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Voting on open space: an analysis of the decision to hold a referendum and of referendum results

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Voting on open space: an analysis of the decision to hold a referendum and of referendum results

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Abstract: This paper presents the first comprehensive analysis of municipal-level open space referenda, both the decision to hold a referendum and referendum results, across the entire contiguous United States. We find that municipalities populated by more educated, environmentally aware and politically left-leaning people and that experienced substantial population growth in surrounding areas were more likely to hold open space referenda than other municipalities. Overall, there are fewer statistically significant relationships in the referenda results estimation than in the selection estimation. Referenda support was significantly affected only by the finance mechanism, unemployment rate, education and region dummy variables. We find limited evidence of selection bias in the estimated referenda results equations.

Keywords: open space, referenda, public goods, selection bias, Heckman correction

I. Introduction

Increases in population and economic development have led to continuing declines in open space in the United States; with much larger percentage reductions in the eastern half of the country (see Table 1).[1] In an apparent response to these land and population dynamics, many American communities are showing greater willingness to spend public funds to secure increasingly scarce open space (Myers 1999). From 1996 through 2004 there were 1,373 ballot referenda at the state-, county-, special district- and municipal-levels that included funding for community parks and open space (TPL 2004). Of these, 1,062 passed, authorizing the use of approximately $26.4 billion (January 2000 dollars) in public funds to acquire open space or development rights or improve already existing open space (TPL 2004).

In this paper, we analyze a data set that contains information on 718 municipal-level[2] ballot referenda that proposed public monies for the procurement or improvement of open space and were held at some point from 2000 through 2004 (see Table 2 and Figures A-D).[3] We examine two issues: i) what factors make it more likely for a community to hold an open space referendum, and ii) given that a referendum occurs, what factors influence the likelihood of passage. We include in our analysis landscape, political, demographic and socio-economic variables and trends that could explain either a municipality's likelihood to hold a referendum on open space or the referendum's likelihood of passage. In analyzing the likelihood of passage, we account for potential selection bias in choosing to hold a referendum.

We find a number of intuitive factors and several non-intuitive factors related to the likelihood of holding an open space referendum in the period from 2000 through 2004. Our results show that municipalities with larger percentages of highly educated residents in 2000, environmental non-profit group members in 2000, and Democratic voters in the 2000 presidential election were more likely to hold open space referenda. We also find that the probability of a holding referendum increased as median household income increased – up to a point: beginning at a municipal median household income level of approximately $100,000, further increases in median income tended to lower the probability of a referendum appearing on a ballot (a reverse environmental Kuznets Curve type relationship). We also find that municipalities with lower population densities were more likely to hold a referendum. Somewhat counter to our intuition, we find that the probability of a referendum being held in a municipality at some point from 2000 through 2004 was generally not a function of recent changes in a municipality's stock of open space. Population growth and housing stock growth in a municipality in the the 1990s (proxies for open space loss in a municipality) did not significantly affect the likelihood of subsequent referendum appearance. Conversely, changes in open space stock in the county area surrounding a municipality did significantly affect the likelihood of a referendum being held – albeit in an inconsistent manner. The probability of holding a referendum at some point from 2000 through 2004 increased in population growth in the county area surrounding a municipality while major losses in farmland in the municipality and county area surrounding a municipality were associated with a lower probability of holding a referendum.

In terms of open space referenda results, municipalities with low unemployment rates at the time of the referendum and a highly educated population provided more support for open space referenda than other municipalities. Other landscape, demographic and socio-economic variables, including population growth, housing stock growth and relative change in farmland in a municipality and its surrounding county area, did not show consistent relationships with referenda support. We find that referenda support was significantly affected by the choice of the open space finance mechanism. Open space referenda that included a tax rate increase garnered less support than referenda financed by other means; the reallocation of existing public funds was the finance mechanism most associated with higher levels of referenda support. We find limited evidence of selection bias in the estimates of our referenda results.

Several prior studies have econometrically analyzed open space referenda. Prior studies that have focused on which communities have referenda find that areas that are larger, wealthier and more racially homogeneous and that have experienced significant population growth or significant losses in open space stock are more likely to have referenda than others (Romero and Liserio 2002, Howell-Moroney 2004a and 2004b and Kotchen and Powers 2004). Kotchen and Powers (2004) also find – somewhat surprisingly – that New Jersey municipalities with larger shares of open space in their surrounding county area are more likely to hold referenda than those communities with relatively little existing open space in their surrounding county area. None of these studies are geographically comprehensive in scope, however. These studies focus on communities within a state or region or that are considered to be significantly affected by urban sprawl.

With respect to referenda outcomes, prior research indicates that wealthier, more educated and more homogenous communities that have experienced recent significant losses in local open space or do not have immediate access to existing open space are more likely to vote "yes" on open space referenda (Kline and Wichelns 1994, Schläpfer and Hanley 2003, Howell-Moroney 2004a and 2004b, Solecki et al. 2004 and Kotchen and Powers 2004). Vossler and Kerkvliet (2003) and Vossler et al. (2003) found that support for open space referenda in Corvallis, Oregon was inversely related to the amount of tax dollars the voter would have to pay if the referenda passed. In addition, there is evidence that municipal voters prefer bond financing to “pay as you go” mechanisms (Kotchen and Powers, 2004). Finally, Fishel (1979) and Kahn and Matsusaka (1997) analyze the effect of perceived opportunity costs on environmental referenda support. These authors find that voters in areas where blue-collar type work is relatively prevalent and lucrative tend to give less support to environmental referenda, including open space referenda. These authors conclude that voters in these areas – many who are blue-collar workers or rely on blue-collar industry for their economic security – decide that local environmental protections will lead to future restrictions on blue-collar industry growth in the immediate area. Of the papers analyzing referenda results, only Kotchen and Powers (2004) include data for the whole contiguous US.

This paper represents the first comprehensive analysis of municipal-level open space referenda, analyzing both the decision to hold a referendum (selection stage) and referendum results (results stage), across the entire contiguous US. By tying together the selection and results equations we can correct for any omitted variable bias in the estimated results equation caused by municipal selection. Further, we use a more extensive accounting of landscape and population dynamics in and around the community as compared to most past research. For example, we use variables such as new house construction and recent farmland loss in the community and in the surrounding county area to explain the role of landscape and population change on holding a referendum and referendum results. In addition, we include several governmental and community preference explanatory variables in our model that have not been used in open space related referenda research in the past. These variables include membership levels in environmental groups, voting behavior in presidential elections, type of local government, and whether there have been prior open space referendum in the municipality. Many of these variables have statistically significant effects in our model.

II. Methods and Data

A. Methods

We analyze two related questions: i) what factors make it more likely for a municipality to hold an open space referendum, and ii) given that a referendum occurs, what factors influence the level of support for the referendum. These questions are linked because the decision on whether or not to hold a referendum (the selection stage) generates a non-random sample of communities, which should be taken into account when analyzing referendum results. In what follows, we describe our estimation procedure for both the selection and results stages and explain how we control for selection bias in the estimation of results.

We use the Heckman two-stage procedure (Heckman 1979) to estimate the selection stage (stage 1) and the referendum results stage (stage 2). The Heckman procedure used in this analysis employs a discrete choice model to estimate stage 1 and ordinary least squares (OLS) to estimate stage 2. In the first stage (selection), the estimation equation is:

$$\Pr(W_i = 1) = f(D_i, SE_i, P_i, L_i, G_i, C_i) + \varepsilon_i \qquad (1)$$

where $W_i = 1$ if municipality i ($i = 1,\ldots, N$) had a referendum that proposed the use of public funds for open space preservation or improvement at some time from 2000 through 2004, and 0 otherwise, D_i is a vector of demographic variables, SE_i is a vector of socio-economic variables, P_i is a vector of political variables, L_i is a vector of landscape variables, G_i is a vector of municipal government structure variables, C_i is a vector of control variables and ε_i is an error term. See Table 3 for complete descriptions and sources of the independent variables in (1).[4]

We estimate (1) with two different likelihood functions, a PROBIT and a weighted endogenous sampling maximum likelihood (WESML) function (Manski and Lerman 1977). Our database of US municipalities (described below) includes all municipalities that held a referendum at some point from 2000 through 2004 and an additional 1000 that did not; in other words approximately 42% of the observations in our database had an open space ballot referendum. Yet, only 2% of all US municipalities held an open space referendum at some point from 2000 through 2004 (TPL 2004; USCB 2000). The WESML estimator corrects for any bias this over-sampling may introduce in our estimate of (1) by weighting each observation according to its probability of occurrence in the population. The WESML estimator tends to create large standard errors, however, and population parameter estimates that are statistically significant in the PROBIT estimation tend to become statistically insignificant in the WESML estimation. Each first stage estimation procedure produces an inverse Mill's ratio vector (Greene 2003). Accordingly, each procedure used to estimate (1) is associated with its own second stage OLS estimation.

Some of our expectations for the estimated selection model are guided by Press (2002) and his "policy capacity" framework. Press argues that communities are most likely to initiate action to acquire or improve open space when: i) they face pressure to do so, and ii) they have the capacity to act on this pressure. The pressure to take action on open space comes in two forms: development pressure that threatens the community's remaining open space and pressure from regional programs and governments that encourage local action on open space preservation. To measure development pressure (i.e., losses in open space) we use data on population and housing stock growth from 1990 to 2000 and relative farmland loss from 1987 to 1997 in the municipality and the rest of the surrounding county in which the municipality is located.[5] We expect that the probability of holding a referendum to be increasing in population growth, housing stock growth, and farmland loss, in the municipality and the surrounding county. Moreover, we also suspect that larger municipalities also face unique pressures to secure remaining open space. Specifically, residents of larger municipalities may encounter greater congestion in the green areas in their community and may have to travel further distances to access open space amenities. To reduce congestion and travel time to open space amenities, residents in larger municipalities may be more willing to initiate actions to acquire more open space and/or improve existing open space.

We control for regional government pressure to preserve open space by including dummy variables for Massachusetts and New Jersey; both states have programs that encourage local action on open space preservation.[6] These two state variables, along with other regional dummy variables, are also used to control for broad regional population and land dynamics that may affect the decision to hold a referendum.

According to Press (2002), a municipality's capacity to respond to pressure on its remaining open space is influenced by its administrative expertise, budget, political leadership and grassroots activism. To account for a municipality's capacity we collected information on the political orientation of the community and municipal government structure. We expect communities that are more politically left-leaning to be more willing to support the provision of public goods, including publicly-owned open space, through government actions. We also expect municipalities with larger populations more likely to contain a subset of individuals willing to do the grassroots work to get an open space measure on a ballot. Finally, following earlier work, we would also expect wealthier and more homogeneous communities to have greater capacity and willingness to initiate action on open space.

In the second stage, we estimate the logged odds of a "yes" vote in an open space referendum as a function of referendum-specific, demographic, landscape, political and socio-economic variables and a selection correction term using OLS. Let $j = 1,...,M$ index the subset of observations that held an open space referendum at some point from 2000 through 2004 (i.e., $W_i = 1$). The selection-bias corrected referendum result equation for $j = 1,...,M$ be given by,[7]

$$\log\left(P_j / 1 - P_j\right) = g(V_j, D_j, SE_j, P_j, L_j, C_j) + s\,\hat{l}_j + e_j \qquad (2)$$

where P_j is the proportion of total referendum votes recorded as "yes" votes in j's referendum, $P_j / 1 - P_j$ measures the odds of a "yes" vote in j's referendum, V_j is a vector of data describing the referendum in j and $\hat{l}_j$ is the calculated inverse Mill's ratio for observation j (Greene 2003).[8] A statistically significant $\hat{l}_j$ would indicate that referenda outcome is partly determined by the characteristics that determine whether a municipality has a referendum in the first place. See Table 4 for descriptions and sources of the independent variables in (2) that are not included in (1).[9]

Referendum results are determined by tallying the votes of the individuals who voted. Under standard assumptions, a voter chooses the option that yields the greatest utility as determined by their utility function. However, only the aggregate vote to the referendum is observed. Using individual utility maximization as the foundation for explaining referenda outcomes requires that individual choices in a municipality be aggregated. Various authors have provided the appropriate theory, justification and empirical approach for such an aggregation (see Deacon and Shapiro 1975, Fair 1978 and Fischel 1979). Equation (2) is consistent with the voter aggregation literature. Specifically, the empirical referendum result equation used in this analysis is a linear specification of a voter aggregation model that does not consider abstentions in the referendum vote (see Kline and Wichelns 1994, Kahn and Matsusaka 1997 and Kotchen and Powers 2004 for previous applications of this model).

We expect the odds of a "yes" vote in an open space referendum to be an increasing function of the scarcity of open space stock in the municipality and the surrounding county, development pressure in the municipality and the surrounding county, attitudes toward publicly-provided environmental goods, income of people in the community and economic security. We use unemployment rate in the municipality's county at the time of the open space vote as a measure of economic security.[10] As in equation (1), we include regional dummy variables to control for broader population and landscape dynamics, and in the case of Massachusetts and New Jersey, to control for the effect of state programs that encourage local action on open space preservation. We also expect the type of finance mechanism proposed will affect the vote. Specifically, we expect that new taxes will decrease the odds of a "yes" vote the most, bond financing and the continuation of existing open space taxes will have less of an adverse effect on referenda support and that a reallocation of existing public funds will be the financing option least objectionable to referendum voters. We also expect that the type of open space measure proposed, whether it includes recreation, farmland preservation, water conservation or other non-conservation related items, may affect the outcome.

Rates of membership in national environmental organizations (LCV 2004) and levels of support for Green Party presidential candidate Ralph Nader in the 2000 general election (Leip 2004) were two explanatory variables of interest that we did not include in the standard formulations of equations (1) and (2). Though not included in (1) and (2), we expect municipalities with higher rates of membership in national environmental organizations circa 2000 more likely to have the type of grassroots activity necessary to have placed an open space referendum on a municipal ballot at some point from 2000 through 2004.[11] Further, we expect municipalities that had proportionally more Green Party supporters in 2000 to have had a greater propensity to initiate open space preservation activities and support open space preservation related referenda. We did not include these variables in (1) and (2) because membership data was only collected in 27 states and Nader was not on the 2000 general election ballots in several states and the inclusion of these two variables in our model would reduce our sample size and introduce non-randomness issues. Yet, because the non-randomness would be due to exogenous sample selection, the Heckman estimation of our model that included these variables would still produce consistent, albeit inefficient, estimates (see Wooldridge 2003, p. 310). Therefore, we use the estimation procedure described above to estimate $(1')$ and $(2')$ where $(1')$ is the same as (1) except *i*'s share of votes for President Bush in the 2000 general election is dropped and the per capita membership in environmental groups and ***i***'s share of votes for Nader and 2000 Democratic presidential candidate Albert Gore are added[12] and $(2')$ is the same as (2) except ***i***'s share of votes for Bush is dropped and ***i***'s share of votes for Gore and Nader are added.[13] Given the inefficiencies introduced in the estimated coefficient standard errors of $(1')$ and $(2')$ by the inclusion of membership and Nader data in our model, however, conclusions regarding statistical significance of results in $(1')$ and $(2')$ should be treated cautiously.

B. Data

As mentioned above, the 718 municipal-level open space referenda held at some point from 2000 through 2004 in the contiguous US forms the basis of our dataset. In order to estimate equation (1) we need to include a random sampling of US municipalities that did not hold an open space referendum at some point from 2000 through 2004. We randomly selected 1000 municipalities from a list of all contiguous US municipalities that did not have an open space referendum from 2000 through 2004.[14] Thirteen of the 718 municipalities that held an open space referendum and 26 of the 1000 control municipalities were dropped when estimating (1) due to missing data. Therefore, the estimation of (1) was based on 1679 observations, including 705 observations where $W_i = 1$. An additional 271 municipalities that held an open space referendum and 423 of the 1000 control municipalities were dropped when estimating $(1')$ due to missing environmental organization membership and Nader voting data. In estimating (2), the sample is reduced to 613 observations. Not only are the 1000 non-referendum observations dropped, but 105 municipalities that held referenda have incomplete data and are also dropped.[15] An additional 230 referenda-holding municipalities are dropped in the estimation of $(2')$ due to missing environmental organization membership and Nader voting data. See Table 5 for a statistical summary of the data used in the estimates of (1), (2), $(1')$ and $(2')$.

III. Results

A. Selection Equation

The estimated results for the selection equation (the types of municipalities more likely to hold an open space referendum) are shown in table 6. The results show that the following factors are significantly correlated with higher likelihood of holding an open space referendum at some point from 2000 through 2004: larger population, lower population density, more highly educated voters, higher percentage of Democratic votes in the 2000 presidential election, greater per capita membership in environmental organizations and population growth in the surrounding county area.

The size of the estimated coefficient on the effect of environmental membership in equation $(1')$ is particularly striking: a 1% increase in a municipality's per capita membership in environmental organizations increased the likelihood of an open space referendum by approximately 40%. The affect of population and landscape changes in the county area surrounding municipalities is also conspicuous. Population growth and significant increases in new housing stock in a municipality's surrounding county area in the 1990s was associated with higher probabilities of subsequent open space referendum in the municipality at some point from 2000 through 2004. Curiously, the other proxy for open space change in the municipality and the surrounding county area, the relative loss of farmland from 1987 to 1997, is at loggerheads with the effect of population change and growth in housing stock on referendum appearance probability. Municipalities with relatively large amounts of farmland within their boundaries and in the surrounding county in 1987 and that subsequently lost little farmland (or even slightly gained farmland) over the next decade were more likely to have referenda than municipalities that lost significant portions of the farmland within their boundaries and in the surrounding county. Kotchen and Powers (2004) partially corroborate these results in their econometric analysis of New Jersey municipalities. According to their research, New Jersey municipalities with larger shares of open space in their surrounding county were more likely to have open space referenda than other municipalities.

While it appears that people generally responded to conditions in their surrounding areas, increased development pressure within the municipality appears to have had more of an ambiguous effect on the likelihood of holding an open space referendum. New housing growth in municipalities had a positive effect on the likelihood of a referendum in 3 of 4 specifications of the selection equation but was statistically significant only in the PROBIT estimation of equation (1). Further, population change within the municipality itself was not statistically significant in any estimation.

We also found it surprising that municipalities with higher rates of owner-occupied housing were less likely to have referenda from 2000 through 2004 and that more homogeneous communities were no more likely to have a referendum than more heterogeneous communities. Given that the prices of houses near open space have been shown to receive a positive boost from this amenity (see Irwin and Bockstael 2001, Irwin 2002, Geoghegan et al. 2003, Marshall 2004 and Turner 2005), we expected homeowners to care more about nearby open space than renters. To the extent that open space financing falls on property owners, however, homeowners may be more reluctant to support open space referenda. Further, the hypothesis that communities need to be fairly homogeneous in order to make progress on the provision of communally provided goods is not supported by our results.

Our results show a statistically significant inverted-U relationship between the likelihood of holding an open space referendum and municipal median household income. Initial increases in median wealth in a municipality had a positive effect on the probability of holding a referendum. However, at very high income levels, approximately $100,000, marginal increases in median household income were associated with a decrease in the likelihood of a referendum. It may be that very wealthy communities can provide open space more easily through private actions (e.g., large lot sizes, a country club within or near the municipality).

In equation (1), municipalities that had a larger share of votes cast for President Bush in the 2000 election were less likely to have an open space referendum in the period 2000 though

2004. In equation $(1')$, where we included vote shares for Nader and Gore (and dropped the share of votes for Bush in order to avoid near-perfect multicollinearity), we find that municipalities with a larger percentage of voters for Gore in the 2000 election were more likely to have an open space referendum, while municipalities that had larger percentage of voters for Nader in the 2000 election were less likely to have an open space referendum. Generally, we would expect left-leaning voters to be more likely to rely on government to provide for collective goods like open space, and the patterns for Bush and Gore voters are consistent with this view. However, Nader voters, though left-leaning and environmentally oriented, appear to be more like Bush voters in their effect on reducing the likelihood of open space referenda.

The estimated results of the selection equation also indicate that municipalities with council-manager and selectmen government systems were more likely to have an open space referendum than municipalities with commission, mayor-council or other systems. This result may be because elected selectmen or council members are either sensitive to community pressure or more likely themselves to initiate action, but the reason for these results is not fully clear. Municipalities that had open space related votes in the past at the local level were generally more likely to hold subsequent municipal-level referenda. Past local referenda may signal that the pressures on remaining open space in a municipality are significant and that there is willingness amongst some municipal voters to address the open space scarcity issue. Past open space referenda also may have created familiarity and greater acceptance amongst voters with the use of referenda to secure open space.

Municipalities in New Jersey and Massachusetts, states with programs that encourage local action on open space preservation and with relatively small stocks of open space (see Table 1), were more likely to hold referenda than municipalities in all other regions. Further, municipalities in the dense and highly developed New England and Mid-Atlantic regions were more likely to have referenda than municipalities in the less densely populated regions elsewhere.

B. Results Equation

The referendum results, given by the estimation of (2) and $(2')$, are shown in table 7. Overall, there are fewer statistically significant relationships in the referendum results estimations than in the selection estimations. Further, of the few statistically significant relationships in the results equation estimations, several are counter-intuitive. These results may occur because voting behavior depends on the particulars of the referendum (e.g., wording of the ballot initiative, spatial pattern and location of the open space, etc.), whether there is organized support for and/or opposition to the measure and the mood of the electorate at the time of the vote, details which are not readily observable or contained in our data set.[16] For example, a 1995 open space referendum was defeated in Corvallis, OR, a left-leaning college town with highly educated voters where it would otherwise seem likely to pass. The initial referendum failed largely because it was viewed as vague, allowed too much discretion to elected officials and faced organized opposition (Vossler et al. 2003). A subsequent, more clearly defined, proposal passed several years later.

Much to our surprise, we find only limited evidence of selection bias in the estimates of equations (2) and $(2')$. Only in the un-weighted estimate of equation (2) (the OLS estimate that uses the inverse Mill's ratio generated by the PROBIT estimate of (1)) is the inverse Mill's ratio statistically significant at the 10% level, a result indicative of selection bias. In general, it appears that controlling for selection bias is relatively unimportant in analyzing referenda results.

The estimated relationships between referenda support and referenda financing mechanisms variables were one of the few sets of results fairly consistent with expectations. Proposals to fund referenda via increases in existing taxes or completely new taxes lowered the odds of a "yes" votes versus the base of bond funded measures. In contrast, the estimated coefficient on funding via the reallocation of existing public funds was positive and statistically significant relative to bond financing. Finally, measures funded by the continuation of existing sales, property or income taxes at current rates were not statistically different than bond financing in affecting the odds of a "yes" vote than bond funding.

The other relationships in (2) and $(2')$ that were consistently significant and aligned with expectations were the effect of unemployment and education levels. High unemployment rates in the county at the time of the referendum had a negative impact on referenda support. Specifically, a 1% increase in the county's unemployment rate was associated with an approximate 4% drop in the odds of a "yes" vote in a referendum in both estimates of (2) and a 3.4% drop in the odds of a "yes" vote in a referendum in both estimates of $(2')$.

We found little evidence that the proposed per voter cost of a referendum influenced the outcome. In all estimates of equation (2) and $(2')$ there is a slight positive, albeit statistically insignificant, relationship between cost and logged odds of referenda support. Normally one would expect an increase in cost to result in a decrease in support. However, because we do not have a measure of what is being purchased, increased referendum costs may also indicate a larger or more extensive open space purchase or improvement. It is unclear whether an open space referendum package that purchases or improves great quantities of open space with a high price tag or one that purchases or improves a small amount of open space with a low price tag is more popular with voters. Similarly, it did not seem to matter much whether the referendum was strictly about open space or contained other unrelated provisions. The coefficient on the share of referendum funds earmarked to open space was positive but statistically insignificant. The effect of type of open space on the odds of a "yes" vote – measured by the variables that indicate whether recreation, farmland preservation and/or water conservation projects are part of the referendum package – were also statistically insignificant.

Further, other than the effect of 1990 to 2000 growth in a municipality's housing stock on the odds of referenda support – the relationship was statistically significant and positive in 3 of the 4 estimated results equations – population and landscape dynamics either did not significantly affect referenda outcomes or affected the odds of support in unexpected ways. Municipalities that grew faster in the 1990s and experienced significant growth in population and in housing stocks in their surrounding county area in the 1990s were not more likely to support referenda. Even more surprising, a municipality that lost relatively little farmland within its borders and its remaining surrounding county from 1987 to 1997 (or even slight gained farmland) tended to support referenda more readily than other municipalities. Kline and Wichelns (1994) and Kotchen and Powers (2004) found similar results for counties in Pennsylvania and municipalities in Massachusetts and New Jersey.[17]

We also found little evidence that municipal population, population density or median income was significantly related to referendum outcome, unlike the results in equations (1) and $(1')$. Except for the share of Nader voters in the estimates of equation $(2')$, coefficients on political orientation were also statistically insignificant.

Interestingly, municipalities that had held municipal-level open space referenda in the past were somewhat less likely to support subsequent referenda while, all else equal, municipalities that had participated in county-, special district- or state-level open space referenda in the past were somewhat more likely to support subsequent municipal-level open space referenda. Whether prior municipal-level open space referenda were associated with lower subsequent referenda support because the community had already satisfied its demand for open space cannot be determined by our model. Nor can we explain why prior county-, special district- or state-level open space referenda had a positive effect on subsequent municipal-level referenda; it may be that these higher jurisdiction referenda made the voters of a municipality more familiar with and accepting of using the voting booth to secure open space. Finally, as basic economic theory would suggest, support for a particular open space referendum tended to decline as the number of separate open space proposals on a ballot increased.

Other than the already mentioned lack of data on the size and magnitude of the open space project proposed in a referendum, there are other potential omitted variables in the results equations that could bias estimated coefficients. For example, even though we include proxies for recent open space loss in a municipality and its surrounding county area in our model, the share of land in a municipality and its surrounding county that was in farmland in 1987 is the only instance where we account for the stock of open space in a municipality and the remaining surrounding county in the base period. Solecki et al. (2004) demonstrates that open space stock can have a significant effect on an open space vote by showing that New Jersey municipalities near the Pinelands National Reserve and other open space reserves were less likely to support a state-wide open space referendum, ceteris paribus. Further, overall demand for open space in a municipality may be partially satiated by land conservation funded by NGOs such as the Nature Conservancy or local land trusts, making the passage of an open space referendum in the municipality an unnecessary redundancy.

IV. Conclusion

Several general results emerge from our analysis of municipal-level open space referenda from across the contiguous US. In this analysis we jointly estimated what factors increased the likelihood that a municipality held an open space referendum and the factors that increased voter support for open space referenda. We find limited evidence to suggest that the suite of factors that explain referenda appearance on a municipal ballot also significantly explain referenda outcome. Furthermore, we find more systematic patterns in explaining decisions to hold an open space referenda compared to explaining the pattern of voting on such referenda. There are a large number of statistically significant coefficients in the selection equation. In particular, per capita membership in environmental organizations in 2000 was a very powerful predictor of holding open space referenda in the period from 2000 through 2004. Among the statistically significant coefficients, most coefficients have the expected sign in the selection equation. There are fewer statistically significant coefficients generated by the estimate of the results equation, and of the few significant relationships between the odds of referenda support and explanatory variables, several have signs that ran counter to expectations. There may be several reasons why there appears to be greater explanatory power at the selection stage than at the results stage. The decision to hold a referendum may be driven by a small number of highly motivated individuals or groups. The ability of motivated individuals or groups to place an item on the ballot depends on effective organization, as demonstrated by the highly positive coefficient on environmental group membership. On the other hand, important information that would help predict election results, such as details of the referenda itself, and details of the campaign (e.g., whether there was an active campaign for passage or an organized opposition), were not part of the data set.

One difficulty with analyzing open space referenda is the lack of information on exactly what would be gained with referenda passage. Open space referenda typically do not specify what specific land parcels will be targeted for easements or purchase, or even how much land is involved. Because of this, it is difficult to test economic predictions such as whether likelihood of passage of an open space referendum will fall as price increases. In our results, we found a statistically insignificant positive relationship between the odds of voting "yes" on a referendum and per voter cost. This result may simply reflect that higher costs are associated with larger open space purchases and that such large programs may be slightly more popular with voters. On the other hand, voters may not be well informed about costs – either at the aggregate municipal level or their individual burden level. Our analysis, along with Kotchen and Powers (2004), suggests that voting on open space referenda may be more affected by referendum finance mechanism choice and its general tax implications (i.e., whether passage of the referendum would involve an increase in the municipality's overall tax burden) than on less easily discernable cost burdens. It may also be the case that rapidly growing areas are experiencing both escalating land prices and a growing willingness amongst its voting citizens to preserve remaining open space; therefore making it difficult to disentangle the negative effect of rising land prices on the demand for open space from the positive effect of increased open space scarcity on the demand for open space.

There is also evidence that the particular location of development pressures and the proposed location of conserved open space within a community affect overall community support for an open space referendum. For example, Dubin et al. (1992) found that growth control measures in San Diego had greater support in precincts with greater traffic congestion (a proxy for development pressures). Further, overall community support for a proposed open space project may increase if it is easily accessible to a majority of municipal residents, if the proposed open space is centrally located or complements other municipal amenities. In this research we do not control for any of these spatial issues. (See Deacon and Shapiro 1975, Irwin 2002, Vossler and Kerkvliet 2003 and Vossler et al. 2003 for a discussion of spatial issues and referenda.)

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Table 1: America's vanishing open green space and increasing population density

Region	Fraction of land area in open space			Population density (people per 1,000 acres)		
	1987	**1997**	**Pct Chg 1987 - 97**	**1987**	**1997**	**Pct Chg 1978 - 97**
New Jersey	0.659	0.577	–12.48	1,605	1,696	5.68
Massachusetts	0.745	0.665	–10.73	1,185	1,219	2.87
New England	0.901	0.871	–3.30	199	206	3.92
Mid-Atlantic	0.867	0.837	–3.52	397	416	4.62
South	0.908	0.891	–1.84	121	138	14.20
Great Lakes	0.851	0.838	–1.48	221	236	6.54
Midwest	0.931	0.930	–0.14	35	39	9.27
West	0.874	0.886	–0.55[§]	101	121	19.90
Contiguous United States	0.898	0.891	–1.09	127	140	10.61

Note: The *New England* region includes CT, ME, NH, RI and VT; the *Mid-Atlantic* region includes DE, MD, NY, PA, VA and WV; the *Midwest* region includes CO, IA, KS, MO, MT, ND, NE, SD, UT and WY; the *Great Lakes* region includes IL, IN, OH, MI, MN and WI; the *South* region includes AL, AR, FL, GA, KY, LA, MS, NC, NM, OK, SC, TN and TX; and the *West* region includes AZ, CA, ID, NV, OR and WA. Land use data comes from Vesterby and Krupa (2001) and population data comes from USCB (2005). Open space includes land used for crops, pasture or other agricultural purposes, forested land, land in national and state park systems, land in forest wilderness and primitive areas and land conserved for fish and wildlife conservation purposes. Non-open space land includes land in urban use, land used for rural transportation and land in military and industrial uses. The one land category excluded from both categories is 'other land' and is defined by Vesterby and Krupa as "miscellaneous areas such as marshes, open swamps, bare rock areas, deserts, urban, and other special uses not inventoried." This was not included due to the aggregation of open space and urban land categories in this category. This omission generally does not appear to be an issue; 'other land' was not greater than 9% of total land area in any region in 1997.

[§] Using data from Vesterby and Krupa (2001) the *West* saw a 1.41% **increase** in open space from 1987 to 1997. Ruben Lubowski of the USDA-ERS notes that according to Vesterby and Krupa (2001) rural parks and wildlife areas in the *West* increased by approximately 11 million acres from 1987 to 1997, as opposed to an urban area increase of 2.2 million acres. However, a large part of this gain may be due to a reclassification of 'other land' open space into rural parks and wildlife open space; as noted above 'other land' open space is not included in Table 1's totals. Therefore, the 1.41% gain in open space in the *West* in all likelihood does not represent an actual increase in open space. Given the 2.2 million acre increase in urban areas from 1987 to 1997 in the *West*, given that the *West* has an area of 399,843,000 acres and assuming no true gains in open space from 1987 to 1997 in the *West*, the best estimate of the open space change from 1987 to 1997 is –0.55% ((–2,200,000 / 399,843,000) x 100).

Table 2: Municipal-level ballot referenda held from 2000 through 2004 that proposed public monies for the procurement or improvement of open space

Region	**Number of municipalities that held open space referenda**	**Number of municipal-level open space referenda held**	**Number of municipal-level open space referenda passed**	**Total open space funds approved (Millions of January 2000 $)**
New Jersey	162	205	167	530
Massachusetts	123	138	80	224
New England	61	84	75	166
Mid-Atlantic	79	91	77	844
South	58	70	58	650
Great Lakes	53	56	34	318
Midwest	34	38	34	442
West	31	36	24	654
Total	**601**	**718**	**549**	**3,829**

Note: A municipality may have had more than one municipal-level open space referendum from 2000 through 2004. All data comes from TPL (2004). Fund information is missing for twenty open space referenda that passed.

Figure A: Municipal-Level Open Space Referenda Held from 2000 through 2004 that Passed (549 Referenda)

Figure B: Municipal-Level Open Space Referenda Held from 2000 through 2004 that Failed (169 Referenda)

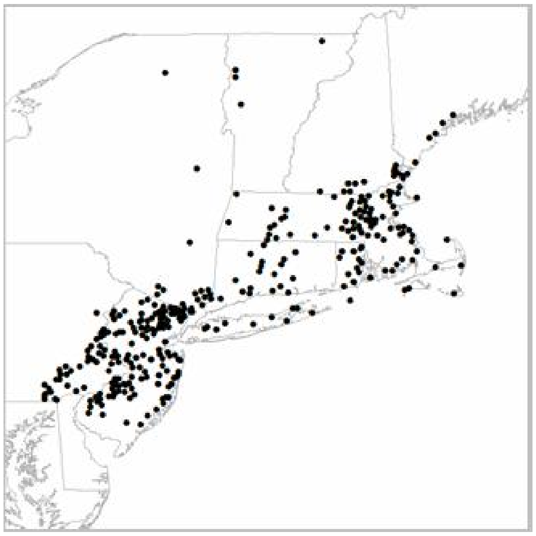

Figure C: Municipal-Level Open Space Referenda Held from 2000 through 2004 that Passed - Northeast USA (395 Referenda)

Figure D: Municipal-Level Open Space Referenda Held from 2000 through 2004 that Passed - Northeast USA (117 Referenda)

Table 3: Variables Used in (1)

Variable	Variable description
W_i	A dummy variable that = 1 if *i* held an open space referendum at some time from 2000 through 2004 and = 0 otherwise.
Vector of demographic variables	
pop_i	*i*'s population in units of 10,000 in 2000.
$popd_i$	*i*'s population density in units of 10,000 people per square mile in 2000.
$popc_i$	*i*'s population change from 1990 to 2000 in decimals.
$bpopc_i$	Population change in decimels from 1990 to 2000 in *i*'s host county not including the change in *i* itself.
Vector of socio-economic variables	
$popwh_i$	The share of non-Hispanic white people in *i*'s 2000 census.
occ_i	The share of *i*'s housing that was owner occupied in 2000.
ed_i	The share of *i*'s 25 year old and older residents that had a bachelor's degree or higher in 2000.
$medi_i$	*i*'s median household income in units of $10,000 in 1999.
$medi_i^2$	The square of $medi_i$.
Vector of political variables	
$bush_i$	The share of *i*'s votes cast for President Bush in the 2000 general election. Vote data are given at the county level and we assume that the voting pattern in *i* mimics the voting pattern in its host county. Therefore, $bush_i$ is equivalent to the proportion of votes for President Bush in *i*'s host county in the 2000 general election.
Vector of landscape variables	
$newhses_i$	The share of *i*'s housing units in 2000 that was constructed between 1990 to 2000.
$bnewhses_i$	The share of housing units that were constructed between 1990 to 2000 in *i*'s host county not including the share in *i* itself.
$bfarmchs_i$	The share of farm acreage gained in *i* and its host county from 1987 to 1997 ($bfarm_i$) multiplied by 1 - shf_i where shf_i measures the share of farm acreage in *i* and its host county in 1987.
Vector of government type variables	
$mayor_i$	A dummy variable that = 1 if *i*'s government structure is a mayor-council system (elected mayor and elected governing body) and = 0 otherwise.
$council_i$	A dummy variable that = 1 if *i*'s government structure is a council-manager system (elected governing body and appointed manager) and = 0 otherwise.
$commish_i$	A dummy variable that = 1 if *i*'s government structure is a commission system (elected board of commissioners, with each commissioner responsible for one or more departments) and = 0 otherwise.
$select_i$,	A dummy variable that = 1 if *i*'s government structure is a selectmen system (elected body responsible for day-to-day administration) and = 0 otherwise.
$othgov_i$	A dummy variable that = 1 if *i*'s government structure is some other system and = 0 otherwise.
Vector of control variables	
$prevote_i$	The number of municipal-level open space referenda in *i* previous to the vote in question (the database only includes municipal-level referenda from 1996 to 2004).
$oprevote_i$	The number of open space referenda in *i* that were not municipal level votes (i.e., county, special district or state-level votes) previous to the vote in question (the database only includes non-municipal-level referenda from 1996 to 2004).
$mass_i$	A dummy variable that = 1 if *i* is in Massachusetts.
nj_i	A dummy variable that = 1 if *i* is in New Jersey.
ne_i	A dummy variable that = 1 if *i* is in New England state other than Massachusetts (CT, ME, NH, RI, VT).
ma_i	A dummy variable that = 1 if *i* is in a Mid-Atlantic region state other than New Jersey (DE, MD, NY, PA, VA, WV).
gl_i	A dummy variable that = 1 if *i* is in a Great Lakes region state (IL, IN, OH, MI, MN, WI).
mw_i	A dummy variable that = 1 if *i* is in a Midwest region state (CO, IA, KS, MO, MT, ND, NE, SD, UT, WY).
s_i	A dummy variable that = 1 if *i* is in a South region state (AL, AR, FL, GA, KY, LA, MS, NC, NM, OK, SC, TN, TX).
w_i	A dummy variable that = 1 if *i* is in a West region state (AZ, CA, ID, NV, OR, WA).

Note: All variable data in the table are from USCB (1990) and USCB (2000) except $mayor_i$, $council_i$, $commish_i$, $select_i$ and $othgov_i$ (USCB 1992); $bush_i$ (Leip 2004); $bfarmchs_i$ (USDA-NASS 1997); and $prevote_i$ and $oprevote_i$ (TPL 2004).

Table 4: Variables Used in (2)

Variable	Variable description
P_j	The proportion of referendum votes recorded as "yes" votes in *j*'s referendum
Vector of referendum specific variables	
$cost_j$	The estimated total per voter cost of *j*'s referendum in January 2000 $1,000 units. For each observation we assumed the population of eligible voters at the time of the referendum was equal to the municipality's population of people 18 years old and older in 2000.
$share_j$	The share of *j*'s total referendum funds earmarked for open space related projects. Many of the observed open space referenda included proposed funding for non-open space public goods such as road improvement.
$unemp_j$	The unemployment rate in *j* and its host county in the month of the referendum vote.
$cocur_j$	The number of other open space referenda that voters are asked to consider when voting on the referendum in question. In our database each concurrent vote is a separate observation.
$taxincr_j$	A dummy variable that = 1 if the passage of *j*'s referendum would involve an increase in the amount of tax money collected and = 0 otherwise.
$sales_j$	A dummy variable that = 1 if a sales tax would be used to raise the proposed funds in *j*'s referendum and = 0 otherwise.
$prop_j$	A dummy variable that = 1 if a property tax would be used to raise the proposed funds in *j*'s referendum and = 0 otherwise.
inc_j	A dummy variable that = 1 if an income tax would be used to raise the proposed funds in *j*'s referendum and = 0 otherwise.
$othtax_j$	A dummy variable that = 1 if some other tax type would be used to raise the proposed funds in *j*'s referendum and = 0 otherwise.
$bond_j$	A dummy variable that = 1 if a bond would be used to raise the proposed funds in *j*'s referendum and = 0 otherwise.
$allocate_j$	A dummy variable that = 1 if an allocation of already raised public monies would be used to fund the open space programs in *j*'s referendum and = 0 otherwise
rec_j	A dummy variable that = 1 if *j*'s proposed open space program has a recreation component and = 0 otherwise.
$farm_j$	A dummy variable that = 1 if *j*'s proposed open space program has a farmland preservation component and = 0 otherwise.
$water_j$	A dummy variable that = 1 if *j*'s proposed open space program in *j* has a water conservation component and = 0 otherwise.
Selection bias correction term	
$\hat{l}_j$	$\hat{l}_j = f(\hat{g}'\mathbf{X}_j)/\Phi(\hat{g}'\mathbf{X}_j)$ is the estimate of *j*'s inverse Mill's ratio where f is the normal probability density function, $\hat{g}$ is a vector of estimated coefficients generated by estimating (1), $\mathbf{X}_j$ is the vector of independent variable data associated with observation *j* used in (1) and Φ is the normal cumulative density function (see Greene 2003).

Note: All variable data in the table are from TPL (2004) except $unemp_j$ (BLS 2004).

Table 5: Statistical summary of variables used in model

	Obs. in (1) where W = 1		Obs. in (1) where W = 0		All obs. in (2)		Obs. in $(1')$ where W = 1		Obs. in $(1')$ where W = 0		All obs. in $(2')$	
Variable	*Mean / Count*	*Std. Dev.*	*Mean / Count*	*Std. Dev.*	*Mean / Count*	*Std. Dev.*	*Mean / Count*	*Std. Dev.*	*Mean / Count*	*Std. Dev.*	*Mean / Count*	*Std. Dev.*
No. of obs.	705		974		613		434		551		383	
pop	5.155	19.73	0.465	1.835	5.243	20.72	5.838	17.55	0.529	2.031	5.981	18.08
popd	0.148	0.166	0.085	0.138	0.147	0.164	0.137	0.161	0.091	0.132	0.136	0.158
popc	0.279	1.261	0.085	0.310	0.294	1.343	0.332	1.580	0.105	0.334	0.348	1.671
bpopc	0.144	0.176	0.081	0.129	0.145	0.168	0.157	0.203	0.097	0.126	0.159	0.195
popwh	0.866	0.136	0.894	0.176	0.867	0.134	0.875	0.141	0.904	0.154	0.872	0.142
occ	0.775	0.140	0.779	0.121	0.776	0.139	0.768	0.140	0.783	0.118	0.767	0.139
ed	0.387	0.152	0.158	0.123	0.388	0.154	0.405	0.151	0.163	0.120	0.406	0.153
medi	6.597	2.146	3.908	1.607	6.607	2.148	6.557	2.194	4.060	1.360	6.569	2.215
$medi^2$	48.12	34.01	17.86	23.53	48.26	34.06	47.79	35.92	18.33	15.69	48.05	36.24
bush	0.431	0.099	0.552	0.104	0.434	0.097	0.423	0.102	0.523	0.094	0.428	0.101
newhses	0.191	0.142	0.135	0.106	0.195	0.145	0.201	0.145	0.141	0.104	0.205	0.146
bnewhses	0.974	0.540	0.895	0.165	0.969	0.463	1.002	0.677	0.883	0.157	0.995	0.575
bfarmchs	-0.068	0.156	-0.038	0.087	-0.064	0.161	-0.102	0.136	-0.044	0.090	-0.098	0.141
mayor	222		472				95		278			
council	204		107				125		61			
commish	8		16				4		2			
select	267		366				208		208			
othgov	4		13				2		2			
prevote	198		7		181		97		4		92	
oprevote	276		335		243		98		227		96	
mass	136		7		105		136		7		105	
nj	204		8		178							
ne	81		23		70		54		17		49	
ma	90		136		84		90		125		84	
gl	53		364		49		48		273		47	
mw	37		219		34		29		33		28	
s	70		179		64		50		76		45	
w	34		38		29		27		20		25	
$log(P/1\text{-}P)$					0.448	0.554					0.428	0.601
cost					0.547	0.763					0.655	0.807
share					0.837	0.289					0.754	0.325
unemp					4.400	1.406					4.501	1.419
cocur					0.137	0.600					0.178	0.701
taxincr					358						179	
sales					23						18	
prop					323						140	
inc					28						28	
othtax					12						11	
bond					223						184	
allocate					4						2	
rec					270						134	
farm					132						47	
water					27						14	
gore							0.521	0.090	0.437	0.089	0.516	0.091
nader							0.045	0.026	0.029	0.017	0.044	0.025
emem							0.017	0.008	0.009	0.005		

Note: A municipality that had more than one municipal-level open space referendum from 2000 to 2004 is included in the summary statistics above the appropriate number of times.

Table 6: Estimates of (1) and (1')

Variables	Equation (1) PROBIT Estimate	SE	Equation (1) WESML Estimate	SE	Equation (1') PROBIT Estimate	SE	Equation (1') WESML Estimate	SE
pop	0.089***	0.019	0.049***	0.016	0.061***	0.024	0.037***	0.014
popd	-0.953**	0.418	-0.535	0.328	-1.043*	0.569	-1.048**	0.468
popc	-0.011	0.085	0.056	0.043	0.004	0.128	0.133	0.138
bpopc	2.545***	0.553	1.801***	0.556	2.459***	0.718	2.130***	0.635
popwh	0.104	0.524	0.541	0.503	-0.461	0.673	0.208	0.655
occ	-1.563**	0.635	-0.717	0.719	-1.351*	0.815	-0.962	0.831
ed	2.113***	0.592	1.274	0.756	2.584***	0.750	1.950***	0.718
medi	0.798***	0.131	0.607***	0.149	0.798***	0.173	0.568***	0.180
$medi^2$	-0.041***	0.007	-0.033***	0.009	-0.039***	0.009	-0.027***	0.009
bush	-2.860***	0.692	-2.421***	0.686				
gore					2.253**	0.897	2.109***	0.777
nader					-11.10**	4.539	-14.63***	5.177
emem					39.71***	11.95	40.13***	12.561
newhses	1.279**	0.581	0.815	0.553	0.532	0.763	-0.413	0.744
bnewhses	0.698**	0.322	0.421	0.360	0.535	0.342	0.281	0.316
bfarmchs	0.993**	0.472	0.970**	0.450	0.985*	0.578	1.066**	0.522
council	0.644***	0.147	0.586***	0.150	0.370**	0.177	0.236	0.175
commish	-0.267	0.426	-1.398	0.895	0.579	0.669	0.626	0.420
select	0.427***	0.153	0.441***	0.163	0.435**	0.190	0.321	0.220
othgov	0.344	0.573	0.599**	0.288	0.742	0.845	0.772	0.472
prevote	0.444**	0.198	0.451*	0.256	0.532**	0.269	0.425	0.322
oprevote	0.156	0.131	0.062	0.145	0.030	0.167	-0.155	0.184
mass	1.580***	0.329	1.295***	0.341	1.384***	0.332	1.468***	0.286
nj	2.004***	0.288	1.693***	0.330				
ne	0.920***	0.277	0.640***	0.240	0.545	0.274	0.532*	0.302
ma	0.531**	0.221	0.210	0.214				
gl	-0.395*	0.232	-0.429**	0.216	-0.800***	0.196	-0.605***	0.198
mw	-0.403	0.245	-0.585**	0.272	-0.286	0.328	-0.390	0.359
s					-0.386	0.293	-0.191	0.275
w	-0.258	0.274	-0.117	0.240	-0.017	0.350	0.388	0.281
constant	-3.073***	0.692	-4.445***	0.721	-4.661***	0.989	-5.620***	0.921
No. of Obs.	1679		1679		985		985	
Log Likelihood	-353.99		-77.85		-239.63		-50.45	

Note: The dependent variable in (2) and (2') is *W*. The omitted government type variable in all estimates is *mayor*. The omitted regional dummy in (1) is the South (*s*). The omitted regional dummy in (1') is the Mid-Atlantic (*ma*). New Jersey (*nj*) municipalities are not included in (1') because this state was not surveyed by LCV for environmental membership levels. *** indicates significance at the 1% level, ** indicates significance at the 5% level and * indicates significance at the 10% level.

Table 7: Estimates of (2) and (2')

Variables	Equation (2) with PROBIT Estimate	SE	Equation (2) with WESML Estimate	SE	Equation (2') with PROBIT Estimate	SE	Equation (2') with WESML Estimate	SE
cost	0.019	0.028	0.017	0.029	0.046	0.037	0.045	0.037
share	0.155	0.114	0.137	0.115	0.133	0.135	0.122	0.134
unemp	-0.041***	0.015	-0.044***	0.015	-0.035*	0.020	-0.034*	0.020
cocur	-0.102***	0.033	-0.101***	0.033	-0.094**	0.040	-0.091**	0.040
taxincr	-0.386***	0.103	-0.387***	0.103	-0.515***	0.144	-0.518***	0.145
sales	-0.018	0.137	-0.005	0.140	0.109	0.176	0.120	0.175
prop	0.010	0.121	0.001	0.123	0.081	0.160	0.072	0.162
inc	0.066	0.152	0.053	0.154	0.183	0.193	0.167	0.194
othtax	0.186	0.158	0.175	0.164	0.297	0.186	0.302	0.190
allocate	0.813***	0.221	0.784***	0.236	1.662***	0.344	1.679***	0.344
rec	0.001	0.046	-0.001	0.046	0.015	0.067	0.014	0.067
farm	0.055	0.054	0.045	0.054	0.078	0.086	0.067	0.086
water	0.129	0.093	0.125	0.094	0.047	0.133	0.046	0.134
pop	0.003	0.004	0.003***	0.001	0.004	0.006	0.003	0.003
popd	-0.249	0.185	-0.268*	0.158	-0.326	0.249	-0.267	0.224
popc	-0.014	0.026	-0.016	0.017	-0.024	0.035	-0.033	0.020
bpopc	-0.261	0.225	-0.190	0.192	-0.319	0.271	-0.434*	0.260
occ	-0.287	0.302	-0.337	0.262	-0.646	0.416	-0.639*	0.381
ed	0.861***	0.274	0.942***	0.235	0.752**	0.365	0.649*	0.357
medi	-0.099	0.068	-0.064	0.064	-0.055	0.095	-0.069	0.093
$medi^2$	0.004	0.004	0.002	0.003	0.003	0.005	0.004	0.005
bush	-0.062	0.327	-0.180	0.294				
gore					0.188	0.464	0.097	0.455
nader					-1.167	1.871	-0.586	1.729
newhses	0.362	0.253	0.426*	0.209	0.677*	0.355	0.760**	0.299
bnewhses	-0.049	0.090	-0.035	0.053	-0.038	0.100	-0.048	0.063
bfarmchs	0.273	0.178	0.312**	0.144	0.195	0.247	0.133	0.222
prevote	-0.088	0.065	-0.076	0.051	-0.134	0.091	-0.161**	0.079
oprevote	0.170**	0.067	0.174***	0.059	0.144	0.108	0.157	0.104
mass	-0.031	0.167	0.019	0.161	-0.046	0.175	-0.145	0.186
nj	0.044	0.157	0.113	0.152				
ne	0.233*	0.131	0.281**	0.113	0.182	0.125	0.151	0.119
ma	0.115	0.128	0.144	0.116				
gl	-0.378***	0.132	-0.405***	0.124	-0.476***	0.145	-0.477***	0.139
mw	-0.175	0.131	-0.194	0.123	-0.247	0.200	-0.234	0.189
s					-0.138	0.157	-0.138	0.143
w	-0.356***	0.134	-0.353***	0.116	-0.535***	0.185	-0.583***	0.171
$\hat{l}$	-0.603*	0.328	-0.019	0.068	-0.605	0.427	-0.137	0.113
constant	1.304***	0.392	1.000***	0.364	1.323**	0.563	1.462**	0.644
No. of Obs.	613		613		383		383	
Adj. R^2	0.288		0.284		0.323		0.324	

Notes: The dependent variable in (2) and (2') is $log(P/1\text{-}P)$. The omitted finance mechanism dummy variable in all estimates is *bond.* The omitted regional dummy in (2) is the South (*s*). The omitted regional dummy in (2') is the Mid-Atlantic (*ma*). New Jersey (*nj*) municipalities are not included in (2') because this state was not surveyed by LCV for environmental membership levels and thus was not in included in (2')'s selection equation (1'). *** indicates significance at the 1% level, ** indicates significance at the 5% level and * indicates significance at the 10% level.

[1] In this research open space includes undeveloped green spaces and farmland.
[2] A city, village, town, township or borough is considered a municipality.
[3] All ballot referenda included in this analysis proposed some monies for land or land development rights acquisition. Many of the referenda also included monies for the improvement or augmentation of already existing community-owned open space, such as park and trails improvement. In addition, at least 164 of the 718 municipal-level referenda proposed public monies for non-open space public goods as well.
[4] If a municipality had more than one open space vote from 2000 through 2004 each vote was considered a separate observation. Thus, several municipalities are indexed more than once. In total, 1 municipality had 5 open space referenda from 2000 through 2004, 4 had 4 referenda, 10 had 3 referenda and 81 had 2 referenda. To determine if duplicate records significantly affect estimation results, we also ran the analysis without any duplicate records. If a municipality had more than one municipal-level open space referendum from 2000 through 2004 we only included the municipality's first referendum. The estimates of our model's equations without the duplicate records are very similar to the estimates with the duplicate records.
[5] For municipalities located in more than one county, we take the weighted average for the multiple counties in which the municipality is located.
[6] The Massachusetts program is called the Community Preservation Act (see http://www.communitypreservation.org/index.cfm). The New Jersey program is called "Green Acres" (see http://www.state.nj.us/dep/greenacres/).
[7] A consistent and efficient estimate of (2) requires the identification of at least one variable that appears in the selection equation – a variable that affects open space referendum appearance – but is not included in the referenda result equation. While a municipality's government type may have great influence on the ability to get a referendum on a ballot, we see no reason why a municipality's aggregate vote on an open space referendum should be affected by the structure of its local government. Further, while we believe that a municipality's racial makeup may affect the likelihood of the appearance of an open space referendum on a ballot, we have no reason to believe that a voter's race or his consideration of the municipality's racial mix, all else equal, will affect how he votes on the referendum. Therefore, we do not include variables related to government type and municipality racial make-up in equation (2) and $(2')$.
[8] Incorrect estimates of the variance-covariance matrix are produced when using OLS to estimate (2) and $(2')$. Erroneous estimates are produced for two reasons. First, the referenda results equation is heteroskedastic. The second source of error is introduced by the use of an estimated inverse Mill's ratio, instead of the true Mill's ratio. The standard errors reported in table 7 have been appropriately corrected (see Greene 2003, p. 785).
[9] The referendum result equation includes several variables, such as estimated per voter referendum cost and referendum finance mechanism, that are only observed after a municipality has decided to have a vote. Theoretically this could introduce omitted variable bias into the selection equation. For example, if residents of a municipality knew ***a priori*** that any open space provision approved by a referendum would involve an increase in property taxes and the majority of residents were vehemently opposed to property tax increases, then the omission of a finance mechanism variable in the selection equation might bias the estimated selection equation. Here we assume that the variables that describe a municipality's open space referendum (i.e., per voter cost, finance mechanism, etc.) do not affect the likelihood that an open space referendum was placed on a municipal ballot.
[10] Thalmann (2004) hypothesized that voter support of green taxes via referendum in Switzerland would be greatest amongst the well-educated, the politically left-of-center and the "safely" employed, i.e., those who live in areas or worked in a field with very low unemployment.
[11] LCV collected membership data in 27 states. While the roster of organizations used to tally membership information was not completely consistent across states, the variation was minimal. In some states the national-level environmental organization membership data was collected at the municipal and county level, in other states it was collected at the county level only. We use county level data to be consistent across states. To scale the membership data at the county level to a municipal level we assumed that membership in national environmental organizations was uniformly distributed in a county.
[12] As already mentioned in table 3, general election vote data are given at the county level and we assume that the vote in ***i*** mimics the voting rates in its host county. Therefore, ***nader***$_i$ is equivalent to the proportion of votes for Nader in ***i***'s host county in the 2000 general election and ***gore***$_i$ is equivalent to the proportion of votes for presidential candidate Al Gore in ***i***'s host county in the 2000 general election.
[13] We do not include environmental organization membership data in $(2')$ because in most municipalities in the dataset the per capita membership levels were very small and the affect of this variable on overall vote results should

be very low. Specifically, in our database the mean value of membership levels was 0.014 per capita with a standard deviation of 0.009 and a maximum value of 0.045.

[14] Every municipality in our dataset has a local government that has the ability to raise funds for public projects. The list of all US municipalities that we used to select the 1000 municipalities that did not have an open space referendum from 2000 to 2004 comes from USCB (2000).

[15] Of the 105 municipalities that held referenda and are dropped in the estimation of (2), 58 are dropped because of missing referenda funding information, 35 are dropped because of missing vote count information, 4 are dropped because they were "advisory" measures and another 8 are dropped for miscellaneous missing data.

[16] We did test whether the year of the referendum (was the referendum held in 2000, 2001, 2002, 2003 or 2004?), the timing of the referendum (was the referendum on a national general election ballot or not?) and the level of voter participation in the referendum had a statistically significant effect on odds of a "yes" vote. None of these 3 variables had a statistically significant effect in our estimated model.

[17] Counties in Pennsylvania that lost larger swaths of farmland were less supportive of a proposed state-wide farmland preservation program than counties that had only suffered marginal farm acreage losses. Unlike our analysis, however, Kline and Wichelns use a separate variable to control for the amount of farmland in the county in the base period. We re-ran equations (1), (1'), (2) and (2') with $bfarm_i$ and (1 - shf_i) as separate variables, just as Kline and Wichelns did in their analysis of farm preservation program voting in Pennsylvania. The separate use of the variables did not significantly change our estimates of (1), (1'), (2) and (2'). Kotchen and Powers (2004) found that New Jersey municipalities that lost relatively large swaths of open space in their surrounding county area were less likely to vote "yes" on open space referenda than those that lost relatively little open space in their surrounding county area.