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Abstract

This paper examines if contagion effects from nearby localities affect whether or not a county successfully satisfies its residents' demands. We use the generalized axiom of revealed preference to compare each county's tax and spending bundle with what would have obtained under the median voter hypothesis (MVH). We next employ spatial logit to determine the extent to which government structure or spatial interaction lead to systematic MVH violations. Nonresidential taxable capital mobility increases the likelihood that counties will satisfy the MVH, but there is also a significant spatial contagion or copycat behavior; a greater likelihood of surrounding counties satisfying the MVH increases the likelihood of a given county doing the same.

Keywords: homevoter hypothesis, median voter, GARP, spatial interdependence, spatial contagion

JEL Codes: H72, R51

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1 Introduction

It is widely accepted that public sector structure affects its fiscal behavior and overall performance. Decentralization, for example, is presumed to increase efficiency at least in part by subjecting a wider range of public sector activities to the discipline of intergovernmental competition for residents or for mobile non-residential tax base. But even if the existence of alternative jurisdictions creates competitive pressure on local governments, the question remains whether the fiscal choices made by those alternative jurisdictions matter as well. Simply put, is local government performance subject to contagion or copycat effects? Is it the existence of an alternative jurisdiction that matters or is it the behavior of the alternative jurisdiction that more strongly influences the behavior of a given local government?

This paper examines the extent to which the horizontal competition induced by the structure of the local government sector or contagion across local governments in proximity affect whether or not they successfully meet the demands of their residents. The median voter hypothesis (MVH) depicts a political equilibrium that is the public choice analogue to competitive equilibrium in the theory of markets; under fairly restrictive conditions the median income voter's optimum characterizes the community choice under pure democracy.[1] Fischel's (2001) homevoter hypothesis helps explain why the literature finds remarkably strong empirical support for the median voter model of public demand despite the highly restrictive conditions required by the theory.[2] Fischel's homevoter hypothesis hinges on the discipline introduced by property owners' interests and the existence of alternative jurisdictions. Relative government performance is capitalized into property values, making poor local government performance (i.e., choosing tax and service bundles that do not meet residents' demands) a potentially costly outcome for homeowners in particular, thereby providing an incentive for them to vigorously express their demands to the local government. Effective capitalization, of course, requires the existence of alternative jurisdictions; Fischel's homevoter hypothesis does not work without them.

[1] See, e.g., Mueller (2003) for a summary of these conditions.

[2] See, for example, Turnbull and Djoundourian (1994), Fischel (2001, 87-92), or Mueller (2003, 241-248) for summaries of the relevant empirical literature.

This paper employs a conceptually simple exercise to determine whether it is the existence of alternative jurisdictions per se or the behavior of these surrounding jurisdictions that affects local government performance. We focus on U.S. county governments. We begin by comparing each county's tax and spending bundle with what would have obtained under the pure democracy median voter hypothesis outcome. Once we determine whether each county government meets the competitive benchmark, we study the factors influencing the probability of satisfying the MVH. We offer an empirical approach capable of distinguishing the Fischel-Tiebout interjurisdiction competition effects on local government performance from spatially interdependent behavior arising from contagion or copycat effects.

Revealed preference offers a useful approach for identifying which local governments meet the MVH benchmark behavior and which do not. In general, the procedure first involves testing the observed price vectors and goods bundles to see if they satisfy appropriate revealed preference axioms. Those that do can be rationalized by the median voter hypothesis, and in that sense are satisfying voters' demands. Similarly, we conclude that those locales whose observed spending behavior violate the revealed preference axioms cannot be rationalized by the MVH and in that sense are not fully satisfying their voters' demands. The next step of the analysis employs spatial logit to determine which aspects of government structure, socioeconomic characteristics, or spatial interaction effects, if any, lead to systematic violation of the revealed preference axioms by individual county governments. This step identifies the specific factors underlying revealed preference violations and provides the answer to our question concerning the roles of alternative jurisdiction existence and surrounding jurisdictions' behaviors on observed performance.

Our empirical study finds that the form of county government and external constraints that create interjurisdiction competition both matter. The threat or actual migration of nonresidential taxable capital appear to increase the likelihood that counties will replicate the competitive benchmark outcome satisfying the median voter hypothesis–a result consistent with both the Fischel-Tiebout homevoter model as well as Brennan and Buchanan's (1980) leviathan view of government. What is new, however, is that we also find a robust spatial contagion or copycat behavior in which the effectiveness of surrounding counties in meeting the competitive benchmark increases the likelihood of a given county doing the same. As important, it turns out that introducing the possibility of contagion effects or copycat behavior does not eliminate the role of public sector structure as a relevant determinant of local government performance.

The paper is organized as follows. Section 2 explains the empirical revealed preference method and how it is applied in the local public goods environment. Section 3 provides the first step in the empirical analysis, applying the revealed preference technique to identify the individual county governments that satisfy or violate the median voter hypothesis. Section 4 then introduces a spatial logit model to identify the extent to which the local government structure and the behavior of surrounding counties affect the performance of US counties. Section 5 concludes.

2 Revealed Preference and Public Spending

There are basically two alternative approaches for testing whether or not observed public spending data satisfy the median voter hypothesis. The first approach assumes a specific functional form for the median voter's utility function to derive demand functions or a specific functional form for the demands and then estimates the utility function or demand parameters, testing the estimates for consistency with theory. This approach, however, really provides a joint test of both the median voter hypothesis and the functional form. Failure to find support for the hypothesis in the data implies that either the median voter utility maximization hypothesis does not hold, the assumed utility function is not correct, or both.

In contrast, the approach taken here is nonparametric; no specific functional forms for the underlying utility or demand functions are assumed. The data indicate either consistency with the median voter hypothesis (MVH) or not. Only the weakest of restrictions is imposed on the preference structure in the test. Our version tests the data for consistency in observed local government fiscal behavior satisfying the generalized axiom of revealed preference (GARP). By structuring the revealed preference test appropriately, we can conclude that data satisfying GARP also satisfy the MVH and data violating GARP also violate the MVH. This approach has an additional advantage over other parametric econometric approaches: the test procedure indicates which specific governments violate GARP, that is, which governments do not satisfy the MVH. Econometric approaches can determine whether or not an entire sample of local governments satisfies the MVH, but they cannot identify the individual observations that do or do not replicate the competitive benchmark behavior (Turnbull and Djoundourian, 1994).

The revealed preference tests undertaken in this paper are structured as follows. Consider the voter with the median income in local jurisdiction i. Assume that the voter's private consumption is x_i and his consumption of the public good is g_i. Both x_i and g_i are composite commodities. The price of private consumption is normalized to unity throughout and the median voter's tax price of an additional unit of public good consumption is t_i. Using this notation, the voter's consumption vector is $\mathbf{x}^i = [\ x_i \quad g_i\ ]$, the price vector is $\mathbf{p}^i = [\ 1 \quad t_i\ ]$ and total consumption spending is $\mathbf{p}^i\mathbf{x}^i$. Denote direct revealed preference between two vectors by R and strict revealed preference by P. Let $\mathbf{x}^i$ indicate the voter's chosen consumption bundle when prices are $\mathbf{p}^i$.

There are two complications that must be overcome in order to apply the revealed preference model to testing the median voter hypothesis. First, the total service level provided by the local government is not generally observable. We follow the convention of measuring the governmentally provided goods as expenditures, which are observable. Second, the governmentally provided good may be subject to a degree of publicness or consumption congestion that is not observable. In order to take care of this second difficulty, we follow Borcherding and Deacon (1972) and Bergstrom and Goodman (1973) and a large subsequent literature and assume that the median voter's public good consumption g is a function of the services provided by the government, G, and jurisdiction population, n:

$$g = Gn^{-\pi} \tag{1}$$

where π is the consumption congestion parameter reflecting the degree of publicness. The empirical implementation allows for $0 \leq \pi \leq 1$, with the extremes indicating purely public and private goods, respectively. Other consumption congestion specifications have been used in the parametric literature, but this specification is both popular and works well within the revealed preference methodology.

The government budget constraint provides the median voter's price vector in equilibrium. Denote the amount of lump-sum intergovernmental aid received by the locale as A_i. Given this aid, the local government must raise $G_i - A_i$ taxes to balance its budget. Following most empirical applications of the median voter model to local governments, we assume that all local revenues are raised from the property tax; the adequacy of this convention as a practical simplification will be revealed in the empirical tests below. Given the voter's share of the property tax base in jurisdiction i is s_i, the median voter's share of local taxes is $s_i(G_i - A_i)$. With income M_i and private consumption spending y_i, the voter's budget constraint is $M_i = y_i + s_i(G_i - A_i)$, so that

$$y_i = M_i - s_i(G_i - A_i) \tag{2}$$

Solve (1) for G and substitute into the voter's share of the local taxes. Differentiating the result with respect to g yields the median voter's marginal tax price $t = sn^{\pi}$. Summarizing these results, we can express the price and consumption vectors as

$$\mathbf{p}^i = \begin{bmatrix} 1 & s_i n_i^{\pi} \end{bmatrix} \tag{3}$$

$$\mathbf{x}^i = \begin{bmatrix} M_i - s_i(G_i - A_i) & G_i n_i^{-\pi} \end{bmatrix} \tag{4}$$

where $\mathbf{p}^i \mathbf{x}^i = M_i + s_i A_i$.

Under the Weak Axiom of Revealed Preference (WARP), if $\mathbf{x}^i R \mathbf{x}^j$ then $\sim \mathbf{x}^j R \mathbf{x}^i$, or algebraically

$$\mathbf{p}^i \mathbf{x}^i \geq \mathbf{p}^i \mathbf{x}^j \Longrightarrow \mathbf{p}^j \mathbf{x}^j < \mathbf{p}^j \mathbf{x}^i \tag{5}$$

In terms of the voter's income, tax share and government spending and intergovernmental aid, WARP is

$$\begin{aligned} M_i + s_i A_i \quad &\geq \quad M_j + s_j A_j + G_j \left(s_i \left(\frac{n_i}{n_j} \right)^{\pi} - s_j \right) \\ &\Longrightarrow \quad M_j + s_j A_j < M_i + s_i A_i + G_i \left(s_j \left(\frac{n_j}{n_i} \right)^{\pi} - s_i \right) \end{aligned} \tag{6}$$

The Generalized Axiom of Revealed Preference (GARP) represents a transitive closure of the direct relation R under WARP in the following sense. Under GARP, for all sequences $\mathbf{x}^i, \mathbf{x}^j, ..., \mathbf{x}^k, \mathbf{x}^l$ such that $\mathbf{x}^i R\mathbf{x}^j, \mathbf{x}^j R\mathbf{x}^k, ..., \mathbf{x}^l R\mathbf{x}^m$ then $\sim \mathbf{x}^m P\mathbf{x}^i$, or algebraically[3]

$$\mathbf{p}^i\mathbf{x}^i \geq \mathbf{p}^i\mathbf{x}^j, \mathbf{p}^j\mathbf{x}^j \geq \mathbf{p}^j\mathbf{x}^k, ..., \mathbf{p}^l\mathbf{x}^l \geq \mathbf{p}^l\mathbf{x}^m \Longrightarrow \mathbf{p}^m\mathbf{x}^m \leq \mathbf{p}^m\mathbf{x}^i \tag{7}$$

When applied to local government spending, these GARP inequalities become

$$\begin{aligned} M_i + s_iA_i &\geq M_j + s_jA_j + G_j\left(s_i\left(\frac{n_i}{n_j}\right)^\pi - s_j\right), \\ M_j + s_jA_j &\geq M_k + s_kA_k + G_k\left(s_j\left(\frac{n_j}{n_k}\right)^\pi - s_k\right), ... \\ &\Longrightarrow M_m + s_mA_m \leq M_i + s_iA_i + G_i\left(s_m\left(\frac{n_m}{n_i}\right)^\pi - s_i\right) \end{aligned} \tag{8}$$

For a given value of π, all of the inequalities (6) and (8) are in terms of observable variables. The congestion parameter π, of course, is not observable. Chang and Turnbull (1998) estimate π as the value or values minimizing the number of GARP violations in the tested data. Here, as in other public choice applications of the Chang-Turnbull methodology, we find a range of π values that minimize the number of violations for each state. In these situations, we follow the refinement proposed by Turnbull and Tasto (2008) and estimate π using the value that minimizes Varian's (1982) violation index, which is a measure of how close the various GARP violations in the data are to satisfying the transitive closure in (7).[4]

Varian (1982) extends Afriat's Theorem (Afriat, 1967) to show that any finite number of $\{\mathbf{p}, \mathbf{x}\}$ observations satisfying the GARP inequalities (7) can be rational-

[3] The weak inequality in the right hand side of the implication condition below allows for non-singleton choice sets, the revealed preference analogue to "flat" regions on indifference curves.

[4] An intuitive explanation of Varian's (1982) violation index is the following. The shortest transitivity path from observation A to observation D is A to D directly. However, if A and D cannot be directly compared using WARP, then a wider range of possibilities must be examined. For example, one path that sequentially compares A to B, B to C, and C to D yields a transitive chain from A to D. But consider the case where there also exists a path that directly compares A to C and then C to D. This second transitive path is more direct and in that sense, less costly. Varian's violation index assigns a value to each possible chain of transitivity and then chooses the least cost path. Therefore, when comparing two different π values that yield the same number of GARP violations, the π value with a lower violation index is in a sense the value closest to satisfying the transitivity requirements of GARP.

ized by an increasing concave utility function. For the local government behavior application considered here, this result means that the observations that satisfy GARP can be generated by maximizing a well-behaved neoclassical utility function subject to the median voter's budget constraint. Therefore, the answer to our question of whether or not a particular county government is fully satisfying its voters reduces to whether or not its spending satisfies or violates the inequalities in (7). Our extension of Afriat's Theorem to the public choice context means that any finite number of observations satisfying (8) also satisfy the median voter hypothesis. In this sense the empirical revealed preference method provides a straightforward test of the MVH for each county in the sample.

3 The GARP Test Results

The sample for the GARP tests comprises 2,249 counties, almost three quarters of the total number of US counties. Town governments in New England states take on what are county functions elsewhere so we exclude Connecticut, Massachusetts, Maine, New Hampshire, Rhode Island, and Vermont from the data set. We omit Virginia as well because city governments in that state are independent from their surrounding county governments and operate as if they were on the same tier in the system of local governments instead of different tiers as in the other states in the sample (Turnbull and Tasto, 2008). The sample also excludes Alaska, Arizona, Delaware, Hawaii, and Nevada because these states either are not among the contiguous 48 or do not have enough counties with complete data to conduct the individual state GARP or determinant analysis. The GARP test sample covers the thirty eight states listed in Table 1. Finally, we note that the GARP tests exclude some counties in these states because of incomplete data.

The data pertain to county spending behavior in 1990, the time period reflecting the availability of the information needed to construct the variables needed to complete the GARP tests. (The *Census of Governments* ceased collecting county tax base information in 1997.) The cross-sectional county data are from the 1992 *Census of Governments*, 1990 *Census of Population*, *County and City Data Book 1994*, and

1994 Municipal Year Book. Total tax base, county government general expenditure and state and federal aid receipts for 1990 are from the 1992 *Census of Governments*. The data for median house value, median household income and population variables are drawn from the *1994 County and City Data Book*.

The variables in (6) and (8) for the revealed preference tests are defined as follows:

M_i = median household income in county i;

s_i = median value house divided by the property tax base of county i;

A_i = intergovernmental aid receipts of county i;

G_i = county i general expenditures; and

n_i = population of county i.

We conduct the WARP and GARP tests of counties for individual states in order to control for state-specific definitions of county responsibilities or other effects on expenditures. Table 1 summarizes the test results. It is somewhat surprising, given the strictness of the nonparametric tests,[5] to find that 9 of the 38 states have no GARP violations (California, Florida, Idaho, Maryland, New Mexico, Oregon, South Dakota, Washington and Wisconsin). An additional three states (Illinois, Nebraska, and Texas) have fewer than 5% of their counties involved in GARP violations.

4 MVH Violation Determinants

We are now at the point where we can directly address the question we asked at the outset: Is it the existence of alternative jurisdictions for homevoters and nonresidential capital or is it the fiscal decisions of these alternative jurisdictions that drive competitive fiscal behavior among counties? This section presents a more formal approach to examining how government form affects the local government's ability to meet voter-taxpayer demands. The empirical procedure evaluates the separate effects

[5] Recall that any violation of the requisite inequalities, whether $1 or $1 million, represents a GARP violation.

of the structure of the county government and the behavior of surrounding counties on the likelihood that a county meets the competitive benchmark. We control for the influences of jurisdiction characteristics suggested by theory or that have been identified in earlier studies. Chang and Turnbull (2002) first applied a nonspatial version of this type of determinants analysis of GARP violations to study the behavior of public sector bureaucracy in Taiwan. In the closest antecedent to this work, Turnbull and Geon (2006) use a nonspatial version of the method applied here to evaluate how internal government structure and statewide constitutional constraints influence local government behavior. That study uses the entire sample of 38 states–those satisfying the MVH completely as well as those containing violations–in the MVH violation determinants analysis. We must, however, exclude from our determinants study the nine states identified in Table 1 with zero MVH violations in order to accommodate the spatial interaction effects. This leaves 1,873 counties in 29 states for our determinants analysis.[6]

We note at this point that the broad qualitative differences between the nonspatial estimates for the 29 states reported here and the Turnbull and Geon (2006) nonspatial estimates for the entire set of 38 states are modest. Taking into account the differences in variable definitions, only their jurisdiction size and government form effects are qualitatively different from our nonspatial estimates.

4.1 The Spatial Estimation Method

In order to allow for possible contagion or copycat effects, we model the probability of a WARP or GARP violation as a function of a weighted average of the tendency towards such violations in neighboring counties, as well as a linear index function of other explanatory variables. The basic model can be written:

$$\mathbf{V}^* = \rho \mathbf{W} \mathbf{V}^* + \mathbf{X}\boldsymbol{\beta} + \mathbf{u}, \tag{9}$$

where the elements of the $(n \times 1)$ vector $\mathbf{V}^*$ are V_i^*, which denotes the propensity for a violation in county i. This is a linear function of the propensity for a violation

[6] The specific counties in our and the Turnbull-Geon samples also differ somewhat because our choice of county socio-economic characteristics reflects an effort to minimize dropping counties at this stage because of missing variable observations.

in neighboring counties, where the $n \times n$ matrix $\mathbf{W}$ provides the pattern of interdependence across counties. The $(k \times 1)$ vector x_i includes the explanatory variables believed to influence the propensity for a violation. The error term, u_i, represents the unobservable factors affecting V_i^*. The unknown parameters to be estimated are given by $\gamma' = (\beta', \rho)$.

We assume that the variables in $\mathbf{X}$ are exogenous, and that the errors have mean zero and variances σ_{ii}. The weight matrix has 0's on the diagonal, and off-diagonal elements are given either by $w_{ij} = 1/d_{ij}$, where d_{ij} denotes the distance between county i and county j for both counties in the same state, or $w_{ij} = 0$, if counties i and j are in different states. The weight matrix is row-normalized, so that $\sum_{j=1}^{n} w_{ij} = 1$, for $i = 1, ..., n$.[7] Note that the model and model results should be interpreted based on the underlying continuous propensity variable, rather than on the observed outcomes. Thus the propensity to violate revealed preference axioms in county i depends on the weighted value of the propensity for violation in county j, not just on whether or not a violation is observed in county j. The zero weight for counties across state borders reflects the notion that states' definitions of county functions can vary considerably (Bingham and Hedge, 1991; Turnbull and Geon, 2006), which limits the type of contagion or copycat interdependence we envision in the spatial model to within-state borders.

Estimating the spatial relationship in equation (1) can be problematic because the dependent variable, V_i^*, is not observed. We observe $v_i = 1$ if $V_i^* > 0$ and $v_i = 0$, otherwise. LeSage (2000), Case (1992), Pinkse and Slade (1998), McMillen (1992) and Klier and McMillen (2007) (hereafter referred to as K&M) propose estimators for binary choice spatial models. We use the GMM spatial logit estimator recently proposed by K&M primarily because it avoids the numerical problems inherent in inverting $n \times n$ matrices for large n.

The estimator is based on an extension of the Pinkse and Slade (1998) GMM estimator for a binary choice model with spatially correlated errors. Equation (9)

[7] We also estimate versions of the model with spatial weight matrices based on distance with weights for distances in excess of 200 miles set equal to zero as well as a model with weights based on similarity of size of population. The implications are robust with respect to these alternative formulations.

can be written in a more convenient form as

$$\mathbf{V}^* = (\mathbf{I} - \rho\mathbf{W})^{-1}\mathbf{X}\boldsymbol{\beta} + (\mathbf{I} - \rho\mathbf{W})^{-1}\mathbf{u} \tag{10}$$

Parameters in binary choice models are identified only up to a scale factor, so we define $x_i^* = x_i/\sigma_i$ and $\mathbf{X}^{**} = (\mathbf{I} - \rho\mathbf{W})^{-1}\mathbf{X}^*$. Assuming a logistic distribution, the probability that the underlying continuous variable takes the value 1 is given by $P_i = \exp(x_i^{**\prime}\beta)/(1 + \exp(x_i^{**\prime}\beta))$. Thus, the generalized logit residuals are given by $u_i = v_i - P_i$. The GMM estimator for γ minimizes the criterion function, $\mathbf{u}'\mathbf{Z}\mathbf{M}\mathbf{Z}'\mathbf{u}$, where $\mathbf{Z}$ is a matrix of instruments and $\mathbf{M}$ is the positive definite weighting matrix. If the $\mathbf{M}$ matrix is defined as $(\mathbf{Z}'\mathbf{Z})^{-1}$, then the GMM estimates can be obtained through an iterative nonlinear two-stage least squares process fully described in K&M. To summarize, construct the gradient terms, $\mathbf{G} = \partial u/\partial\gamma$, and regress them on the instrument matrix $\mathbf{Z}$, so that the parameters can be updated following:

$$\gamma_1 = \gamma_0 + (\widehat{\mathbf{G}}'\widehat{\mathbf{G}})^{-1} * \widehat{\mathbf{G}}'u_0$$

The key K&M insight is that this estimator can be greatly simplified by linearizing the model around initial parameter estimates. These initial values are obtained under the assumption that $\rho = 0$, this considerably simplifies the gradient matrix. Thus, we obtain the estimates by first estimating a standard (nonspatial) logit and using these estimated $\widehat{\beta}$ to construct u_0 and $\mathbf{G}$. Note that $\mathbf{G}$ can be divided into $\mathbf{G}_\beta = \frac{\partial u}{\partial\beta}$ and $\mathbf{G}_\rho = \frac{\partial u}{\partial\rho}$. Projecting both $\mathbf{G}_\beta$ and $\mathbf{G}_\rho$ onto the matrix of instruments to obtain predicted values and then, finally, regressing the errors $u_0 - G_\beta\widehat{\beta}_0$ on $\widehat{\mathbf{G}}_\beta$ and $\widehat{\mathbf{G}}_\rho$ yields estimates of $\boldsymbol{\gamma}$. The variance/covariance matrix of the parameters can be obtained via a robust, nonlinear two-stage least squares estimator.

The loss of information inherent in any dichotomous dependent variable model means, in this case, that we cannot allow for both a spatially-lagged dependent variable and a spatial error process. Thus, following K&M, we allow only for the spatial process in the conditional mean of V^*. The interpretation of this specification is that, conditioning on variables X that influence the propensity for violation, a county's tendency to violate revealed preference axioms is partly determined by that same tendency in other counties in the state.

Table 2 defines the variables in the matrix $\mathbf{X}$ we use in the analysis of GARP and WARP violation determinants. Table 3 presents summary statistics for the sample. The first and third columns in Table 4 report the nonspatial (assuming $\rho = 0$) logit estimates of WARP and GARP violation determinants, respectively, while the second and fourth columns report the spatial (unconstrained ρ) logit parameter estimates. The relative magnitudes of the various determinants effects do not affect our conclusions, so we do not report marginal effects.

Overall, the nonspatial WARP and GARP violations determinants are similar (columns 1 and 3, respectively), with differences in the education level and the elected executive effects. The spatial WARP and GARP violations determinants estimates resemble each other, with the only important differences in the effects of the population density measure of jurisdiction size and government form.

4.2 Socioeconomic determinants

The first variable in the model is *Median household income.* There are two views of the role of this variable in the logit model. In the first, higher income means that residents have greater opportunity costs for engaging in local politics or monitoring local government behavior. To the extent that greater income captures this effect, the coefficient on income in the determinants function should be positive, to indicate that counties with higher income constituents enjoy greater freedom to diverge from their residents' core interests because those residents' opportunity costs are too high to justify careful monitoring or enforcement through the usual formal or informal political channels.

Fischel's (2001) homevoter hypothesis provides an alternative view of the relationship between income and local government performance. This view hinges on the positive correlation between a voter's income and his or her residential property value. According to Fischel, higher income reflects a greater potential cost to local taxpayers when poor government decisions are capitalized into property values. Because the potential penalty of poor local government performance is greater for higher income homeowners, these homeowners have a stronger incentive to monitor local fiscal behavior and engage in the local political process accordingly. In Fischel's view, income is an indicator of the marginal benefit from engaging in the local political process to influence local government behavior. This is the key discipline mechanism in Fischel's homevoter model version of the median voter hypothesis. To the extent that income captures this effect, the coefficient on the household income variable in the violation determinants model should be negative, indicating that a greater potential loss from the county deviating from the median voter's demand prompts residents to more carefully enforce their will on the government.

Table 4 indicates that the coefficient on median family income is not precisely estimated in any of the four models. Interestingly, the WARP models all show similar positive point estimates on median family income whereas the point estimates in the GARP models are all negative. In sum, we cannot ascertain which–if either–of the alternative interpretations of the role of income is valid.

The *Population density* variable is included as one measure of jurisdiction configuration. Because the model also includes *Population* as a separate variable, increases in population density while holding total population constant indicates a more compact jurisdiction–a smaller land area. The results reveal point estimates for all four models that are negative; the estimates are significantly or marginally significantly different from zero in the WARP models but not in the GARP models. The negative coefficient indicates that counties in the central urban counties or urban "collar" counties–those with greater population densities–are more likely to violate the median voter hypothesis than are their less dense suburban, exurban, or rural counterparts. This pattern is consistent with the notion that suburban and exurban jurisdictions in metropolitan areas are more responsive to their residents than are their older counterparts governing the central and collar communities, although the lack of precision in the GARP models makes such a conclusion tentative at best.

The *Population* variable captures the scale effects of overall jurisdiction size on performance. A greater population holding population density constant indicates both greater land area and a commensurately larger total population. Looking at the reported coefficients on this variable, the significant positive population coefficient in all models is consistent with the notion that larger governments (recall that larger in this context means both geographic size and population) tend to be less responsive to their residents. This result supports Fischel's (2001) hypothesis that the homevoter political discipline effect diminishes for larger local governments at the municipal level. The GARP violation estimates reveal that this conclusion holds whether or not spatial effects are taken into account.

We also include controls for county population characteristics. We have no a priori expectations regarding how these factors are likely to influence government behavior. *Percent Hispanic*, *Percent Poverty* and *Percent 65* are all significant in the nonspatial models, whereas the spatial models show somewhat less precise estimates on *Percent Hispanic*. The nonspatial estimates indicate that greater proportions of Hispanics, persons in poverty, and younger populations are associated with a greater likelihood that the local governments will replicate the competitive MVH benchmark. The spatial estimates are less precise for the effects of Hispanics, persons in poverty or over 65.

The county population *Education level* estimated effect varies substantially across models. Although the coefficients are positive in all four models, the size of the coefficient and its standard error vary widely. In the GARP model that ignores the spatial interaction among counties, the results suggest that a greater proportion of population with at least a high school education increases the probability of a GARP violation. This result is similar to that found by Turnbull and Geon (2006) for their pooled and non-MSA counties samples. Once we introduce the spatial interaction effects, however, the coefficient becomes insignificant, so it is difficult to place much confidence in this otherwise surprising and counter-intuitive result.

The *Tax concentration* and *Expenditure concentration* variables are Herfindahl indices measuring tax and spending concentration across the revenue and broad budget categories spelled out in Table 2. There are several rationales for including these budget structure variables in the set of WARP and GARP violation determinants. For one, a more complicated budget makes it more difficult to voters to ascertain the true relationship between taxes and government provided services (Turnbull, 1998). Therefore, greater government budget complexity, whether on the tax or spending side, is associated with greater fiscal illusion. Greater fiscal illusion pushes the equilibrium away from the median voter's most preferred tax-spending mix (Oates, 1979;

Turnbull, 1998, 2007). If this view is correct, then greater tax or expenditure concentration (i.e., less budgetary complexity) reflects less fiscal illusion and a greater probability that the county satisfies the MVH.

Alternatively, the tax and spending Herfindahl indices also measure how close the county is to functioning as a single tax-single purpose government. Counties with high Herfindahl index values, getting most of their own revenues from the property tax or spending most of their budgets in one service category, present voters with a setting approximating a single dimension issue assumed in the simple median voter hypothesis (Turnbull and Djoundourian, 1994). Counties with low Herfindahl index values, getting their tax revenues from a variety of equally important sources and spending their budgets on a wide variety of service categories, confront voters with multiple dimensional issues. Plott's theorem implies that the median voter hypothesis should be expected to pertain when decisions are single dimensional, like how much tax revenue to raise, than when issues are inherently multiple-dimensional, like how much revenue to raise from each of different tax sources (Plott, 1976; Kadane, 1972; Slutsky, 1977; Cohen, 1979). This line of reasoning suggests that higher tax and expenditure concentration index values, indicating a government that is closer to the single-tax-single-service archetype, will be less likely to lead to GARP violations. Even though different, both of these rationales suggest negative tax and/or expenditure concentration coefficients in the logit equation.

Looking at the results for these variables in Table 4, the expenditure concentration coefficient is statistically significantly positive in all of the models. The tax concentration coefficient is also positive for all models, but is precisely estimated only for the nonspatial GARP violation models. Taken together, these results show that simpler budgetary structure increases the probability of both WARP and GARP violations, a result that is just the opposite of both the fiscal illusion and Plott's theorem rationales for including these variables in the model. The estimates, however, are consistent with the specification study in Turnbull and Djoundourian (1994) showing that small and medium size cities with more complex budgetary structures provide stronger statistical support for the MVH than do their counterparts that are closer to satisfying the single-tax-single-service assumption. Further, the general conclusions are robust across nonspatial and spatial estimating environments.

4.3 County government form

Regarding the internal decision-making structure of county government in the US, most counties take either the elected executive, council-administrator or county commission forms of government. The characteristics of these forms differ in terms of professional versus elected management and separation-of-powers (Bingham and Hedge, 1991; MacManus, 1995). Voters directly elect the chief executive officer (CEO) in the elected executive form. In contrast, the elected county council hires the CEO in council-administrator counties. In these counties the CEO is a professional administrator who answers to the council. In the council-commission government form, individual elected council members serve as agency heads or commissioners, each typically serving as the head of one or more departments in the county government.

Looking at the essential elements of these government forms, one of the differences hinges on whether the administrator is elected or is a hired professional. Obviously, elected officials perform the required management oversight activities in the elected executive and commission forms of county government. In contrast, elected officials hire a professional manager to take responsibility for the administration of the government bureaucracy in the council-administrator form of government. It is not clear how the difference between elected and professional management affect government behavior. Booms (1966) argues that the formal training of professional administrators equips them better for dealing with administrative problems. He also argues that they may be more cost conscious because they are less concerned with politics and less influenced by interest groups. But there is an additional principal-agent relationship between professional administrators and elected councils in the council-administrator government form that is not present in the elected executive form, which can open another source of potential divergence from the median voter outcome when public sector bureaucrats do not share the goals of the taxpayers of the locale (Turnbull, 2007).

Different forms of government also create different degrees of separation-of-powers between executive and legislative functions. The elected executive form delineates a sharper difference in executive and legislative powers than does the council-administrator form. If stronger separation of powers creates checks-and-balances that increase the responsiveness of both the administration and council to voters' demands then it is likely to curb expansionary tendencies of the public bureaucracy.[8] At the same time, stronger separation of powers gives the executive agenda control or veto powers in the budgetary process, which can fundamentally alter the decision-making dynamics in ways that are difficult to predict (McKelvey, 1976). Therefore, we have no clear expectation about whether local government behavior comes closer to meeting the MVH benchmark under strong separation-of-powers than under a unified executive-legislative structure.

We include *Council-Administrator* and *Elected Executive* dummy variables in the models, leaving the *Commission* form of government as the omitted category.

Both GARP models reveal that counties with council-administrator forms of government are less likely than elected executive and commission forms of government to violate WARP or GARP, that is, they are more likely to behave according to the competitive benchmark. The point estimates are similar in size for all four models, although the precision of the estimates is lower in the spatial WARP model. Recall that the main difference between council-adiministrator and the other forms of government lies in its reliance on professional management. Our results imply that professional management improves the likelihood that the county replicates the MVH outcome relative to the effects of elected management. The literature on the relationship between management form and spending or costs yields no broadly accepted conclusions as yet (Booms, 1966; Campbell, 2004; Campbell and Turnbull, 2003; Deno and Mehay, 1987; Grosskopf and Hayes, 1993; Hayes and Chang, 1990; Turnbull, 2007). While the question here differs from the spending level and cost questions addressed in the government form literature thus far, the robustness of our government form GARP results across nonspatial and spatial model configurations suggest that spatial contagion effects probably do not play a role in those questions

[8]For direct empirical evidence on public sector bureaucracy preferences, see Blais and Dion (1991) and Chang and Turnbull (2002) and the references therein.

as well.

4.4 Structure of the local sector versus contagion effects

We now turn to the effects of the structure of the local government sector and contagion from surrounding locales, the main focus of this study. We introduce several variables to capture how the structure of the local government sector affects performance: *Manufacturing*, *Wealth* and the *MSA* dummy variable. The spatial interaction parameter, ρ in the empirical model (10), indicates if there are contagion effects present.

Jurisdiction *Wealth* is defined as the assessed value of taxable property. Household income is included as a determinant in the estimating equation and since income is correlated with residential property, we expect variations in our wealth variable holding household income and population constant to pick up the differences in nonresidential taxable property across county jurisdictions. There is no widely-accepted theory explaining how owners of nonresidential taxable property influence local government behavior. Turnbull and Niho (1986), Wilson (1986), and a vast subsequent literature identify one possible channel through which nonresidential capital mobility can influence local government behavior; in this view, local governments have incentives to adopt lower tax rates and spending levels when nonresidential capital is mobile, regardless of whether they expect net in-migration or out-migration of taxable wealth as a result of their decisions. This notion depends upon the existence of alternative jurisdictions for nonresidential capital, and so reflects one aspect of the structure of the county government tier. It remains an empirical question whether or not the nonresidential capital mobility effect can constrain local governments enough to emulate the median voter's optimal outcome. Interestingly, the coefficients on the *Wealth* variable are statistically significantly negative in all of the models in Table 4 – results consistent with the notion that a larger nonresidential presence in the jurisdiction reinforces government behavior that is consistent with the MVH.[9] Whether it is through the direct action of political lobbying or indirectly through threatened

[9] Excluding *Manufacturing* from the models does not qualitatively affect the other coefficient estimates, including that for *Wealth*.

mobility, nonresidential property owners appear to reinforce the discipline introduced by horizontal competition among local governments.

We include the *Manufacturing* variable to capture possible differences in counties whose employment is more heavily vested in export base activities. We surmise that firms engaged in export base activities enjoy greater potential mobility than firms tied to nearby locations by serving the local consumption sector. The coefficient on this variable is very small and insignificant in all cases. Apparently, the composition of local employment across export base and local consumption does not affect the likelihood that the local government satisfies the competitive MVH benchmark behavior.

We also include the binary *MSA* variable in the model, indicating whether or not the county lies within a metropolitan statistical area. Counties may serve a different role for metropolitan residents than rural residents, leading to differences in metropolitan and rural county behavior. In metropolitan areas, much of the land within each county may be incorporated and served by municipal governments. These overlapping jurisdictions create vertical demand relationships between county and municipal governments (Turnbull and Djoundourian, 1993). It would therefore not be surprising to find that the presence of ubiquitous municipalities within metropolitan areas affects urban county behavior. In contrast, rural counties have much unincorporated land; for many county residents there are no overlapping municipal-county jurisdictions. The only local public services those residents receive are those provided by the county government. While this does not imply that either metropolitan or rural counties should adhere more closely to the median voter hypothesis, it nonetheless does imply that the two types of counties can reasonably be expected to exhibit different fiscal behavior relative to the competitive MVH benchmark.

In addition, though, the *MSA* variable also picks up how the presence of alternative jurisdictions affects county government performance. By definition, MSA counties lie within a single local labor market, leaving residents free to choose from among the county jurisdictions covering the single urban area. Fischel's (2001) homevoter hypothesis draws on the Tiebout effect to explain why actual or threatened residential mobility puts additional pressure on local governments–counties in this case–to do a better job offering desirable tax-service bundles to residents. To the extent that this pressure is missing or attenuated for rural counties, we expect urban and rural county tax and spending behavior to diverge, with urban county behavior more likely to satisfy the median voter hypothesis. A negative coefficient on *MSA* is consistent with this Fischel-Tiebout effect on county government behavior. We find significant negative *MSA* coefficients consistent with the Fischel-Teibout effect in both the nonspatial and spatial WARP and GARP models.

The *Wealth* and *MSA* estimates together provide indirect evidence that the local government sector structure per se affects the likelihood of counties satisfying the MVH.[10] What is interesting is that it appears that the disciplining effect of local government sector structure is not through the threatened mobility of resident taxpayers as envisioned in Fischel (2001) but rather through the threatened mobility of nonresidential capital in the tax base emphasized by Turnbull and Niho (1986) and Wilson (1986).

Finally, the interactive term coefficient ρ in the spatial models indicates the extent to which the performance of a county depends upon the performance of surrounding counties (with, of course, a diminishing effect assumed for more distant counties in the state). The coefficient is positive and statistically significant in both the WARP and GARP violation models. This indicates a contagion or copycat effect among counties: the greater the likelihood that surrounding counties meet the MVH benchmark, the greater the likelihood that a particular county will also meet the MVH benchmark. Being surrounded by counties that meet the competitive benchmark increases the pressure on a county to perform similarly while being surrounded by counties that fail to meet the competitive benchmark reduces the pressure on a county to do so itself.

The significant interactive effect combined with the significant *Wealth* and *MSA* coefficients in the GARP model implies that both the structure of the local public sector and the behavior of surrounding jurisdictions affect the extent to which counties replicate MVH behavior. Comparing the nonspatial and spatial results, it appears

[10] The existing empirical evidence on the relationship between local government structure and size is mixed. See, for example, Oates (1985), Nelson (1987), Zax (1989), and Campbell (2004).

that the some of the socioeconomic characteristics affecting county performance are picking up neglected spatial interaction effects in the nonspatial model.

5 Conclusion

This paper examines the role of contagion from neighboring jurisdictions as an influence on whether or not a given locale successfully meets the demands of its residents. It adopts a two stage approach. The first stage uses the axioms of revealed preference to identify which counties adopt tax and service bundles that replicate competitive equilibria consistent with the median voter hypothesis. The second stage studies the jurisdiction socioeconomic and fiscal characteristics and government form to identify factors influencing whether or not a county satisfies the median voter hypothesis benchmark. We also introduce interjuridisctional spatial interdependence into the model to test for contagion or copycat effects among nearby counties. We find that socioeconomic characteristics and the form of government do not appear to affect the probability that a county successfully satisfies its residents' demands. External constraints conducive to interjurisdiction competition, on the other hand, do matter. In particular, the threat or actual migration of nonresidential taxable capital increases the likelihood that counties will replicate the median voter hypothesis. Importantly, we also find significant spatial contagion or copycat behavior in which the effectiveness of nearby counties in meeting the competitive benchmark affects the likelihood of a given county also meeting the benchmark.

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Table 1 WARP & GARP Test Results

State	Number of Counties Tested*	Counties with WARP Violations	Counties with GARP Violations
Alabama (AL)	44	5 (11.4%)	5 (11.4%)
Arkansas (AR)	55	16 (29.1%)	19 (34.5%)
California (CA)	57	0	0
Colorado (CO)	40	5 (12.5%)	7 (17.5%)
Florida (FL)	66	0	0
Georgia (GA)	154	21 (13.6%)	29 (18.8%)
Iowa (IA)	63	9 (14.3%)	12 (19.0%)
Idaho (ID)	23	0	0
Illinois (IL)	72	2 (2.8%)	3 (4.2%)
Indiana (IN)	90	44 (48.9%)	52 (57.8%)
Kansas (KS)	104	57 (54.8%)	69 (66.3%)
Kentucky (KY)	112	17 (15.2%)	19 (17.0%)
Louisiana (LA)	26	2 (7.7%)	5 (19.2%)
Maryland (MD)	23	0	0
Michigan (MI)	82	18 (22.0%)	20 (24.4%)
Minnesota (MN)	47	27 (57.4%)	31 (66.0%)
Missouri (MO)	54	10 (18.5%)	36 (66.7%)
Mississippi (MS)	35	9 (25.7%)	14 (40.0%)
Montana (MT)	38	14 (36.8%)	15 (39.5%)
North Carolina (NC)	100	12 (12.0%)	18 (18.0%)
North Dakota (ND)	45	38 (84.4%)	40 (88.9%)
Nebraska (NE)	93	3 (3.2%)	3 (3.2%)
New Jersey (NJ)	20	2 (10.0%)	2 (10.0%)
New Mexico (NM)	27	0	0
New York (NY)	56	45 (80.4%)	50 (89.3%)
Ohio (OH)	51	7 (13.7%)	8 (15.7%)
Oklahoma (OK)	46	9 (19.6%)	10 (21.7%)
Oregon (OR)	29	0	0
Pennsylvania (PA)	54	19 (35.2%)	25 (46.3%)
South Carolina (SC)	46	12 (26.1%)	12 (26.1%)
South Dakota (SD)	37	0	0
Tennessee (TN)	88	23 (26.1%)	28 (31.8%)
Texas (TX)	157	4 (2.5%)	4 (2.5%)
Utah (UT)	28	5 (17.9%)	6 (21.4%)
Washington (WA)	38	0	0
Wisconsin (WI)	72	0	0
West Virginia (WV)	54	25 (46.3%)	37 (68.5%)
Wyoming (WY)	23	8 (34.8%)	8 (34.8%)

*Total number of tested counties is 2,249.

Table 2 Variable definitions

Variable	Definition	Data Source
Median Household Income		Social and Economic Characteristics, *1990 Census of Population*, 1990 CP-2-1-52, Table 148
Wealth	County assessed property tax base	Assessed Valuations for Local General Property Taxation, *1992 Census of Governments*, GC92(2)-1, Taxable Property Values, Vol. 2, No. 1
Population density	County population per square mile	*City and County Data Book 1994*, Table B. Counties, Area and Population
Population	County Population	*City and County Data Book 1994*, Table B. Counties, Area and Population
Percent Hispanic	Percent of population of Hispanic origin	*City and County Data Book 1994*, Table B. Counties, Population Characteristics
Percent poverty	Percent of population below poverty level	*City and County Data Book 1994*, Table B. Counties, Population Characteristics
Percent 65	Percent of population over 65	*City and County Data Book 1994*, Table B. Counties, Area and Population
Education level	Percent with high school education or higher	*City and County Data Book 1994*, Table B. Counties, Education and Money Income
Manufacturing	Percent employment in manufacturing	*City and County Data Book 1994*, Table B. Counties, Labor Force and Personal Income
Expenditure concentration	Calculated as sum of squared percentages of general expenditures of Police, Roads, Sanitation Health and Other: $(\text{Police }\%)^2 + (\text{Roads }\%)^2 + (\text{Sanitation }\%)^2 + (\text{Health }\%)^2 + (\text{Other }\%)^2$	Finances of County Governments, *1992 Census of Governments*
Tax concentration	Calculated as sum of squared percentages of own revenue from property taxes and all other sources: $(\text{property tax revenue }\%)^2 + (\text{other own revenue }\%)^2$	Finances of County Governments, *1992 Census of Governments*
Council-administrator	= 1 if council-manager form of government = 0 otherwise	*The Municipal Year Book 1994*, Directory 1/10, Officials in US Counties
Elected executive	= 1 if elected executive form of government = 0 otherwise	*The Municipal Year Book 1994*, Directory 1/10, Officials in US Counties

Commission	= 1 if commission form of government = 0 otherwise	*The Municipal Year Book 1994*, Directory 1/10, Officials in US Counties
MSA	= 1 if county is part of a Metropolitan Statistical Area = 0 otherwise	

Table 3 Descriptive statistics*

Variable	Mean	Min	Max
Median household income	23,528.13	8,595	56,273
Wealth ($1,000)	1,172.53	1,599	106,181
Population density	142.08	0.3	11,883
Population	71,290.9	457	5,139,341
Percent Hispanics	3.5%	0.0%	93.9%
Percent poverty	16.7%	2.6%	56.8%
Percent 65	14.9%	1.4%	29.7%
Education level	68.0%	10.9%	94.8%
Manufacturing	28.5%	0.0%	85.6%
Expenditure concentration	0.53	0.23	1.00
Tax concentration	0.63	0.50	1.00
Council-administrator	0.78	0	1
Elected executive	0.13	0	1
Commission	0.09	0	1
MSA	0.24	0	1

*All descriptive statistics based on levels

Table 4 Logit analysis of WARP & GARP violation determinants

Explanatory variable	Non-spatial WARP Model	Spatial WARP Model	Non-spatial GARP Model	Spatial GARP Model
Constant	-12.582	-10.628	-2.570	0.835
	(7.521)	(7.285)	(7.062)	(7.066)
Median household income	0.374	0.550	-0.670	-0.599
	(0.714)	(0.686)	(0.674)	(0.665)
Wealth	-0.476**	-0.247*	-0.517**	-0.262**
	(0.054)	(0.097)	(0.052)	(0.091)
Population density	-0.264**	-0.205*	-0.172	-0.140
	(0.101)	(0.108)	(0.097)	(0.101)
Population	0.710**	0.459**	0.698**	0.483**
	(0.121)	(0.150)	(0.115)	(0.140)
Percent Hispanic	-0.065**	-0.020	-0.063**	-0.051
	(0.022)	(0.038)	(0.017)	(0.032)
Percent poverty	-0.040*	-0.021	-0.055**	-0.041*
	(0.020)	(0.020)	(0.018)	(0.019)
Percent 65	0.062**	0.059**	0.051**	0.044**
	(0.020)	(0.019)	(0.019)	(0.018)
Education level	0.0654	0.287	0.967**	0.457
	(0.355)	(0.349)	(0.356)	(0.372)
Manufacturing	0.005	0.006	0.002	0.001
	(0.005)	(0.005)	(0.004)	(0.004)
Expenditure concentration	1.247**	0.905**	1.356**	1.012**
	(0.198)	(0.235)	(0.188)	(0.223)
Tax concentration	0.519	0.553	0.752**	0.802**
	(0.368)	(0.363)	(0.349)	(0.345)
Council-administrator	-0.478*	-0.415	-0.468**	-0.454*
	(0.224)	(0.241)	(0.211)	(0.223)
Elected executive	0.014*	0.007	0.159	0.136
	(0.169)	(0.165)	(0.154)	(0.161)
MSA	-0.432**	-0.403*	-0.625**	-0.596**
	(0.190)	(0.200)	(0.182)	(0.191)
Rho		0. 505**		0.499**
		(0.176)		(0.151)

Notes: Dependent variable is v = 1 for condition violation, v = 0 otherwise. All explanatory variables are in log form except government form and MSA dummies, percent Hispanic, percent 65, percent poverty, and manufacturing.
Standard errors in parentheses
* Significant at the 5% level
** Significant at the 1% level