



## Analysis

## Explaining the appearance and success of open space referenda

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## ABSTRACT

Many communities in the United States have begun enacting policies to preserve open space, often through local voter referenda. New Jersey sponsors such municipal action through the Green Acres Program by providing funding and low interest loans to towns that choose to increase property taxes and spend the money raised on open space preservation for the purposes of conservation and/or recreation. This paper endeavors to understand which factors contribute to the appearance and success of these measures. Although previous literature has examined this issue, this is the first study to account for spatial dependence/spatial autocorrelation and to explore dynamic issues through survival analysis. The traditional two stage model from the literature is extended by incorporating a Bayesian spatial probit for the first stage and a maximum-likelihood spatial error model in the second stage. A Cox-proportional hazard model is used to examine the timing of referenda appearance. Spatial dependence is found in the second stage of the analysis, indicating that future studies should account for its influence. There is no strong evidence for spatial dependence or correlation in the first stage. The survival model is found to be a useful complement to the traditional probit analysis of the first stage.

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## 1. Introduction

In the face of increasing urban sprawl, communities around the country have taken an active role in preserving open space. There are many approaches to preservation, including outright purchase of undeveloped land, the purchase of development rights and conservation easements, and public/private partnerships with land trusts or other preservation organizations. All of these approaches, however, require financing, and many communities have turned to voter-approved tax increases or bond issues to finance preservation. There have been 2299 voter referenda on this issue since 1988 in the United States, of which 1740 have passed. These measures have raised more than \$56 billion for land preservation.<sup>3</sup>

There are many factors which might influence whether or not a community holds and/or passes preservation referenda. Most basically, voting behavior in referenda resembles purchasing behavior; voters are choosing yes or no on a measure that would provide some benefits at some cost. An individual voter should vote yes or no on the question depending on whether or not, on balance, the benefits that a voter expects to receive exceed the costs that the voter expects to pay.

These benefits and costs may depend on existing levels of consumption of both private and public goods that are related to the good in question, will include any direct expected tax costs which may or may not depend on income or the value of one's property, as well as indirect benefits or costs in the form of changes in property values or other macroeconomic effects. Obviously, individual preferences will also play a role in determining an individual's voting behavior.

Deacon and Shapiro (1975) laid the groundwork for analyzing voter behavior by developing a theoretical model in the context of referenda and applying that model to an empirical analysis of two referenda in California, one of which aimed to control development along the California Coast. Using voting data for 334 cities, they found evidence that conservation is a normal good and that the likelihood of voting for conservation is increasing in education and decreasing in the share of employment in a county that is in construction or related industries. Using voting data aggregated to the county level, Kahn and Matsusaka (1997) find a concave relationship between income and the proportion of votes for environmental propositions. Their results also confirm the findings of Deacon and Shapiro (1975) regarding the effects of education and the composition of the local economy. Wu and Cutter (2011) improve on these analyses by using census block-group level data (a much finer scale) and spatial error and lag models similar to those used in this paper to account for spatial dependence and autocorrelation. Finding that this more disaggregated data as well as the spatial controls matter, they find evidence that income has a convex relationship with the proportion of yes votes, but confirm the results of Kahn and Matsusaka (1997) as regards education. They also show that older populations seem less likely to support environmental referenda, but

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that denser and more urban populations are more likely to be supportive.

A related set of papers focuses on local referenda as opposed to local voting results on statewide referenda. These referenda may give a better picture of demand for conservation since the costs and benefits of these programs are more closely tied to the voting populations. Howell-Moroney (2004) used a sample of communities in the Delaware Valley of Pennsylvania and New Jersey to look at the decision to hold referenda. Kotchen and Powers (2006) and Nelson et al. (2007) expanded this analysis by simultaneously examining not only the decision to hold a referendum, but, like the studies above, the proportion of votes for such measures in studies of referenda across the United States. Kotchen and Powers (2006) also provide more detailed analyses of referenda in Massachusetts and New Jersey, two of the most active states in the land conservation movement. Banzhaf et al. (2010) provide a similar nationwide analysis but are careful to control for two facts; that communities that hold referenda are likely to be those jurisdictions that are most likely to pass referenda and that the chosen financing mechanism (e.g. municipal bond or tax) is also likely to be the mechanism most likely to pass. These studies largely find that communities with higher income and more educated populations, and which have experienced more loss of open space, are more likely to hold and pass conservation referenda.<sup>4</sup>

We build on this literature using municipal-level data on referenda in New Jersey to answer many of the same questions addressed in the papers discussed above. However, we make two notable contributions to this literature. First, we use spatial econometric models to explicitly account for spatial autocorrelation. The traditional two stage model from the literature is extended by incorporating a Bayesian spatial probit for the first stage and a maximum-likelihood spatial error model in the second stage. Spatial factors come into play when the appearance or passage of a referendum is either partially determined by the decisions of nearby communities, or is subject to the same unobserved factors which drive these decisions in nearby communities. Whereas Wu and Cutter (2011) found spatial factors to be important in state-level referenda, we extend that work to municipal referenda and the two-stage referenda model. In addition, we use a Cox-proportional hazard model to take advantage of the temporal variation in our sample. Whereas the previous literature has largely thought of these referenda as static phenomena, we look to explain not only the static question of whether or not a municipality holds or passes a referendum, but also the dynamic question of why some towns adopt earlier than others.

We find that accounting for spatial effects is important in the second stage model of referenda voting. There is strong evidence of spatial autocorrelation at this stage that is controlled for in the spatial error model. We also find the survival model to be a useful complement to traditional approaches, as, qualitatively, the results match up very closely with those in the first stage (appearance) models. Overall, we find mixed impacts of income on referenda, although referenda appear and pass less often in periods of high unemployment. Referenda are also significantly impacted by existing property taxes and home values, the age and gender distributions of the population, existing open space, general political attitudes, homeownership rates, and the average education level in a community. Finally, voters are more likely to support referenda geared towards farmland preservation and less likely to support those directed at recreation.

Section 2 provides more details about our study area and the referenda under consideration. Section 3 describes our dataset. Section 4 goes into detail on our methodology and Section 5 presents our results. Section 6 concludes the paper.

## 2. Study Area and Policy Details

New Jersey, sandwiched between two of the six largest cities in the United States, is the most densely populated state in the United States according to the 2010 census. Hasse and Lathrop (2008, 2010) state that if 2007 rates of development and urbanization were to continue, the state would develop all available land by 2053. In response to this increasing density and growth in urban development, New Jersey has been a leader in preservation of open space through voter referenda. This leadership can, in part, be attributed to a statewide initiative, the Green Acres Open Space Land Conservation Program. Begun in 1961, there have been 13 statewide ballot measures that have provided funding for open space preservation in New Jersey, with the most recent in 2009. Much of the money raised through these initiatives has been used to match funds raised through local ballot measures that have provided additional resources for preservation. Since 1989, these statewide programs have resulted in 493 municipal referenda on conservation. Of these, 389 measures have passed which have raised approximately \$1.3 billion for land conservation.<sup>5</sup>

The Green Acres Program, broadly speaking, has four program areas: State Park and Open Space Acquisition, Local Governments and Non-Profit Funding, Stewardship – Keeping it Green, and Planning and Information Management. The second of these is what we address in this paper. The Green Acres program provides funding and low interest financing to local authorities for the protection and/or acquisition of existing open space as well as for the provision of recreation facilities. A substantial portion of this funding depends on the local governments having put in place an “open space tax” and associated implementation plan. The program also supports non-profit organizations which often work with local communities to acquire undeveloped land or the associated development rights.<sup>6</sup> Also, any land acquired through the use of Green Acres funding must be used solely for conservation or recreation. In these ways, the program provides substantial incentives for municipalities to actively engage in land preservation programs.

We look at those referenda held at the municipal level and which proposed a property tax increase to fund preservation (this excludes only 9 referenda which used Bonds or other financing mechanisms) and exclude those at the County or State levels from our analysis. In total, 257 municipalities held at least one referendum. This represents about 44% of all municipalities in New Jersey. These referenda, on average, proposed raising \$3.97 million for conservation by increasing property taxes by 1.62 cents per \$100 dollars of property value. On average, these referenda received support from 58% of voters. All of those referenda for which information on the purpose was provided mentioned open space preservation as the primary purpose. Of those, 195, or not quite 50% mentioned recreation and 182, or 42%, mentioned farmland preservation. Fig. 1 provides a map of the referenda included in our dataset. Fig. 1 also illustrates how the state of New Jersey is divided into municipalities. Contrary to the urban implications of the name, all land, including agricultural and open space, is assigned to a particular municipality.

Because all New Jersey municipalities are eligible to participate in these programs, it is an especially attractive context within which to study the drivers of referendum appearance and success. We look to exploit the variation across New Jersey communities to understand what drives some to participate while others defer. Given the large number of municipalities in our dataset, it is also a very good area in which to study the spatial relationships which may underlie these issues.

<sup>4</sup> Additional contributions to this literature include Kline and Wichelns (1994), Nelson et al. (2007), Kline (2006), Sunderberg (2006) and Vossler and McKee (2006).

<sup>5</sup> TPL LandVote Database (<http://www.landvote.org>).

<sup>6</sup> For more details on the program, see the Green Acres website at: <http://www.nj.gov/dep/greenacres>.

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