Tobler's Law, Urbanization, and Electoral Bias:
Why Compact, Contiguous Districts are Bad for the Democrats

Jowei Chen
University of Michigan

&

Jonathan Rodden
Stanford University

ABSTRACT: When one of the major parties in the United States wins a substantially larger share of the seats than its vote share would seem to warrant, the conventional explanation lies in manipulation of maps by the party that controls the redistricting process. Yet this paper uses a unique data set from Florida to demonstrate a common mechanism through which substantial partisan bias can emerge purely from residential patterns. When partisan preferences are spatially dependent and partisanship is highly correlated with population density, any districting scheme that generates relatively compact, contiguous districts will tend to produce bias against the urban party. In order to demonstrate this empirically, we apply automated districting algorithms driven solely by compactness and contiguity parameters, building winner-take-all districts out of the precinct-level results of the tied Florida presidential election of 2000. The simulation results demonstrate that with 50 percent of the votes statewide, the Republicans can expect to win around 59 percent of the seats without any "intentional" gerrymandering. This is because urban districts tend to be homogeneous and Democratic while suburban and rural districts tend to be moderately Republican. Thus in Florida and other states where Democrats are highly concentrated in cities, the seemingly apolitical practice of requiring compact, contiguous districts will produce systematic pro-Republican electoral bias.

Can one political party have a long-term legislative advantage over another simply because of the residential locations of voters? This paper builds on classic observations in the political geography literature and mobilizes new data and empirical techniques to demonstrate that this partisan advantage indeed occurs quite dramatically. We use detailed voting data from Florida to illuminate a pattern whereby urban centers are densely packed with leftists, while right-wing voters form more modest majorities in suburban and rural areas. We show that when compact winner-take-all electoral districts are imposed on this relatively common residential pattern, the right-wing party will win significantly more than its proportionate share of legislative seats, even without any intentional partisan gerrymandering in the drawing of districts.

In order to distinguish between electoral bias owing to residential patterns and bias caused by the manipulation of maps by incumbents, we use repeated computer simulations of the legislative districting process. Our simulations use precinct-level election results from Florida, where voters were evenly split between Bush and Gore in the 2000 election. We demonstrate that any seemingly apolitical districting process that requires legislative districts to be geographically compact and contiguous will produce a significant pro-Republican bias in the overall distribution of legislative seats.

The motivation for this analysis comes in part from recent developments in U.S. electoral politics. In recent presidential elections, attention has focused on the large and evenly divided states of Ohio, Michigan, Pennsylvania, and especially Florida. Yet while the outcomes of presidential and other statewide votes indicate razor-thin margins and a number of victories for Democrats in these states, the Republicans were able to maintain comfortable majorities in the U.S. Congressional delegations and both chambers of the state legislatures, generally surviving even the strong statewide swings toward the Democrats in 2006 and 2008. Even in heavily Democratic New York, the resilience of Republican control of the state senate has been astounding. For many observers, the explanation is clear: in addition to the advantages of incumbency, crafty Republicans controlled the districting process, and they were able to pack Democrats into a relatively small number of districts to generate a more efficient distribution of support for Republicans.[1] To bolster their case, critics display maps of districts with odd shapes and bizarre subdivisions of municipalities that would make Elbridge Gerry blush.

To reform advocates, this is a serious challenge to democracy with a straightforward solution: strip politicians of their power to draw districts, and create "non-partisan" districting boards, constraining them to draw compact, contiguous districts that respect municipal boundaries and maintain "communities of interest," as is the practice in other countries with plurality single-member districts. Advocacy groups have introduced referenda to this effect in a number of states in recent years, most notably in California, and the movement is gaining momentum around the country. At the same time, the Supreme Court may be on the verge of inserting itself into questions pertaining to the constitutionality of partisan gerrymandering, with a majority of justices now willing to at least consider the development of a workable standard for judging some asymmetric vote-seat curves to be a violation of the equal protection clause (Grofman and King 2007).

The rhetoric of reformers and the debates among judges and lawyers largely adopt the assumption that partisan bias is the result of intentional, strategic behavior by leaders of the party that controls the districting process. To the extent that scholars have noticed that electoral bias in the large Eastern and Midwestern states tends to systematically favor Republicans, this is often viewed as an outgrowth of the Republicans' good fortune to control the districting process in those crucial states during recent rounds of redistricting (see Hirsch 2003).

This paper explores a different explanation with roots in classic works of British and Commonwealth political geography. Gudgin and Taylor (1979) show that in a competitive two-party

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[1] See, e.g., www.fairdistrictsflorida.org and www.lwv.org

system, if one of the parties has a right-skewed support distribution across districts, it will suffer in the transformation of votes to seats because too many of its supporters are packed into the districts in the right tail. Writing in the 1970s about Britain, they conjecture that due to the inevitability of densely-packed support in coalfields and manufacturing districts, Labour unavoidably faced a right-skewed support distribution, causing it to suffer in the translation of votes to seats. Rydon (1957) and Johnston (1976) provide similar descriptive accounts of electoral bias in Australia and New Zealand respectively. Erikson (1972, 2002), Jacobsen (2003), McDonald (2009) and Rodden and Warshaw (2009) have made similar observations about the relative concentration of Democrats in urban U.S. House districts in the post-war period.

Building on more recent research in spatial statistics, this paper expands upon these arguments and explores their impact on districting and electoral bias in practice, drawing out implications for current debates about districting reform. We begin with three simple empirical observations. First, virtually all democracies exhibit pronounced variation in population density across space. Some voters live in very high density in cities, with many neighbors living in close proximity, while others live in low density in rural areas, and there are a range of suburban, exurban, and small town settings in between. Second, we note that for a host of reasons, Waldo Tobler's "first law of geography" generally holds true for political behavior: the probability that two individuals exhibit similar political preferences is a function of the distance between their residential locations. Third, perhaps because of differences in occupation, economic activity, or in moral or other values associated with different ways of life, it is common for a party system to develop in which population density is highly correlated with political preferences and voting behavior.

We argue that when these three relationships characterize a polity, any representation scheme based strictly on geographically contiguous and compact winner-take-all districts with equal population will tend to generate a right skew in the distribution of district-level vote shares of the party with the urban support base. Because of their high population density, small geographic extent, and high spatial correlation of preferences, urban districts will be more homogeneous than larger, sparser districts. As a result, the urban party with its excessively concentrated support base will suffer from systematic electoral bias, meaning that it can expect less than 50 percent of the seats when it obtains 50 percent of the vote.

Our central claim is that a substantial, systematic bias against the urban party does not require any intentional manipulation of maps by its opponents. On the contrary, our contention is that under political geography conditions that are quite common in industrialized societies, virtually any districting scheme that privileges compactness and contiguity will produce a bias against the urban party.

We examine these claims by using a unique data set from one of the most notorious "tied" elections in American history: the 2000 US Presidential election in Florida. We analyze geo-coded data on registered voters in Florida, along with precinct-level boundaries and vote tabulations. We choose Florida for our analysis because of the usefulness of a tied statewide election for which digitized precinct-level boundaries available, as well as our ability to assemble a unique dataset of individual-level geo-coded registration data. We demonstrate striking global spatial dependence of registration and voting, and we demonstrate that local spatial dependence is highest, meaning that potential districts are more homogeneous, in the areas with high population density that are dominated by Democrats.

Given our argument, it is not enough to point out that as a result of this underlying geography, observed elections to the United States Congress and the two chambers of the Florida legislature are biased against Democrats. The key empirical contribution of this paper is to use automated districting algorithms using the building blocks of individual party registration and precinct-level presidential voting to simulate thousands of alternative districting plans, guided only by requirements of compactness and contiguity, knowing that the underlying two-party presidential vote share was 50 percent. Our simulations indicate that as long as Florida is divided into any reasonable number of districts, Republicans will hold an electoral majority in approximately 58-61% of these districts**.** Furthermore, we show that as Florida is hypothetically divided into larger numbers of smaller districts, the size of this bias decreases. But in order for the pro-Republican electoral bias to disappear, Florida would need to be divided into an impracticably large number of legislative districts.

The relationship uncovered in our simulations is clearly reflected in observed electoral bias in Florida. Analysis of data from actual district-level election returns in both chambers of the Florida legislature as well as the Florida delegation to the U.S. Congress indicates that Republicans can indeed expect at least a ten percent seat advantage with 50 percent of the vote.

In short, a substantial share of Florida's observed electoral bias can be accounted for without any intentional manipulation on the part of mischievous Republican cartographers. Pro-Republican bias is a natural outgrowth of the geographic distribution of voters when districts must be compact and contiguous and Democrats are concentrated in cities. Our findings provide a potentially important new insight into debates about redistricting reform and the role of the courts in adjudicating claims of partisan bias. While it may seem quite reasonable to outlaw the use of political and demographic data in the districting process and delegate the job to independent boards or even computer programmers with a mandate only to maximize compactness, contiguity, and respect for municipal boundaries, in many large states this might lock in rather than ameliorate partisan bias. Moreover, if reformers or judges wish to reduce partisan bias, they should ignore the intentions of cartographers and push for an empirical standard that assesses whether a districting plan is likely to treat both parties equally (e.g. King et al 2006 or Hirsch 2009).

The next section lays out the conditions under which the electoral geography of urbanization generates a distribution of partisans in space that gives rise to electoral bias, and we demonstrate these conditions using data from contemporary Florida. The following section pursues approaches to automated districting and presents the results of thousands of simulated districting plans for Florida.

The penultimate section links the simulations with information about observed electoral bias in Florida's representative institutions. The final section concludes and explores implications beyond Florida.

1. Urbanization and Tobler's Law, with Applications to Florida

1.1 The geographic distribution of voters

In virtually all societies, humans are neither evenly nor randomly distributed in space. Even well before the industrial revolution, people have lived in settings characterized by widely varying population density. The industrial revolution dramatically amplified this phenomenon, as the countryside emptied out while dense cities greatly expanded. While in some countries this trend has slowed as changes in transportation technology, and hence urban form, make it possible for middle- and upper-class individuals to move from cities to suburban and exurban areas (Nas, Arnott, and Small 1998, Mieszkowski and Mills 1993), the distribution of voters in space in modern democracies is still quite lumpy.

Like many other U.S. states, the demographic geography of Florida residents clearly exhibits this phenomenon. A rather large share of Florida's population resides in a few, relatively dense urban centers including Miami, Fort Lauderdale, Tampa-St. Petersburg, Orlando, and Jacksonville. As a consequence, most of Florida's geographic space exhibits a relatively low population density. Already in the 1940s, Key (1949) pointed out that Florida's high degree of urbanization and lumpy settlement patterns set it apart from predominantly rural Southern states.

Building on Isaac Newton's Law of universal gravitation, Waldo Tobler's "first law of geography" (1970) makes the simple claim that "Everything is related to everything else, but near things are more related than distant things." Our first and most basic observation is that this is true of population density. Moran's (1950) Index of spatial autocorrelation is a test of Tobler's Law, and helps quantify the clustering of dense populations in Florida, measuring whether geographically closer units exhibit more similar values of a particular attribute. Formally, the Moran's I test statistic measures the correlation between a variable, such as the population density of census block *i*, and its spatial lag, the average population density of other census blocks near *i*. Measured values of Moran's I range from +1 to -1, indicating positive to negative spatial autocorrelation, respectively, and are compared against a null expected value of approximately 0, indicating no spatial autocorrelation.

[TABLE 1 HERE]

In Table 1, we find that the population density of Florida's 362,000 census blocks is positively and strongly spatially autocorrelated, with a Moran's I of +0.330 and a 99.9% confidence interval of +0.327 to +0.333. In other words, highly dense blocks in Florida tend to be geographically proximate to other densely populated blocks.

1.2 Population Density and the Spatial Correlation of Preferences

A second basic observation flowing from Tobler's Law is that the partisanship of individuals is not randomly distributed across geographic space. Geographers and political scientists have long observed that voters are clustered into neighborhoods with other individuals who display similar attitudes and behavior (Key 1949, Taylor and Johnston 1979, Huckfeldt 1979, Johnston 1992, O'Loughlin 2002, Klos 2008, Cho and Gimpel 2009). Social scientists have developed a wide range of arguments about the possible causal mechanism behind such "neighborhood effects," but given the difficulty of empirical identification, there is little agreement about the independent causal role for social context beyond individual-level characteristics in explaining attitudes and behavior (Durlauf 2004). Yet as a descriptive fact, the spatial dependence of political behavior is widely observed in practice. The key implication of Tobler's Law for our purposes is that political behavior is spatially dependent: the probability that two voters exhibit similar political preferences or behavior is a function of the distance between their residential locations.

To illustrate this phenomenon in Florida, we analyze a set of 190,694 randomly selected[2] voters who are registered as either Democrat or Republican affiliates. We geocode each of these voters' residential addresses, as illustrated in the map on Figure 1, with blue dots representing Democrat voters and red dots indicating Republicans. We use this spatial data in two ways to illustrate how Tobler's Law manifests in voters' partisan affiliations.

[FIGURE 1 HERE]

First, we analyze the likelihood that two voters share the same partisanship, given the geographic distance between them. To do this, we calculate the distance between each possible combination of two voters in our sample and determine if they share the same partisanship. The inset plot in Figure 1 summarizes the estimated results from a locally weighted regression: Two voters who are neighbors separated by approximately 0 miles have a 0.59 probability of having the same partisan affiliation. In contrast, voters who are separated by 5 miles in space have a 0.53 probability of sharing their partisanship. By 20 miles apart, this probability decreases and converges to 0.50. Beyond 20 miles, two voters are no more likely to share the same partisanship than if two random voters throughout Florida had been chosen. These results concretely illustrate the relevance of Tobler's Law with respect to voters' partisan preferences: Voters who are relatively closer in space are more likely to identify with the same party.

[2] Specifically, we searched through the Florida voter registration list for the November 2004 election and selected each individual whose date of birth falls on the 15th day of any month and who cast a ballot in November 2004. We include only those voters who identified as either a Democrat or a Republican on their registration forms.

A second, more succinct illustration of this phenomenon is Moran's I. As Table 1 reports, the partisanship of the registered Florida voters exhibits significantly positive spatial autocorrelation, with an estimated Moran's I between +0.0141 and +0.0145.

[FIGURE 2 HERE]

A straightforward extension of this result is that Tobler's Law manifests in election outcomes across space as well. We analyze two-party vote shares in the Bush-Gore Presidential election of November 2000 among Florida's 6,045 precincts, as Figure 2 illustrates. This map reveals that the most strongly pro-Gore precincts, shaded in dark blue, are tightly concentrated in space, particularly in the Miami-Fort Lauderdale region. As Table 1 reports, the Moran's I test statistic for precinct-level Bush vote shares is +0.220, with a 99.9% confidence interval of +0.215 to +0.224, confirming that voters' partisan election-day behavior exhibits high spatial autocorrelation.

The lumpiness of human settlement patterns, combined with the spatial correlation of preferences, yields a potentially important implication for the drawing of plurality electoral districts. If the correlation between the preferences of individuals is a function of the distance between their residential addresses, it follows that on average, when individuals (and in practice, precincts) are joined together to form electoral districts, densely populated urban districts will be more homogeneous than sparse rural districts where individuals live further apart from one another.

To illustrate this logic, we examine variation in the spatial autocorrelation of voting behavior across Florida's urban, suburban, and rural precincts by presenting results using Anselin's (1995) Local Indicators of Spatial Autocorrelation (LISA). We calculate a separate LISA for each Florida precinct. Intuitively, the LISA for precinct *i* measures the spatial autocorrelation exhibited by the precincts that are most geographically proximate to *i*. High values of LISA indicate significantly positive local spatial autocorrelation, while a negative LISA indicates negative autocorrelation . Formally, each precinct's LISA represents its relative contribution to the Global Moran's I statistic, calculated in Table 1 for all Florida precincts.

[FIGURE 3 HERE]

Figure 3 displays the LISA calculated for each of Florida's 6,045 precincts with respect to their 2000 Bush-Gore vote share. In this map, dark red areas indicate precincts of high local autocorrelation, while light-colored regions exhibit less significant local spatial autocorrelation, and blue regions exhibit negative local autocorrelation. The most striking pattern in this map is that the precincts with the highest positive local spatial autocorrelation are located around the urban cores of Miami and Fort Lauderdale. By contrast, most rural precincts throughout Florida tend to exhibit either no or insignificantly negative local spatial autocorrelation.

In other words, urban precincts are more likely to be closely surrounded by other precincts with similar levels of Bush support. We illustrate this urban-rural contrast more clearly in Figure 4, which plots the precinct-level LISA against the population density of each precinct. As population density increases, local spatial autocorrelation rises, and the most densely populated urban precincts have uniformly positive indices. Anticipating the discussion below, Figure 4 also uses blue, red, and purple dots to differentiate between Democratic, Republican, and moderate districts respectively, showing that virtually all of the high density districts with high local spatial autocorrelation are dominated by Democrats.

[FIGURE 4 HERE]

Why do precincts in rural areas exhibit less local spatial autocorrelation than urban precincts? Recall our earlier individual-level finding that neighboring voters are more politically similar, but voters exhibit no correlation in their partisanship once they are over 20 miles apart. This 20 mile threshold has implications when comparing urban to rural precincts. A voter who resides in urban Miami will find several hundred thousand other voters, and hence a large number of precincts, within a 20 mile radius, and the individual-level data suggest a high probability that these voters have similar preferences. Urban precincts, as a result, are surrounded by other urban precincts that exhibit relatively similar voting behavior. By contrast, a rural resident will find relatively few other voters and extremely few other precincts located within a 20 mile radius. When we take a rural precinct and examine the correlation between its voting behavior and that of its neighbors, we are including a rather small number of individual who live in close proximity to one another, and a large number of individuals who live more than 20 miles from one another. Following Tobler's Law, we should not be surprised to find that they are more heterogeneous.

1.3 Population Density and Political Preferences

A tight link between population density and local spatial autocorrelation of partisanship need not translate into electoral bias. It may be that each party has its own dense, homogenous cities of strength. Or if the underlying cause of global spatial correlation of preferences in the society has to do with residential sorting according to income, ethnicity, or political preferences themselves, it may be that *within* a single metropolitan area, each party has its own dense bailiwick, perhaps separated by a well-known railroad track or highway, and these offset one another such that neither party has a more concentrated support base than the other. For example, there may be high local spatial correlation of preferences for low taxes and votes for the right in wealthy neighborhoods, with a high local spatial correlation of preferences for high taxes and votes for the left in poor neighborhoods.

This is where our third observation, foreshadowed in Figure 4, becomes crucial. For a variety of reasons, population density itself is often correlated with salient political preferences and voting behavior. Rodden and Warshaw (2009) show that the correlation between population density and Democratic vote share in presidential elections has been positive throughout the postwar period in the United States, and it has only grown stronger in recent decades—a relationship that is only partially attributable to the concentration of African Americans in the wake of the great migration. One possible explanation for this pattern is that land is a normal good such that demand increases with income, and as a result, within metropolitan areas, the wealthy will tend to live in lower density than the poor.[3] Another set of arguments has to do with divisions between urban and non-urban voters on issues related to religiosity and traditional versus "cosmopolitan" social values, which have gained salience in United States elections since the 1980s. This explanation seems especially attractive in Florida, where the rise of such an issue dimension in recent decades has corresponded to an increasing correlation between population density and voting for Democrats.

[FIGURE 5 HERE]

Whatever the underlying reason, the relationship between population density and Democratic voting in recent decades is as striking in Florida as in other states. Figure 5 illustrates the urban concentration of left-wing support more clearly by plotting the Bush-Gore two-party vote against the population density of Florida precincts, making note of the precincts with the highest local spatial autocorrelation using red dots. The Democratic electoral base is highly concentrated in very densely populated precincts that tend to be locally spatially autocorrelated with respect to partisanship. Republican electoral support, by contrast, is located throughout a more heterogeneous range of rural and suburban precincts. This can also be visualized by referring back to Figure 2, which illustrates that the Democratic electoral base is generally found in urban areas, including Miami-Fort Lauderdale, Tampa-St. Petersburg, Orlando, and Tallahassee.

The central contention of this paper is that given this underlying geography, feasible districting plans relying on compactness and contiguity cannot help but generate the skewed distribution of support across districts that generate asymmetries in the translation of votes to seats. In fact, the inset kernel density in Figure 2 shows that the distribution of support for the two parties is

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[3] A related possibility is raised by Glaeser, Kahn, and Rappaport (2007) who argue that the economics of public transportation and automobile ownership lead to a clustering of the poor in American cities.

already quite skewed even at the precinct level. The tails of the distribution are especially interesting: while Bush received over 80 percent of the vote in only 80 precincts, Gore received over 80 percent in almost 800 precincts. This suggests that any scheme for drawing compact, contiguous districts is likely to create more surplus votes in the districts won by Democrats than those won by Republicans. The remainder of this paper examines this claim.

2. Automated Districting and Electoral Bias

Does the geography of voters' residential patterns, as described in the previous section, produce partisan electoral bias in geographically districted elections? In their classic paper, Kendall and Stuart (1950) demonstrate that partisans are typically distributed across districts such that the vote-seat curve will produce a substantial "winner's bonus," meaning that any vote share above 50 percent will produce a disproportionately larger seat share. Thus, in order to determine whether an electoral system systematically produces extra seats for one party or the other, scholars have tried to find ways of analyzing "hypothetical" elections in which the overall vote is split evenly between two parties. The traditional way to achieve this is to apply a "uniform swing" to all districts (Brookes 1959, Johnston, Rossiter, and Pattie 1999), and examine how many seats each party would win in the hypothetical tied election. Gelman and King (1991, 1994) introduce a Bayesian technique making use of past elections and other district-level covariates to simulate hypothetical elections with an even vote split without relying on the blunt assumption of a uniform swing.

A key advantage of the Gelman-King approach is that it allows for the simulation of hypothetical elections in which all seats are contested and no incumbents are running. These issues are quite important in Florida legislative elections, where incumbents often go unchallenged. In fact, in the state House, somewhere between one third and half of all seats are contested, and under Florida election law, no general election is held in uncontested seats. Thus any measure of electoral bias based on actual legislative election results, no matter how sophisticated, would require the analyst to conjure up a substantial amount of data. For our purposes, an even bigger problem with the use of district-level election results is the confounding fact that politicians drew the districts, and there is a strong presumption in academic and popular discussions that any observed bias was actually the result of creative cartography rather than the basic facts of electoral geography outlined above.

Thus, we take a unique empirical approach to the analysis of electoral bias. Rather than using district-level information to simulate hypothetical tied elections, we use precinct-level data from an election that was almost an exact tie: Florida's November 2000 presidential election. To illustrate the districting patterns that arise as a result of the urban concentration of left-wing voters, we perform a large number of automated, computer-based simulations of legislative districting plans. Our computer simulations construct these districting plans in a random, partisan-blind manner, using only the traditional districting criteria of equal apportionment and geographic contiguity and compactness of single-member legislative districts. For each of these simulated districting plans, we calculate the Bush-Gore vote share of each single-member district, and we use this vote share to predict whether the district would have been a Democratic or Republican seat.

Because of the virtual 50-50 Bush-Gore tie in Florida, an unbiased partisan division of Florida's legislative seats would result in approximately 50% of the seats being Republican, defined as any seat having a pro-Bush majority. In other words, we are using the distribution of Bush-Gore (Republican-Democrat) vote shares across the simulated Florida districts as a measure of electoral bias.

In our automated districting simulations, we show that, despite the 50-50 split of the two-party vote statewide, Republicans (Bush voters) actually win well over 50% of the seats in the average districting plan. We repeat these simulations for a very wide range of legislative sizes. For any reasonably-sized legislature – i.e., any legislative size that might be observed in real life – we observe a significant pro-Republican electoral bias in the distribution of legislative seats. For example, when we simulate districting plans in which Florida is divided into 100 single-member districts, Republicans (Bush voters) win an average of 58 legislative seats.

We are certainly not the first to use automated districting algorithms to examine partisan bias. In fact, in the 1960s there was a brief burst of enthusiasm for automated districting as a potential solution to the problem of partisan gerrymandering (Vickrey 1961, Weaver and Hess 1963, Nagel 1965). Our work builds directly on the recent work of Cirincione, Darling, and O'Rourke (2000), who developed a GIS-based approach to automated districting, and Altman and McDonald (2009), who have developed sophisticated and flexible open-source districting tools using geographic information systems. Districting simulations have also been used by McCarty, Poole, and Rosenthal (2009) to examine whether districting generates partisan polarization.

In this section, we first describe our algorithm for automated districting, and describe how we operationalize the traditional, partisan-neutral, geography-based criteria for drawing legislative districts. We then illustrate the results of the simulations, calculating the distribution of Bush-Gore support across the newly drawn districts. Next, we demonstrate how these results flow from the logic laid out above. Finally, we illustrate that these simulation results generalize even when we use other election results rather than the November 2000 Bush-Gore contest.

2.1 The Automated Districting Algorithm

As of the November 2000 election, Florida consists of 6,045 voting precincts. These precincts are the smallest geographic unit at which election results are publicly announced, so we use the precinct as the building block for our simulations. Hence, a complete districting plan consists of assigning each one of Florida's precincts to a single legislative district. Florida voters cast 5.96 million Presidential election ballots in 2000, so the average precinct cast a total of 986 presidential votes.

We perform our automated simulations using the legislative districting algorithm presented by Cirincione, Darling, and O'Rourke (2000). These authors performed computer simulations of

South Carolina's congressional districting to show that the state's actual redistricting plan exhibited significant racial gerrymandering. More importantly, for our purposes, Cirincione et al. (2000) show that their districting algorithm guarantees equal apportionment of population across all legislative districts while substantially achieving geographic contiguity and compactness for nearly all simulated districts. Furthermore, these simulated districts are drawn without regard to either voter partisanship or any demographic information other than simple population counts. Hence, the simulation algorithm is designed to be a partisan-neutral and race-blind districting process, using only traditional geographic criteria.

We implement's Cirincione et al.'s (2000) automated districting algorithm as follows: Suppose we wish to divide Florida into *m* number of single-member legislative districts, where $m \geq 2$. First, we select one precinct at random and assign it to the first district. Next, we randomly select and add one of the precincts that borders the initially-chosen precinct. We continue building up this first district by adding more bordering precincts until the emerging district contains $1/m^{th}$ of the state's total population. Before we add each additional precinct, however, we first construct the smallest bounding box[4] that encloses all of the existing precincts of the emerging district. When randomly selecting the next precinct for the district, we first randomly choose among those bordering precincts that are already located within the bounding box. Only if the bounding box contains no unassigned precincts do we randomly select among bordering precincts located outside of the box.

Once the first district is fully apportioned, we begin construction of the second district by randomly selecting a precinct among those bordering the first district. The identical process begins

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[4] Specifically, the bounding box is defined by the four directional (ie, east, north, etc.) extremes among the centroids of the precincts already assigned to the district.

anew, except that precincts assigned to the first district cannot be assigned to any further districts. We repeat this process until all m districts have been fully constructed.

Our use of precincts as the building blocks of districting plans introduces the possibility of slightly over or under-apportioned districts, and we address this problem by introducing a simple assumption allowing our simulation algorithm to split precincts. Suppose that an emerging district is currently just below the target population size – that is, it contains just under $1/m^{\text{th}}$ of the state's total population. But the addition of one new precinct would increase the district's population well over the target size. To remedy this problem, we split up the new precinct by assigning just enough randomly selected voters from the precinct to our emerging district. The remaining unassigned voters are grouped together as a precinct to be assigned to a later district. Hence, in implementing this remedy, we are effectively assuming that all voters within a precinct are geographically contiguous with one another. This remedy also allows us to simulate districting plans that contain more districts than the total number of precincts in Florida.

Once we have divided all of Florida up into m districts, the districting simulation is complete. After completing this districting simulation, we aggregate the precinct-level Bush-Gore vote counts within each district, and determine whether each of the m districts is a Republican (pro-Bush) or a Democratic (pro-Gore) seat.

We repeat a simulation of this sort for many different hypothetical legislative sizes, ranging from a legislature of two districts to a legislature of 100,000 districts. For each legislative size, we repeat the simulation procedure 200 times, constructing an independent districting plan each time. For example, we conduct 200 independent simulations dividing Florida into 100 districts; hence, this set of simulations constructs a total of 20,000 districts, of which 11,506 (57.9%) are Republican seats.

To evaluate the accuracy of our simulation procedure, we conduct the same set of Florida districting simulations using the Better Automated Redistricting software created by Altman and

McDonald (2009), which includes an implementation of the Cirincione et al (2000) algorithm. Using the Altman and McDonald software for districting plans in which Florida precincts were combined into a reasonable (2 to 200) number of districts, we obtained results that were virtually identical to those reported below.

2.2 Simulation Results

[FIGURE 6 HERE]

Our simulations reveal significant pro-Republican bias in the partisan distribution of seats in any realistically sized legislature; that is, significantly over one-half of the legislative seats have Republican majorities. Figure 6 summarizes the distribution of seat shares produced under our simulations. In this figure, the horizontal axis represents the number of single-member districts in each simulated plan. The vertical axis reports the average percentage of these districts that have Republican majorities. For each different hypothetical legislative size, the dot represents the mean, district-level Bush vote share across the simulated districts, and the vertical line represents a 95% confidence interval. The Figure illustrates, for example, that when we conducted 200 independent simulations of dividing Florida into 100 districts, Republicans won an average of 57.9% of the seats, with a confidence interval of 57.2 to 58.6%. Overall, this plot illustrates the significant pro-Republican bias that results from the districting of the legislature based solely on the traditional principles of geographic contiguity, compactness, and equal apportionment.

[FIGURE 7 HERE]

Why does this significant pro-Republican bias arise in our districting simulations? Figure 7 illustrates the distribution of district-level Bush vote shares that emerges when we repeatedly simulate dividing Florida into 10 districts. This histogram, reminiscent of the distribution across precincts in Figure 2 above, reveals that Republicans win well over one-half of the seats because of the pattern we described earlier: Democratic voters tend to be clustered in heavily left-leaning precincts, so the Democratic party's electoral base is concentrated in a relatively smaller number of urban-based districts. The Republicans' electoral base, by contrast, is geographically spread throughout the moderately right-leaning hinterlands. As a result, for most reasonable legislative sizes, the distribution of seats across the state consists of a large number of moderately Republican districts in the rural and suburban areas and a relatively smaller number of more extreme Democratic, urban districts. Too many left-wing voters are wasted in urban, landslide Democratic districts, so the overall seat share across the state favors the Republicans.

Specifically, the plot in Figure 6 details how this pro-Republican bias increases as the legislature grows in size from two to eight districts. A legislature consisting of only two single-member districts will always have exactly one Democratic and one Republican seat, a result that follows naturally from Florida's 50-50 Bush-Gore vote share. But as the legislature grows in size, the partisan division of legislative seats begins to favor the Republicans. When the simulated legislature has eleven seats, Republicans win an average of nearly 66% of the districts.

As the size of the legislature increases beyond eleven seats, the Republican seat share slowly declines, but Republicans always continue to control over one-half of the total seats. In fact, this pro-Republican bias never fully disappears until the size of the simulated legislature becomes unrealistically large. As the hypothetical legislature grows in size to several million seats in size, we approach the equivalent of a direct democracy in which each voter represents only himself or herself in the legislature. In such a direct democracy, the partisan seat share will be identical to the underlying population's overall partisanship by definition. Our simulation results in Figure 6 reflect this approach toward direct democracy as the hypothetical legislature becomes extremely large: As the simulated legislature grows to several thousand districts, the pro-Republican bias begins to disappear, and the Republican share of total legislative seats approaches 50%.

Nevertheless, for any districting plan of realistic size, the pro-Republican bias exhibited in our simulations is significant. Florida's state Senate and House chambers consist of 40 and 120 single-member districts, respectively, and the Congressional delegation is divided among 25 districts. Our simulations demonstrate that for these legislative sizes, Republicans should control an average of 58-61% of the seats statewide. The confidence intervals for these estimated average seat shares rule out the null hypothesis of no electoral bias.

2.3 Tobler's Law Revisited

How does Tobler's Law cause Republicans to win such a disproportionate share of these 25 districts? Figure 8 illustrates why the urban concentration of left-wing support hurts the Democratic Party in districting plans. In Figure 8, we analyze the results of 200 independent random simulations in which Florida was divided into 25 districts.

[FIGURE 8 HERE]

Each plotted point in Figure 8 represents one of Florida's 6,045 precincts, and we plot high, medium, and low density precincts separately, referring to them loosely as urban, suburban, and rural. For each plotted point, the horizontal axis measures the partisanship of the precinct, as measured by Bush-Gore vote share in November 2000. The vertical axis measures the average partisanship of the 200 simulated districts to which the precinct was assigned during our simulations.

Overall, these plots show a generally positive correlation between the partisanship of a precinct and the partisanship of the precinct's legislative district. In other words, pro-Bush precincts are typically assigned to pro-Bush districts. In particular, the plots reveal that pro-Bush precincts in rural and suburban regions are almost always assigned to pro-Bush districts. Yet this correlation is much weaker for left-wing precincts in rural and suburban areas.

In the top and middle plots that focus on lower-density areas, left-wing precincts tend not to be assigned to equally left-wing districts. Instead, the plots reveal that most of the heavily pro-Gore precincts in suburban and especially rural areas are actually assigned to moderately Republican districts. That is, rural and suburban Democratic voters are very likely to find themselves in majority-Republican districts.

How does Tobler's Law cause this misalignment between Democratic voters and their legislators in the hinterlands? Recall our finding that the positive spatial autocorrelation of voters' preferences extends only about 20 miles; voters separated by over 20 miles of distance do not have correlated political preferences. Because of the relatively sparser populations of rural and suburban regions, left-wing voters in the hinterlands have fewer neighbors within a 20-mile radius. Consequently, rural and suburban legislative districts tend to be larger in geographic area than urban districts, in many cases extending beyond any voter's 20-mile radius. Hence, in legislative districting, left-wing voters in the hinterlands are likely to be grouped together with more conservative voters from over 20 miles away. At such a distance, voters' preferences are not spatially autocorrelated, so non-urban left-wing precincts tend not to be districted together with other similarly left-wing neighborhoods.

Instead, as Figure 8 reveals, left-wing precincts in the hinterlands are most often assigned to moderately Republican districts. These hinterland districts are moderately Republican because Florida, like most other states, has generally experienced overall conservative-party electoral dominance in its rural and suburban regions. Outside the urban centers, pockets of left-wing voters in college towns, blue collar suburbs, or clusters associated with unionized industrial activity, are surrounded by larger populations of Republicans. Hence, the Democrats hardly ever win legislative districts in the hinterlands, given that Republicans outnumber Democrats in rural and suburban Florida. In this sense, a rather large number of Democratic votes in the hinterlands are wasted because they are insufficiently geographically concentrated to win a proportionate share of hinterland legislative districts.

By contrast, note that Democratic voters in cities are in fact paired with other Democrats. The bottom plot in Figure 8 illustrates that pro-Gore precincts in urban areas are generally assigned to solidly Democratic districts during our simulations. Because of Tobler's Law, left-wing urban voters are surrounded by many other voters within a 20-mile radius with spatially autocorrelated political preferences. In other words, due to the relatively high population densities of cities, left-wing urban Democrats are surrounded by many more nearby Democrats with whom they share a legislative district. Hence, in contrast to the hinterlands, there is no electoral misalignment between urban Democratic voters and their elected legislators. To the contrary, we see a rather large number of precincts in the extreme lower left corner in urban areas, and we see far fewer extreme observations in the upper right corners of the plots for suburban and rural areas. This indicates that Democrats not only waste more votes in the districts they lose, but they also rack up more surplus votes in the districts they win. These two phenomena explain the rather extreme pro-Republican bias indicated by our simulations.

2.4 Simulations Using Alternative Elections

A possible concern with our simulations is that, for a variety of reasons, Bush-Gore vote shares from November 2000 may not be an accurate measurement of voter preferences among Florida's voting precincts. One reason for this suspicion is that the two parties may have employed geographically asymmetric campaign strategies in 2000; for example, perhaps the Democrats targeted urban voters, while the Republicans targeted the hinterlands. Another reason for suspicion is that in November 2000, various non-presidential elections, such as local and Congressional races, may have affected voter turnout differently in Republican and Democratic regions of Florida. Moreover, we wish to make inferences about causes of electoral bias in state legislative elections, and it is possible that presidential vote shares are of limited value if the state party system is sufficiently distinctive from the national party system.

To address these and other concerns about the possible uniqueness of the 2000 election, we show that our simulations produce a similar pro-Republican bias when we use alternative election results from different years and offices to measure the partisanship of simulated districts. Specifically, we re-conduct our legislative districting simulations using election results from the following Florida statewide races: 1) The 1992 Presidential election between Democrat Bill Clinton and Republican George Bush; 2) The 1994 Gubernatorial election between Democrat Chiles and Republican Jeb Bush; 3) the 1998 Gubernatorial race between Democrat MacKay and Republican Jeb Bush; and 4) the 2000 U.S. Senate race between Democrat Nelson and Republican McColumm. We choose these four races because in each election year from 1992 to 2000, these are the four races that produced the closest to a 50-50 split of the statewide two-party vote share. It is noteworthy that three of these are for statewide offices, and two are gubernatorial elections. Using each of these four sets of election results, we conduct a new set of 200 random districting simulations for each of a wide range of legislative sizes.

Overall, these new simulations, displayed in Appendix A, reveal a pattern of pro-Republican bias that is comparable to the electoral bias we find in Figure 6. In each election, for any reasonable legislature size, the Republicans win significantly more than 50% of the simulated legislative seats, even though the underlying two-party split in each of the four elections is close to 50-50.[5]

3. Electoral Bias in Florida

Another potential critique of our approach is that no matter which statewide elections we choose, examination of hypothetical districts in such races does not capture the dynamics of campaign strategies, advertising, candidate recruitment, and other factors that might be unique to

[5] Note that some of the differences in estimated bias across elections can be explained by deviations in the overall two-party vote from 50 percent. For example, the estimated bias is unusually large in 1998 in large part because Jeb Bush won by a comfortable margin.

legislative races that take place in geographic districts. For this reason, it is useful to compare our simulation results to measures of electoral bias obtained directly from district-level results of elections to the state house, senate, and U.S. Congress.

Using district-level election results, we use the approach of Gelman, King, and Thomas (2008) to simulate a range of hypothetical tied elections to the state House and Senate, as well as the Florida delegation to the U.S. Congress between 1992 and 2008. In conducting the analysis, we have aggregated precinct-level results of U.S. Senate, presidential, and gubernatorial elections to the level of state and Congressional legislative districts. These precinct-level results, along with district-level results of past legislative elections (within each redistricting cycle) and whether or not an incumbent is running in each district, serve as covariates in this analysis. From these simulated elections, we calculate the average electoral bias for each election, which can be interpreted as the "extra" seat share beyond .5 that a party can expect in a hypothetical tied election. The results are displayed in Figure 9, where negative numbers indicate pro-Republican bias.[6]

[FIGURE 9 HERE]

The estimates must be approached with caution due to the prevalence of uncontested seats and dominant incumbents, but they indicate a large and growing pro-Republican bias in each legislative body. The pro-Republican bias has averaged around 10 percent in the Florida House and Senate and 18 percent in elections for the Florida Congressional delegation. These estimates are in

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[6] In years ending in two (after redistricting), all Florida Senate districts are up for election. Otherwise, odd numbered districts face elections in presidential years, and even numbered districts face elections during non-presidential years. We aggregate over the "split" elections and display the estimated bias in Figure 9 to correspond with the year of the second election (e.g. 2004-2006 are displayed as 2006).

line with those arising from our automated districting simulations for legislatures of size 120, 40, and 25 in Figure 6 above and in the appendix.

In the Florida House of Representatives, the estimated bias displayed in the early 1990s, while statistically distinguishable from zero, is somewhat small relative to the automated districting simulations that used aggregated results of statewide and presidential elections. To understand this, we have also calculated electoral bias by applying the Gelman, King, and Thomas technique to each year's presidential, U.S. Senate, and gubernatorial elections aggregated to the level of electoral districts. For each chamber, these estimations produce measures of electoral bias in the early 1990s of approximately 9-10 percent. As with Figure 9, this bias is also increasing over time.

The most likely explanation for lower estimates of pro-Republican bias in the early 1990s in the Florida legislature lies in the ongoing realignment of the Florida party system that started in the 1980s (Beck 1982). From the perspective of the ideological battles generated by the New Deal, racial politics, along with Key's (1949) characterization of Florida's tendency toward "atomized," issue-free elections, generated a lingering mismatch between ideology and partisanship among Florida voters. This mismatch survived into the 1980s but then gradually faded away, first in presidential elections, and then more slowly in House, Senate, and then state elections. The typical Southern realignment pattern, perhaps combined with immigration, led to a substantial change in the political geography of Florida. The precinct-level correlation between population density and Democratic vote share has increased steadily over the last two decades.

Largely because of the persistence of conservative Southern Democrats, the district-level correlation between the Democratic vote share in statewide and legislative elections was only around .6 in 1992, but it grew to almost .9 by 2000. As a result, the estimates of electoral bias obtained with district-level election results, and those obtained by analysis of district-level tallies of statewide and presidential votes, begin to look very similar by the end of the 1990s. Moreover, Figure 9 demonstrates that the trend has been toward increasing pro-Republican bias. The most likely explanation lies in the fact that, as in other states, the correlation between population density and Democratic voting has continued to increase during this period. We can only speculate about the reasons, but one possibility is that this correlation reflects the increasing electoral salience of issues related to religion and moral values.

Another possible explanation, of course, is partisan gerrymandering by the Republicans in the 2002 redistricting process. It is entirely possible that a substantial share of pro-Republican bias after the 2000 census was driven by gerrymandering. Indeed, it is worth noting that the estimated bias indicated in Figure 9 using actual districts over the last decade is larger than the bias uncovered in our simulated districting exercises, and gerrymandering is the most obvious explanation for the discrepancy. On the other hand, Figure 9 does not indicate a clear discontinuity in 2002, except perhaps in the state house, and pro-Republican bias in all three chambers was already quite large and trending larger under the court-imposed plan of 1992, when Florida had a Democratic governor and Democratic majorities in both houses of the state legislature. Hence, these results do not conclusively indicate whether partisan gerrymandering exacerbated the pro-Republican bias resulting naturally from the residential geography of voters.

4. Conclusion

This paper has demonstrated that in contemporary Florida, partisans are arranged in geographic space in such a way that virtually any districting scheme favoring contiguity and compactness will generate substantial electoral bias in favor of the Republican Party. This result is driven largely by the partisan asymmetry in voters' residential patterns: Since the realignment of the party system, Democrats have tended to live in dense, homogeneous neighborhoods that aggregate into landslide Democratic districts, while Republicans live in more sparsely populated neighborhoods that aggregate into geographically larger and more politically heterogeneous districts. This phenomenon appears to substantially explain the pro-Republican bias observed in Florida's recent legislative elections.

Our findings do not conclusively demonstrate whether intentional gerrymandering occurs or produces important partisan effects. In a related literature, scholars have taken sharp positions in favor (e.g. Crespin et al. 2007) and against (Abromowitz, Alexander, and Gunning 2006, Mann 2007, McCarty, Poole, and Rosenthal 2009) the hypothesis that gerrymandering affects polarization in the House of Representatives, and scholars have also examined the impact of gerrymandering on the incumbency advantage (Friedman and Holden 2009). Our results cannot be interpreted as evidence against the importance of intentional gerrymandering in Florida or elsewhere. Rather, our results caution against the temptation to conflate observed electoral bias with intentional gerrymandering. We show that in a state like Florida, the Republicans benefit from substantial electoral bias even if they cede control of the districting process altogether and place it in the hands of computer algorithms or independent boards, so long as these "apolitical" district-drawers ignore political or demographic data and simply draw compact, contiguous districts. The best hope for Democrats to reclaim the Florida Congressional delegation or state legislature is to insist on a districting scheme that minimizes the importance of compactness. In fact, the only way for Democrats to obtain a seat share that approximates their vote share in Florida would be to strategically draw long, narrow districts shaped like pie slices emanating from downtown Miami and Tampa into the suburban and rural periphery.

Although presidential and statewide elections have been quite close over the last decade, the Republicans have consistently controlled between 60 and 70 percent of the seats in the state legislature and U.S. Congressional delegation. Beyond the electoral bias in the transformation of votes to seats that we illustrate in this paper, Ansolabehere, Leblanc, and Snyder (2005) describe another, more subtle impact of the asymmetric distribution of partisans across districts. It is conceivable that because of the extent to which liberals are packed into urban districts, the

Democratic platform, or at least its perception by Florida votes, is driven by its legislative incumbents—a small group of leftists from Miami-Dade and Broward counties who never face Republican challengers—which in turn makes it difficult for the party to compete in the crucial moderate districts. This hypothesis may help to explain why the Democrats consistently receive higher vote shares in presidential than in state races.

It is striking that political geography can turn a party with a persistent edge in statewide registration and presidential voting into something approaching a permanent minority in legislative races. Although unlikely, it is possible to imagine that a future Supreme Court might entertain the notion that this situation reaches the rather high bar for justiciability of partisan gerrymandering laid out in *Davis v. Bandemer* (1986), where a gerrymander must be shown to have essentially locked a party out of power in a way that frustrates "the will of the majority." The recent opinions of the pivotal justices, however, betray a notion that a claimant would need to demonstrate that an "egregious" gerrymander is intentional. The key finding of this paper is that dramatic partisan asymmetries in expected seat shares with 50 percent of the vote naturally arise under traditional districting criteria without any partisan manipulation.

Our simulations from Florida elections underscore the practical importance of distinguishing between electoral bias resulting from residential patterns and bias resulting from the intentional placements of boundaries (Gudgin and Taylor 1979, Wildgen and Engstrom 1980). From a normative perspective, it is quite reasonable to argue that the former is just as troubling as the latter. Yet curiously, reform advocates—many of them Democrats—have assumed that the problem with partisan bias lies in the manipulation of maps by strategic politicians. As a result, rather than advocating reforms that would explicitly require partisan symmetry in the translation of votes to seats (see, e.g. King et al 2006, Hirsch 2009), they have pushed for reforms that would outlaw the use of political or demographic data and place districting powers in the hands of experts or computer programmers with a mandate to produce compact, contiguous districts that respect municipal boundaries and maintain "communities of interest." Perhaps because it can be measured, like equal population standards in controversies about malapportionment, compactness is an appealing standard for reformers. Yet the idea that compactness is an indication of fairness was debunked long ago (Dixon 1968). Our results suggest that these seemingly apolitical districting criteria would perpetuate rather than ameliorate electoral bias.

Finally, the key question left unanswered by this paper is whether Florida is an outlier. A worthy goal for future research is to apply the techniques developed in this paper to a large number of states in order to assess the prevalence of natural Republican bias and the conditions under which it is most acute. Preliminary analysis suggests that a similar pattern prevails in recent elections in much of the upper Midwest and Northeast, where Democrats are highly concentrated in dense, homogeneous cities, and Republicans maintain modest majorities in more heterogeneous suburbs, towns, and rural areas. In fact, while this geographic pattern has emerged only recently in the South, it has existed at least since the New Deal in the Northeastern manufacturing core (Fenton 1966). Future researchers might use precinct data to simulate baseline compact, contiguous districts and contrast these simulations with observed legislative results using actual districts. Such work would yield further insight into the distinction between observed electoral bias measured using traditional techniques and the "latent" bias lurking in the distribution of partisans across precincts and, in so doing, help to identify instances of successful cartographic manipulation.

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Table 1: Global Moran's I Test Statistics

Variable	Unit of Analysis	N	Moran's I	99.9% Confidence Interval
Party Affiliation of Registered Voter	Individual Voter	190,694	+0.014323	[0.0141, 0.0145]
Population Density	Census Block	362,499	+0.330453	[0.3274, 0.3335]
Percentage of Voters Registered as Republicans	Precinct	6,045	+0.228371	[0.2238, 0.2330]
Bush Vote Share	Precinct	6,045	+0.219778	[0.2152, 0.2244]

Note: Measured values of Moran's I range from +1 to -1, indicating positive to negative spatial autocorrelation, respectively. The expected value of Moran's I under the null hypothesis, indicating no spatial autocorrelation, is slightly below zero.

Figure 1: Tobler's Law and the Residential Locations of Florida Voters

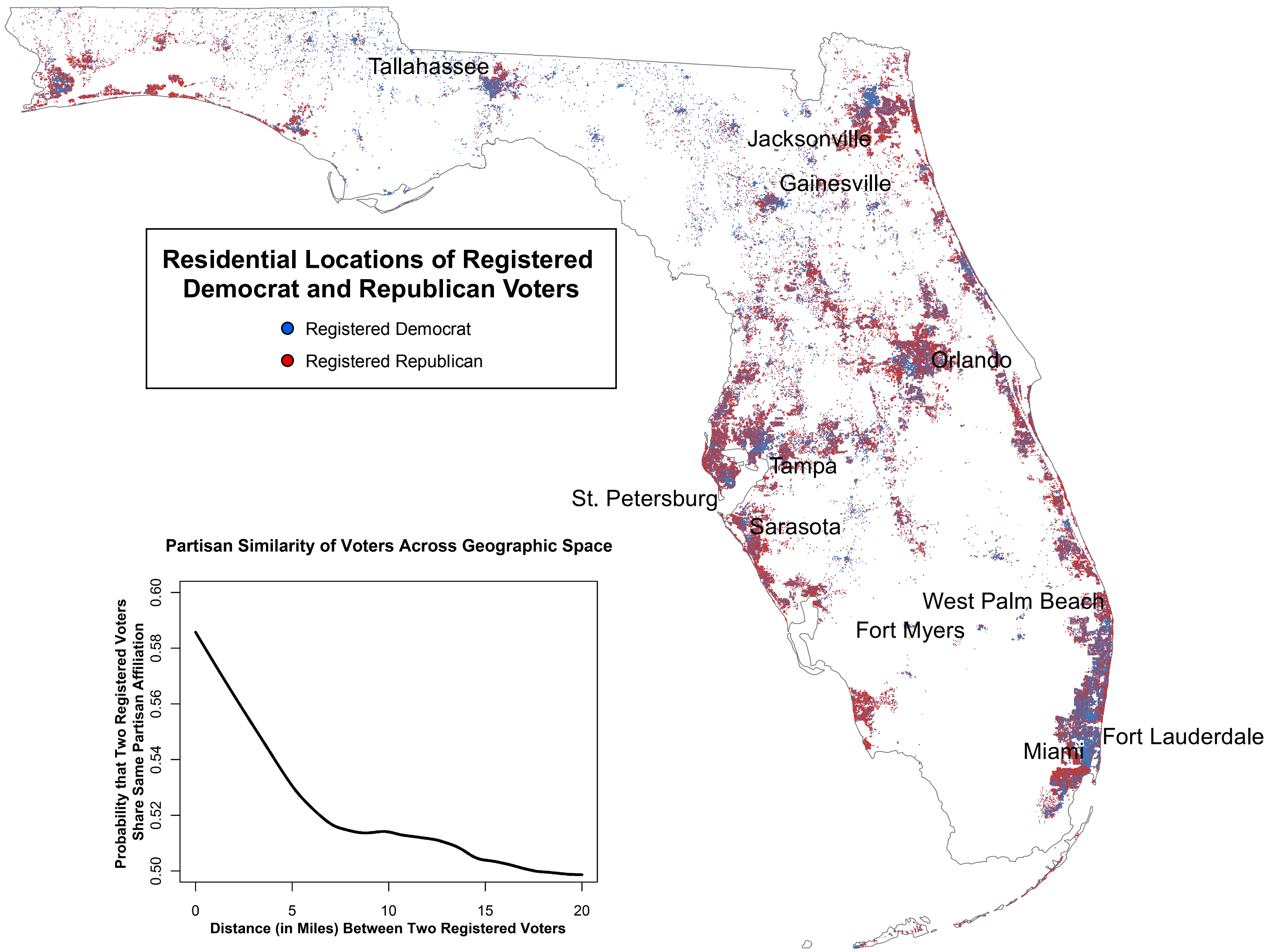


Figure 2: The Distribution of Partisanship Across Florida Voting Precincts

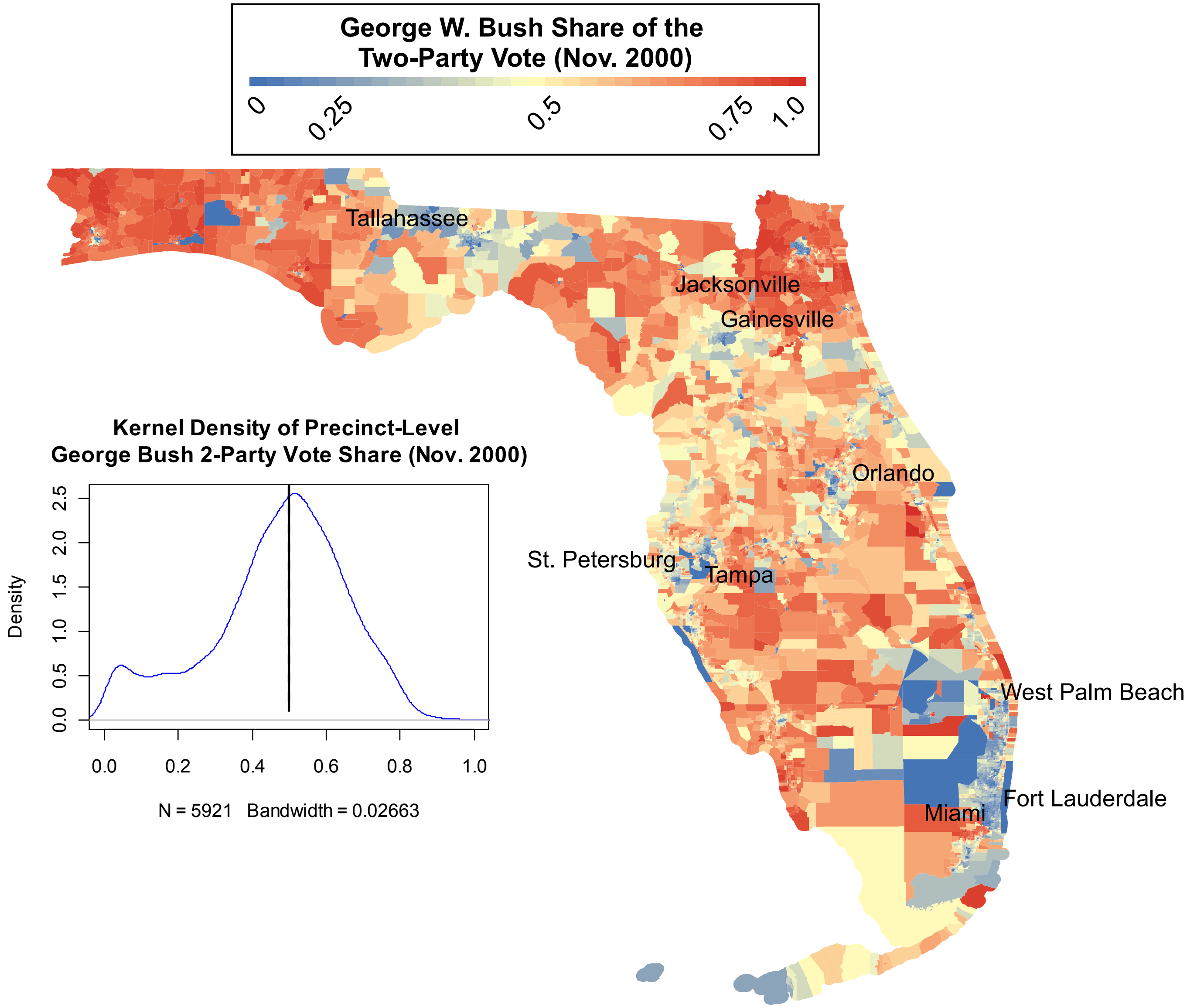


Figure 3: Local Spatial Autocorrelation of Voter Partisanship Across Florida

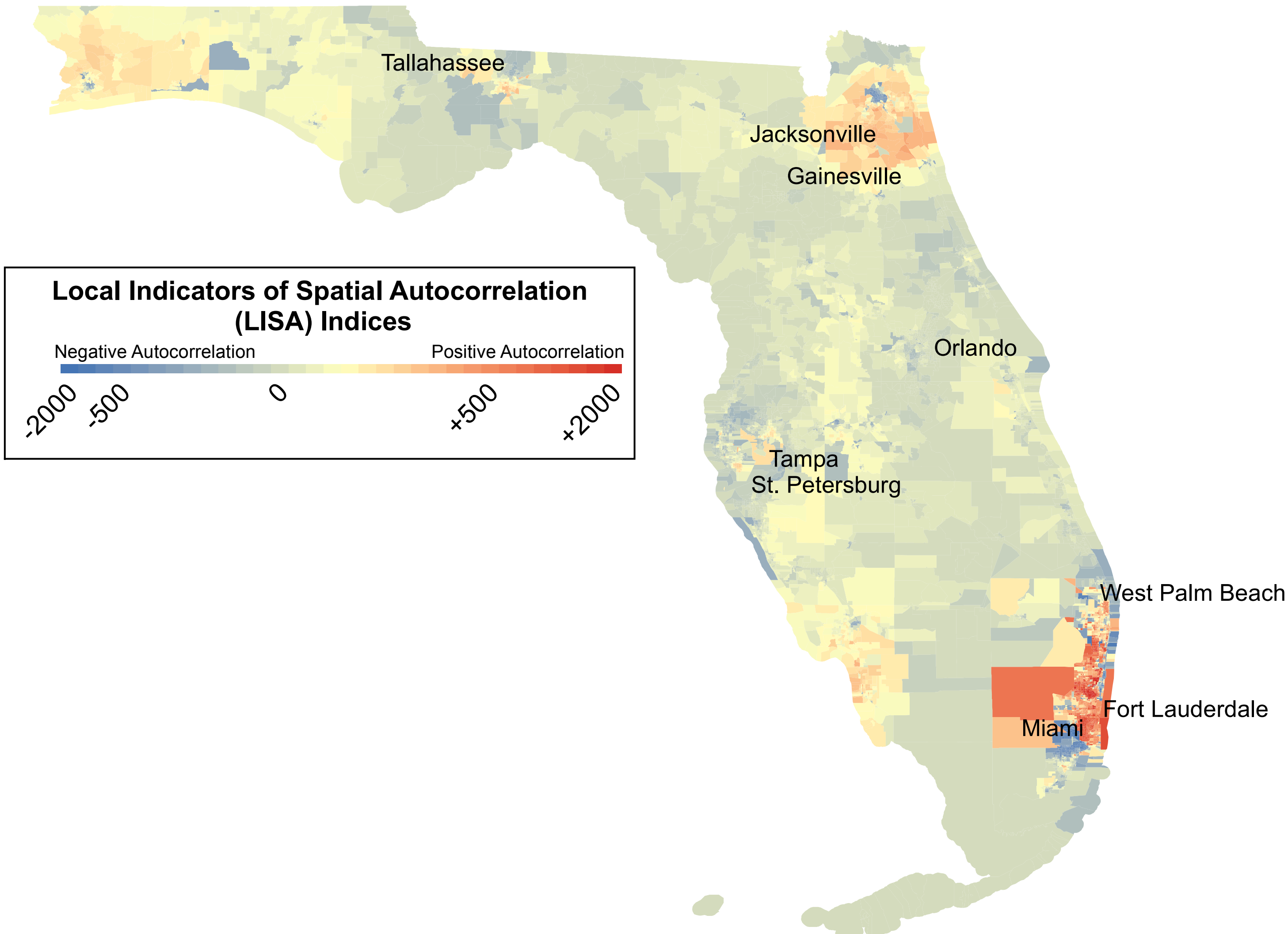


Figure 4: The Local Spatial Autocorrelation of Voter Partisanship by Population Density

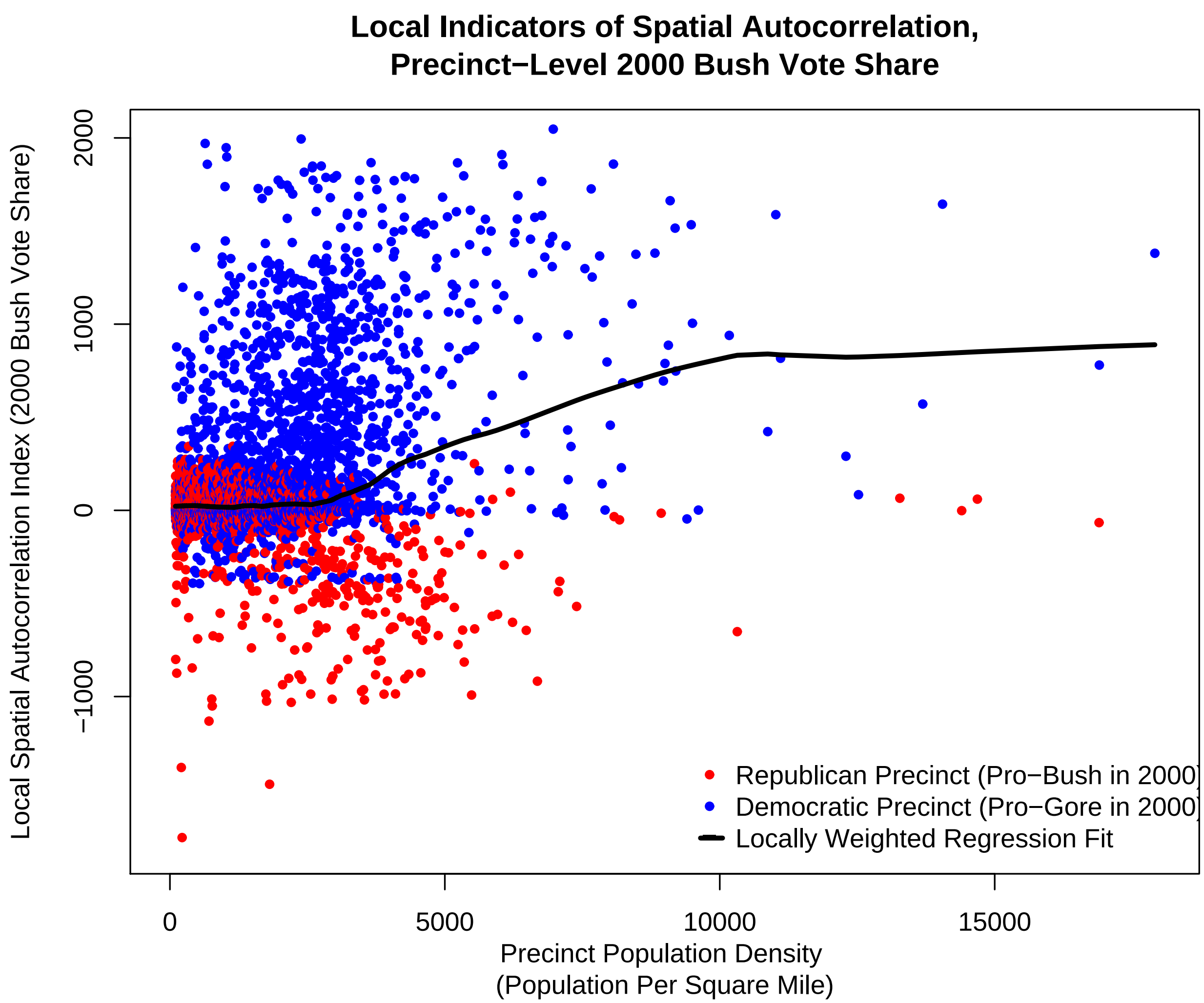


Figure 5: The Partisanship of Florida Voters by Population Density

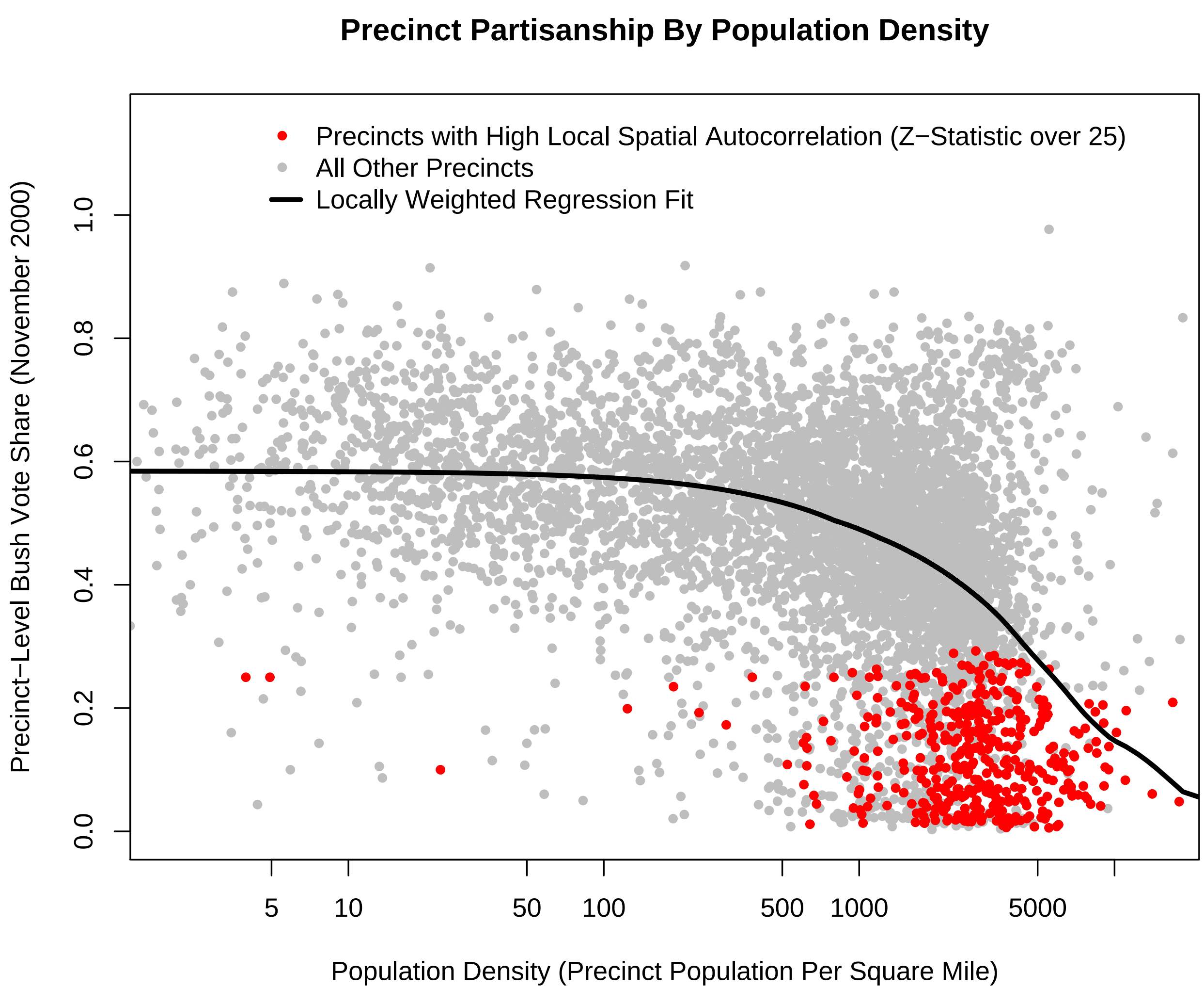


Figure 6: Results of Districting Simulations Using 2000 Bush-Gore Vote Counts

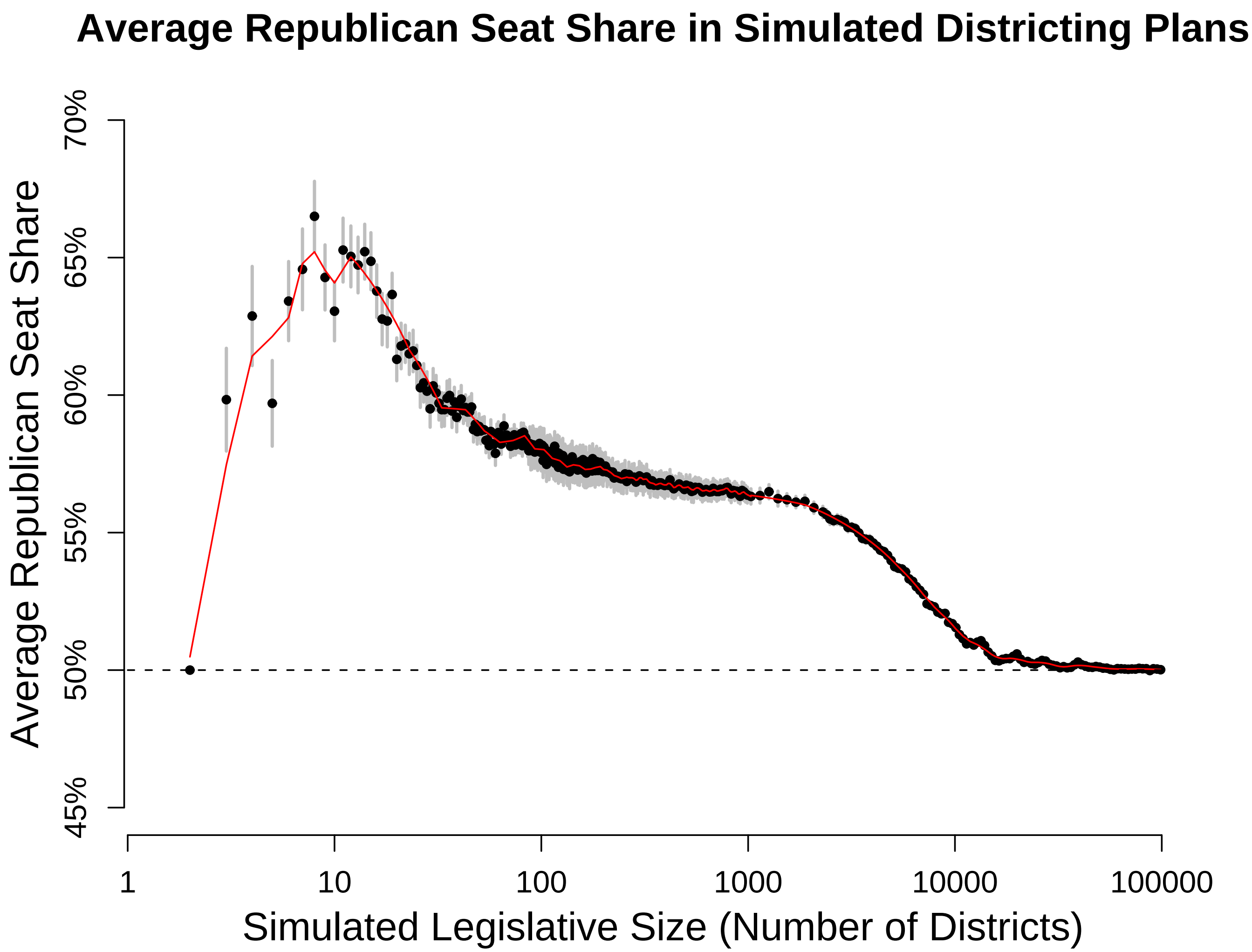


Figure 7: The Partisanship of Districts Created by Random Simulations

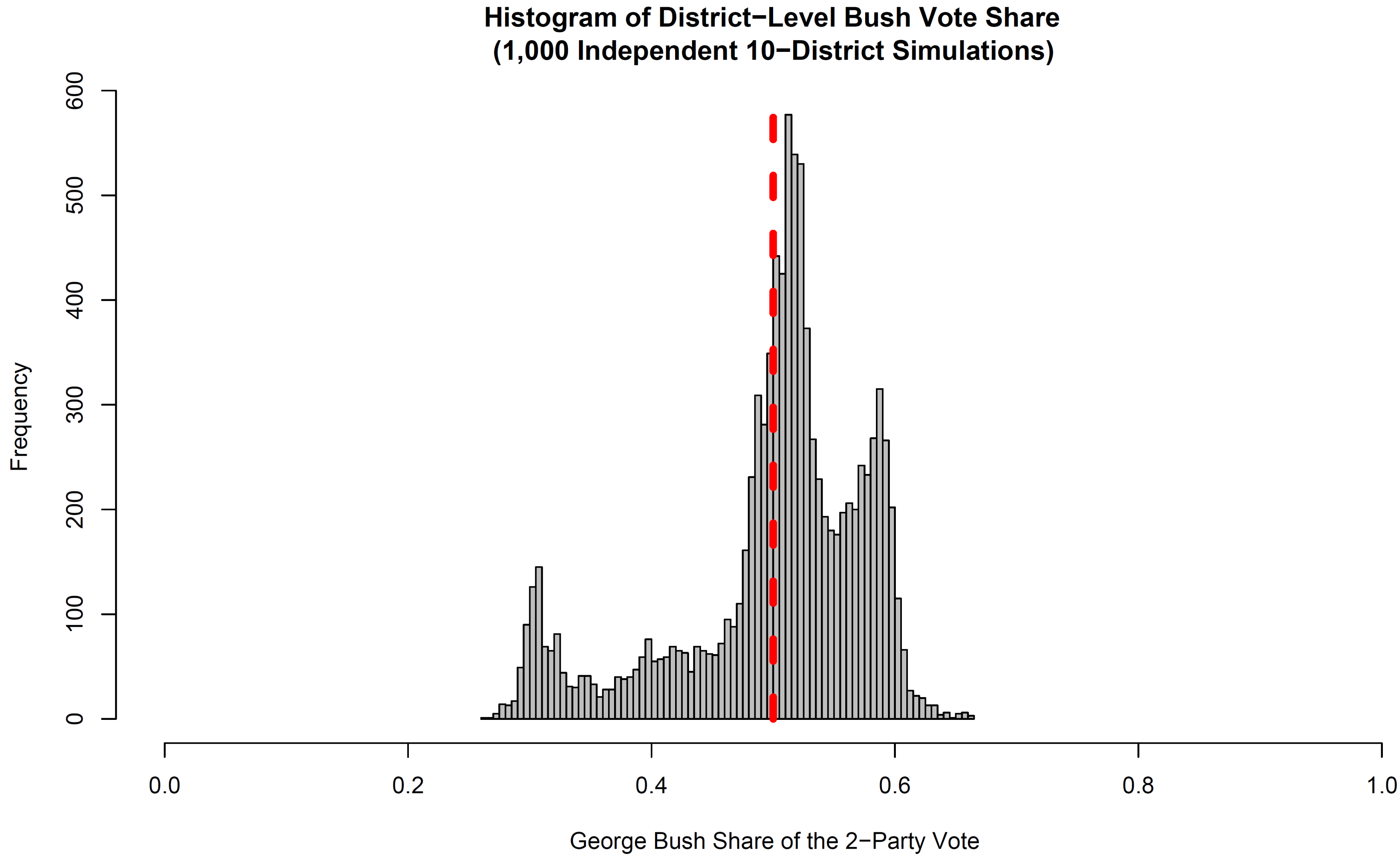


Figure 8: The Partisanship of Precincts' Assigned Districts

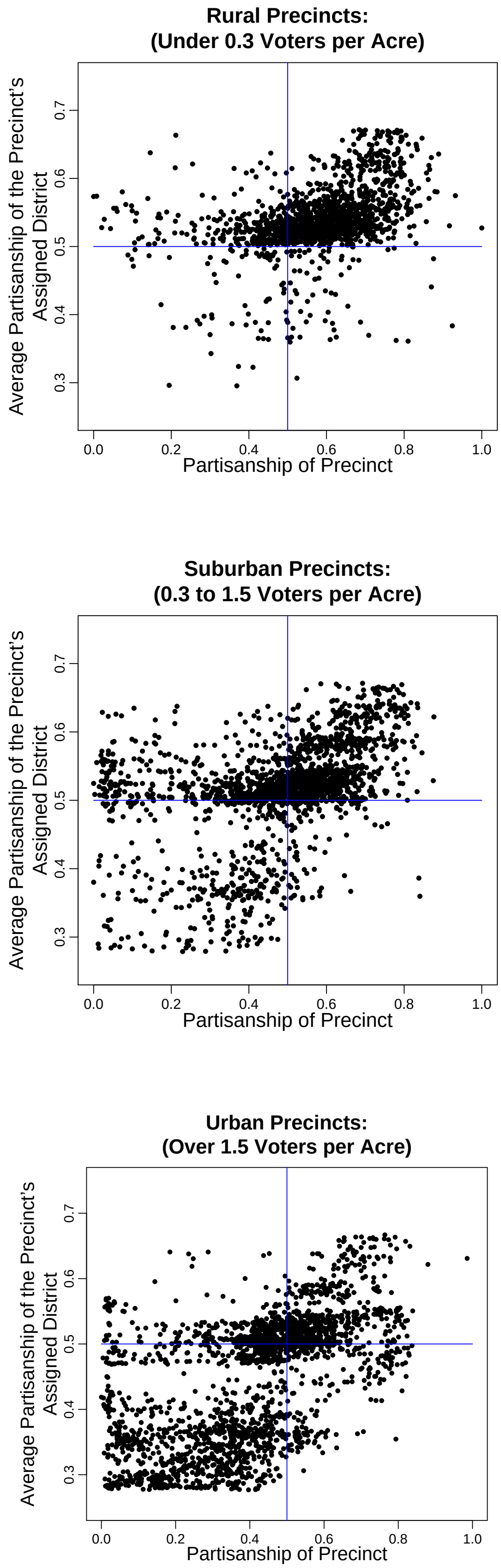
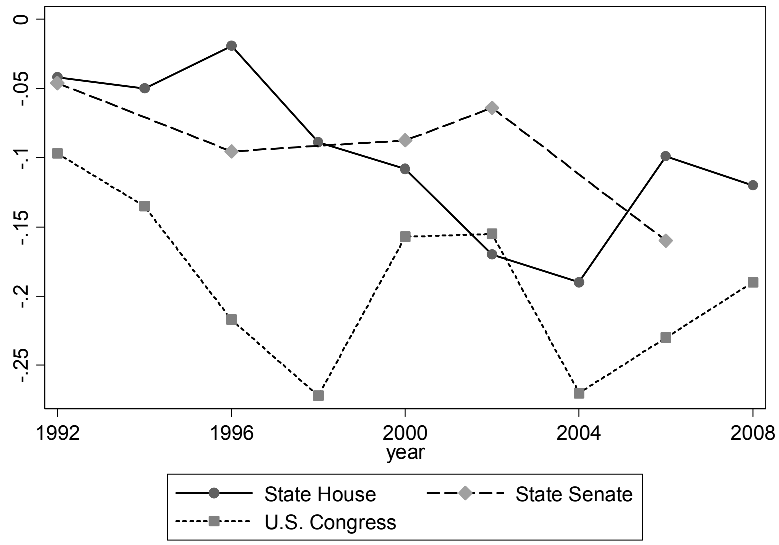
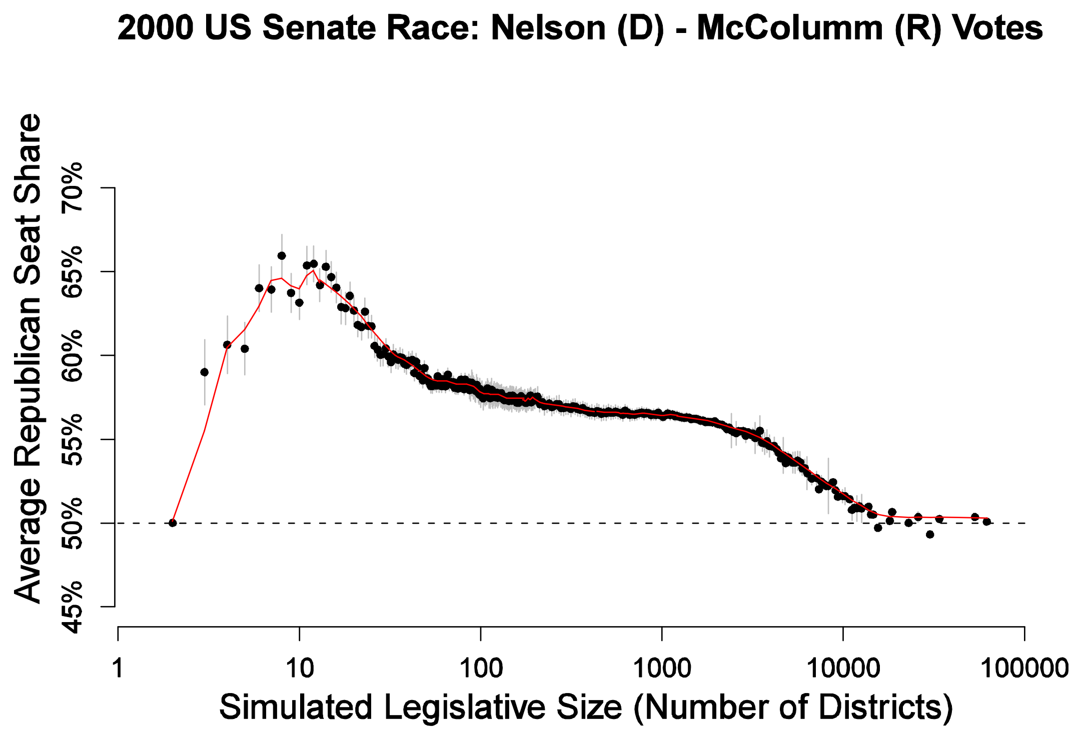


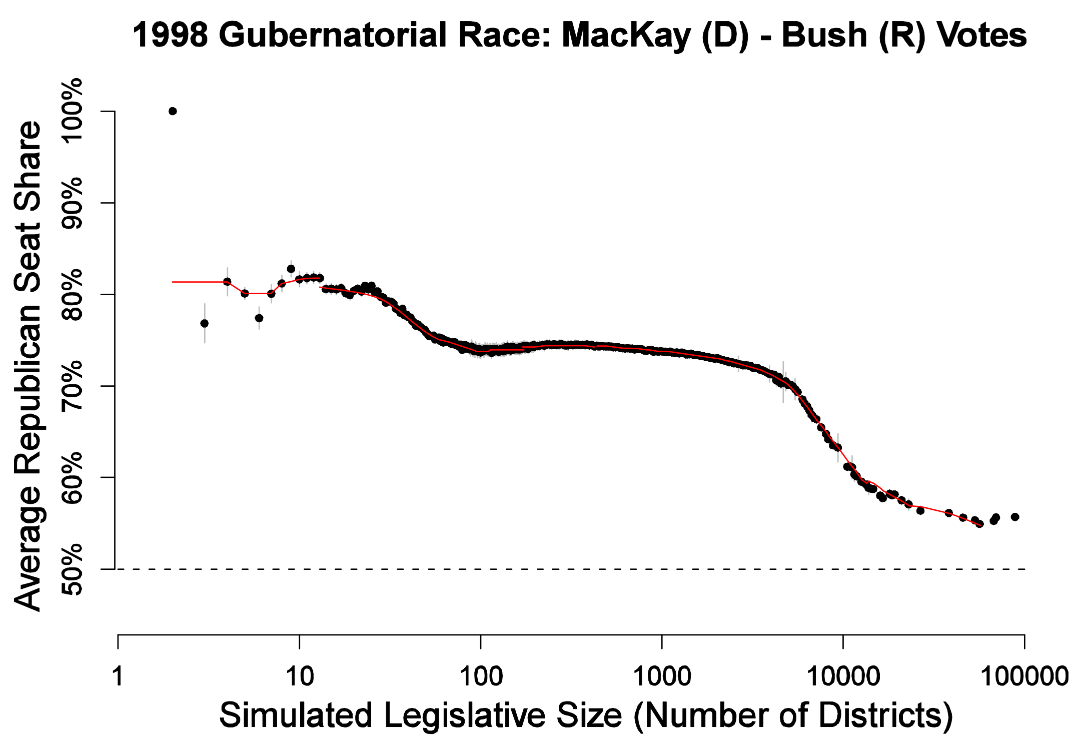
Figure 9: Observed electoral bias in Florida, measured using district-level results of legislative elections



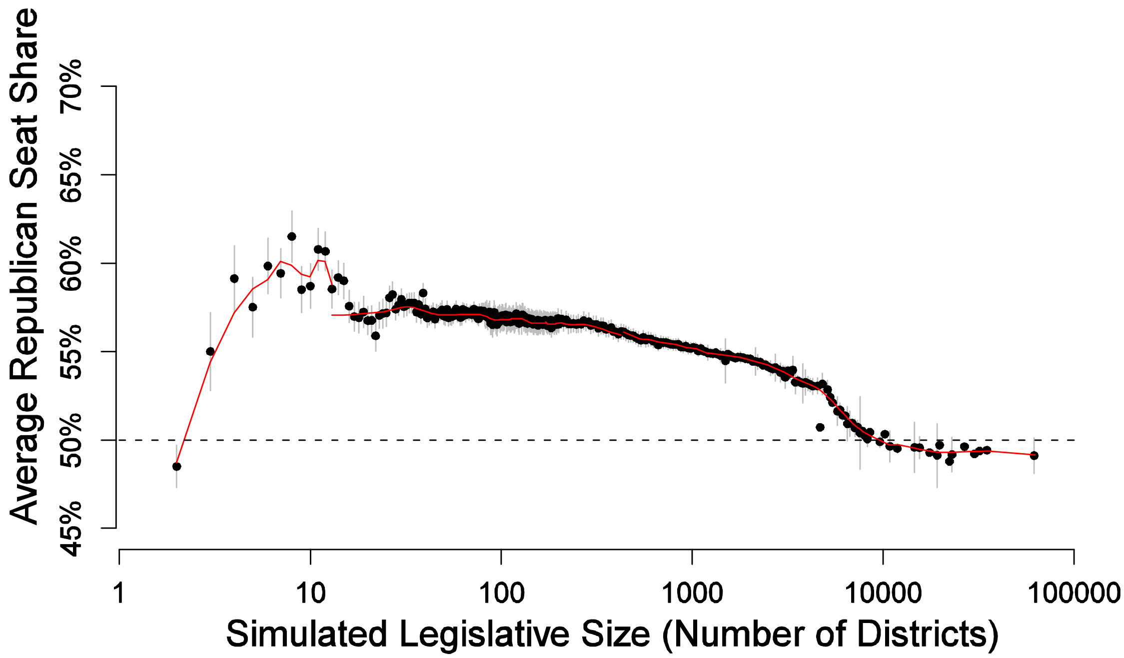
Calculated using Gelman, King, and Thomas (2008) JudgeIt II *R* package, version 1.3.4. Negative numbers indicate pro-Republican bias, expresses as "extra" Republican seats as a share of total seats under the hypothetical of equal vote shares. In the top panel, electoral bias was estimated directly from district-level results of legislative elections. In the lower panel, "underlying" electoral bias was calculated from precinct-level results of statewide elections that were aggregated to the level of Florida House, Florida Senate, and U.S. Congressional districts.

Appendix A: Districting Simulations using Alternative Election Results





1994 Gubernatorial Race: Chiles (D) - Bush (R) Votes



1992 Presidential Race: Clinton (D) - Bush (R) Votes