Public Choice (2006) 129:381–398
DOI 10.1007/s11127-006-9062-8

ORIGINAL ARTICLE

Public choice principles of redistricting

Thomas W. Gilligan · John G. Matsusaka

Received: 17 August 2005 / Accepted: 20 June 2006

Abstract This paper uses fundamental principles of public choice, mainly the median voter theorem, to develop a simple theory of redistricting. The focus is on how closely policy outcomes correspond to majority rule. The main results are: (1) Potential policy bias in favor of nonmajority groups is structurally linked to the number of legislative seats and the population, and the structure of most states puts them very close to the theoretically maximum bias. (2) Random districting, which might seem like the essence of neutrality, does not eliminate policy bias on average. (3) Traditional principles of compact, contiguous districts that respect existing political boundaries, stressed in the Supreme Court's *Shaw v. Reno* decision, minimize the chance of nonmajoritarian outcomes. Our analysis also offers a gerrymandering explanation for the positive relation between seats and spending that is usually taken as support for the "Law of 1/*n*."

Keywords Redistricting · Voting rights · Median voter

1. Introduction

Policy outcomes in a representative democracy depend on the rules for choosing the representatives. These rules include who can vote, who can stand for office, how campaigns are financed, and, critically, how voters are grouped into districts. The importance of districting can be seen in the intense interest of parties and interest groups in decennial redistricting, and the simmering controversies surrounding racial and partisan gerrymandering, multimember districts, and at-large versus district elections. Although public choice principles have been applied to a wide array of electoral rules, much less attention has been devoted to districting questions, and what little there is tends to be narrowly tailored to a specific issue.[1] The aim of

T. W. Gilligan · J. G. Matsusaka
University of Southern California
e-mail: gilligan@marshall.usc.edu; matsusak@usc.edu

[1] For example, Mueller's (2003) authoritative 768-page Public Choice III, the most extensive survey of the field, contains no index entries and apparently no discussion at all on redistricting. Some important articles that do employ public choice principles are discussed below.

our paper is to develop an approach to districting based on simple public choice principles, and then use the theory to shed light on a number of specific issues.

Our model is essentially an application of the median voter model of Downs (1957) and Black (1958). We imagine a population of citizen-voters, each with an ideal policy position (such as a preferred level of spending on schools), who are grouped into legislative districts. Each district elects a representative by majority vote who is assumed to have the same ideal point as the median voter in the district. The representatives meet and adopt a policy by majority vote that results in the ideal point of the median representative. Thus, the policy choice is "the median of medians." For some groupings of citizens into districts, the policy outcome will not be the ideal point of the median voter in the population.

Deviations from median voter outcomes are worth studying because they represent departures from majority rule, a central value of democracy. When a non-median outcome attains, a majority of the voters would agree on an alternative to the existing policy and only a minority of voters would oppose the change. Certainly majority rule is not the only relevant value in democracy, but it is an important one. If we are going to weigh electoral rules in terms of how they advance core democratic values, the effect on majority rule is one thing we want to consider. Accordingly, much of our analysis is concerned with how districting schemes promote or hinder majority rule.

Three theoretical results lay the groundwork for our analysis. One concern with districting is that those in charge may draw the district lines in a way that gives disproportionate influence to groups they favor. Our first result characterizes the potential deviation that can be created between the ideal point of the median voter and the ultimate policy, what we call "policy bias." We derive a simple formula for the potential policy bias that depends only on the number of seats in the legislature and the population, and show that potential bias increases in the number of seats and the population. This highlights the connection between the potential effects of gerrymandering and quantifiable features of a legislature's constitutional structure. Using the formula, we also show that the structure of all states places them very close to the theoretically maximum potential bias. Our result is fairly general in that it does not require any assumptions about the distribution of preferences in the population.

Much of the law surrounding redistricting is aimed at reducing the amount of bias from gerrymandering. One popular approach, currently used in 20 states, is to have districting decisions made by nominally nonpartisan panels (Garrett, 2005). Such panels are not supposed to gerrymander in favor of any particular group, but this leaves unspecified exactly what principles they should use when drawing lines. Our second result considers an extreme case, assigning voters to districts at random, which at first glance would seem to be the essence of neutrality. However, we show that random districts are likely to be biased except in the special case where ideal points are distributed symmetrically. Because the distribution of key demographic variables, such as income and education are skewed, ideal points over policies such as spending on public goods are likely to be skewed as well. With a skewed distribution of ideal points, random assignment of voters to districts produces an expected policy that is biased away from the median voter in the direction of the skewness. Randomness turns out to be a biased way of districting.

For our third result, we consider assigning voters to districts so as to maximize the homogeneity of preferences within districts. We believe this is an approximate way to think about districts that are compact and contiguous and respect existing political boundaries because people tend to live near other people with similar preferences (Tiebout, 1956). We show that homogeneous districting results in the median legislator having the preferences of the median citizen, that is, it eliminates all policy bias. Respect for "traditional principles" of districting has grown in importance since the Supreme Court's *Shaw v. Reno* decision in 1993. Yet

the Court and many observers seem to think the main benefit of traditional principles lies in providing a constraint on harmful gerrymandering. We believe our theory provides the first justification for traditional districting principles that is not essentially negative in nature, namely that it tends to deliver majority outcomes.

With these propositions as a stepping off point, we then apply the principles to a variety of issues. In the area of public finance, several recent studies have identified a positive relation between the number of seats in a legislature and government spending, a correlation usually seen as supporting the idea of fiscal externalities and "the law of 1/*n*" (Buchanan & Tullock, 1962; Weingast et al., 1981). Our finding that potential policy bias increases in the number of seats provides an alternative explanation for the correlation based on gerrymandering rather than logrolling. In voting law, we discuss the effects of majority-minority districts and, in particular, the "perverse effects" claim that such districts may end up hurting the minority groups they are designed to help (Lublin, 1999; Shotts, 2003). We also show that the pursuit of representation for racial and language minority groups, which has driven American voting law for decades, may conflict with the goal of making policy more responsive to their interests.

To put our paper in context, we should note that some of its lessons are understood on an intuitive level by policymakers, judges, and empirical researchers. And we are certainly not the first to apply public choice principles to districting issues: Buchanan and Tullock (1962) developed what is probably the first public choice model of gerrymandering more than four decades ago. Our model represents a significant departure from previous work in two respects. First, while the literature has emphasized *partisan* bias due to gerrymandering (for example, Owen & Grofman, 1988; Sherstyuk, 1998; Gilligan & Matsusaka, 1999 & Shotts, 2001), here we focus on *policy* bias.[2] We believe policy bias is important to understand because not all Democrats (or Republicans) are alike. A districting scheme that elects a majority of moderate Democrats is different in a critical way from one that elects a majority of extremely liberal Democrats. Second, previous studies tend to tailor their models to the specific problems they are interested in, such as racial gerrymandering, which obscures the powerful central intuitions that are common to the public choice approach. Our paper is an attempt to illustrate how fundamental principles of public choice can provide a powerful, unified approach to a wide variety of districting issues.

The paper proceeds as follow. Section 2 lays out the model. Section 3 develops the three key propositions. Section 4 applies the model to a number of issues. Section 5 concludes.

2. A public choice model of districting

Our model is a double application of the median voter theorem, one of the workhorses of public choice. In a given district, candidates converge on the policy position of the median voter, and in the legislature, the policy position of the median representative prevails. The conditions under which the median voter theorem holds are well known, such as a unidimensional issue space and single-peaked preferences (Mueller, 2003). Whether the conditions

[2] Two interesting recent papers also focus on policy bias. Buchler (2005) studies a median voter-type model and compares random and homogeneous districting, similar to what we do, and Coate and Knight (2005) study a citizen-candidate model with an eye on the seat-vote relation. In both papers, bias emerges from partisan primaries, a consideration we abstract away from.

hold in practice is the subject of a lively scholarly literature, but there is a fair amount of evidence suggesting that it is not a bad first approximation.[3]

The population consists of N (an odd number) people, all of whom vote, that we call "citizens" and "voters" interchangeably. The citizens elect representatives who select a policy x, a number on the real line, such as the amount of spending on public education or the income tax rate. We assume that preferences are single peaked in the sense that each person has an "ideal" policy outcome, and increasingly dislikes a policy choice as it exceeds or falls short of his ideal. Let $F(x)$ be the cumulative distribution function of voter ideal points. We assume there is a unique median voter in the population with ideal point x^*_{POP} such that $F(x^*_{\text{POP}}) = 1/2$.

The legislature is composed of K equal-sized districts, each person is allowed to vote in only one district, and each district has a unique median voter. Let x^*_k denote the ideal point of the median voter in district k. The legislature chooses the policy outcome that corresponds to the ideal point of the median representative, that is, the median of $\{x^*_1, ..., x^*_k, ..., x^*_K\}$, denoted x^*_{LEG}. Thus, the policy outcome is the "median of the medians."

We are interested in understanding under what conditions the policy chosen by the legislature deviates from the median voter outcome in the population at large, that is, when $x^*_{\text{LEG}} \neq x^*_{\text{POP}}$. When such deviations occur, the prevailing policy is not supported by a majority of voters.

To get an intuition for when deviations do and do not occur in this setup, consider a population of nine voters with ideal points {1, 2, 3, 4, 5, 6, 7, 8, 9}. The median voter's ideal policy is $x^*_{\text{POP}} = 5$. Suppose there are three legislative districts. One way to group the citizens into districts is {1, 2, 3} {4, 5, 6} {7, 8, 9}. The political process can then represented as follows:

Districts	{1, 2, 3}	{4, 5, 6}	{7, 8, 9}
	↓	↓	↓
Legislators	2	5	8
		↓	
Final policy (x^*_{LEG})		5	

In words, since each representative adopts the position of the median voter in his or her district, the ideal point of the three legislators would be 2, 5, and 8. In the legislature, the median legislator prevails: $x^*_{\text{LEG}} = 5$. With the apportionment in this example, there is no deviation: the legislative outcome and the population median are the same.

To see how districting can matter, consider an alternative grouping of voters into districts: {1, 2, 5} {3, 4, 6} {7, 8, 9}. The political process is then:

Districts	{1, 2, 5}	{3, 4, 6}	{7, 8, 9}
	↓	↓	↓
Legislators	2	4	8
		↓	
Final policy (x^*_{LEG})		4	

[3] For evidence that the median representative prevails in legislatures, see Krehbiel (1998) and McCarty, Poole, and Rosenthal (2001). Cox and McCubbins (1993) argue instead that legislative outcomes are at the majority party median. We suspect that many of our results would be qualitatively similar under this assumption. For evidence that state fiscal policy tracks the preferences of the median legislator rather than the median voter, see Bradbury and Crain (2005).

With these districts, legislators end up with ideal points of 2, 4, and 6, and the policy outcome is $x^*_{\text{LEG}} = 4$. This particular districting scheme causes policy to deviate from the ideal point of the median voter in the population. Our next task is investigate more systematically the conditions under which deviations do and do not occur.

3. Three theoretical propositions

The next three propositions characterize deviations between the policy outcome and the ideal point of the median voter. We measure the amount of bias in terms of population (the policy space does not have a natural metric) as $B = |F(s^*_{\text{LEG}}) - F(s^*_{\text{POP}})|$. It could also be thought of as the magnitude of the deviation from majority rule. Since $F(s^*_{\text{POP}}) = 1/2$ by definition, B can range from zero (no bias) to 1/2 (maximum bias).

3.1. Potential bias

Imagine that the person drawing the district lines wants to make the final policy x^*_{LEG} as small as possible (the case of an upward bias is symmetric). The "cracking and packing" algorithm to accomplish this is well known: first, citizens with high-value ideal points are "cracked" into districts where they are the minority, maximizing the influence of citizens with low-value ideal points, and second, the remaining high-value citizens are "packed" into districts containing a preponderance of like-minded citizens in order to waste their votes through overkill. Cracking and packing is what happened in the second numerical example in Section 2 that exhibited a bias – cracking in the first two districts and packing in the third. Proposition 1 characterizes the amount of bias that can be induced for a given legislature size and population.

Proposition 1. *Let* $B = |F(s^*_{\text{LEG}}) - F(s^*_{\text{POP}})|$ *be the bias between the policy outcome and the median voter outcome. Then* $\max\ B = 1/2 - (K+1)(K+N)/4KN$.

Proof: Given K districts and a population of N, population per district is N/K, and it takes $.5(N/K + 1)$ citizens to form a majority in a district. (For ease of exposition, we assume all fractions are integers.) Consider a districting scheme to bias down the policy. Bias is maximized by successively combining $\frac{1}{2}(N/K + 1)$ unassigned voters with the lowest ideal points and $\frac{1}{2}(N/K - 1)$ voters with the highest ideal points. Under this assignment, the proportion of voters whose ideal point is less than or equal to the median voter in the first district is $F(s^*_1) = \frac{1}{2}(N/K + 1)/N = \frac{1}{2}(K+N)/KN$, found by dividing the fraction of voters with ideal points below the population median by N. Likewise, $F(s^*_2) = (K+N)/KN$, $F(s^*_3) = \frac{3}{2}(K+N)/N$, and so on. The median legislator in this construction represents district $.5(K+1)$ The proportion of voters whose ideal point is less than or equal to the median voter in the median district is $(K+1)(K+N)/4KN$. Since the ultimate policy is $x^*_{\text{LEG}} = x^*_{.5(K+1)}$, the bias is simply $1/2 - F(x^*_{.5(K+1)})$. □

Proposition 1 shows bias is not entirely a political phenomenon – it also has roots in the constitutional structure of the legislature. The proposition is fairly general in that it does not require any assumptions about the distribution of the population. The practical application might be more complicated since the gerrymanderer would have to know the idea points of all citizens.

Table 1 Potential bias in select states

K	*N*	Example	Maximum bias
20	436,000	Alaska Senate	.237
39	4,182,000	Mean upper house/mean population	.244
67	3,631,000	Minnesota Senate	.246
40	436,000	Alaska House	.244
116	4,182,000	Mean lower house/mean population	.248
400	927,000	New Hampshire House	.249

Note. *K* is the number of seats. *N* is the number of people over the age of 18 according to the 2000 Census

Straightforward differentiation of the expression for maximum bias yields several implications. First, the potential bias is increasing in *N*: holding constant legislature size, gerrymandering is more of a problem as the population grows. Second, the potential bias is greatest when $K = \sqrt{N}$. Third, when $K < \sqrt{N}$ (which is the empirically relevant case for all American states today), the potential bias is increasing in *K*; otherwise, potential bias is decreasing in *K*. We summarize these results in the following corollary.

Corollary 1. *The maximum potential bias is 1/4, and occurs when* $K = \sqrt{N}$. *Potential bias is increasing in N, increasing in K when* $K < \sqrt{N}$, *and decreasing in K when* $K/\sqrt{N}$.

Corollary 1 implies that states could reduce their potential bias by shrinking the number of seats in their legislatures. In practice, the gains from doing so are likely to be modest. To get a feel for the magnitudes,Table 1 reports the potential bias for the smallest, largest, and average size upper and lower houses among the states as of 2000. The number of seats varies from 40 to 400 in the lower house, and from 20 to 67 in the upper house (Gilligan & Matsusaka, 1995). As can be seen, the scope for bias is large in practice, typically over .240. However, even in the Alaska Senate, which has only 20 seats, the potential bias is .237. The potential bias in the Alaska Senate would still be .225 with 10 seats, and .200 with 5 seats. Although bias can be controlled by reducing seats, the gains appear to be small without a dramatic reduction in seats.

When the median voter outcome attains, bias is zero, and in some sense the majority rules. As bias increases, the policy process becomes one of minority dominance. For example, with a deviation of 0.200, a minority of 30 percent of the population is able to maintain a policy that 70 percent of all voters agree should be moved toward the median outcome.

So far, courts have resisted voting rights claims related to the size of legislatures. For example, in *Holder v. Hall* (1994), the Supreme Court refused to require a Georgia county to change from having a single commissioner to multiple commissioners, saying in part, that there was no workable or objective benchmark for determining the proper size of a governing authority. Our analysis is too narrow to produce an empirically relevant optimal size, but it indicates that legislature size is an important determinant of potential bias, particularly when there are less than 10 seats, and that larger legislatures are more susceptible to bias.

Buchanan and Tullock (1962) long ago noted the possibility that with geographically based representation, policy decisions can be controlled by less than a majority of the population, even if majority rule governs elections and legislative decisionmaking. Their argument was that in order to control policy, a coalition only needs to control half of the seats, which can be accomplished by controlling only half of the votes in those districts. In principle, a coalition of approximately 1/4 of the voters (1/2 of the voters times 1/2 of the districts) can control policy:

> Thus, a logrolling bargain to obtain benefits from the political process need only involve about 1/4 of the voters under a representative system. Therefore, representative institutions of this type are almost equivalent to permitting any group of 1/4 of the voters in direct democracy to form a logrolling coalition empowered to determine what roads will be repaired, which harbors dredged, and which special interest groups will receive government aid. (Buchanan & Tullock, 1962, p. 221)

Buchanan and Tullock reached their conclusion that 1/4 of the population can dominate the policy process by envisioning a logroll between group members. The simplicity of their analysis is purchased with the strong assumption that the minority coalition can coordinate and unanimously agree on a policy. Our spatial model strengthens their observation by showing that minority dominance can emerge even without coordination among group members. In fact, we can show as a corollary to Proposition 1 that the maximum deviation tends to 1/4 in the limit as the number of seats and population increase.

Corollary 2. $\lim_{K\to\infty}\lim_{N\to\infty}|F(s^*_{\mathrm{LEG}}) - F(s^*_{\mathrm{POP}})| = 1/4.$

3.2. Random districting

Proposition 1 shows that while bias is regulated by the number of seats, in practice most states are going to have live with a potential bias very near the theoretical maximum. This raises the question of what can be done to prevent those who draw the district lines from exploiting the potential bias for their own advantage. One possibility, at least in theory, is to draw the district lines randomly.[4] While such a "neutral" approach would end up favoring one group or another at times, it would seem at first blush to offer an unbiased outcome on average.

However, random districting is not unbiased except under very special circumstances. To see why not, consider the following population of nine citizens: {1, 1, 1, 1, 1, 2, 2, 2, 2}. The median voter outcome is $x^*_{\mathrm{POP}} = 1$. Clearly, it is not possible to have a legislative outcome less than $x^*_{\mathrm{LEG}} = 1$. It is possible, though, to have a legislative outcome greater than one:

Districts	{1, 1, 1}	{1, 2, 2}	{1, 2, 2}
	↓	↓	↓
Legislators	1	2	2
		↓	
Final policy (x^*_{LEG})		2	

Since random assignment may create a district with $x^*_{\mathrm{LEG}} = 1$ and may create a district with $x^*_{\mathrm{LEG}} = 2$, the expected policy will exceed the median voter's ideal point, that is, $E[x^*_{\mathrm{LEG}}] > 1$. Random assignment in this example creates an upward bias in the policy on average. One of our results in this section is that it is the underlying skewness of the preference distribution that gives rise to the expected bias. Random assignment yields an expected policy with no bias is when ideal points are distributed symmetrically about the mean.

[4] In his dissent in *Bush v. Vera* (1996), Justice Souter explicitly raised the question of whether the Court's jurisprudence was leading in the direction of random districting. Iowa's redistricting law that prohibits the use of information concerning political affiliation, previous election results, addresses of incumbents, and any demographic information other than population, is one attempt to create "neutral" districts.

Proposition 2. *Random districting. (1) Random assignment of voters to districts does not in general imply an expected bias of zero. (2) Random assignment does result in an expected bias of zero in the special case where idea points are distributed symmetrically around the median. (3) When the distribution of ideal points is skewed upwards in a particular sense, the expected policy is biased upwards.*

Proof: (1) The first part of the proof, that random assignment does not in general imply an expected bias of zero, is proved by the preceding example. (2) For the second point, consider a random allocation of N voters with ideal points $x_1, \ldots, x_i, \ldots, x_N$ (ordered from high to low) across K districts, and define x_M as the median in the population ($M = .5(N + 1)$). After the random allocation, arrange the median voters in each of the districts so that $x_1^* < x_2^* < \ldots < x_K^*$ (here the subscripts refer to districts not individuals) and note that $x_{.5(K+1)}^* = x_{\text{LEG}}^*$ is the median legislator. Let $p(x_i) = \Pr(x = x_{\text{LEG}}^* | N, K)$ be the probability that a given voter's ideal point is the same as the median legislator's ideal point. Now if $x_i = x_{\text{LEG}}^*$, it must be the case that in half of the districts, half of the citizens have ideal points less than x_i, and in the other half of the districts, half of the citizens have ideal points greater than x_i. This is impossible for x_i in the top and bottom quartiles of the distribution. Therefore $p(x_i) = 0$ for $i \notin [\frac{1}{4}N, \frac{3}{4}N]$, call it fact (1). Second, given the symmetry of ideal points around the median, $p(x_{M-j}) = p(x_{M+j})$, call it fact (2). Any two voters who have the same number of other voters with ideal policies between them and the median voter have the same chance of being the median of the medians. Now by definition, the expected policy under random assignment is $E[x_{\text{LEG}}^*] = \sum_{i=1}^{N} p(x_i)x_i$. Using fact (1) reduces this to $E[x_{\text{LEG}}^*] = \sum_{i=M-j}^{M+j} p(x_i)x_i$, where $i \in [\frac{1}{4}N, \frac{3}{4}N]$. Adding fact (2) gives $E[x_{\text{LEG}}^*] = \sum_{j=1}^{N/4} p(x_{M-j})(x_{M-j} + x_{M+j}) + p(x_M)x_M = x_M$, call it (*), where the last relation follows from the fact that $(x_{M-j} + x_{M+j})/2 = x_M$. (3) Suppose that the ideal points are skewed right in the sense that $x_M - x_{M-j} \leq x_{M+j} - x_M$, that is, for each symmetric pair of voters $\{M - j, M + j\}$ above and below the median, the ideal point of the voter below is never farther from the median than the ideal point of the voter above. Then $(x_{M-j} + x_{M+j})/2 \geq x_M$ and expression (*) becomes

$$E[x_{\text{LEG}}^*] = \sum_{j=1}^{N/4} p(x_{M-j})(x_{M-j} + x_{M+j}) + p(x_M)x_M \geq x_M,$$

□

The main point of Proposition 2 is that random assignment does not guarantee an unbiased outcome in expectation. We believe the exceptional symmetry case is seldom relevant in practice. More typically, preferences are likely to be skewed in one direction. For example, willingness to pay for government services is likely to be increasing in income and the distribution of income is skewed to the right, so the demand for government services is likely to be skewed to the right as well. In short, while random assignment seems to hold the promise of eliminating bias, it will not do so typically. This implies, among other things, that empowering neutral commissions to draw district lines without taking into account the underlying preferences of the citizens will not solve the bias problem.

3.3. Homogeneity

Randomization does not remove potential bias from districting. Our third result identifies a procedure that does eliminate bias: there is no bias when districts are designed to make the preferences of the members in a given district as similar as possible.

Proposition 3. *If districts are designed so that within-district preferences are as homogeneous as possible,* $s^*_{\text{LEG}} = s^*_{\text{POP}}$.

Proof: As before, consider a population of N voters with ideal points $x_1, \ldots, x_i, \ldots, x_N$ (ordered from high to low), and let x_M represent the ideal point of the median voter. To maximize homogeneity with districts, assign the first N/K citizens to the first district, the next N/K citizens to the second district, and so on. The median district then contains citizens $i = M - (N - K)/2K, \ldots, M + (N - K)/2K$, and the district median is x_M. Thus, $x^*_{\text{LEG}} = x_M \equiv x^*_{\text{POP}}$. □

Proposition 3 provides a justification for the "traditional redistricting" principles of compactness, contiguity, and respect for existing political boundaries that were revived by the U.S. Supreme Court in *Shaw v. Reno*. It is evident that people with similar preferences tend to live near each other: residents of Beverly Hills have much more in common with each other than they do with residents of the city of Compton in South Central Los Angeles, and vice versa. This is not happenstance: one of the oldest principles in public finance is that people with similar preferences over public services will tend to sort into the same communities (Tiebout, 1956). To the extent that preferences are linked to home values, neighbors will tend to have similar views about local government services (Fischel, 2001). Location-specific amenities like beaches or lakes will also tend to attract people with similar preferences. Because people with similar preferences tend to cluster near each other and within existing political jurisdictions, district lines that group people with their neighbors and respect existing political boundaries will tend to create homogeneous districts.[5] The consequence, shown by Proposition 3, is to minimize the amount of bias.

The Supreme Court's endorsement of traditional districting principles in *Shaw v. Reno* and its progeny follow a different line of argument. In those decisions, compact and contiguous districts are seen primarily as a constraint on would-be gerrymanderers – by reducing the degrees of freedom, the Court seems to believe that the potential for mischief will be reduced. However, the Court has not offered an explanation why traditional districting principles are desirable per se.[6] We believe our Proposition 3 is the first theoretical justification for why traditional districting principles are desirable in their own right.

Proposition 3 also suggests how concepts like "compactness" should be approached. Some scholars have offered measures of compactness based on geometry, such as minimizing the longest distance between two points in the district (Young, 1988; Niemi et al., 1990). Our analysis suggests that compactness (and contiguity) should be viewed largely as social rather than geographic or mathematical concepts: the idea should be to group together individuals with similar preferences. We suspect the longstanding use of compactness, contiguity, and respect for other political boundaries, emerged over time as a shortcut to create districts with homogeneous interests.[7]

[5] Geographical preference homogeneity is likely to be stronger for issues that are provided locally such as schools and police, and less so for other issues such as abortion. Nevertheless, to the extent that preferences are associated with underlying social and economic factors such as income, education, and occupation, we might expect a fair amount of homogeneity even for issues that are not locally provided.

[6] The Court has argued that by creating irregular districts, legislators are encouraged to focus too much on the interests of the group for which the district was designed (in the actual cases, this would be black voters).

[7] Shotts (2001) draws a more negative conclusion regarding geographic constraints but his results are based on an assumption that traditional districting principles maximize the heterogeneity of districts. That is, he supposes respect for geographic constraints makes each district a mirror of the preference distribution in the

4. Applications

4.1. Fiscal policy and the law of 1/*n*

A basic implication of our analysis is that policy decisions by legislatures are not generally median voter outcomes. With a potential bias of nearly 1/4 for all states today, it is possible to create districts that lead to policies opposed by 75 percent of the electorate. And, as Proposition 2, shows, even if those drawing the lines do not intend to gerrymander, random lines in themselves are likely to give rise to bias.

The most extensive evidence available on policy bias concerns fiscal policy, and much of it shows that fiscal policy choices made by legislatures do not arrive at the median voter's idea point. Matsusaka (2004) reports a variety of evidence from opinion surveys about taxes and spending. A majority of citizens (approaching the theoretical 75 percent in some polls) express a desire for less spending and lower taxes, more decentralization of spending from state to local governments, and greater reliance on user fees and charges for services than broad-based taxes. With median voter outcomes, exactly half of the population would favor an increase and half would favor a decrease. Evidence on initiatives and referendums also undercuts the idea that legislatures choose median voter outcomes. If legislatures selected median voter policies, then initiatives and referendums (attempts to change the status quo policy) would not be able to gain support from a majority of voters. In fact, tax and spending propositions have had a long run of success beginning with California's famous tax-cutting Proposition 13 in 1978 that was approved by 65 percent of the electorate. Systematic evidence using panel data shows that initiative states spent and taxed less than noninitiative states over the last several decades, even controlling for the ideology of the state's citizens and other proxies for preferences (Matsusaka, 1995, 2004). Initiative states also pushed more spending down to local governments and raised relatively more money from user fees and charges, as opinion surveys indicate voters wanted.

In short, the evidence is fairly strong that legislative policies have been biased toward more spending than the median voter wanted since the late 1970s. Our analysis does not predict a direction of bias; it only describes the scope for bias if the individuals drawing the district lines want to induce a bias. One explanation of the evidence would be that pro-spending interests were disproportionately influential in apportionment over the last several decades. Unfortunately, we are not aware of any evidence whether this is true or not. However, a parallel argument suggests that the bias would run the other way – toward lower spending – in the early decades of the twentieth century. In those days before one-person-one-vote was in effect, rural interests controlled the legislatures of many states, and were opposed to the new spending programs favored by urban voters, such as water projects, public transportation, and old age pensions (Matsusaka, 2004). Consistent with this line of reasoning, initiatives did systematically increase spending during the first half of the twentieth century (Matsusaka, 2000).

A stronger implication of our analysis is that the bias increases in the number of seats (Corollary 1). Given that the bias appears to have run in the direction of higher spending over the last several decades, the expectation is that states with many legislative seats would have spend more than states with fewer legislative seats, all else equal. Several studies have found such a pattern (Gilligan & Matsusaka, 1995; Bradbury & Crain, 2001; Baqir, 2002).

population as a whole. Given the evidence that like-minded people tend to cluster geographically, we believe his assumption is more likely to represent non-compact districts.

The conventional explanation for the positive relation between seats and spending is the "Law of 1/*n*" developed by Weingast et al. (1981) that is an implication of the fiscal externalities theory of Buchanan and Tullock (1962). The theory is based on the observation that government spending typically benefits a narrow segment of the population, while taxes are distributed across the population at large. When this is true, a legislator's constituents will stand to gain 100 percent of the benefits of a program in his or her district but they will only have to bear 1/*n*-th of the cost, where *n* is the number of districts. The fiscal externality involved in financing government programs will tend to make legislators favor spending in their districts beyond the point of efficiency (where marginal benefit equals marginal cost), and the problem will grow in severity as *n* increases. If legislators logroll and defer to each other on local spending projects, then total spending will be increasing in *n* (decreasing in 1/*n*).

Our analysis suggests that the evidence previously interpreted as supporting the fiscal externalities theory could be caused by gerrymandering instead: because the potential bias is increasing in the number of seats, empirical studies may be detecting increasingly effective policy gerrymanders as the number of seats increases. We do not know of a direct test that distinguishes the theories yet, but the fact (noted above) that spending in the early years of the 20th century was lower than the median voter wanted, seems inconsistent with the fiscal commons theory (Matsusaka, 2000).[8] There are also some wrinkles in the existing evidence that raise questions, for example, Gilligan and Matsusaka's (1995, 2001) finding that the Law of 1/*n* holds for the upper house but not always the lower house of the legislature. More direct tests are easy to construct in principle. For example, one way to test the gerrymandering view would be to compare the strength of the seats-spending relationship in the years immediately before and after redistricting. The gerrymandering view implies larger effects after redistricting while the Law of 1/*n* implies no change. Another approach would be to compare the strength of the effect in states where the lines were drawn by pro-spending interests to the effect in states where fiscal conservatives drew the lines.

4.2. Partisan bias

While our analysis focuses on the relation between district lines and policy outcomes, much of the previous literature emphasizes the partisan consequences of districting: how does districting affect the partisan balance in the legislature? In practice, much gerrymandering appears directed to helping a political party rather than promoting a policy outcome, and there is a large empirical literature that attempts to measure "partisan bias," roughly speaking the deviation between the proportion of seats held by a party the proportion of votes its members received at the polls (Cain, 1985; King & Browning, 1987).

Our model can be recast in terms of partisanship by supposing that $x_i \in \{0, 1\}$ now represents citizen i's preference for one of two competing parties.[9] The fraction of voters favoring party 1 is $V_1 = \frac{1}{N}\sum_{i=1}^{N} x_i$ and the fraction favoring party 0 is $1 - V_1$. Similarly, the party affiliation of representative k is $x_k^* \in \{0, 1\}$ corresponding to the median voter (or equivalently, the preference of the majority) in the district. The fraction of seats held by party 1 and party 0 in the legislature is then $L_1 = \frac{1}{K}\sum_{k=1}^{K} x_k^*$ and $1 - L_1$, respectively. Partisan bias is defined as $\beta = |L_1 - V_1|$. When the share of seats held by party 1 is the same as

[8] However, this evidence also creates problems for our gerrymandering explanation. If anti-spending interests were in control of districting in the early 20th century, then we might expect a negative relation between seats and spending.

[9] The analysis here is adapted from Gilligan and Matsusaka (1999).

its share of supporters in the population, $L_1 = V_1$ and $\beta = 0$. Bias rises if party 1's share of seats increases or decreases, holding constant its popular support. The next proposition characterizes partisan bias in terms of seats and population.

Proposition 4. *Let V_1 be the fraction of the population that supports party 1 and suppose there are enough party 1 voters to comprise a majority in at least one district but not every district: $(N + K)/2KN < V_1 < (N + K)/2N$. Then* $\max \beta = V_1(N - K)/(N + K)$. *Also, when districts are designed so that within-district preferences are as homogeneous as possible, $\beta = 0$.*

Proof: To maximize bias in favor of party 1, construct as many districts as possible that contain $(N + K)/2K$ party 1 voters and $(N - K)/2K$ party 0 voters. The constraint on creating such districts is $\sum_{k=1}^{K} x_i^*(N + K)/2K \leq \sum_{i=1}^{N} x_i$, call it condition (1), which can be restated as $L_1(N + K)/2N \leq V_1$ after dividing by N. By assumption there are enough party 1 voters to form a majority in at least one district but not enough to form a majority in every district. Then condition (1) together with the definition of partisan bias implies that $\beta \leq |V_1(2N/(N + K)) - V_1| = V_1(N - K)/(N + K)$, given that we are assuming a gerrymander in favor of party 1. □

The maximum bias is again a simple function of population and the number of seats. In contrast to the case for policy bias, partisan bias is decreasing in the number of seats, holding constant population and the underlying support for the parties in the population. Intuitively, an increase in the number of seats hurts the favored party because it has proportionately fewer of its supporters than opponents to allocate to the new districts. Gilligan & Matsusaka (1999) test this implication using data from Congressional elections over 1950–1984, and find that partisan bias was decreasing in the number of seats, except for states with extremely weak parties where partisan gerrymandering was unlikely to be effective.

4.3. Voting rights law

Voting rights law in the United States underwent a revolution beginning in the 1960s with the Supreme Court's *Baker v. Carr* (1962) decision and passage of the federal Voting Rights Act (1965), a revolution that sought to eliminate practices that deprived members of racial and language minority groups of their basic electoral rights. Sweeping changes in law catalyzed a fundamental restructuring of representative institutions over the subsequent decades at all levels of government. As a result, every state now apportions its legislature and U.S. House seats so that each district has an equal population, and under certain conditions, so that racial minorities are elected in rough proportion to their prevalence in the population; more than 30 states replaced their multimember state legislative districts with single member districts; and more than half of cities switched from at-large city council elections to ward or district elections in the 1980s alone (Niemi et al., 1985; Renner & DeSantis, 1993).

4.3.1. Definition of voting rights

At the center of voting rights law is the question: what are the voting rights of a citizen in a democracy? At a minimum, a citizen's rights include the right to vote in a literal sense, that is, the *right to cast a ballot*. Guaranteeing this right to all citizens was the object of the Voting Rights Act of 1965, and by all accounts, the Act was a success. A second and more controversial right is the *right to choose a representative*. The Voting Rights Act states

that citizens have the right "to participate in the political process and to elect representatives of their choice." Similarly, in the Supreme Court's view (*Davis v. Bandemer*, 1986), "each political group in the state should have the same chance to elect representatives of its choice as any other political group." Notwithstanding the Voting Rights Act's disavowal that "[n]othing in this section establishes a right to have members of a protected class elected in numbers equal to their proportion in the population," in practice the right to representation has often been seen as a right to a roughly proportional number of representatives for members of racial/language minority groups.

Public choice principles place more importance on the ability to achieve outcomes rather than the ability to elect representatives, what might be thought of as a *right to influence the outcome*. For one thing, the concept of a representative "of one's choice" is inherently ambiguous. If it means a representative at one's ideal point, then almost every citizen will end up without a representative. If candidates relatively close to a person's ideal point are allowed, how far from the ideal point is acceptable? More fundamentally, from a public choice perspective representatives are primarily a means to an end, not an end in themselves. Allowing citizens to choose representatives is a right with little value if the representatives are unable to influence the government's choices. At a practical level the distinction between representatives and outcomes would not matter if having more representatives led to more favorable policy outcomes, but this is no guarantee that such a relation holds. Indeed, we will show next that electoral structures designed to increase the number of minority representatives can lead to policy outcomes less favorable for the group.

4.3.2. Majority-minority districts and perverse effects

A popular approach to the "right to representation" is to apportion by grouping together members of a race or language group (typically blacks or Latinos) so they form a majority in one or more districts. Citizens in these so-called "majority-minority" districts are expected to vote along racial or language lines and elect representatives from the minority group, and they usually do select minority representatives (Handley et al., 1998). While it is fairly clear that such "racial gerrymandering" leads to more representatives who are black or Latino, it is less obvious that it leads to better policy outcomes for black and Latino citizens. Many have noted that majority-minority districts might have the perverse effect of concentrating left-wing voters in a few districts, and thereby causing the election of more right-wing candidates in the other districts (Lublin, 1999; Shotts, 2003). Our model suggests that there may or may not be perverse effects from creation of majority-minority districts, but they are unlikely to shift policy in favor of the minority group.

The main intuition can be seen by expanding our simple numerical example. As before, suppose there are nine citizens with ideal points {1, 2, 3, 4, 5, 6, 7, 8, 9}, but now assume that citizens 1, 2, and 3 are black and citizens 4, 5, 6, 7, 8, and 9 are white. We have assigned members of the racial groups ideal points at opposite ends of the distribution to capture the idea that there are underlying policy differences, which is part of what motivates the concern for racial representation in the first place. Since blacks comprise one-third of the population in our example, proportional representation would deliver one black and two white legislators. We assume that legislators are drawn from the citizens, so that if the median voter in a district has an ideal point of 1, 2, or 3, the representative is black, otherwise the representative is white. If districts were drawn according to traditional districting principles, which we interpret as homogenizing preferences, the districts would be {1, 2, 3} {4, 5, 6} {7, 8, 9}, and there would be one black and two white representatives.

The only way for all three districts to elect white representatives is if citizens 1, 2, and 3 are salted one to each district. This could only happen with a gerrymander that seeks to bias x upwards, a "conservative" gerrymander (a "liberal" gerrymander would automatically create a district with a majority of blacks). One such gerrymander that leads to an all-white legislature is this:

Districts	{1, 4, 5}	{2, 6, 7}	{3, 8, 9}
	↓	↓	↓
Legislators	4	6	8
		↓	
Final policy (x^*_{LEG})		6	

The final policy here is $x^*_{\text{LEG}} = 6$ and the legislature is composed of members with ideal points of 4, 6, and 8. Now suppose the state is required to create at least one district that elects a black candidate. This can be accomplished by switching voter 4 with either voter 2 or 3, for example {1, 2, 5} {4, 6, 7} {3, 8, 9}. These districts result in a legislature with one black and two whites, but have no effect on the policy bias. This is a fairly general result: a requirement to create majority-minority districts has no effect on the policy bias unless the minority group is very sizable, although it may increase the number of representatives from the minority group. Intuitively, citizens with ideal points below the legislative median (here $x = 6$) can be traded between districts without altering the legislative median.

The perverse effect arises if majority-minority districts are required to contain supermajorities of the minority group, which is generally what happens in practice. To model this, we suppose that a district with 1, 2, and 3 together must be created. As previously noted, this has no effect on a conservative gerrymander. However, it will undo a liberal gerrymander if one is in effect; packing so many liberal voters in a single district leaves conservative voters in a stronger position in the other districts. In this example, the supermajority-minority district makes a liberal gerrymander impossible. In short, a districting scheme that helps elect more minority representatives may lead to less favorable policies for minority voters.

Proposition 5. *Suppose there are two groups of voters, minority voters with low ideal points and majority voters with high ideal points, and the ideal points of the two groups do not overlap. Also suppose the default districting plan either maximizes within-district homogeneity, maximizes the policy bias downward (liberal plan), or maximizes the policy bias upwards (conservative plan). (1) If a new plan is required with majority-minority districts, the number of minority representatives may increase but policy bias will not change. (2) If a new plan is required with supermajority-minority districts, the number of minority representatives may increase, but policy bias will not change or will become less favorable for members of the minority group.*

Proof: (1) If the original plan maximizes within-district homogeneity or maximizes liberal bias, the districts will already satisfy the majority-minority requirement and the constraint is redundant. If the original plan maximizes conservative bias and produces $x^*_{\text{LEG}} = x' > x^*_{\text{POP}}$, then $.5(K + 1)$ districts have a bare majority of voters with ideal points greater than or equal to x'. Voters with ideal points less than x' can be exchanged across any of the districts (including both districts controlled citizens with high ideal points and those controlled by citizens with low ideal points) without affecting x^*_{LEG}, meaning the majority-minority districts can be created without changing the final policy. (2) By the same argument, supermajority-minority districts can be created without changing the outcome of a maximum bias conservative

gerrymander. If the original plan maximizes liberal bias with $x^*_{\text{LEG}} = x'' < x^*_{\text{POP}}$, then .5(K + 1) districts have bare majorities of voters with ideal points less than or equal to x''. The only way to add more voters with low ideal points to any of the $.5(K + 1)$ districts is to take them from one or more of those districts. As a consequence of such a shift, fewer than half of the districts will have a legislator with an ideal point less than or equal to x'', and the ideal point of the median district will increase. If the initial plan maximizes within-district homogeneity, then the supermajority-minority constraint will be satisfied without any change. □

Proposition 5 at first glance might seem to be at variance with the result of Shotts (2003) that racial gerrymandering in a conservative state can cause policy to shift to the left. The key difference in his approach is that he assumes that the majority-minority constraints are in force in only a subset of states, and those states are conservative. If majority-minority districts must be created from only a conservative subset of voters, the constraint can force the breakup of conservative districts and cause the overall median to shift to the left. Proposition 5 should be understood as describing what happens to a state or local legislature when required to create majority-minority districts. The U.S. House of Representatives is a unique and complicated case in which the overall districting plan is comprised of 50 separate state plans. Whether racial districting has a perverse effect in fact is a matter of controversy, for example, see Lublin (1999) and Shotts (2003).[10]

4.3.3. Multimember districts and at-large elections

Another trend in electoral practices that has been driven by voting rights law is the replacement of multimember districts with single-member districts and the replacement of at-large local elections with district elections. When such changes are made in response to racial vote dilution claims, the new systems usually feature one or more majority-minority districts in an effort to create roughly proportional representation in the legislature. For example, in *Thornburg v. Gingles* (1986), the leading case on multimember districts, the Supreme Court held that North Carolina's multimember districts for its state legislature violated the Voting Rights Act by impairing the ability of black citizens "to elect representatives of their choice."

The logic underlying the law is straightforward. Consider an area in which one third of the population is black and two-thirds is white. If the voters are grouped into a single district that selects three representatives, black voters will be the minority in all three races, and all three seats will be filled by white candidates if voting is primarily based on race. If instead three separate districts are formed on a racial basis, then blacks will comprise a majority in one district and one of the representatives will be black (again, assuming citizens vote primarily on the basis of race).

Our analysis agrees that race-based single member districts will lead to the election of more minority candidates if voting is primarily based on race, but it adds that adopting such districts comes with a potential cost. In our model, when legislators are elected by the population at large, they take on the preferences of the median voter. With at-large elections, all legislators would have the ideal point of the median voter, and there would be no bias. In

[10] We also note, but do not explore, that in most examples creation of majority-minority districts tends to increase or keep constant the amount of polarization in the legislature, measured as the distance in the ideal points between the two most extreme legislators.

a district-based system, however, it is possible to have policy biases. Thus, a cost of single member districts is an increased risk of policy bias.

Proposition 6. *Potential bias is greater with single-member districts than at-large districts.*

If district lines tend to be drawn with a pro-spending bias, as we suggest above, then Proposition 6 implies spending is higher in cities with ward elections rather than at-large elections. Dalenberg and Duffy-Deno (1991) and Southwick (1997) document such a pattern among American cities.

5. Conclusion

In this paper we employ standard principles of public choice, mainly the median voter theorem for candidate elections and legislatures, to develop a theory of legislative districting. Our analysis focuses on policy bias, the distance between the policy preferred by the median voter and the policy that actually emerges from the legislature. In the context of a fairly simple model, we derive an expression for the maximum possible bias and discuss how that bias might be controlled. One important result is that purely random districting, what might seem like the essence of a neutral procedure, will not eliminate bias on average except under specific conditions that are not likely to occur in practice. A second important result is that districting plans that maximize the homogeneity of preferences within each district will eliminate bias. Thus, to the extent that people with similar preferences tend to live near each other and preferences tend to be similar within political jurisdictions, adherence to the traditional districting principles of compactness, contiguity, and respect for existing political jurisdictions is likely to ameliorate policy bias.

Implicit in our analysis is the idea that median voter outcomes have a normative value. We would not push this too far. Median voter outcomes are known to fall short on other normative criteria such as utility maximization and Pareto efficiency and a focus on outcomes does not take into account possible expressive benefits of representation. On the other hand, we do not believe median voter outcomes can be entirely ignored either. Majority rule – which is what the median outcome represents – is a central value of democracy, and one that should not be sacrificed lightly without a clear gain in terms of some competing democratic value.

The emphasis on outcomes sets our public choice analysis apart from much of the related social science and law literature that focuses on representation. Our theory views representatives primarily as means to an end, and the value of having a representative is largely determined by the effectiveness of that representative. We show that some electoral practices can increase the number of representatives controlled by a group while at the same time reducing the group's influence on the final legislative outcome, sometimes called a "perverse effect." We do not take the position that only outcomes matter, but we think outcomes are at least as important as representation, and believe the existing focus on representation alone is undesirable.

Finally, we should note that in order to bring out the essentials of the public choice approach, and hopefully make them accessible to non-public choice scholars, we have stripped the model down to the bare essentials. As a result we have omitted some important theoretical and empirical considerations, among them uncertainty and the multidimensionality of the issue space. A person who wants to gerrymander a state must take into account that voter behavior is somewhat unpredictable, typically creating a tradeoff between expected bias and risk of losing everything. The multidimensionality of issues further complicates

matters because an optimal gerrymander along one policy dimension may not be optimal along another. How these competing interests are balanced gives another layer of complication. Our attempt to show the broad applicability of public choice principles has also led us to restate some results that have been noted previously in the literature or are known by practitioners. We have taken the risk of revisiting some issues that might already be familiar to some readers in the belief that collecting all these results together in one place highlights the utility of public choice principles as a broad and general tool for studying districting issues.

Acknowledgements We thank Stephen Coate, Jonathan Katz, Gordon Tullock, and an anonymous referee for helpful comments, Paul Edelman for correcting an error, and USC for financial support.

References

Baqir, R. (2002). Districting and government overspending. *Journal of Political Economy*, *110*(6), 1318–1354.
Black, D. (1958). *The theory of committees and elections*. Cambridge, UK: Cambridge University Press.
Bradbury, J.C., & Crain, W.M. (2001). Legislative organization and government spending: cross country evidence. *Journal of Public Economics*, *82*(3), 309–325.
Bradbury, J.C., & Crain, W.M. (2005). Legislative district configurations and fiscal policy in American States. *Public Choice*, *125*(3–4), 385–407.
Buchanan, J.M., & Tullock, G. (1962). *The calculus of consent: logical foundations of constitutional democracy*. Ann Arbor, MI: University of Michigan Press.
Buchler, J. (2005). Competition, representation, and redistricting: the case against competitive congressional districts. *Journal of Theoretical Politics, 17*(4), 431–463.
Cain, B.E. (1985). Assessing the partisan effects of redistricting. *American Political Science Review*, *79*(2), 320–333.
Coate, S., & Knight, B. (2005). Socially optimal redistricting. Working Paper, Cornell University and Brown University.
Cox, G.W., & McCubbins, M.D. (1993). *Legislative leviathan: party government in the house*. Berkeley, CA: University of California Press.
Dalenberg, D.R., & Duffy-Deno, K.T. (1991). At-large versus ward elections: implications for public infrastructure. *Public Choice*, *70*(3), 335–342.
Downs, A. (1957). *An economic theory of democracy*. New York, NY: Harper & Row.
Fischel, W.A. (2001). *The homevoter hypothesis: how home values influence local government taxation, school finance, and land-use policies*. Cambridge, MA: Harvard University Press.
Garrett, E. (2005). *Redistricting: another California revolution?*, IRI Report 2005-1, February 2005 available at www.iandrinstitute.org.
Gilligan, T. W., & Matsusaka, J.G. (1995). Deviations from constituent interests: The role of legislative structure and political parties in the states. *Economic Inquiry*, *33*(3), 383–401.
Gilligan, T.W., & Matsusaka, J.G. (1999). Structural constraints on partisan bias under the efficient gerrymander. *Public Choice*, *100*(1–2), 65–84.
Gilligan, T.W., & Matsusaka, J.G. (2001). Fiscal policy, legislature size, and political parties: Evidence from state and local governments in the first half of the twentieth century. *National Tax Journal*, *54*(1), 57–82.
Handley, L., Grofman, B., & Arden, W. (1998). Electing minority-preferred candidates to legislative office: The relationship betweeen minority percentages in districts and the election of minority-preferred candidates. In: GrofmanB. (ed.), *Race and redistricting in the 1990s*. New York, NY: Agathon Press.
King, G., & Browning, R.X. (1997). Democratic responsiveness and partisan bias in congressional elections. *American Political Science Review*, *81*, 1251–1276.
Krehbiel, K. (1998). *Pivotal politics: a theory of U.S. lawmaking.* Chicago, IL: University of Chicago Press.
Lublin, D. (1999). *The paradox of representation: racial gerrymandering and minority interests in congress*. Princeton, NJ: Princeton University Press.
Matsusaka, J.G. (1995). Fiscal effects of the voter initiative: evidence from the last 30 years. *Journal of Political Economy*, *103*(3), 587–623.
Matsusaka, J.G. (2000). Fiscal effects of the voter initiative in the first half of the twentieth century. *Journal of Law and Economics*, *43*(2), 619–650.

Matsusaka, J.G. (2004). *For the many or the few: the initiative, public policy, and American democracy*. Chicago, IL: University of Chicago Press.
McCarty, N.M., Poole, K.T., & Rosenthal, H. (2001). The hunt for party discipline in congress. *American Journal of Political Science*, *95*(3), 673–687.
Mueller, D.C. (2003). *Public choice III*. New York, NY: Cambridge University Press.
Niemi, R.G., Hill, J. S., & Grofman, B. (1985). The impact of multimember districts on party representation in U.S. state legislatures. *Legislative Studies Quarterly*, *10*(4), 441–455.
Niemi, R.G., Grofman, B., Carlucci, C., & Hofeller, T. (1990). Measuring compactness and the role of a compactness standard in a test for Partisan and racial gerrymandering. *Journal of Politics, 52*(4), 1155–1181.
Owen, G., & Grofman, B. (1988). Optimal Partisan gerrymandering. *Political Geography Quarterly, 7*(1), 5–22.
Renner, T., & DeSantis, V. (1993). Contemporary patterns and trends in municipal government stucture. *Municipal Yearbook*, *60*, 57–69.
Sherstyuk, K. (1998). How to gerrymander: A formal analysis. *Public Choice, 95*(1–2), 27–49.
Shotts, K.W. (2001). The effect of majority-minority mandates on partisan gerrymandering. *American Journal of Political Science*, *45*(1), 120–135.
Shotts, K.W. (2003). Does racial redistricting cause conservative policy outcomes: policy preferences of southern representatives in the 1980s and 1990s. *Journal of Politics*, *65*(1), 216–226.
Southwick, L., Jr. (1997). Local government spending and at-large versus district representation: Do wards result in more 'Pork'? *Economics and Politics*, *9*(2), 173–203.
Tiebout, C.M. (1956). A pure theory of local expenditure. *Journal of Political Economy*, *64*(5), 416–424.
Weingast, B.R., Shepsle, K.A., & Johnsen, C. (1981). The political economy of benefits and costs: A neoclassical approach to distributive politics. *Journal of Political Economy*, *93*(4), 642–664.
Young, H.P. (1988). Measuring the compactness of legislative districts. *Legislative Studies Quarterly*, *13*(1), 105–115.