when there are *low marginal participation costs*.

(ii) The fraction of residents who unconditionally oppose higher spending has a *negative* effect on the probability that a local tax referendum passes when there are *high marginal participation costs*.

The "low marginal participation cost" case assumes that all individuals face non-positive net marginal participation costs. This setup is nearly identical to Feddersen & Pesendorfer's (1996) strategic (pivotal) voting model, in which they assume costless voting. The "high marginal cost" case provides a rigorous example that demonstrates why strategic behavior does not cancel out the effects of partisans when the marginal cost of participation is positive and non-trivial.

[7] Yinger's (1982) model and later models of preferred local spending assume that either the homeowner sells their house to someone with identical preferences or the homeowner does not care about the resale value of the home. Due to moving costs and/or a supply of housing that is not perfectly elastic, it is possible that this perfect Tiebout (1954) sorting does not actually occur. One can easily modify Yinger's model so that a home-owner's goal is not to simply maximize the market value of her home, but rather to maximize an objective function that is a weighted average of the expected present value of her own utility from residing in the home and the expected present value of her home when she sells it (appendix available upon request). If there is some uncertainty concerning the preferences of potential home-buyers, then this may be another reason why a resident would care about other people's preferences; the preferences of other residents currently residing in the district may be related to the preferences of the highest bidder for the home.

A. Basic Setup of the Model

Suppose that there is a referendum concerning whether to increase local property taxes to increase local public school spending. I will hereafter refer to eligible voters, (adults residing in the school district), as residents. Some residents possess imperfect information concerning the impact of higher spending on local public school quality. For simplicity, assume that there are only two possible states, $S \in \{1, 2\}$. In State 1 (S= 1), a spending increase would be mildly productive, while in State 2 (S= 2) a spending increase would be extremely productive. Nature chooses State 1 with probability .5 and chooses State 2 with probability .5, which is common knowledge.[8] There are two potential outcomes for the referenda, $X \in \{Fail, Pass\}$. The referendum will Fail if the number of "No" votes is equal to or greater than the number of "Yes" votes.

Suppose that there are three types of residents: partisan-o's, partisan-f's, and non-partisans. Partisan-o's *oppose* higher spending in either state, partisan-f's *favor* higher spending in either state, and non-partisans oppose higher spending in State 1 but favor higher spending in State 2. Similar to the setup in pivotal voting studies, let the net benefit to non-partisans from the referenda failing in State 1 equal the net benefit to non-partisans from the referenda passing in State 2.

In the local public school finance context, partisan-o's are residents who do not directly consume local public schooling and do not care much about potential increases in the market value of their homes. They do not care much about the market value of their homes, because they either do not expect to sell their homes in the near future or do not expect to sell them during their lifetimes.[9] Partisan-f's are residents who consume local public schooling and have a high marginal utility associated with increases in local public school quality. Since residents do not have inelastic demand for schooling, the fraction of residents who are partisan-f's is endogenous with respect to the amount of spending that the referendum proposes. Non-partisans are either residents who consume public schooling and have a low marginal utility of schooling, or

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[8] A strategic voting equilibrium such as the one below may arise even if there is not an equal probability of each state occurring. As shown below, this assumption will simplify the effect of residential composition on the likelihood of referenda success, because there is a symmetric probability that the referendum ends up with the "wrong" result: passing in State 1 or failing in State 2.

[9] Though they may gain utility from leaving a larger bequest, they do not value the increase in the wealth of their estate as much as the expected present value of greater tax payments while they are living.

residents who do not consume public schooling, but would significantly benefit from an increase in the market value of their home.

Nature chooses a set of residents by taking N independent draws. Similar to Feddersen & Pesendorfer (1996), assume that each resident is uncertain about the total number of residents and is uncertain about the number of residents of each type. In each draw, nature selects a resident with probability (1 - ρ_ϕ). If a resident is selected, then with probability ρ_o she is a partisan-*o*, with probability ρ_f she is a partisan-f, and with probability ρ_n she is a non-partisan. These probabilities are common knowledge, with $\rho_o + \rho_f + \rho_n = 1$ and $\rho_\phi, \rho_o, \rho_f, \rho_n \in [0,1]$.

After nature has chosen the state and the set of residents, then resident j receives a message concerning the state, $m_j \in M$, where $M = \{0,.5,1\}$. Resident j receiving a message m_j knows that State 2 has occurred with probability m_j, so that residents are either completely informed (m_j equals either 0 or 1) or possess the common knowledge prior (m_j equals .5). Let q equal the probability that a resident is informed.

In a school spending referendum, the number of uninformed non-partisans would likely be sufficiently large so that neither partisan group possesses a majority among partisans and uniformed non-partisans. Assumption 1 states that, in expectation, there are a sufficient number of uninformed non-partisans to cancel out the difference in representation between partisan-o's and partisan-f's:

Assumption 1: (1-q)$\rho_n \geq |\rho_o - \rho_f|$.

Each resident's type and message may be mapped to a strategy profile $s = (p^n, p^y, p^a)$. Resident j votes 'No' with probability p_j^n, votes 'Yes' with probability p_j^y, and abstains from voting with probability p_j^a, so that $p_j^n + p_j^y + p_j^a = 1$ and $(p^n, p^y, p^a) \in [0,1]^3$.

Define c_j as the marginal cost of participating in the referendum for resident j and define b_j as the non-pecuniary benefit enjoyed by resident j when she participates. Let Pr(*piv*) equal the probability of a pivotal vote (indicated by *piv*). Let $E\lfloor B_j \mid piv \rfloor$ equal resident j's expectation of the absolute value of the net

benefit she enjoys when the referendum passes, conditional on a pivotal vote. Resident j will choose $p_j^a \in [0,1]$ to maximize:

$$(1) \qquad (1-p_j^a)*E[B_j \mid piv]*\Pr(piv \mid p_j^a)+(1-p_j^a)(b_j-c_j). \qquad (1)$$

Given the low participation rates observed in when referenda are not held concurrently with political elections,[10] it is plausible to assume that the majority of residents feel that the probability of a pivotal vote is sufficiently small and the participation cost is sufficiently high to warrant high rates of abstention. Most voter participation models conjecture that these participation trends, with a moderate fraction of eligible voters participating, are due to heterogeneous net participation costs, i.e., cross-sectional variation in (b_j-c_j) in equation (1). How these voter participation models differ is explaining why people *do* participate, even when the probability of a pivotal vote is so small. Dhillon and Peralta (2002) and Feddersen (2004) survey the theoretical literature on voter participation.

Similar to many of the models surveyed by those authors, Assumption 2 below is based on "expressive" or "group-based" explanations of voter participation.[11] Some residents gain a significant, non-pecuniary benefit simply from the act of voting, a benefit associated with "helping one's side." In particular, the benefits of participation may only exceed the costs of going to the polls if a resident is a "side-taker," who always favors the same outcome and thus enjoys a non-pecuniary benefit from participation.

[10] As discussed in the empirical sections, this paper uses referenda held outside of general political elections as examples of high marginal cost referenda, since the marginal cost of participating in these types of referenda includes the cost of going to the polls. In Minnesota referenda during the late 1990's, referenda held during general elections had turnout rates more than twice as large as referenda held during special elections. Examining data from other states, other researchers (Dunne, Reed, & Wilbanks, 1997; Pecquet, Coats, & Yen, 1996) have also noted the greater turnout when referenda are held during general elections.

[11] An example of the expressive view of voting is the "intensity hypothesis," which states that people who feel most strongly about an issue participate in order to express their views or feelings. In this paper's context, one may view some of the partisans as feeling strongly about the issue, because they are certain which side that they favor and face a large benefit from their desired outcome. An example of group-based explanations of participation is the "rule-utilitarian hypothesis" (Harsanyi, 1980; Feddersen & Sandroni, 2001; Coate & Conlin, 2002), which states that members of a "side" who favor a particular outcome choose the participation strategy that would maximize aggregate utility if all other members of this "side" behaved this way. Although this paper's model does not propose that residents' objective function is to maximize the aggregate utility of all residents or the aggregate utility of their "side," this paper's model reflects a more general mechanism by which partisans derive pleasure out of trying to help other members of their side.

Assumption 2: Let Cj equal the marginal cost of voting in a "high marginal cost referendum," in which there are not any political elections that would attract residents to the polls. For all partisan-o's and partisan-f's, assume that bj>Cj>0. For non-partisans, assume that bj=0.

In the next sub-section, I characterize equilibria in which all residents choose dominant strategies and all residents who are the same type and receive the same message choose identical strategies. I characterize these equilibria for two cases: a low marginal cost referenda and a high marginal cost referenda.

B. Equilibrium Strategies for Low Marginal Cost Referenda

Suppose that the marginal cost of participation in the referendum equals zero for all residents, $c_j=0$ for all j. This is Fedderson & Pesendorfer's (1996) costless voting assumption and this may be close to what occurs when referenda are held during general elections. Since the majority of the cost of a voter's participation is the cost of going to the polls, residents who choose to go to the polls to vote for politicians face trivial marginal participation costs for voting in the referendum. Although not all residents actually go to the polls to vote in political elections, one may derive similar referendum voting results as long as uninformed non-partisans go to the polls at a sufficient rate and have some expectations concerning other type's propensities to show up at the polls. (One could simply modify ρ_o, ρ_f, and ρ_n to reflect the probability that a type participates rather than the probability that a type is drawn into the population.)

With $c_j=0$ for all j, as shown by Fedddersen & Pesendorfer (1996), the equilibrium in which all individuals choose dominant strategies consists of the following strategies:

Partisan-o's: always vote No, s=(1,0,0)

Partisan-f's: always vote Yes, s=(0,1,0)

Non-partisans:

if m=1, then vote Yes**,** s=(0,1,0)

if m=0, then vote No, s=(1,0,0)

if m=.5 and $\rho_f > \rho_o$, then $s = \left(\frac{(\rho_f - \rho_o)}{\rho_n(1-q)},\ 0,\ 1 - \frac{(\rho_f - \rho_o)}{\rho_n(1-q)} \right)$

if m=.5 and $\rho_o > \rho_f$, then $s = \left(0, \frac{(\rho_o - \rho_f)}{\rho_n(1-q)},\ 1 - \frac{(\rho_o - \rho_f)}{\rho_n(1-q)} \right)$

if m=.5 and $\rho_o = \rho_f$, then abstain, s=(0,0,1).

The behavior of the partisans (partisan-f's and partisan-o's) and informed non-partisans is straightforward: voting for one outcome strictly dominates voting for the other outcome and strictly dominates abstention. The intuition behind the uninformed non-partisans' (m=.5) behavior comes from their desire to allow the informed non-partisans to decide the outcome. In a majority rule election, this will occur when enough non-partisans unconditionally vote in the opposite direction of the larger partisan group to exactly offset the difference in size between the two partisan groups. Since the uninformed non-partisans cannot collaborate and determine who will vote and who will abstain, they each choose a mixed strategy so that they expect that their votes will collectively offset those of the partisan voters. None of the non-partisans would want to deviate from this equilibrium behavior.[12]

In order to motivate the empirical analysis below, I will focus on the implications of this equilibrium behavior on the relationship between the fraction of partisan-o's and the probability that a referendum passes. As described in Section III, I use various proxy variables, such as the proportion of residents who are elderly, to measure the fraction of partisan-o's. (Although the focus of the empirical work is on the effect of partisan-o's, I will include various control variables, such as the fraction of residents who are children, that could influence the fraction of residents who are partisan-f's).

[12] For example, suppose that one expects there to be 11 residents, with 3 informed non-partisans, 4 uninformed non-partisans, 3 partisan-o's, and 1 partisan-f. In the equilibrium described above, the 3 informed non-partisans would vote based on their messages and the 4 uninformed non-partisans would engage in a mixed strategy in which they vote 'Yes' with probability .5 and abstain with probability .5. The uninformed non-partisans would not want to deviate from this

In a low marginal cost referendum, this implies that the informed non-partisans, who vote based on their message, will likely determine the referendum outcome. As a result, the expected fraction of residents who are partisan-o's should not affect the probability that the referendum passes:

Proposition 1: Variation in ρ_o will *not* affect the probability that a low marginal cost referendum passes.

Proof: First, consider the case of $\rho_o > \rho_f$, and either State:

a. State=1. In this case, the probability that a randomly selected resident will vote "Yes" equals $\rho_f + \rho_n(1-q)\frac{(\rho_o - \rho_f)}{\rho_n(1-q)} = \rho_o$, and the probability that a randomly selected resident will vote "No" equals $\rho_o + q\rho_n$. The difference between these two probabilities equals $-q\rho_n$, which is influenced by variation in ρ_o through the correlation between ρ_o and ρ_n. The probability that the number of "Yes" draws exceeds the number of "No" draws is thus only related to ρ_o through the negative correlation between ρ_o and ρ_n.

b. State=2. In this case, the probability that a randomly selected resident will vote "Yes" equals $\rho_f + q\rho_n + \rho_n(1-q)\frac{(\rho_o - \rho_f)}{\rho_n(1-q)} = \rho_o + q\rho_n$ and the probability that a randomly selected resident will vote "No" equals ρ_o. The difference between these probabilities equals $q\rho_n$, so that the probability of a "Yes" vote rather than a "No" vote is not influenced by ρ_o except for the effect of a change in ρ_o on ρ_n. The probability that the number of "Yes" draws exceeds the number of "No" draws is thus only related to ρ_o through the negative correlation between ρ_o and ρ_n.

An increase in ρ_o affects the outcome of referenda by decreasing ρ_n and thus decreasing the probability of a 'correct' outcome (i.e., the referendum failing in State 1 or passing in State 2). Since each state occurs with probability .5, an increase in ρ_o will lead to an equal decrease in the number of 'correct' outcomes, so that there is no overall effect on the probability that the referendum passes.

By symmetry, one can show that if $\rho_o < \rho_f$, the difference in the probabilities again equals $-q\rho_n$ in State 1 and $q\rho_n$ in State 2. Therefore, ρ_o does not affect the probability that the referendum passes. Finally, if $\rho_o = \rho_f$, then the two partisan groups cancel each other so that the differences in these probabilities again equal $-q\rho_n$ in State 1 and $q\rho_n$ in State 2, and the same result follows.

C. Equilibrium Strategies for High Marginal Cost Referenda

Suppose that residents face a non-trivial, positive marginal cost of participating in a referendum, Cj>0. This is similar to what occurs during special election referenda, (not held concurrently with political

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behavior, because a deviation would increase the probability that the election outcome is in the opposite direction of the majority of the votes of the informed non-partisans.

elections), since the marginal cost of participation includes the cost of going to the polls. Assumption 2 implies that all participants in high marginal cost referenda vote in the same direction as their naïve voting choice, the voting choice based simply on their preferences and messages. An exogenous increase in the expected fraction of voters who are partisan-o's would therefore only have the direct effect of decreasing the likelihood that the referendum is successful.

Proposition 2: The probability that a high marginal cost referendum passes is a decreasing function ρ_o.

Proof: Regardless of the state, the probability that a randomly selected resident votes "Yes" equals ρ_f and the probability that a randomly selected resident votes "No" equals ρ_o. The difference between these two probabilities equals $\rho_f - \rho_o$. This is decreasing with respect to ρ_o, so that the probability that N random draws will result in more "Yes" votes than "No" votes is also decreasing with respect to ρ_o.

D. Implications of These Theoretical Results

In the real world, few residents would be perfectly informed concerning the state. Furthermore, there could be a continuum of possible states and the payoff structure to non-partisans need not be symmetric as it is above. Even under these conditions, some non-partisan individuals with relatively weak signals concerning school productivity may be influenced by strategic considerations, based on their prior beliefs concerning the distribution of residents and the probability that various states occur when the vote is pivotal. Feddersen and Pesendorfer (1997) characterize the asymptotic features of this type of equilibrium. One may still observe some degree of strategic voting, with a realistic result that strategic voters dampen, (but do not necessarily eliminate), the effects of partisans on referenda outcomes.

In order to motivate an empirical test for strategic voting, this section has revealed that strategic voting may cancel out the effects of partisans on referenda outcomes during low marginal cost referenda, but not during high marginal cost referenda. Propositions 1 and 2 focus on the differential effect of partisan-o's, residents unconditionally opposing a referendum, because it is possible to find proxies for the empirical fraction of residents in a school district who are partisan o's. This allows one to analyze how the marginal participation cost influences the cross-sectional relationship between partisan-o's and referenda success. Partisan-o's should have an unambiguously negative effect on the probability of referenda success during

high marginal cost referenda. For low marginal cost referenda, if strategic voting occurs, then strategic voters may effectively cancel out the negative effects of partisan-o's on the probability of referendum success. Without strategic voting, the fraction of residents who are partisan o's should negatively affect the likelihood of success for either type of referendum. The baseline empirical test for strategic voting is then to determine whether there is a variable that: (i) is positively related to the fraction of residents who unconditionally oppose higher spending, (ii) is negatively related to referenda success for referenda with high marginal participation costs, but (iii) is unrelated to referenda success for referenda with low marginal participation costs.

On the other hand, even in the absence of strategic voting, the magnitude of the negative effect of the fraction of *residents* who are partisan-o's on referenda success would not necessarily be equal for the two types of referenda. First, since high marginal cost referenda participation rates are lower than in other referenda, an increase in the expected fraction of residents who are partisan-o's may have a greater effect on high marginal cost referendum, even in the absence of strategic voting in other referenda. This would bias the baseline results in favor of the strategic voting hypothesis. Second, there might not actually be exogenous participation rates in high marginal cost referenda, as implied by Assumption 2. It is possible that partisans' and/or informed non-partisans' non-pecuniary benefit from participating may be endogenous with respect to the turnout. An increase in the size of one partisan group might increase or decrease the participation rates of other residents, because they expect the vote margin to be closer or less close. This latter phenomenon would likely bias the baseline results against strategic voting.[13] In light of these issues, the analysis in Section IV.B focuses on the estimated fraction of *voters*, rather than residents, who are partisan-o's. This strategy allows for a more direct test of strategic voting.

[13] Since the high marginal cost referenda described in the empirical section are more likely to be successful than not, there are, on average, more partisan-f's than partisan-o's. If participation increases when residents expect a closer vote, then the fraction of residents who are partisan-o's would be positively related to the fraction of partisan-f's who participate. By diminishing the magnitude of the effect of partisan-o's for high marginal cost referenda, this would bias the baseline results against the strategic voting hypothesis.

III. Empirical Model

Propositions 1 and 2 provide theoretical motivation for a baseline empirical test for strategic voting using measures of the fraction of residents who are partisan-o's, residents who always oppose referenda. If strategic voting exists, then the relationship between referenda support and the fraction of partisan-o's should differ, depending on the marginal cost of participating in a referendum. This section describes how I use data from Minnesota to test for the existence of strategic voting. In Minnesota, local public school spending referenda are generally held either concurrently with Presidential, Senatorial, Gubernatorial, and other major political elections during the November of an even-year (general election) or during November of an odd-year (special election). Define "even referenda" as referenda occurring during the November, general election of an even year and define "odd referenda" as all other referenda. Most of the cost associated with participation is the cost of going to the polls, so that if residents are already planning on going to the polls to vote in political elections, then the marginal cost of voting in an even referendum is relatively low. One may thus consider even referenda as low marginal cost referenda and odd referenda as high marginal cost referenda.[14]

In order to test the hypothesis concerning the effects and presence of strategic voting, one may compare even referenda with odd referenda. During even referenda, if strategic voters exist, then they would eliminate the negative effect of partisan-o's on referenda success. Thus, one may test whether a measure of the fraction of partisan-o's is negatively related to referenda success for districts that held even referenda. If the measure is not negatively related to referenda success for even referenda, but the measure is negatively related to referenda success for odd referenda, then this result is consistent with the previous section's theory based on strategic voting.

As mentioned in Section II.D, converting this measure from the fraction of *residents* who are partisan-o's to the estimated fraction of *voters* who are partisan-o's may provide a more rigorous test of the

[14] If a resident does not plan on going to the polls to vote in political elections, then the marginal cost of voting could possibly be lower during odd referenda. These referenda generally have lower participation rates, so that there may be less congestion costs associated with voting. On the other hand, odd referenda also have fewer polling locations, so that congestion costs are not necessarily lower and, for some residents, there may be greater costs associated with going to the polls.

strategic voting model. As I discuss in Section IV.B, in the absence of strategic voting, the magnitude of the impact of the fraction of voters who are partisan-o's should be at least as large for even referenda as for odd referenda. One may thus test the null hypothesis, the estimated fraction of voters who are partisan-o's has an equal effect on each type of referendum, against the strategic voting hypothesis that this variable has a stronger effect during odd referenda.

I use data from all Minnesota general school operating revenue referenda held between 1991 and 1998. In Minnesota, public school districts must hold school operating revenue referenda in order to levy a local tax rate that exceeds the default rate. These referenda have nothing to do with the issuing of bonds for capital construction, which would require a completely separate type of referendum. All Minnesota school districts face the same default property tax rate for regular school spending. The school board is responsible for deciding when to hold referenda to try to get permission to tax above this default rate. The board decides the amount of money that it would like approved, and poses it as a referendum question in the annual, November elections. In very few cases can the school board hold this type of referendum in a non-November election. The general restriction to November elections makes the Minnesota referenda data particularly useful, since school boards may have less room to try to hold "special elections" in which school supporters are disproportionately aware of the election date. Any year that a district holds a referendum, the school board must mail letters alerting every household. There is no limit on the number of years in which school boards can hold referenda, and currently a new referendum may authorize the excess local taxes for up to ten years. The school board must propose the duration of these taxes and include this in the referendum. In any year, referenda may authorize new spending or replace previous spending authorization that will soon expire.

School boards thus decide whether to hold a referendum each November, and if so, how much money and how long a duration to propose. As discussed in Section IV.D below, it appears that most school districts do not strategically decide whether to hold a referendum during an odd or even year, so that sample selection does not prohibit comparisons of odd and even referenda. However, the school boards' decisions such as whether to hold a referendum at all and how much money to request are likely to be endogenous.

Although data are available on these decisions, they are likely correlated with unobserved variables, such as the school board's confidence that the referendum will pass and the amount of resources used to advertise support for the referendum. Therefore, one should not use referendum pass rates or voting rates as dependent variables. Given the endogenous nature of events within the referendum process, this type of analysis could produce misleading results, such as a positive relationship between the proposed amount of spending and the likelihood of success. In light of this endogeneity, my approach is to use the amount of referenda revenue raised by a certain year divided by the number of adults as the dependent variable.

I define "referenda revenue" as a district's annual revenue resulting from the passage of at least one referendum. In the empirical analyses, I regress "referenda revenue" per adult in the 2000-2001 school year (hereafter referred to as 2001) on other district-level variables. I characterize districts by whether they held even and/or odd referenda between 1991 and 1998. It is reasonable to assume that, during these eight years, the school district board had sufficient time to maximize the amount of local support. I use 2001 revenue, because a referendum may specify a starting year that is two years ahead.[15]

The referenda revenue measure may sometimes include state subsidies of local referenda revenue. Starting in 1994, the state began providing a limited amount of equalization aid. Though referenda continue to be posed in terms of the amount of total referenda revenue (local revenue plus any state matching aid), the letters sent home to all households notifying them of the referendum give examples of how the proposed spending would affect the tax burden for homes with certain market values. Many referenda in the sample passed before this equalization aid began. Therefore, my preferred empirical strategy is to predict the total amount of referenda revenue per adult and to include measures of the district's property base per pupil in 1989 as independent variables. Larger property bases may be associated with greater local spending due to the income effect, or they may be associated with less local spending because property wealth is inversely related to the amount of state subsidies. To capture both of these effects, I include quartile spline variables for the log of the 1989 property base per pupil. Using quartiles may be particularly appropriate, since

[15] Prior to 1990, referenda could propose taxes with infinite duration, so that it is possible that districts that did not hold referenda after 1991 have positive local excess support in 2001.

approximately 25% of districts were ineligible to receive state subsidies for referenda revenue because their property tax bases were too large.

The other independent variables include control variables for residents' income, house values, residents' education levels, the total number of households in the district, whether the district is in a rural area, the fraction of residents in the district who are children (under age eighteen), the average tenure of households in the district, the fraction of households with heads younger than fifty-five years old who own their homes, and the amount of state aid that the district received in the baseline year.[16] All of these independent variables, as well as the number of adults used for the denominator of the dependent variable, come from Census data based on the 1989 school year.[17] Table 1 presents formal definitions of these variables and summary statistics by sample group.

The empirical model for school district i holding referendum type s is:

$$Y_{si} = \beta_{s0} + \beta_{s1}\rho_{oi} + \psi_i\beta_{s2} + \varepsilon_{si}. \quad (2)$$

where Y_{si} equals referenda revenue per adult,[18] ρ_{oi} is the variable capturing the expected fraction of residents who are partisan-o's, and Ψ_i is a vector of the aforementioned control variables. In order to test the model of Section 2, I estimate equation (2) separately for districts that held only odd referenda (s=1), only even referenda (s=2), any odd referendum (s=3), or any even referendum (s=4). If Propositions 1 and 2 are correct, then the coefficient on the fraction of residents who are partisan-o's should only be significantly negative for the odd referenda groups (s=1 and s=3). After examining whether the results are consistent with strategic voting, I test whether the results are due to strategic voting or simply due to differences in participation trends. In particular, Section IV.B describes the relevant t-test of the strategic voting

[16] State aid in this baseline year (1989) was not a function of one's local tax effort, so one need not worry about local tax revenue positively affecting this measure of state aid.

[17] Between 1989 and 2001, about 25% of Minnesota's districts merged with other districts. In order to avoid losing these districts from the sample, I construct appropriately weighted averages of the original districts' 1989 values to calculate the 1989 values for the consolidated districts. Four districts are lost from the sample because they merged in 1990 and the Census data are not available for either the original districts or the new, consolidated district. There is little reason to expect the coefficients of the independent variables of interest to be influenced by whether a district is the result of the merger of two or more previously existing districts. Controlling for whether a district is the product of a merger causes virtually no change in the results of the regression analyses.

hypothesis, based on a version of equation (2) in which the estimated fraction of *residents* who are partisan-o's is replaced with the estimated fraction of *voters* who are partisan-o's.

IV. Results

For the baseline analysis described in Section IV.A, the expected fraction of the residential population consisting of partisan-o's (ρ_o) equals the fraction of the adult population who is at least sixty-five years old. Residents of this age are unlikely to have school-age children and a large fraction of these residents will remain in the same house for the rest of their lives.[19] The remainder of Section 4 describes similar analyses with various modifications. Section IV.B replaces ρ_o with estimates of the fractions of *voters* who are partisan-o's. Section IV.C discusses the results using alternative empirical measures of partisan-o's (ρ_o). Section IV.D explores whether the evidence in favor of strategic voting can be attributed to the selection effect of districts choosing to hold odd or even referenda.

A. Baseline Results

Table 2 displays the OLS regression results for the various sample groups. (For Table 2, the expected fraction of the residential population consisting of partisan-o's (ρ_o) equals the fraction of the adult population who is at least sixty-five years old.) If strategic voting exists, then one would expect the partisan-o coefficient (β_{s1}) to be significantly negative for the odd groups, but close to zero for the even groups. The estimates of β_{s1}, presented in bold at the top of Table 2, are consistent with the strategic voter hypothesis. These coefficients are negative and are larger in magnitude for the odd referenda sample groups (A and C). The "ever odd" group coefficient (column C) is statistically significant at the .02 level, whereas neither of the even group coefficients is statistically significant at any conventional level. Although the "only odd" group (A) coefficient is not statistically significant, it is even larger in magnitude than the statistically significant

[18] One need not worry about the implications of this dependent variable being left-censored at zero. Only 5% of districts that held any referenda have zero values for this dependent variable and the proceeding results remain very similar regardless of whether one uses OLS or a Tobit model to estimate equation (3).

"ever odd" (C) coefficient. The coefficient for the "only odd" (A) group is almost four times as large in magnitude as for the "only even" (B) group, while the coefficient for the "ever odd" group (C) is more than twice as large as the "ever even" group (D). Table 2's estimates are thus consistent with strategic voting, though further tests will be needed to determine with a reasonable level of certainty whether these results may be attributed to strategic voting.

The estimated magnitude of the differential impact of partisan-o's on referenda revenue during even or odd referenda is nontrivial. Given the estimated parameters, column A of Table 3 implies that a one standard deviation increase in the percentage of residents who are partisan-o's will cause a district originally with a fraction of partisan-o's equal to the mean level to spend about $50 less per adult if it holds only odd referenda. If this district holds an even referendum in which strategic voting may occur, a similar change in residential composition may only cause a $12 (column B) or $18 (column D) decrease in spending per adult. This difference seems important considering that average spending via referenda for districts that held any referenda was about $150 per adult and the standard deviation in this spending was about $92. Section IV.B finds even larger differences associated with strategic voting.

B. Testing the Strategic Voting Hypothesis

Even in the absence of strategic voting, other differences between odd and even referenda could lead to differences in the partisan-o coefficients. An increase in the fraction of residents who are partisan-o's may not have the same effect on the fraction of *voters* who are partisan-o's for odd and even referenda. Perhaps the results in Table 2 thus underestimate or overestimate differences in the coefficients due to strategic voting. A corollary to Propositions 1 and 2 is that the likelihood of referenda success should be negatively related to the expected fraction of *voters* who are partisan-o's during odd referenda, but unrelated to the expected fraction of *voters* who are partisan-o's during even referenda.

[19] The mean tenure in a household in Minnesota is quite lengthy: on average, households remain in the same home for over thirteen years. Data on the fraction of households who move within a certain time period are unavailable.

One cannot actually observe the fraction of voters who are partisan-o's during either type of referenda. Unfortunately, I do not have individual-level data for both types of referenda to identify voter characteristics. However, I can use aggregate data to proxy for the fraction of voters who are partisan-o's.

For the odd referenda groups, I estimate the fraction of voters who are partisan-o's by estimating values of the partisan-o and partisan-f participation rates, represented by δ_o and δ_f, respectively. Using the available district-level data measuring the number of "No" votes for odd referenda held between 1995 and 1999, I estimate the average fraction of partisan-o's who participate. Next, using similar data for the number of "Yes" votes, I predict the fraction of referenda supporters as a function of the fraction of residents who are partisan-o's. Though Section II.C assumed exogenous participation rates, using a predicted value of referendum supporters rather than the average value is appropriate in case there is actually strategic participation.

The expected fraction of voters who are partisan-o's in a high marginal cost referendum equals $\frac{\rho_o \delta_o}{\rho_o \delta_o + \rho_f \delta_f}$. I measure the expected fraction of voters who are partisan-o's during odd referenda by finding $\frac{\rho_o \overline{\delta}_o}{\rho_o \overline{\delta}_o + g(\rho_o)}$, where $\overline{\delta}_o$ equals the estimated fraction of partisan-o's who participate and $g(\rho_o)$ equals the estimated fraction of residents who participate and vote Yes. I calculate $\overline{\delta}_o$ by using the average value of the observed number of No votes divided by the estimated number of partisan-o's. I calculate $g(\rho_o)$ by predicting the fraction of residents voting Yes, based on the regression results when the fraction voting Yes is regressed on cubic terms for the estimated fraction of partisan-o's and a constant.[20] Using the baseline definition of partisan-o's (residents over the age of 64), the estimated fraction of voters who are partisan-o's has a mean of .38 with a standard deviation of .09 among districts holding only odd referenda.

Column (A) of Table 3 displays the coefficients and standard errors for the "only odd" group regression analogous to Column (A) of Table 2, where the partisan-o variable is now the fraction of *voters*

[20] Estimation results suggest that g(o) is increasing with respect to the fraction of partisan-o's and that the slope is largest for districts with fractions of partisan-o's above the median level. This is consistent with strategic participation,

who are partisan-o's. For the "only even" referenda sample group, in theory, the partisan-o measure should remain the same as in previous sections, since the model of Section II.B assumes full participation or representative participation for the low marginal cost referenda. This assumption allows for a conservative test of strategic voting. Partisan-o's likely participate in even referenda at higher rates than non-partisans, because they may participate even if they have no interest in the political elections. A relatively high partisan-o participation rate during even referenda would imply that using the residential fraction of partisan-o's causes one to understate the fraction of voters who are partisan-o's and thus overstate the effect of these partisan-o's.[21]

The odd group partisan-o coefficient in Table 3 (row 1, column A) is much larger in magnitude than the corresponding even referenda group coefficient (row 1, column B). One may reject this null hypothesis in favor of the strategic voting hypothesis at the .12 level, (or the .09 level if Huber-White standard errors are not used). As discussed in the next subsection, the statistical significance of this test increases when I use the natural logarithms of these variables as independent variables or use alternative definitions of partisan-o's. The qualitative evidence for strategic voting is further supported by row 1, column C of Table 3, which displays the coefficient for the group of districts that held both even and odd referenda. As one would expect, this coefficient is much smaller in magnitude than the only odd coefficient and slightly larger in magnitude than the only even coefficient.[22]

The magnitude of the effect of strategic voting is significant. Based on the estimate in the first row of Column A in Table 3, in the absence of strategic voting, a one standard deviation increase in the fraction of residents who are partisan-o's is associated with a decrease in referenda revenue of more than $61 for a district initially at the mean level in terms of the fraction of residents who are partisan-o's.[23] When districts

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in which a partisan-f is more likely to enjoy participating when she anticipates a closer election due to a larger fraction of partisan-o's.

[21] Another reason why this may be a conservative test is that even referenda tend to be decided by smaller margins than odd referenda. A small change in the fraction of voters who are partisan-o's may thus be more likely to affect the outcome of an even referendum than an odd referendum.

[22] The independent variable used to measure the fraction of voters who are partisan-o's for this third group (row 1 of column C) is identical to the one used for the odd referenda group. When this variable is replaced by one constructed similar to the even group version, the magnitude of the coefficient is even smaller.

[23] The mean fraction of residents who are partisan-o's for this group of districts is .192 with a .0687 standard deviation. For this definition of partisan-o's, a one standard deviation increase in the fraction of *residents* who are partisan-o's is

hold only referenda where strategic voting may occur (Column B) or hold at least one referenda in which strategic voting may occur (Column C), a similar change is only associated with a $12 or $18 change respectively in the amount of referenda revenue. A one standard deviation increase in the fraction of residents who unconditionally oppose spending thus has about a .69 standard deviation effect on spending in the absence of strategic voting, but only about a .17 standard deviation effect on spending when strategic voting may occur.

A robustness check is to examine whether the odd coefficient in row 1 of Table 3 is simply greater in magnitude than the even coefficient due to the scaling of the variables. As explained above, the even referenda group partisan-o measure is the appropriate proxy for the fraction of voters in even referenda who are partisan-o's. However, one should make sure that the statistically significant odd referenda group coefficient in Table 3 is not simply the product of the construction of an independent variable that is more closely related to actual levels of support. In order to test this, I estimate regressions with a counterfactual specification for the even group referenda. I compute a partisan-o measure for the even group in a similar fashion as the odd group partisan-o measure in row 1 of Table 3, but using data from even referenda. The partisan-o variable in this counterfactual regression may be interpreted as the estimated fraction of even referenda voters who vote No, based on the fraction of residents who are partisan-o's (residents at least sixty-five years old). The coefficient of this variable equals -324 with a 525 standard error. The odd group coefficient is thus almost four times as large in magnitude as the similarly constructed even referenda coefficient. Overall, the regression results based on estimates of the fraction of *voters* who are partisan-o's support the idea that strategic voting may dampen or eliminate the effect of partisan-o's on even referenda success.

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associated with an estimated .0504 change in the fraction of *voters* who are partisan-o's. The estimated coefficient on the fraction of voters who are partisan-o's is –1216, so that .0504 times –1216 translates into a –61.3 change in the dependent variable, referenda revenue per adult.

C. Alternative Definitions of Partisan-o's

An important robustness check is to use different measures for the fraction of partisan-o's residing in a district. Rows (1) through (9) of Table 4 show how the coefficients of the natural logarithm of the estimated fraction of voters who are partisan-o's changes with various definitions of partisan-o's. Natural logarithms are used so that the magnitudes of these coefficients are comparable. As displayed in row (1) of Table 4, this log specification slightly improves the statistical significance at which one can confirm the strategic voting hypothesis when partisan-o's are again defined as residents above the age of sixty-four.

Rows (2) and (3) of Table 4 change the age cutoff to 54 and 74 respectively. Lowering the age cutoff increases the magnitude of the coefficient, while raising the age cutoff decreases the magnitude of the coefficient. This might seem unusual, because one might expect the oldest residents to be the least likely to directly benefit from school spending and the least likely to significantly benefit from positive capitalization effects. However, since the demographic variables are based on 1990 data and the sample period is from 1991 to 1998, the fraction of residents aged 55-64 in 1990 may more accurately capture the fraction of residents over the age of sixty during the year that the referendum is held. The fraction of residents over the age of 74 in 1990 may be a noisy measure of the total fraction of partisan-o's who are able to vote when the referendum occurs, since there are relatively few residents in this group and since some of these residents may not be alive or sufficiently healthy to vote between 1991 and 1998,

Rows (4) and (5) of Table 4 attempt to incorporate the effect of homeowner turnover rates on the fraction of partisan-o's. Even if they have no bequest motive, some older residents may care about potential capitalization effects on the value of their home as a result of changes in school spending, because these residents expect to sell their home during their lifetime. These residents would not behave as partisan-o's. The partisan-o measures in Rows (4) and (5) incorporate the average household tenure within the district for homeowners who do not have children residing in their home. Tenure rates by age group are unavailable, so tenure rates for households without children (ages seventeen and under) in residence serve as a proxy for the tenure rates of the older residents. These new partisan-o measures include all individuals over the age of 74 and include a tenure-weighted fraction of the individuals between the ages 55-74 or 65-74. These partisan-o

measures are greater for districts where older residents are less likely to move, (see the Table 4 footnotes for specific formulas). Estimation results suggest that these tenure-adjusted partisan-o measures do not necessarily capture the actual fraction of partisan-o's much better than the corresponding age group measures in rows (1) and (2). The magnitudes of the partisan-o coefficients for the odd group decrease, so that the evidence for strategic voting is slightly less statistically significant.

Another way to alter the partisan-o measure is to adjust for the fraction of individuals renting their homes. In theory, renters who do not directly benefit from school spending should unambiguously oppose higher spending. Renters do not enjoy positive capitalization effects and would likely have to pay higher rents if the gross-of-tax demand, (i.e., the net-of-tax bid price plus the present value of future tax payments), for their housing increased. Since older residents who rent their homes can never directly benefit from higher spending, they might be more likely to behave as partisan-o's than other older residents. Conversely, it is possible that older residents who rent their homes are less likely to behave as partisan-o's, because the impact of a tax rate increase on their rents might be modest or might take a while to occur. Rows (6) and (7) of Table 4 show how the results using partisan-o measures that are positively related to the fraction of older residents who rent their homes. In particular, these partisan-o measures include all residents over the age of seventy-four plus renters over the age of fifty-four (row 6) or sixty-four (row 7). The estimated effect of partisan-o's on referenda revenue dramatically decreases in both magnitude and statistical significance. In fact, the "Ever Odd" coefficient is no longer negative. This suggests that older residents are more likely to behave as partisan-o's, participating in referenda and voting against higher spending, if these residents own their homes. This may result from renters facing lower costs associated with property tax increases or not realizing that tax increases will ultimately lead to higher rental prices.[24] Restricting the measure of partisan-o's to homeowners increases the magnitude of the partisan-o coefficients and produces odd referenda group

[24] Another potential reason that homeowners appear to have a larger impact than renters on school spending is some omitted variable in my analysis that results in the conditional effect of elderly renters having a positive effect on spending. This type of omitted variable bias appears unlikely. One would suspect that if the rental rate of the elderly was highly correlated with an omitted variable, then some of the other independent variables, particularly the home ownership rates among younger residents, would be jointly correlated with this omitted variable and with the rental rate of the elderly. The coefficients on these variables would then vary, depending on whether the partisan-o measure is a function of the elderly rental rate. However, the coefficients of the other independent variables remain nearly identical regardless of whether the partisan-o measure incorporates this rental rate.

coefficients that are statistically significant at similar levels as the baseline analysis (see rows 8 and 9 of Table 4).

D. Testing for Sample Selection Bias

As a final robustness check, it is important to establish whether districts that hold even referenda are similar to those which hold odd referenda. School referenda tend to be less successful when held during elections with federal and Gubernatorial political races (Dunne, Reed, & Wilbanks, 1997; Pecquet, Coats, & Yen, 1996). This observation, combined with the theory presented above, suggests that districts with low fractions of partisan-o's would be much better off holding odd referenda than even referenda. Despite evidence that all districts would maximize revenue by holding only odd referenda,[25] the results below suggest that sample selection probably does not drastically influence the empirical evidence for strategic voting.

The evidence is consistent with the idea that only a few, wealthy districts were non-randomly selected into a sample group. Table 5 displays mean and median values for descriptive variables by various sample groups. Ignoring non-November referenda, districts appear equally likely, on average, to choose an odd or even referendum. The number of districts holding at least one even, November referendum (143) slightly exceeds the number of districts holding at least one odd, November referendum (137).[26] Though the overall frequencies of odd and even referenda are similar, Table 5 reveals that districts in the odd referenda group appear to be slightly wealthier. Odd referenda districts tend to have higher median incomes and property values. On the other hand, this result is due almost entirely to the six wealthiest districts holding

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[25] Holding an odd referendum is more costly to a district than holding an even referendum. However, the difference in cost is not large enough so that one would suspect it to deter districts from choosing odd referenda when they are aware that these referenda are more successful. I received information on the costs of holding each type of referendum from a couple of Minnesota school districts' superintendents. The main difference in cost is due to districts picking up the tab for election judges during odd referenda, which are paid for by counties in general elections. Including this cost, as well as the larger fraction of ballot printing fees paid by districts during odd referenda, the average difference between the two types of referenda is in the neighborhood of $1 per student. Even modest estimates based on the voting trends at even versus odd referenda suggest that a district may expect the same breakdown of votes in an odd referendum by asking much more than $1 over the amount it could ask in an even referendum. Given reasonable levels of risk aversion, all districts would thus be better off holding odd referenda, so that the selection is not based on varying conditions but is based on varying degrees of strategizing.

[26] The number of districts holding even and odd referenda remain similar if one discounts referenda held following an unsuccessful referendum during the previous year.

odd referenda; these districts each have higher median income levels than any of the districts only holding even referenda. This suggests that some relatively wealthy districts may have resourceful administrators or board members who recognize that odd referenda are more likely to be successful. Another possibility is that not all school board members seek to maximize revenue, so that the choice of an even rather than an odd referendum may be the result of a political compromise between those who would favor holding an odd referendum and those who would favor holding no referendum at all.

Even if a few districts with unobserved resourcefulness or unobserved school board solidarity do select odd referenda, how this would affect the empirical test for strategic voting is ambiguous. For example, it is possible that the unobserved resourcefulness associated with choosing an odd referendum could be associated with an ability to weaken the importance of partisan-o's through successful campaigning for higher spending. In this case, the partisan-o coefficient for the odd referenda group may be biased towards zero, causing one to underestimate the presence of strategic voting. Alternatively, perhaps districts that hold an odd referendum *and* have relatively low fraction of partisan-o's possess unobserved resourcefulness in obtaining local funds. Then, the partisan-o coefficient for odd referenda may be negatively biased, so that one would overestimate the presence of strategic voting.

Due to the lack of a proper instrument, I am unable to test for selection effects associated with unobserved variables.[27] There does appear to be a mild, negative bias in the odd partisan-o coefficients due to selection on observable characteristics. To test the importance of sample selection based on observed variables, I estimate a probit model with a dependent variable equal to one if the district falls in the "even only" referenda group. First, I estimate this probit model for the sample of districts combining the "even only" and "odd only" groups. I then re-estimate previous "odd only" group regression analyses with one modification: I weight the districts based on the estimated probability that these districts fell into the "even only" group. Column (C) of Table 6 displays the weighted means based on this procedure, alongside the means of the even only and odd only sample groups. In addition, the first row of column (C) lists the

[27] I was unable to find a variable plausibly related to a district selecting an odd rather than even referendum, yet unrelated to referendum success. Information concerning the expiration years of previously approved referenda was not available.

coefficient and standard error of the partisan-o variable for weighted regression results for the model analogous to row 1 of Table 3. While this coefficient is statistically significant and remains much larger in magnitude than the even group coefficient, it is smaller in magnitude than the corresponding un-weighted odd group coefficient. Similar results are found when one conducts weighted analyses of other models. The possibility of bias due to selection on observable variables thus weakens, but does not eliminate, the evidence in favor of strategic voting.

V. Discussion

The empirical results are generally consistent with a strategic voting model. The presence of partisan-o's, (residents who always vote against higher spending), never has a statistically significant effect on districts' ability to raise local revenue when these districts hold referenda in which strategic voting is likely to diminish the effect of these partisan-o's. Furthermore, based on the empirical test for strategic voting developed in Section 4.2, one can usually confirm the presence of strategic voting at about the .1 level of statistical significance or better (see Table 4). The results are also quantitatively important in terms of referenda revenue. The baseline definition of partisan-o's suggests that a one standard deviation change in the fraction of partisan-o's only leads to about a .17 standard deviation change in referenda revenue when there is strategic voting, as opposed to about a .69 standard deviation change in referenda revenue when there is no strategic voting. Though the statistical significance of the results varies based on the empirical specification, the overall picture is supportive of strategic voting. While this evidence provides a starting point, further empirical tests are necessary before researchers can definitively conclude that strategic voting occurs.

There are three reasons to use caution when generalizing about voting behavior based on this paper's findings. First, as mentioned earlier, these results were found for the local tax setting, where imperfect information is likely to be important, a split vote may provide a readily interpretable signal that could alter one's voting choice, and it is impossible to communicate one's information with all other participants. There is no reason to believe that strategic voting occurs in settings that do not meet these conditions.

Second, the large estimated effect of strategic voting does not necessarily imply that most or many individuals behave this way. This paper's results are *not* driven by a few school districts; the results remain supportive of the presence of strategic voting when one uses various methods of excluding potential outliers. However, it may be the case that in many of the districts where strategic voting mattered, only a few voters actually behaved this way. If many of these referenda were decided by narrow margins, then one would observe evidence for strategic voting even though only a small fraction of the population engaged in this type of behavior.

The third issue to consider when making inferences about voting behavior is that one should distinguish strategic voting from less rational attempts to shift the deciding voter. Perhaps some individuals simply vote in the opposite direction of a large, visible faction of voters, because they do not want this faction to decide the election. This behavior is not actually strategic voting, because it could be the case that this individual reads the morning paper and is disappointed to learn the outcome was in the direction of his or her vote with only a single vote margin of victory. Though the difference is subtle, it is an important one to make. Some skeptics fallaciously argue that strategic voting is irrational, because they mistakenly define strategic voting as trying to shift the deciding voter without regard for one's own conditional preferences.

One can only speculate whether the results of this paper are due to true strategic voting or less rational attempts to shift the deciding voter. If the results are due to true strategic voting, then one can draw much stronger conclusions about voting behavior. For example, one can extend the theory of strategic voting to show that a policy change concerning the required level of support for a measure to pass may have an ambiguous effect on the likelihood of the measure passing.

The results of this paper are useful for motivating both discussions concerning the specific example of the impact of the elderly on public school expenditures, as well as broader discussions of median voter theory and the efficiency of public expenditures. First, consider the implications for the impact of the elderly on public education expenditures. The composition of the elderly in many states will soon rise substantially as the baby boom generation becomes older. Some people fear that this growth in the elderly population will

lead to decreases in spending on younger citizens, such as public school expenditures. As long as the size of the group of those opposing higher public school expenditures remains smaller than the required number of 'No' votes to defeat the referendum, then it is possible that strategic voting could diminish the negative impact of this anti-spending group. This means that if local referenda are held concurrently with major political elections, there is compelling evidence that the rise in the elderly population would have only a small effect on local school referenda.

On the other hand, revenue from local school referenda generally composes only a small portion of total public education spending. About half of all states have local referenda or local town meetings where citizens directly vote on general fund local educational spending. The referenda are usually restricted to cases in which districts would like to exceed some threshold level of local spending, so that these votes do not have a large influence on overall spending levels. Strategic voting could possibly also factor into instances of statewide referenda, such as proposals to guarantee expenditure levels or to cap tax rates. This is unlikely, however, because as the size of the voting population increases, it becomes increasingly difficult to interpret the aggregate signal sent by a split vote. In addition, it is doubtful that this information has much value; a resident might not care about the information of individuals who live outside his or her district. Outside of referenda, it is extremely unlikely that strategic voting would influence policy. The theory of strategic voting becomes tenuous in multi-issue or politicized settings, so that strategic voting would probably not help prevent the election of politicians who are more sensitive to the fiscally conservative interest of the elderly. Overall, if the elderly do oppose public school spending, then strategic voting would probably only dampen the negative effects of a rising elderly population to the extent that local voters directly determine school spending during referenda held concurrently with general elections.

As for the broader issues of median voter theory and the efficiency of public expenditures, strategic voting theory suggests that the common, simplifying assumption of a median voter who decides majority-rule referenda may sometimes lead to misleading conclusions. Individuals may consider other people's information and preferences, as well as the required support rate, when making their voting decision. To the extent that individuals are correctly considering these factors and accounting for other individuals who are

also engaging in strategic behavior, then strategic voting may lead to greater efficiency in public expenditures. This efficiency improvement is associated with election outcomes that are more closely linked to the quality of information held by all citizens.[28]

Although Section II suggests that strategic voting is more likely to occur during low marginal cost elections, it is actually ambiguous whether high or low marginal participation cost elections would be more efficient. During high marginal cost elections, there may be an efficiency gain associated with participants caring more deeply about the issue than non-participants. During low marginal cost elections, there may be an efficiency gain associated with the aggregation of private information through strategic voting. An important topic for further research is to derive the theoretical conditions under which elections with high or low marginal participation costs are more efficient.

[28] Feddersen & Pesendorfer (1997) show that as the population size approaches infinity, elections with strategic voting produce full information equivalence. This means that the election outcome is the same as the outcome that would occur if all of the voters' private signals were common knowledge.

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Table 1: Variable Definitions

All variables are at the district level and are based on data from the 1990 Census (unless otherwise stated).

Variable Name	Definition
$\frac{\text{Referenda Revenue}}{\text{\# of Adults}}$	The dependent variable in the analyses. The numerator equals the total amount of "referenda revenue" during the 2000-2001 school year, revenue resulting from the passage of at least one local referendum during previous years. The denominator equals the number of adults (residents over the age of seventeen) residing in the district, based on the 1990 Census.
ρ_o ("partisan-o" term)	The estimated fraction of adults in the district who are "partisan-o's." In the baseline analysis, ρ_o equals the fraction of adults who are at least sixty-five years old.
% Households w/ Income >=$X	Percentage of households with a total income of at least $X. These variables capture all households above the $X level, so that their coefficients can be readily interpreted as the change in spending given an increase in some of the households' incomes from one range to the next. Percents are in decimal form.
% Households w/ House Value >=$X	Percentage of households living in a house with a value of at least $X. These variables capture all houses above the $X level, so that their coefficients can be readily interpreted as the change in spending given an increase in some of the households' incomes from one range to the next. Percents are in decimal form.
Total # of Households	Total number of households in the district.
RURAL	Dummy variable equal to one if at least 97% of the households in the district are located in a rural area. This is a natural cutoff point, since all other districts have less than 70% of their households located in rural areas.
%H.S._Drop	Percentage of households in which no member has a high school diploma.
%B.A.	Percentage of households in which at least one member has a Bachelor's degree.
%Kids	Percentage of the population composed of people under the age of eighteen.
Average Household Tenure	The average length of time that households in the district had lived in their residence as of the 1990 Census.
% Owner-Occupied (under age 55 only)	Percentage of households who own their residence out of all households with heads who are less than 55 years old. Ownership rates among older residents are not used here, so that they may be incorporated into some specifications of the partisan-o measure.
STATE_AID89/ Adults	The total amount of state revenue provided to public schools in the 1988-89 school year divided by the number of eligible voters (adults). This state aid measure is independent of the local tax effort.
1989 Property Base/ Adults	The effective land property tax base (including both residential and nonresidential property) of the district in 1989, divided by the number of eligible voters (adults).

Table 1 (cont.): Summary Statistics

Means with Standard Deviations in Italics

	District Group				
Variable	ALL	(A) Held Only **Odd** Referenda	(B) Held Only **Even** Referenda	Held at Least One Odd and at Least One Even Referenda	Did Not Hold Any Referenda
Sample Size	330	75	52	91	112
Referenda Revenue / # of Adults	142.02 *115.70*	163.63 *88.74*	107.55 *70.11*	164.51 *99*	125.27 *150.27*
ρ_o (baseline "partisan-o" %)	0.21 *.07*	0.19 *.07*	0.23 *.06*	.19 *.07*	.23 *.06*
% Households w/ Income >=$10,000	0.76 *.17*	0.80 *.14*	0.73 *.15*	.81 *.13*	0.71 *.19*
% Hs. w/ Income >=$30,000	0.39 *.16*	0.43 *.16*	0.34 *.12*	0.45 *.17*	0.34 *.15*
% Hs. w/ Income >=$50,000	0.15 *.11*	0.17 *.11*	0.11 *.06*	0.18 *.12*	0.12 *.10*
% Hs. w/ Income >=$75,000	0.04 *.05*	0.05 *.04*	0.03 *.01*	0.05 *.06*	0.04 *.05*
% Hs. w/ Income >=$100,000	0.02 *.03*	0.02 *.02*	0.01 *.01*	0.02 *.03*	0.02 *.03*
% Hs. w/ House Value >=$15,000	0.42 *.15*	0.44 *.15*	0.39 *.14*	0.48 *.15*	0.38 *.15*
% Hs. w/ House Value >=$35,000	0.32 *.19*	0.36 *.19*	0.28 *.15*	0.38 *.19*	0.27 *.17*
% Hs. w/ House Value >=$60,000	0.19 *.19*	0.24 *.21*	0.13 *.12*	0.24 *.21*	0.15 *.17*
% Households w/ House Value >=$100,000	0.05 *.10*	0.07 *.09*	0.02 *.03*	.07 *.12*	0.04 *.10*
Total # of Households	4917 *12366*	5555 *8455*	7700 *26411*	4548 *6884*	3499 *6375*
RURAL	0.61 *.49*	0.56 *.50*	0.57 *.50*	.48 *.50*	0.75 *.43*
%H.S._Drop	0.28 *.09*	0.27 *.10*	0.30 *.07*	0.25 *.09*	0.29 *.08*
%B.A.	0.13 *.08*	0.14 *.08*	0.12 *.05*	0.15 *.09*	0.13 *.09*
%Kids	0.29 *.04*	0.29 *.04*	0.29 *.03*	0.29 *.03*	0.28 *.04*
Avg. Household Tenure	13.2 *2.5*	12.6 *2.7*	13.7 *2.1*	12.7 *2.6*	13.8 *2.4*
% Owner-Occupied (under age 55 only)	.53 *.08*	.55 *.08*	.51 *.08*	.56 *.10*	.52 *.07*
STATE_AID89/ Voters	960.38 *351.65*	983.69 *366.60*	990.41 *329.03*	1007.01 *362.74*	892.94 *336.65*
Prop. Base/ Adult ('89)	864.91 *796.86*	874.93 *413.17*	716.33 *274.47*	761.55 *411.17*	*1012.48* *1250.61*

Table 2: Impact of Partisan-o's on Referenda Revenue for Odd Versus Even Groups

(OLS Regressions based on equation 2, with the dependent variable equal to Referenda Revenue effective in 2001 divided by the number of adults. See Table 1 for formal definitions of the independent variables.)

Independent Variable District Held…	(A) Only **Odd** Referenda	(B) Only **Even** Referenda	(C) At Least One **Odd** Referendum	(D) At Least One **Even** Referendum
ρ_o (% of residents who are "partisan-o's")	**-701**	**-180**	**-632**	**-255**
	(513)	**(806)**	**(266)**	**(303)**
% Households w/ Income >=$10,000	227	-281	82	-222
	(202)	(210)	(111)	(104)
% Households w/ Income>=$30,000	-78	693	329	898
	(548)	(664)	(333)	(420)
% Households w/ Income>=$50,000	-114	-1184	-601	-980
	(906)	(832)	(504)	(558)
% Households w/ Income>=$75,000	211	-681	700	984
	(2047)	(2294)	(1103)	(1295)
% Households w/ Income >=$100,000	367	3776	-574	425
	(2383)	(3196)	(1248)	(256)
% Households w/ House Value >=$15,000	420	251	159	165
	(393)	(388)	(170)	(175)
% Households w/ House Value >=$35,000	-728	-236	-485	-624
	(492)	(651)	(205)	(257)
% Households w/ House Value >=$60,000	242	-550	221	312
	(319)	(756)	(172)	(221)
% Households w/ House Value >=$100,000	592	2499	654	425
	(688)	(1061)	(301)	(256)
Total # of Households (hundreds)	-.192	-.005	-.048	-.055
	(.189)	(.088)	(.072)	(.038)
RURAL	-18.4	43	2	12
	(35.1)	(33)	(15)	(16)
%H.S._Drop	-160	-696	94	107
	(437)	(472)	(257)	(344)
%B.A.	-389	-445	-241	-165
	(389)	(637)	(206)	(308)
%Kids	-204	571	-329	-51
	(563)	(842)	(341)	(523)
Average Household Tenure	5.7	1.1	9.0	-1.9
	(9.7)	(12.4)	(5.6)	(5.3)
% Owner-Occupied (under age 55 only)	-410	-249	-212	-174
	(291)	(408)	(127)	(173)
STATE_AID89/ Voters	.140	-.039	.123	.043
	(.084)	(.056)	(.044)	(.042)
Ln(1989 Property Base/Voters): 1st Quartile Spline	53	-68	47	20
	(46)	(98)	(28)	(29)
Ln(1989 Property Base/Voters): 2nd Quartile Spline	37	-104	-5	-120
	(107)	(169)	(67)	(81)
Ln(1989 Property Base/Voters): 3rd Quartile Spline	166	-0.2	147	153
	(168)	(199)	(88)	(94)
Ln(1989 Property Base/Voters): 4th Quartile Spline	-12	-62	87	191
	(49)	(125)	(60)	(87)
Constant	-30.1	885	-160	141
	(341)	(693)	(204)	(219)
Number of Observations	75	52	166	143
R-squared	.42	.41	.51	.55

(Robust standard errors in parentheses)

Example of Interpretation: The first row of column (A) suggests: For districts holding only odd referenda between 1991 and 1998, a one percentage point increase in the fraction of residents who are "partisan-o's" is associated with a $7.01 decrease in the amount of referenda revenue per adult during the 2000-2001 school year.

Table 3: Testing the Strategic Voting Hypothesis: The Impact of the Estimated Fraction of Voters who are Partisan-o's on Referenda Revenue for Odd and Even Groups

(Coefficients from equation (2) similar to Table 2, except that a measure for the fraction of *voters* who are partisan-o's replaces the measure of the fraction of *residents* who are partisan-o's. The dependent variable is equal to Referenda Revenue effective in 2001 divided by the number of adults.)

Independent Variable — District Held…	(A) Only **Odd** Referenda	(B) Only **Even** Referenda	(C) At Least One **Odd and** at Least One **Even** Referenda
Estimated % of *voters* who are "partisan-o's" (individuals at least 65 years old)	**-1216 (434)**	**-180 (806)**	**-385 (322)**
% Households w/ Income >=$10,000	276 (212)	-281 (210)	-164 (139)
% Households w/ Income>=$30,000	-20 (548)	693 (664)	1020 (458)
% Households w/ Income>=$50,000	-574 (875)	-1184 (832)	-594 (601)
% Households w/ Income>=$75,000	303 (1869)	-681 (2294)	431 (1362)
% Households w/ Income >=$100,000	808 (2428)	3776 (3196)	-1706 (1633)
% Households w/ House Value >=$15,000	282 (330)	251 (388)	90.900 (192)
% Households w/ House Value >=$35,000	-468 (484)	-236 (651)	-578 (246)
% Households w/ House Value >=$60,000	129 (339)	-550 (756)	228 (220)
% Households w/ House Value >=$100,000	543 (670)	2499 (1061)	596 (339)
Total # of Households (hundreds)	-0.238 (0.180)	-0.005 (0.088)	0.001 (0.001)
RURAL	-450 (275)	-249 (408)	-346 (156)
%H.S._Drop	-15 (30)	43 (33)	12 (16)
%B.A.	-57 (444)	-696 (472)	625 (397)
%Kids	-364 (403)	-445 (637)	112 (315)
Average Household Tenure	8.9 (9.4)	1.1 (12)	3.7 (5.2)
% Owner-Occupied (under age 55 only)	-425 (546)	571 (842)	-306 (522)
STATE_AID89/ Voters	0.081 (0.084)	-0.039 (0.056)	0.125 (0.051)
Ln(1989 Property Base/Voters): 1st Quartile Spline	50 (44)	-68 (99)	69 (34)
Ln(1989 Property Base/Voters): 2nd Quartile Spline	17 (96)	-104 (169)	-69 (70)
Ln(1989 Property Base/Voters): 3rd Quartile Spline	115 (169)	-0.3 (199)	201 (83)
Ln(1989 Property Base/Voters): 4th Quartile Spline	-9 (50)	-62 (125)	240 (79)
Constant	376 (354)	885 (693)	-400 (266)
Number of Observations	75	52	91
R-squared	.47	.41	.73

The t-test of the strategic voting hypothesis is H_o: $\beta_{11} = \beta_{21}$; H_1: $\beta_{11} < \beta_{21}$, where β_{11} and β_{21} are listed in columns (A) and (B) respectively of the top row. One may reject the null in favor of strategic voting at the .12 level with these robust (Huber-White) standard errors (.09 level with unadjusted standard errors).

Table 4: Testing the Strategic Voting Hypothesis: Alternative Definitions of Partisans

(β_{s1} coefficients from equation 2, but based on an independent variable equal to the *natural log* of various proxies for the fraction of *voters* who are partisan-o's. The dependent variable is equal to Referenda Revenue effective in 2001 divided by the number of adults.)

Partisan-o Definition	(A) Odd Only (β_{11})	(B) Even Only (β_{21})	**Statistical Significance of t-test of Strategic Voting Hypothesis H_o: $\beta_{11} = \beta_{21}$ H_1: $\beta_{11} < \beta_{21}$**
(1) % of Adults over age 64 (BASELINE)	-304 (109)	-84 (124)	**.094**
(2) % of Adults over age 54	-380 (135)	-77 151	**.069**
(3) % of Adults over age 74	-155 (78)	-41 (59)	**.123**
(4) Tenure-adjusted % of Adults over age 54[a]	-285 (95)	-75 (115)	**.082**
(5) Tenure-adjusted % of Adults over age 64[a]	-254 (88)	-80 (103)	**.101**
(6) Renter-adjusted % of Adults over age 54[b]	-97 (135)	-313 (105)	**.239**
(7) Renter-adjusted % of Adults over age 64[b]	-136 (86)	-35 (55)	**.163**
(8) Renter-discounted % of Adults over age 54[b]	-408 (128)	-77 (158)	**.053**
(9) Renter-discounted % of Adults over age 64[b]	-313 (105)	-97 (135)	**.106**

(Robust Standard Errors in Parentheses)

[a] These terms serve as proxies for the fraction of the adult population who do not move houses in their lifetime. Define "*tenure*" as the average household tenure for households that currently have no children residing there. The measure in Row (4) equals the fraction of adults over the age of 74, plus min[(1,(*tenure*/20)] times the fraction of adults between the ages of 55 and 64, plus min[1,(*tenure*/30)] times the fraction of adults between the ages of 65 and 74. The measure in Row (5) is similar, but does not include the term for people between the ages of 55 and 64.

[b] The measure in Row (6) equals the fraction of adults over the age of 74, plus the estimated fraction of adults who are between the ages of 55 and 64 *and* rent their homes, plus the estimated fraction of adults between the ages of 65 and 74 *and* rent their homes. The measure in Row (7) is similar, but does not include the term for people between the ages of 55 and 64. The measures in Rows (8) and (9) also include all adults over the ages of 74, but only include other individuals if they own their home.

Table 5: Mean and Median Values by Sample Group

Means Displayed First in Bold, Median Values Displayed Below
(See Table 1 for Sample Statistics for All Variables Used in the Regression Analysis)

	All Districts	Districts that held at least one "Even" referendum	Districts that held at least one "Odd," *November* referendum	Districts that held at least one "Odd" referendum	Districts that held only "Even" Referenda	Districts that held only "Odd" Referenda
Number of Observations	330	143	137	166	52	75
% of Adults who are Partisan-o's (% of population >64 years old)	**21%** 22%	**20%** 22%	**19%** 19%	**19%** 20%	**23%** 23%	**19%** 20%
Total # of Households (Rounded to the nearest 100)	**4,900** 1,900	**5,700** 2,300	**5,200** 2,300	**5,000** **2,300**	**7,700** 2,200	**5,600** 2,100
Median Income (Nearest $100)	**$26,200** $24,100	**$26,400** $24,100	**$28,300** $26,500	**$28,000** 26,200	**$23,200** $23,100	**$27,800** $26,300
Median House Value (Nearest $100)	**$50,100** $45,200	**$50,900** $46,000	**$56,100** $52,400	**$55,300** $51,300	**$43,500** $43,700	**$55,500** $51,900
Rural Dummy: District has over 70% of residences in rural area	**61% of districts**	**52% of districts**	**52% of districts**	**52% of districts**	**58% of districts**	**56% of districts**
% of Households *without* a high school graduate	**28%** 29%	**27%** 28%	**25%** 26%	**26%** 26%	**30%** 31%	**27%** 27%
% of Households where at least one resident has a B.A.	**13%** 11%	**14%** 12%	**14%** 12%	**15%** 12%	**12%** 10%	**14%** 12%
% of total population under the age of 18	**29%** 29%	**29%** 29%	**30%** 30%	**29%** 29%	**29%** 29%	**29%** 29%

Table 6: Partisan-o Coefficients and Variable Means for "Odd Only," "Even Only," and Sample-Selection-Weighted "Odd-Only" Groups

	(A) Districts that held only "Odd" Referenda	(B) Districts that held only "Even" Referenda	(C) Weighted[a] Districts that held only "Odd" Referenda
Partisan-o Coefficient for the Estimated of Fraction of *Voters* Over the Age of 64	-1216	-180	-815
(Standard Error)	(434)	(806)	(397)
Means of Descriptive Variables			
% of Adults who are Partisan-o's (Baseline: % of population >64 years old)	19%	23%	23%
Median Income (Nearest $100)	$27,800	$23,200	$23,500
Median House Value (Nearest $100)	$55,500	$43,500	$42,600
Total # of Households (Rounded to the nearest 100)	5,600	7,700	3,800
Rural Dummy: District has over 70% of residences in rural area	56% of districts	58% of districts	58% of districts
% of Households *without* a high school graduate	27%	30%	30%
% of Households where at least one resident has a B.A.	14%	12%	11%
% of total population under the age of 18	29%	29%	29%

[a] Weighting odd districts by $\frac{\hat{P}}{1-\hat{P}}$, where $\hat{P}$ is the estimated probability (from probit estimation) that the district only held even referenda rather than only holding odd referenda.