Three Essays on the Political Consequences of Geographic Boundaries in U.S. Political Institutions

by

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To my parents

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ABSTRACT

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Chair: Ken Kollman

Electoral and administrative boundaries make geographic space relevant to the United States political system. I examine this relationship between geography and politics in three parts. In the first part, I establish a theoretical link between partisan residential patterns and Congressional representation. Using a computational model to simulate legislative elections in the presence of partisan segregation, I develop predictions about how partisan geography affects the vote-to-seats curve. As a result, I show that when districts are drawn to be compact, contiguous, and equally apportioned, Democratic clustering not only flattens the votes-to-seats curve but, when Democrats cluster more than Republicans, the clustering tends to flatten the curve asymmetrically, causing Democrats and Republicans to translate the same number of votes into a different number of seats. In the second part, I provide empirical evidence that the geographic distribution of partisan voters does, in fact, influence partisan representation as predicted by the computational model. I do this in two ways. I show that a randomly generated sample of potential Congressional districts - drawn only with respect to the underlying geographic distribution of the popula-

tion - nearly replicates the partisanship of Congressional districts across a number of states. And I show that increases in the urban/non-urban divisions in partisanship correspond with a change in district-level partisanship that is consistent with the computational model's predictions. Lastly, in the third part, I analyze differences in the implementation of federal health and safety policy that occur between the geographic jurisdictions of federal and state regulators. I show that OSHA's devolution of federal regulatory authority to the states has not only resulted in a lack of responsiveness by the states, but has also created geographic discontinuities between state and federal jurisdictions. Therefore, whether it is through the residential patterns of partisans across electoral districts, or the manipulation of the geographic shape of the districts themselves, or the execution of policy between states and administrative jurisdictions, I show that political boundaries influence representation and shape policy.

CHAPTER I

Introduction

Geographically defined political boundaries play an important role in U.S. political institutions. They divide the population into geographic jurisdictions such that electoral and administrative processes are carried out separately between them. Because of this, the geographic location of individuals relative to the location of these jurisdictions has political implications. As individuals relocate or as electoral and administrative boundaries relocate around those individuals, there exists a potential to shift elections, alter representation, and change the way in which one is affected by legislation. Therefore, through these boundaries, location and geographic space become relevant to our political system.

I examine this relationship between geography and politics in two contexts. In the first context, I examine how geography influences U.S. Congressional representation through the process of dividing spatially segregated partisans into geographically contiguous, compact, and equally apportioned districts. I show how changes in the spatial distribution of partisans can influence the way in which a party's vote share translates into seat share. Ultimately the analysis shows the myriad ways in which partisan spatial patterns skews representation.

In the second context, I examine how an individual's location across geographically defined administrative districts affects how that individual is regulated by the federal government. Specifically, I show that business establishments subjected to the same federal occupational safety and health standards are regulated differently depending on the administrative district in which they are located. Therefore, an establishment's geographic location matters to how it is affected by federal regulation.

By exploring these two contexts, I provide insight into how geography shapes the input and output of our political system. The geographic patterns of partisan voters interact with geographically-defined electoral districts to influence electoral representation (input). And geographically defined administrative districts create geographic variation in the way regulatory policy is executed (output).

1.1 Partisan Geography and the Votes-Seats Curve

Of the following three chapters, the first two are dedicated to the first context mentioned above. I examine the interaction between geography and Congressional representation by analyzing how the geographic distribution of partisan voters affects the votes-seats curve in Congress. While traditionally ignored in the study of Congressional representation, geography potentially plays a major role in Congressional elections. As is the case in any single-member district electoral system, representatives in Congress are elected from separate geographic regions where votes are aggregated by geographically-defined electoral districts. This means that the location of voter preferences, ideologies, and partisanship across geographic space provide a potential geographic explanation for how votes are distributed across the districts where they are eventually aggregated and translated into legislative seats.

Although the votes-seats relationship has traditionally been explained as a function of gerrymandering, recent research has suggested that gerrymandering is limited in its effect on representation in Congress (Abramowitz, Alexander and Gunning, 2006; McCarty, Poole and Rosenthal, 2009; Masket, Winburn and Wright, 2012; Chen and Cottrell, 2015). Instead, scholars have shifted their focus to voter geography as an alternative explanation for the ideological and partisan composition of Congress. As Republicans and Democrats have increasingly segregated into geographically separate communities (Bishop, 2009; Nall, 2015), scholars have begun to observe how these partisan spatial patterns are consequential for legislative elections.

In particular, recent research by Chen and Rodden (2013) has suggested that the residential patterns of Democrats and Republicans in the United States contribute to electoral bias in legislative elections. They argue that when boundary-makers draw compact, contiguous, and equally apportioned districts in states like Florida, where Democrats cluster in dense metropolitan areas like Miami, Jacksonville, Tampa, and Orlando, the resulting districts will tend to produce a natural Republican seat advantage. Therefore, Democratic votes will inefficiently cluster across the districts in such a way that would convert a 50% vote share into fewer than 50% of the seats. As a result, the authors conclude that Democratic clustering reduces the party's electoral success.

Yet, data availability limits them to a cross-state comparison of twenty states in a single year at a hypothetical 50% vote share. Due to the limited number of observations in their sample, they are unable to generalize this finding across the whole range of potential splits in vote share among various types of Democratic clustering. While they might observe that the outcome of a toss-up election in a state like Florida produces a Republican-majority Congressional delegation, they are unable to observe the counterfactual outcome in the state where a party wins more than the marginal vote under an alternate partisan spatial patterns. Therefore, they fall short of a full explanation for the relationship between partisan spatial patterns and the votes-seats curve.

Developing this full explanation is important. While determining who wins the majority of seats at the margins of a 50%-50% split in vote share is critical for majoritarian political systems, expanding the focus of representation beyond the 50%

mark can answer questions about the extent to which non-marginal majorities and minorities lose or gain legislative seats. This can be important to parties for a number of reasons. For example, parties with strong support that seek to reduce the uncertainty of winning marginal votes or seek to avoid the threat of an executive veto may want to know how partisan spatial patterns affects their ability to achieve legislative super-majorities. Therefore, the electoral effect of increasing vote share beyond the margins is significant to partisan strategy and presents a major gap in the current research.

Moreover, the spatial patterns of partisans, as conceived by Chen and Rodden, only vary along a single dimension where Democrats distribute from an unconcentrated state to a concentrated state. However, this understanding of partisan geography is, perhaps, an oversimplification. The geographic distribution of Democrats can take on a variety of forms. For example, Democrats can concentrate in a single metropolitan area where every Democrat lives next to every other Democrat. Or they can concentrate into multiple metropolitan areas where some Democrats live next to each other but also live far away from other clusters of Democrats. On the other hand, Democratic concentration can be observed as a function of Republican concentration. Therefore, Democrats can concentrate symmetrically with respect to Republicans, where Republicans and Democrats segregate fully. Or Democrats can concentrate asymmetrically with respect to Republicans, such that Democrats concentrate but Republicans do not.

1.1.1 Chapter 1

Ultimately, there is a need for a deeper explanation for how partisan spatial patterns of various types affect the votes-seats curve in its entirety. Chapter 1 attempts to develop this explanation through simulation. Since we lack the empirical data to observe variation in spatial patterns as well as variation in the aggregate support for a party across a particular state, it is difficult to develop an understanding about how, precisely, partisan spatial patterns, with all of their complexities, influence the votes seats curve. However, through simulation, one can observe a hypothetical state where the underlying partisan spatial patterns as well as the aggregate partisan support can be varied as desired. Therefore, the relationship between partisan geography and the votes-seats curve can be given a theoretical foundation.

In Chapter 1, I do exactly this. By simulating congressional elections in a hypothetical ten-district state, I vary the aggregate state partisanship and adjust the manner and degree by which partisans cluster geographically using an agent-based model of segregation. I then measure the outcome that would result from dividing the hypothetical state into ten compact, contiguous and equally apportioned electoral districts. These simulations produce electoral outcomes under symmetric and asymmetric Democratic clustering at all degrees Democratic support, developing the full effect of Democratic clustering on the entire vote-seats curve.

As a result, I show that both types of Democratic clustering leads to a flatter votes-seats curve which has the effect of disadvantaging the majority party, whichever party that may be. Therefore, Democratic clustering can be disadvantageous to Democrats, as Chen and Rodden argue. But it can also be disadvantageous to Republicans. When Republicans hold a majority support, for example, clustering has the effect of reducing the party's seat share and reducing the number of seats that it achieves given an increase in vote share. This revises the findings by Chen and Rodden by developing the conditions under which Democrats are either advantaged or disadvantaged by spatial clustering.

Moreover, the model develop how differences in the type of Democratic clustering can change the effect that the clustering has on the votes-seats curve. When Democrats cluster symmetrically with respect to Republicans, for example, the clustering drastically flattens the votes-seats curve. But when Democrats cluster *asym-*

metrically with respect to Republicans (where Democrats cluster more than Republicans) the clustering flattens the curve more for pro-Democratic states than for pro-Republican states. Such clustering produces partisan asymmetry in the votes-seats curve.

The findings have important implications for Democratic representation. They move our theoretical understanding of the relationship between votes and seats beyond the effect that Democratic clustering has on electoral bias. By developing the geographic underpinnings of the entire votes-seats curve, the model produces a more complex understanding of how partisan geography affects representation in the United States. Not only does the effect of Democratic clustering change as a party increases or decreases its vote share, but it also changes as parties alter the geographic distribution of their vote.

1.1.2 Chapter 2

While the first Chapter develops theoretical expectations for the way in which Democratic clustering affects the votes-seats curve, the second Chapter attempts to validate these expectations with empirical support. Therefore, the goal of Chapter 2 is not only to provide an empirical foundation for the relationship between partisan geography and the votes-seats curve, but it also intends to show that the actual geographic distribution of partisan voters does, in fact, influence partisan representation in a way that is predicted by the computational model. The chapter uses real-world data to convince the reader that the actual districts are constrained geographically in such a way that makes the geographic distribution of partisans relevant to the votes-seats curve. Therefore, the actual districts can be expected to produce a votes-seats curve that responds to partisan geography in a way predicted by the model.

I give evidence of this in two ways. First, I repeat the same process used in the simulations on actual data to show that this process replicates the results of real-world elections fairly well. This suggests that drawing compact, contiguous, and equally apportioned districts around a spatial distribution of partisan votes is a good estimate of how actual districts are drawn. Thus, there is evidence to believe that the expectations generated by the model can be generalized to the actual districts. Moreover, since the computer-generated districts use only the underlying geographic distribution of the population to guide the districting process, the fact that they are a fairly good predictor of the actual districts suggests that the actual districts are designed as a function of geography as the model assumes.

Second, I show that increases in the urban/non-urban divisions in partisanship from 1972 to 2004 correspond with a change in district-level partisanship. This implies that the partisan vote aggregated at the district level is responsive to changes in the underlying geographic distribution of voters. As the geographic distribution of voters changes, so does the district-level distribution of voters. Hence, the geographic concentration of partisans is influential to partisan representation at the district level.

Moreover, the change in district-level partisanship produced by partisan clustering is asymmetric with respect to the parties. Therefore, consistent with the computational model's predictions, an increase in the urban/non-urban differences in vote share produces a distribution of partisanship across the districts that is consistent with the computational model.

In sum, Chapter 2 provides empirical support that partisan geography is a strong determinant of partisan representation in Congress. It suggests that, even in the presence of gerrymandering, partisan geography matters to representation.

1.2 Geographic Differences in Federal Regulation

1.2.1 Chapter 3

Chapter 3 explores a different way in which political boundaries make geography relevant to politics. While Chapters 1 and 2 focused on the representational implications of political boundaries, Chapter 3 focuses on the administrative implications of political boundaries. In particular, Chapter 3 explores how the use of geographically-defined administrative jurisdictions creates geographic discontinuities in the way federal law is implemented. Specifically, I observe how federal standards issued by the Occupational Safety and Health Administration are implemented between geographically separate state and federal jurisdictions.

By doing so, I expand upon the bureaucratic delegation literature by analyzing how OSHA's devolution of authority to state governments potentially leads to a loss of political control to the states. As the federal government gained responsibility for maintaining health and safety standards with the passage of the OSH Act in 1970, states were given the opportunity to apply for permission to implement the federal standards on their own. Within a few year, just under half of the states were implementing OSHA standards using their own administration. The rest would be covered by federal OSHA. While the states would be overseen by the federal government so as to ensure that the state administration was "at least as effective" as their federal counterparts, the nature of the principle-agent problem begs the question as to whether the federal government has lost control.

This devolution sets up a unique case where federal and state administrators are implementing the exact same federal laws in tandem but in separate jurisdictions. This allows for a comparison between state and federal administrations in the implementation of health and safety inspections. One can observe how the federal government inspects an establishment on one side of a state border and can then observe how a state government inspects an establishment on just the other side of the border. Systematic differences in the inspections might suggest that the way in which establishments are inspected depends on the location of the establishment.

In my analysis, I do not find evidence that OSHA's devolution of federal regulatory authority to the states results in a loss of political control. In other words, the stringency with which inspections are implemented does not appear to vary across the state plans according to political variables. However, I do find that devolution has resulted in a lack of responsiveness by the states. For example, as the Obama administration called for greater stringency in inspections, state inspectors did not respond to the call as vigorously as federal inspectors seemed to do so. Moreover, the implementation of inspections at the state level was found to be less vigorous in terms of penalty size than federal implementation of inspection penalties.

This difference is even observable when controlling for location. In an analysis of geographically proximate construction sites on either side of the state-federal border, the penalties were larger for federal agencies than for state agencies. As a result the implementation of federal health and safety standards through separate state and federal jurisdictions create geographic discontinuities in the way the standards are enforced.

Therefore, whether it is through the residential patterns of partisans across electoral districts, or the manipulation of the geographic shape of the districts themselves, or the execution of policy between states and administrative jurisdictions, I show that political boundaries influence representation and shape policy.

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CHAPTER II

A Geographic Explanation for Partisan Representation:

How Residential Patterns of Partisans Shape Electoral Outcomes

Abstract

Partisan favor in the votes-seats relationship is often attributed to gerrymandering, where parties improve their seat share by manipulating district boundaries in order to bias the distribution of votes in their favor. However, recent research by Chen and Rodden (2013), which builds on a thesis developed by Erikson (1972), provides support for the claim that such bias is less a function of gerrymandering than it is a function of the underlying geographic distribution of partisan voters. They find that the tendency for Democrats to cluster in dense urban areas - as we see in states like Florida - gives Republicans a natural seat advantage in legislatures, even in the presence of redistricting. Still, the link between partisan residential patterns and the votes-to-seats relationship remains undeveloped, in part because we are unable to observe the full spectrum of partisan votes at various levels of partisan clustering. In this paper, however, I attempt to develop this link through simulations. By simulating congressional elections at all levels of partisanship, I can measure the hypothetical electoral outcome that results from adjusting the degree to which partisans cluster geographically using an agent-based model of segregation. These simulations allow me to observe the potential electoral effect of partisan clustering on the entire vote-seats curve. As a result, I show that residential clustering of partisans tends to flatten the votes-seats curve, making it disadvantageous to the majority party, whichever party that may be. However, when Democrats cluster more than Republicans, the disadvantage is greater for Democratic majorities than for Republican majorities.

2.1 Introduction

Although Democrats won the majority of the vote in the 2012 House elections, Republicans won the majority of the seats - a result that reveals the inherent disconnect between votes and seats in single member district electoral systems. The election is a reminder that even in the most representative chamber of Congress, there is the potential for unrepresentative electoral outcomes. Of course, with Democrats losing a majority of the seats, many have claimed that the system is not only unrepresentative, but also biased to favor Republicans. A common argument in explaining the source of this bias is that it is due to gerrymandering. Republican-controlled state legislatures manipulate district boundaries to more efficiently convert votes into seats (Wang, 2012). However, while recent research has found the effect of gerrymandering to be significant, its contribution to pro-Republican bias in districting plans is likely marginal in the aggregate (Goedert, 2014; Chen and Cottrell, 2015).

Therefore, to account for the bias beyond that which we can attribute to gerrymandering, scholars have returned to an old thesis that suggests that Democrats are the victims of a 'natural" disadvantage that results from their geographic residential patterns. With the industrial revolution drawing populations into dense metropolitan areas and postwar suburbanization leading to residential sorting along socio-economic and racial lines, there has been an increase in the geographic division between Democrats and Republicans (Nall, 2015). This division is marked by a pattern where Democrats have clustered into densely populated urban areas, while Republicans have dispersed along peripheral suburban and rural communities (Rodden, 2010). As a result, Democratic voters tend to pack into urban districts producing a suboptimal distribution of Democratic votes, which allows Republicans to win more seats per vote than they would have in the absence of such clustering. And even as redistricting corrects for the shifts in the underlying population through reapportioning the districts, this geographic bias seems to persist. This is a phenomenon that

Erikson (1972) noticed years ago when he suggested that pro-Republican bias was an unintended "accident" of geography. Even in the face of gerrymandering, as the thesis goes, the Democratic tendency to reside in dense urban areas has the effect of reducing the Democrats' share of the legislative seats.

This thesis has gained a lot of attention given the recent findings by Chen and Rodden (2013). By redrawing the district maps of state legislatures using a computer to remove intentional gerrymandering, the authors show that as long as districts are designed according to neutral rules - that they are compact, contiguous, and equally apportioned - an increase in the concentration of Democratic voters will naturally lead to an election outcome favoring Republicans. Specifically, Chen and Rodden conclude that in states where "Democrats are inefficiently concentrated in large cities and smaller industrial agglomerations...they can expect to win fewer than 50% of the seats when they win 50% of the votes" (239). Therefore, Democrats can expect to be disadvantaged by geography so long as there is a 50-50 split in the vote.

However, while geographic clustering might reduce Democratic seat share at a hypothetical 50% vote share, it is unclear how such clustering impacts Democrats at alternative shares of the two-party vote. Not only are we unable to observe electoral outcomes under the full spectrum of the potential two-party vote, we are also unable to observe each of those outcomes under various degrees of clustering. It is simply difficult to say whether a party was advantaged by partisan geography because we simply do not know what the counterfactual would look like under other degrees and types of clustering. Therefore, I investigate how the geographic clustering of partisans affects electoral outcomes in hypothetical situations where Democrats and Republicans split the vote across all margins of victory.

In this paper, I develop hypotheses for how partisan clustering affects representation. By simulating Congressional elections in a hypothetical ten-district state, I am able to isolate the effect of partisan geography on the votes-seats relationship across the full spectrum of the partisan vote. Using a simple agent-based model of segregation, I approximate real-world partisan residential patterns by adjusting the degree to which Democrats and Republicans cluster. I then use a districting algorithm to randomly assign these voters to compact, contiguous, and equally apportioned districts, where they are then translated into seats.

As a result, I show how the residential clustering of Democratic voters affects the votes-seats curve. I find that Democratic clustering does not always disadvantage Democrats. Instead, in states where they hold a certain minority of the vote, Democrats can improve their seat share through clustering. While it is common to suggest that Democrats have lost seats due to geography - and there is no doubt that they have - the party has also won seats due to geography. In states where Republicans hold more than a marginal majority of the vote, clustering can have the effect of creating a Democratic district where one might not otherwise have existed. In which case, Republicans are disadvantaged by dense urban areas that create strong Democratic districts. However, in states where Democrats hold the majority of the vote, clustering has the opposite effect. Instead, the clustering of Democratic voters reduces the number Democratic seats that would have been won under a less clustered environment.

In either case, geographic clustering flattens the votes-seats curve, making it harder for both parties to convert additional votes into additional seats. And as the votes-seats curve flattens, minority parties will gain seats as the majority party loses seats. Therefore, the majority party - be it Democrat or Republican - is disadvantaged by Democratic clustering while the minority party is advantaged. However, if the clustering is asymmetric - where Democrats cluster more than Republicans - then the votes-seats curve will bend asymmetrically. As a result, the Democratic majority will lose more seats from the clustering of partisans than the a Republican majority.

2.2 How Votes Translate into Seats: Review of the Votes-Seats curve

Scholars of U.S. electoral systems have long been interested in how a party's aggregate vote share in legislative elections translates into its seat share in the legislature. Unlike proportional rule systems where a party's seat share is approximately equal to its vote share, the votes-seats relationship in single-member district systems is not necessarily proportional, nor is it necessarily linear. In fact, to early observers of elections in both Great Britain and the United States the relationship appeared exponential in nature. Some even went so far as to suggest that the ratio of seats was determined by simply cubing the ratio of votes (Kendall and Stuart, 1950; March, 1957). Today, we understand that the true relationship between votes and seats is more complex. A party's aggregate seat share is not just a function of its vote share, but it is also a function of how its votes are distributed across the many districts.

This phenomenon is interesting to political scientists because it means that a party need not change its aggregate vote share in order to change its seat share. Instead, a simple redistribution of its votes is often sufficient to drastically change the number of seats it wins in the legislature. For example, take the vote-seats relationship of a hypothetical ten-district legislature where the districts are equally apportioned. A party with just over 30% of the vote has the potential to win a majority of the seats. And a party with 50% of the vote can win as many as 100% or as few 10% of the seats, depending on how those votes are allocated across the districts.

Figure 2.1 displays this phenomenon. It gives the range of potential outcomes for an election in an equally apportioned ten-district legislature with a sufficiently large number of voters. Any votes-seats combination can be reached between the two stair-step lines. Which combination depends only on how those votes are distributed. Therefore, in determining the votes-seats relationship, it can be as important to

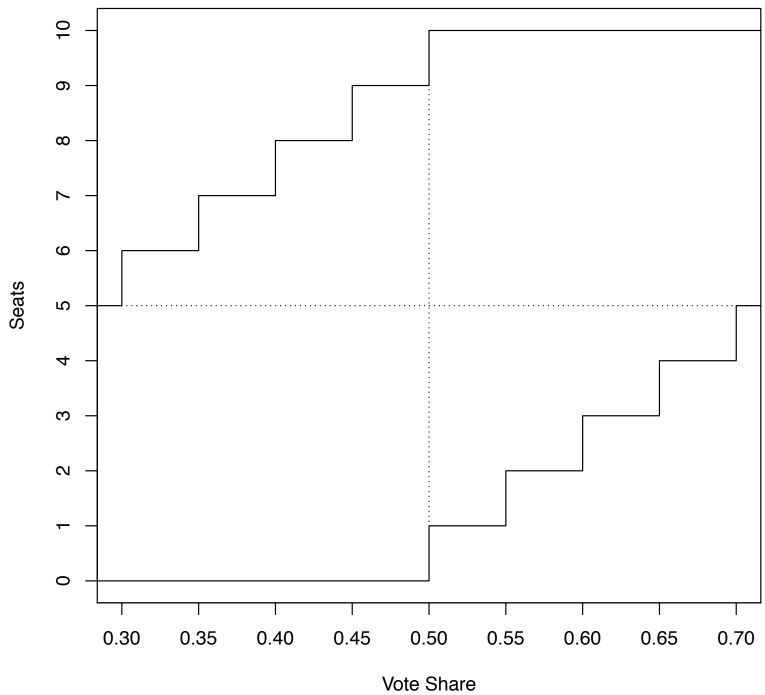


Figure 2.1: The figure above displays the upper and lower bounds for the potential outcomes on the votes-seats curve in a hypothetical ten district legislature where the population is sufficiently large and the districts are equally apportioned. The figure conveys the point that there exists a distribution of the two-party vote across the districts that can produce any number of seats between the stair-step lines. For example, a party with just over 50% of the two-party vote can win as many as 100% or as few 10% of the seats, depending on how those votes are allocated across the districts.

explain the variation of a party's votes across the districts as it is to explain its vote in the aggregate.

2.2.1 Partisan Districting

What, then, explains the variation of a party's vote across districts? One common explanation is that it is the result of districting. In the United States, districting is simply the process of dividing the land among the districts and assigning the voters to the district in which they reside. Therefore, the composition of a district is dependent on how the district is located among the voters. One need only to change the district's location to alter its composition. And by changing the location of the district relative to the location of partisan voters, one could potentially redistribute partisans across the districts in a way that could change the votes-seats curve. As a result, those who control the districting process are able to potentially control the partisan results of a legislative election.

As one might expect, this is particularly troubling for democratic representation in the United States. With state governments in control of the districting process, there is always the potential for partisan influence on district design. For this reason, parties have long been accused of using the districting process to bias legislative elections in their favor.[1] And, of course, this suspicion continues to this day.[2]

Yet, in an effort to move beyond the suspicion, political scientists have made a number of attempts to precisely identify gerrymandering and to measure exactly how and to what extent it affects representation. It was Tufte (1973) who began the practice of using variation in the bias and responsiveness of the votes-seats curve (where "bias" is the deviation from the 50%-50% intercept and "responsiveness" is the slope of the curve) as a way to measure how gerrymandering influenced representation.[3] Scholars have since refined these measurements of bias and responsiveness (King and Browning, 1987; Campagna and Grofman, 1990; Gelman and King, 1994) and have analyzed its variation at both the national and state level, drawing mixed conclusions with respect to its effect. While some scholars have found that partisan gerryman-

[1] The term "Gerrymander" itself was coined in 1812 when Elbridge Gerry was famously accused of advantaging Republicans through the approval of a salamander-like district in Massachusetts.

[2] For example, Florida's Supreme Court is currently adjudicating claims that the Republicans intentionally gerrymandered districts in the state legislature.

[3] Tufte measured the curve's deviation from the 50%-50% intercept, which he referred to as the curve's *bias*, and he measured its slope, which he referred to as the curve's *responsiveness*, and he suggested that the bias and the declining responsiveness of the curve are partly the effect of gerrymandering. To be precise, he defined an unbiased votes-seats curve as one where 50% of the two-party vote would win 50% of the seats. Bias would occur when more or less than 50% of the vote is is needed for a party to win 50% of the seats. He also defined responsiveness to refer to how seat share responds to a change in vote share. Therefore, it is a measurement of the change in seat share for a unit change in vote share.

dering leads to significant shifts in the votes-seats curve (Abramowitz, 1983; Squire, 1985; Erikson, 1972; Niemi and Winsky, 1992; Born, 1985) others have found that gerrymandering is not very influential at all (Ferejohn, 1977; Glazer, Grofman and Robbins, 1987; Squire, 1985; Abramowitz, Alexander and Gunning, 2006). However, to the extent that gerrymandering does play a role in determining the votes-seats curve, recent research has established that the effect is at least conditional on institutional constraints (Gelman and King, 1994; McDonald, 2004; Campagna and Grofman, 1990) Nonetheless, it remains difficult to isolate the effect of gerrymandering on state and federal elections.

2.2.2 Non-partisan Districting: Geographic Explanations

Part of the difficultly in isolating the effect of gerrymandering is being able to attribute bias and responsiveness to partisan motivated gerrymandering. This is especially the case when the same bias and responsiveness in the votes-seats curve can result from non-political forces. For example, scholars noticed that prior to 1966 the votes-seats curve exhibited substantial Republican bias in the division of seats in Congress that seemed to run counter to the Democratic state legislatures. (Tufte, 1973). However, this bias was independent of intentional gerrymandering and instead likely arose from a combination of malapportionment and an increasing partisan divide between rural and urban voters (Erikson, 1972; Cox and Katz, 2002). Since the courts had not yet interpreted the Constitution as requiring states to apportion their districts according to roughly equal populations, district populations varied considerably in size. States rarely redrew their district boundaries to account for shifts in the population and, as a result, urbanization packed a disproportionate number of voters into urban districts. This effectively diluted the urban vote. And because these voters were largely Democrat, the diluted Democratic vote put them at a natural disadvantage in terms of legislative seats. Therefore, the source of the pro-Republican bias was not gerrymandering, but instead it was a combination of urbanization, geographic polarization, and a general failure for districts to correct for over-population. Republicans simply gained an edge through the natural migrations of the underlying population.

However, some of this edge vanished after 1965, when *Westberry vs. Sanders* (376, U.S. 1) required states to apportion their districts equally with respect to population. Coined as the "reapportionment revolution," the next half of the decade would see numerous revisions to district boundaries in order to correct for the imbalance in population. This reapportionment naturally reduced the dilution of the Democratic vote that was caused by overcrowded urban districts. And since most of the unified state legislatures and courts responsible for drawing districts at the time were under the control of Democrats, the Democrats took advantage of the opportunity to draw pro-Democratic bias into their plans (Cox and Katz, 2002). Yet even in the face of reapportionment and pro-Democratic gerrymandering, political scientists still recognized that the geographic concentration of Democrats remained a disadvantageous force against the Democratic party (Erikson, 1972).

This link between the residential patterns of Democrats and pro-Republican bias is still recognized today (McDonald, 2009, 2010; Erikson, 2002; Jacobson, 2003). Yet the link between the geographic clustering of Democrats and the entire votes-seats curve has not yet been thoroughly examined. While Chen and Rodden (2013) are the first to rigorously show that in a hypothetical situation where the partisan vote is split 50-50, urbanization tends to distribute votes across districts in such a way that produces a Republican seat advantage. However, they are also unable to make claims about how such clustering impacts representation across the entire votes-seats curve and not just under a 50-50 split of the vote. This is because they are limited in their ability to make inferences about the effect of geographic clustering at any other partisan share of the two-party vote. There simply aren't enough election results in their data to make strong enough claims about the rest of the curve. However, by simulating elections one can begin to draw inferences about how the underlying geography of partisan voters influences the full votes-seats relationship.

In the next section, I attempt to do just this. I design a model of a hypothetical legislative election where individual voters - either Democrat or Republican - are arranged across two-dimensional space in a particular residential pattern. They are then assigned to randomly drawn, equally apportioned, roughly compact and contiguous districts where their votes are then aggregated and translated into seats. The model repeats this process for every potential partisan split of the vote while varying the geographic patterns of the voters. By manipulating the degree to which Democrats and Republicans cluster geographically, I am able to fully assess the electoral effect of geographic sorting. My findings suggests that Democratic clustering is damaging to Democrats only when they hold voting majorities. Otherwise, contrary to the implications of Chen and Rodden's theory, clustering can lead to advantageous outcomes for the Democratic party.

2.3 Simulating Elections

In this section, I develop a computational model of a legislative elections where I am able to vary the residential patterns of partisan voters. To model partisan residential patterns I simply leverage an agent-based model of segregation. Since the objective is to study the effect of various degrees of clustering on electoral outcomes, I require a model that allows me to manipulate the spatial distributions of partisan voters where Democrats and Republicans can locate across geographic space in a manner that ranges from uniform to clustered. And, moreover, I require the model to be able cluster Democrats asymmetrically with respect to Republicans in order to approximate the real-world residential patterns we see in the United States.

To do this, I employ Shelling's agent-based model of racial segregation (Schelling, 1971; Chen, 2012). Originally, this model was intended to explain the widely observed residential segregation of whites and blacks. Schelling uses it to show that relatively low degrees of intolerance toward living next to others of a difference race can transform an unsegregated neighborhood into a segregated one. While Schelling's interest in this agent-based model was to explain racial segregation with micro-motivations, my interest in this model is primarily that it starts with an unsegregated population and ends with a segregated one, where - until convergence - each iteration is slightly more segregated than the previous iteration. By simply swapping whites and blacks with Democrats and Republicans, the model becomes one of partisan clustering.

Moreover, since there is a random component to the way partisans are initially distributed and there is a random component to the way partisans distribute at each iteration, the model allows for multiple geographic distributions to emerge. Therefore, by running the segregation model repeatedly, I can produce a randomly sampled set of clustered partisan environments that are distinct from their initial uniform distribution. Then to observe how this clustering translates into electoral results, I simply devise a districting algorithm that assigns the voters to a set of compact and contiguous districts of equal size. Then I aggregate the votes in each district by counting the ratio of Democrats to Republicans and assigning district seats to the party that wins the majority of the vote in the district. This gives me the partisan seat share that results from the hypothetical legislative election, which can then be compared against the partisan vote share of the population. After repeating the "election" with different types of clustering and at different splits of the two-party vote, I can begin to make inferences about the vote-seats curve at different levels of partisan clustering.

It is important to note that the purpose of the model is not necessarily to capture the real-world residential motivations of partisans. The goal is to achieve a partisan segregated outcome that abstractly reflects real-world segregation.[4] By randomly moving from a uniform outcome to a segregated outcome, I am able to loosely generate expectations about the effect of clustering across a spatial grid.

2.3.1 Designing the Spatial Patterns

The segregation model begins with 6,400 voters distributed uniformly across a 100 X 100 unit grid. The voters, therefore, occupy 64% of the units on the grid while 36% of the units are left as empty space. Once the voters have been uniformly distributed, each is randomly assigned to a party from an allotment of partisanship that has been predetermined. For example, Figure 2.2 displays the initial stage of a model where the aggregate partisan split between Republicans and Democrats is 50%-50%. At the initial stage, where partisanship is uniformly distributed, the grid will be then subdivided into a set of 10 districts of approximately equal size, each containing 640 voters.[5] The votes of each district is aggregated and the number of Democratic seats are recorded.

Then Schelling's segregation algorithm is initiated. The way the algorithm works is that the voters are asked whether they are satisfied with their current location. Voters are determined to be satisfied if they are in a neighborhood with voters that share their partisanship. For this model, voters are satisfied if more than 14 of their 24 nearest neighbors are of the same party. If they are unsatisfied, they are moved to a randomly chosen blank space. This is repeated for all voters until every unsatisfied voter has been relocated. Once all relocations are made, the algorithm begins a new

[4] Just as we should be skeptical that Schelling's tipping model completely captures the micro-motives that lead to the kind of racial segregation that we see today (Bruch and Mare, 2006), we should definitely be skeptical that it captures the micro-motives behind partisan segregation. I only use the model to achieve a segregated outcome, so I am able to remain agnostic to the micro-motives that lead to it. However, future iterations of this model may refine the micro-motives so that they better map onto real-world motivations such that real-world forms of clustering are subsequently generated.

[5] Of course, an average Congressional district contains more than a thousand times this number. However, computation is made easier with fewer voters.

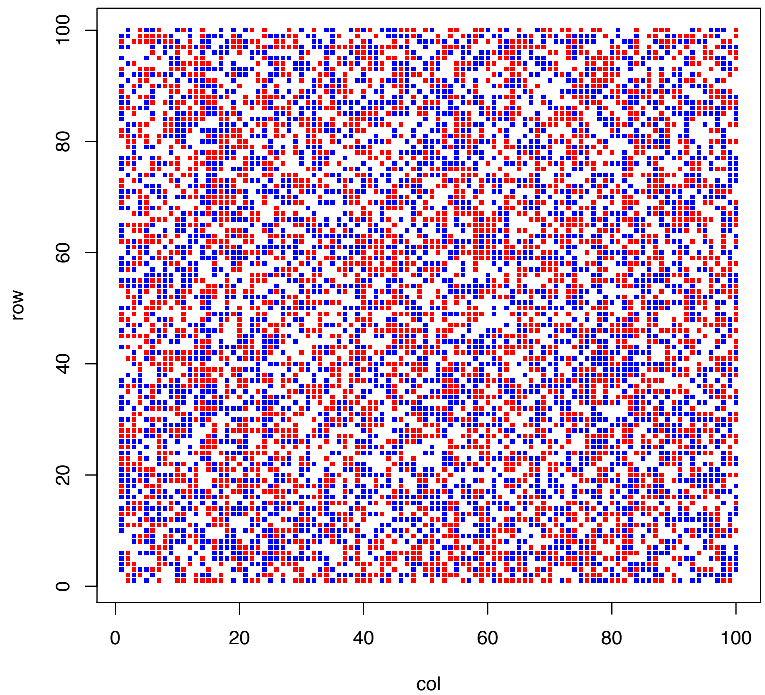


Figure 2.2: A random uniform distribution of the 6,400 "voters", which is used as the initiation step of the segregation model. Partisanship is randomly assigned to each voter given the predetermined ratio of Democrats to Republicans. For example, the figure above displays a 50-50 split in vote share between the two parties.

iteration where voter satisfaction is queried and unsatisfied voters are once again relocated. I repeat this step ten times, regardless of convergence.

The effect of this process is that partisans segregate into geographic communities. Therefore, Democrats and Republicans have relocated to be nearer to each other. In this case, since Democrats and Republicans are given the same motivations, they separate from each other at equal rates. And as a result, their clustering tends to be symmetric. Figure 2.3 displays four examples of the distribution of partisans that result from running the segregation model at a 50-50 split of the aggregate partisan vote.

While the Schelling model accomplishes the goal of geographically concentrating Democratic voters, it also has the effect of concentrating Republican voters. There-

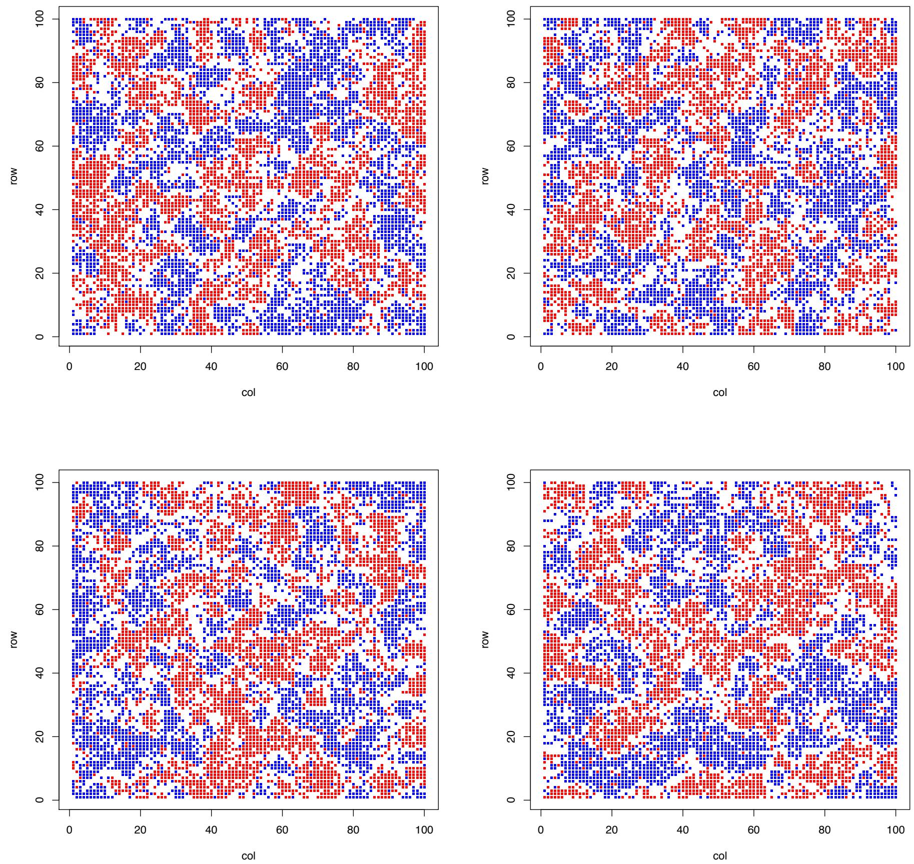


Figure 2.3: Four Examples of Symmetric Partisan Clustering where Democrats hold 50% of the Vote

fore, the segregation it creates is symmetric in nature. An argument could be made that this type of segregation is what we see with suburbanization in the United States. As urban centers become more homogeneously Democrat, the peripheries of these centers become more homogeneously Republican. One can easily see this effect in San Antonio or Houston, where Democrats and Republicans segregate almost equally along the suburban and urban divide. Such partisan sorting may lead to the type of symmetry that we see in Figure 2.3.

However, the more common argument is that the geographic concentration of partisans in the United States is often asymmetric. Democrats concentrate in urban centers while Republicans spread thinly across suburban, exurban, and rural commu-

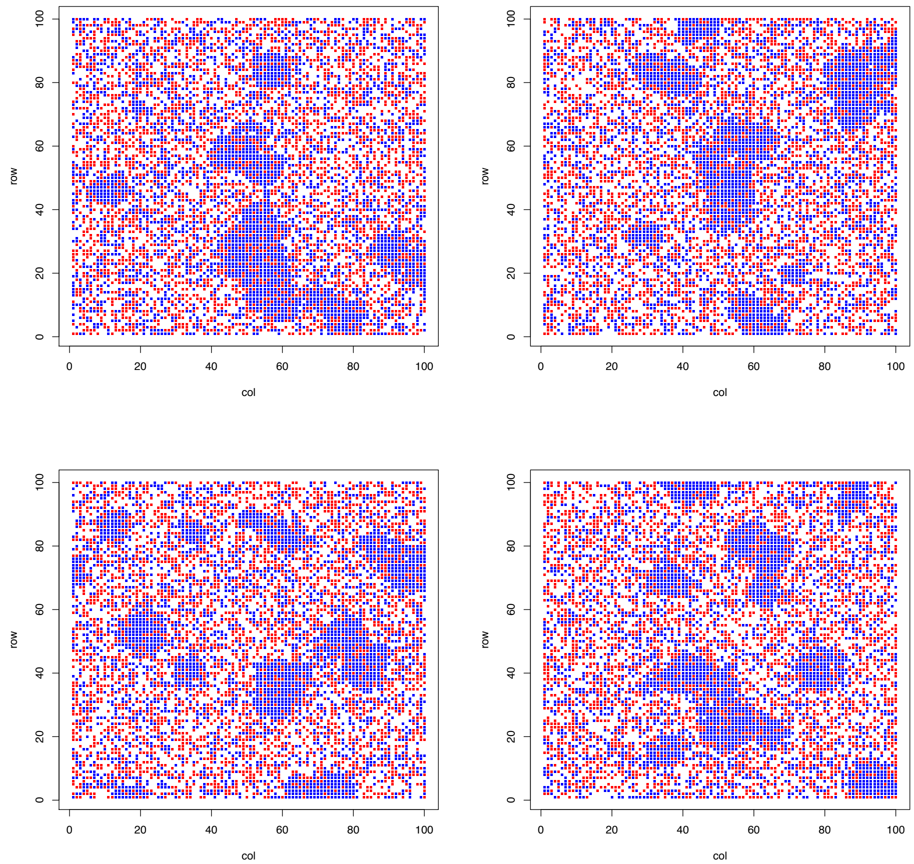


Figure 2.4: Four Examples of Asymmetric Partisan Clustering where Democrats hold 50% of the Vote

nities. Therefore, to capture this effect, I make a simple modification to the Schelling model. Instead of relocating any voter that is unsatisfied with their location, I only relocate Democrats. In other words, Republicans remain at their initial location while Democrats gravitate toward one another. I allow the model to run for ten iterations, regardless of whether each Democrat is satisfied. As a result, Democrats tend to settle in clusters while a thinly distributed Republican party holds the periphery. Figure 2.4 displays four examples of the distributions generated by the model at a 50-50 split of the aggregate partisan vote.

I generate 30 of these grids at every percentage of the two-party vote from 30% to 70% Democrat. And I do this for each of the three partisan distributions that

I mentioned above - uniform, symmetric, and asymmetric. These grids will act as the underlying geographic distribution of partisan voters over which the hypothetical elections will be held. However, the next challenge is assigning voters to districts in order to transform their votes into seats.

2.3.2 Designing the Districts

Since the objective of this hypothetical election is to observe how the spatial patterns of partisans impacts real-world elections, it is important to assign voters to equally assigned districts in a way that approximates the real-world districting process. For example, one important component of U.S. legislative elections is that districts are mapped to their own unique geographic location. Voters are then assigned to the district according to whether they reside in that location. Because districts are designed to be contiguous, no two districts will share the same geographic location and no geographic location will be without a district.

In addition to contiguity, districts tend to be designed to be relatively compact. This simply means that districts cover voters who live near each other rather than voters who are distant from each other. Although this is not an official constraint, it is a principle that is generally followed. It is the reason why a voter in Southern California will likely never share a district with a voter in Northern California. Rather, districts are drawn to contain voters that share the same proximate location. This is a pattern that can be observed across the states. Voters will be more likely to share a district with another voter if that voter is in their "neighborhood."

In order to estimate the likely partisan outcome that would result from the hypothetical ten-district elections generated by the segregation models, I would need to measure the outcomes of all potential voter-district assignments. However, determining the distribution of all potential assignments is a complex problem. Since there are innumerable ways to partition the voters on the grid into ten compact, contiguous and equally apportioned districts, I will instead have to randomly sample from the distribution of potential districts.

To do this, I leverage an algorithm that randomly searches the grid for a set of districts that fit the criteria of being compact, contiguous, and roughly equal in population.[6] Specifically, the algorithm is a variant of a weighted k-means strategy and can be easily described in the following steps (see fFgure 2.5 for a visual of the procedure):

Step 1 Randomly generate a set of 10 seeds using k-means++. Therefore, the first seed is assigned to the location of any voter on the grid with uniform probability. Then the second seed is randomly assigned to the location of any voter on grid with a probability proportional to the distance from that voter to first seed. Then the third seed is randomly assigned to the location of any voter on grid with a probability proportional to the distance from that voter the nearest seed to that voter. This process repeats until all seeds have been set. The seeds will be the centroids of the ten districts. See Figure 2.5 (A).

Step 2 Assign all voters to their nearest centroid, thereby partitioning them into districts.

Step 3 For each district, count the number of voters that have been assigned to it. Continue only if any district population is more or less than 2.5% of the mean population.

Step 4 Marginally change the location of the district centroid along the gradient that best reduces the variance of the population across the districts. Repeat this step until all districts are within 2.5% of the mean population. See Figure 2.5 (B).

[6] The algorithm leverages a similar approach used in Fryer Jr and Holden (2011).

Step 5 The voters are assigned to their nearest centroids and the partisan vote is calculated. See Figure 2.5 (C).

While this districting algorithm is an attempt to replicate real-world map-making by assigning voters to districts in adherence to geographic standards, they are not, however, designed with partisan intent. Of course, partisan intent in the districting process is a reality. Real-world map-makers can choose the most favorable map from the set of potential maps. Or they can draw bias into their districts by ignoring compactness and drawing oddly-shaped districts where boundaries weave through the landscape to produce partisan favor. Yet there are a number of reasons to think that gerrymandering has its limitations and that legislators are bound by geographic constraints.

For example, although we would expect gerrymandered districts to take on wild shapes, most U.S. Congressional districts are designed with some reasonable compactness. Districts do not usually contain voters that live far from each other, which is to suggest that despite the opportunities for gaining advantage by drawing such non-compact, elongated, and far-reaching districts, map-makers tend not to do so. They seem to defer to a standard of maintaining some geographic compactness, meaning that the Congressional districts that contain voters in Los Angeles tend to contain other voters in Los Angeles. And while compact districts can still be designed to carry partisan favor, being constrained by the standard - at least in part - makes gerrymandering more difficult. Moreover, Chen and Cottrell (2015) find that most of the variation in partisanship across Congressional delegations can be explained by districts that have been drawn without partisan intent. Therefore the unbiased districting procedure used in my simulations may convert votes to seats similar to that of a real-world districting plan.

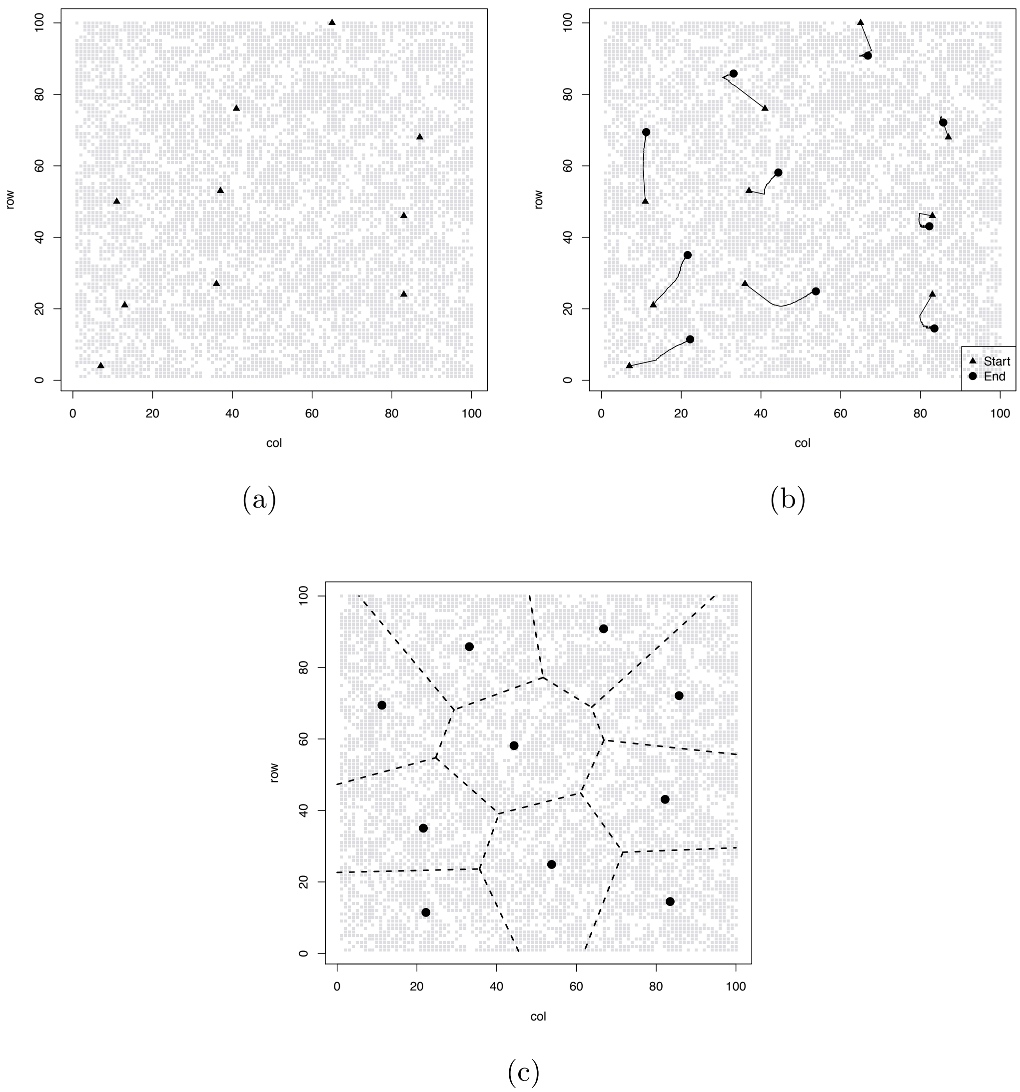


Figure 2.5: Once the locations of partisans have been established on the grid, an algorithm is used to randomly generate ten compact and contiguous districts of roughly equal size. It accomplishes this by randomly distributing ten centroids across the grid(a), where voters are assigned to the nearest centroid. Then, to correct for malapportionment, the gradient-step method iteratively moves the centroids in a direction that makes small improvements in apportionment(b). It stops when a roughly equal number of voters are assigned to a set of centroids(c).

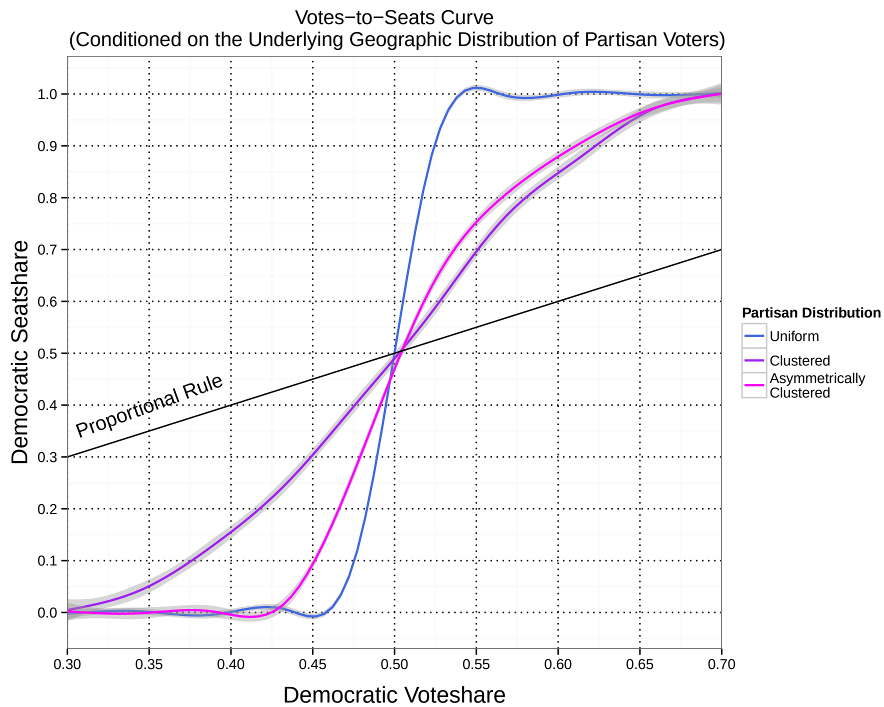
2.3.3 Producing the Votes-Seats Curve

After running the segregation models and assigning voters to districts for each of the three types of clustering at every split of the two party vote, I am able to determine the outcome of each hypothetical election. This produces a Democratic seat share that is associated with every percentage of the Democratic vote. A LOESS smoother averages all the iterations of the model across every split in vote share. This generates the votes-seats curve for each of the three types of clustering.

Figure 2.6 plots these curves against each other. In each plot, the x-axis represents the Democrat's share of the two-party vote and the y-axis represents the resulting Democratic share of the seats. While the first plot allows the x-axis to range from 30% to 70% vote share, the second plot limits the range from 45% to 55% in order to focus on less significant margins of victory. Each curve displays the relationship between vote share and seat share that occurs when drawing compact and contiguous districts over an electorate that is sorted according to the three different partisan spatial patterns. And by comparing the three curves we are able to observe how partisan geography can potentially influences U.S. representation. This is especially important in light of the fact that partisanship is becoming more and more segregated (Nall, 2015). Depending on the manner with which these partisans distribute - symmetrically or asymmetrically - these votes-seats curves will help us to understand its potential effect on partisan representation.

2.3.4 How partisan clustering affects the votes-seats curve

In Figure 2.6, each curve reflects the outcomes of the model under the three versions of clustering, where partisans are uniformly distributed (in blue), symmetrically distributed (in purple), and asymmetrically distributed (in pink). If voters are uniformly distributed, as displayed by the blue line, a "z-shape" curve will link votes-to-seats. This is consistent with winner-take-all representation, where small margins of victory allow the winning party to take all of the seats. This is because when the 6,400 voters are randomly distributed across space and assigned to districts, the partisanship of the 640 members of each district will be very similar to the partisanship



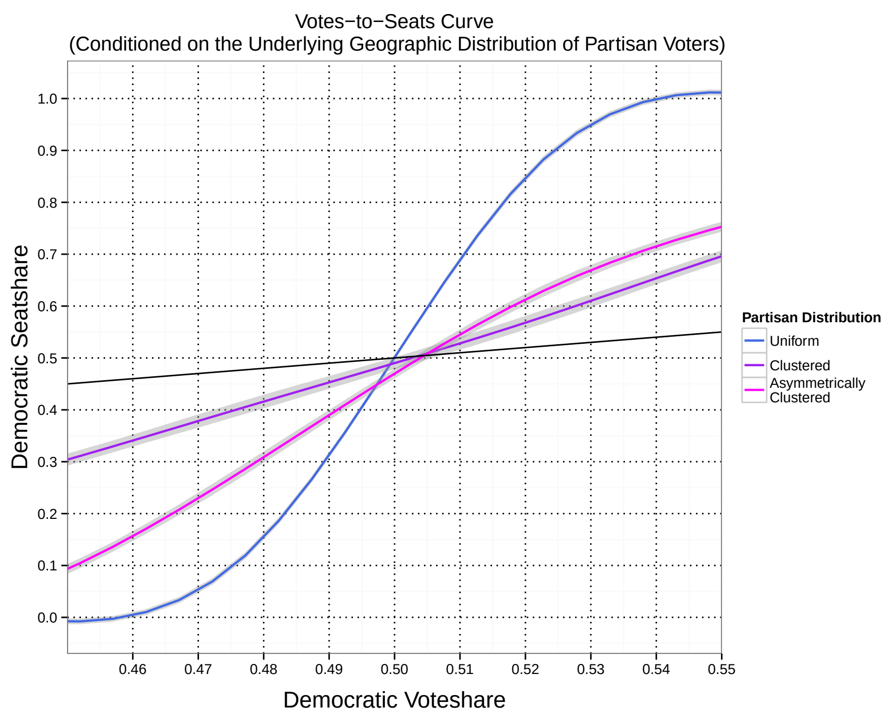


Figure 2.6: The votes-seats curve that results from 30 simulations performed at each split of the two-party vote for the three types of Democratic clustering. Each curve is smoothed using a LOESS smoother and 95% confidence intervals are included.

of the state. Therefore, when the partisanship of the state is just above 50% Republican, the partisanship of each of the districts will be just above 50% Republican. In an election where the partisans are distributed uniformly, a simple margin of victory produces strong gains in seats for the majority party.[7]

The curve generated from symmetric clustering - the purple line - is a symmetric curve much like the curve generated by the uniform distribution. The symmetry simply means that Democrats and Republicans win the same number of seats when holding the same majority of the vote. Therefore, Democrats are no more well-off than Republicans would be when holding the same vote share. However, when compared to the curve produced by the uniform distribution of partisans, the curve produced by the symmetric distribution of partisans is much flatter. Although they both cross the 50%-50% intercept, the curve is closer to proportional representation than winner-take-all. Therefore, a party that wins 55% of the vote wins fewer seats as the underlying distribution of partisans begin to cluster. This means that geographic polarization has the effect of making the majority party worse off, regardless of which party it is.

A similar effect can be observed under asymmetric Democratic clustering, although there are some important differences. When Democrats tend to cluster more than Republicans (asymmetric Democratic clustering), as we often see with urbanization, it produces an asymmetric votes-seats curve. Therefore, when compared to the curve produced by the uniform distribution, an asymmetric votes-seats curve produces different gains and losses with respect to the parties. First, as Chen and Rodden (2013) find, when the two parties approximately split the vote, the Democrats win fewer seats than they would have under a less-urban environment. In which case, Republicans win more seats due to geography alone. This is the Republican advantage that is commonly associated with geography. However, analyzing the effect of Democratic clustering at a hypothetical 50% vote share and inferring that geography

[7] There is some bend in the curve due to noise in the partisan variation across districts, which would likely go away as the number of voters increases. However, we can think of the variation due to the low number of voters as the variation that occurs due to minimal partisan clustering. In which case, each voter on the grid would represent clusters of many voters as opposed to just one.

is only a problem for Democrats misses the full picture of how geography impacts the votes-seats curve. The model improves upon our understanding of the advantages and disadvantages that both parties experience in the face of partisan clustering.

Moreover, it is important to know how parties are represented beyond a 50% votes share. Parties are often rewarded for obtaining a supermajority of the seats. For example, in U.S. legislatures, certain supermajorities can override a veto. This presents a major partisan advantage if the opposite party was able to win the executive seat. Moreover, supermajorities allow for parties to overcome potential defectors when passing legislation. The larger the majority, the more the party can afford to lose potential swing voters.

To achieve supermajorities, parties will need to achieve larger majorities of the vote. So understanding what happens to seat share as vote share increases or decreases across the full spectrum of potential partisan splits is crucial to understanding a party's success in the legislature. Therefore, the benefit of the computational model is that it generates a number hypotheses about what exactly happens to a party's electoral success when it gains or loses votes under various degrees and types of partisan clustering.

2.3.5 Hypotheses

The model tells us about what would happen to the electoral success of a party as partisan clustering increases or decreases, as the type of partisan clustering changes, and as a party's vote share moves from a majority to a minority. Moreover, it gives insight about how each of these variables interact with each other to produce different electoral results. Therefore, the expectations generated by the model are numerous. However, for simplicity I've reduced the expectation to the following five general hypotheses about how Democratic clustering affects the votes-seats curve:

2.3.5.1 Clustering Reduces Majority Party Seat Share

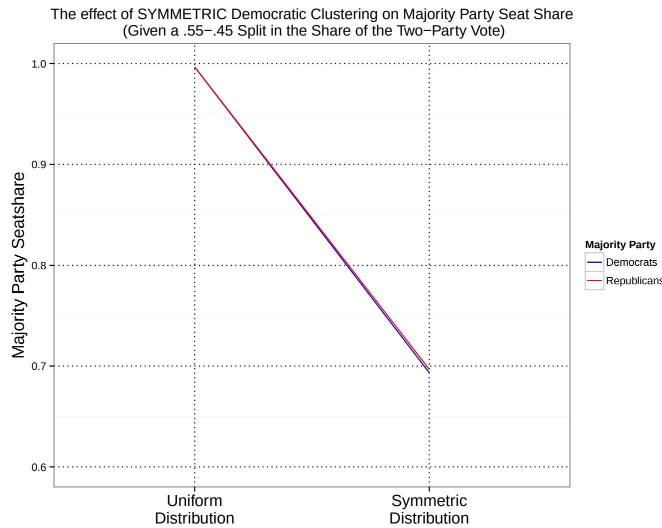
H1: The geographic clustering of partisans has the effect of reducing the seat share for the party that wins the majority of the vote.

Formally, if a party's vote share, V_P, is linked to its seat share, S_P, through the function f_T, where $T \in \{unif, symm, asym\}$ indexes the function generated by each of three types of clustering, then for both parties, $P \in \{Dem, Rep\}$, it is the case that $\int_{.5}^{1} f_{symm}(V_P) - f_{unif}(V_P) < 0$ and $\int_{.5}^{1} f_{asym}(V_P) - f_{unif}(V_P) < 0$.

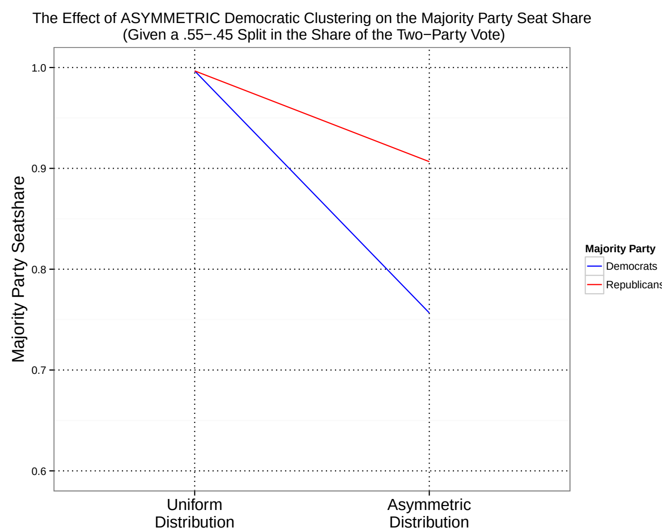
This means that partisan clustering - regardless of the type - flattens the votes-seats curve. This means that the expected number of seats generated by a majority share of the votes is reduced by the clustering of partisans. Both Republican and Democratic majorities would weakly prefer the less clustered environment than the clustered environment, as long as they both hold non-marginal majorities of the vote.[8] For example, from the second plot in Figure 2.6, we can move along the x-axis to observe the outcome of a hypothetical election where a party receives 55% of the vote both in the absence of geographic clustering (the blue line) and in the presence of geographic clustering (purple and pink lines). Comparing the two, we see that when the Democratic party holds 55% of the vote, moving from a non-clustered environment to a clustered environment will reduce the seat share of Democrats. Similarly, if the Republican party holds 55% of the vote, clustering will reduce the seat share of Republicans. Formally, the model implies that $f_{symm}(.55) - f_{unif}(.55) < 0$ and $f_{asym}(.55) - f_{unif}(.55) < 0$.

We can see this effect in the plots of Figure 2.7. The plots capture the effect of partisan concentration on majority party seat share for both Republicans and Democrats when they hold 55% of the vote. The downward sloping lines show the change in seat share when the underlying geographic distribution of partisans moves

[8]This also assumes that the parties prefer a greater share of the seats and does not consider a preference for incumbency protection



(a)



(b)

Figure 2.7: The figure above shows how the geographic clustering of Democrats changes the seat share of a party with 55% of the vote. Plot A gives the effect of symmetric clustering, while plot B gives the effect asymmetric clustering. The red line signifies the effect when Republicans hold the majority, while the blue line shows the effect when Democrats hold the majority. The implication of both figures is that clustering disadvantages both parties. However, in the presences of asymmetric clustering.

from a uniform to a clustered environment. While the first plot captures the effect of symmetric clustering, the second plot captures the effect of asymmetric clustering.

And in both cases, clustering reduces the seat share of the majority party.

Observing the blue line in both plots, it is clear that the effect of clustering on the majority party is that it reduces the number of seats for Democratic majorities. Democratic votes get packed into too few districts, thus having the effect of wasting votes in districts that are already overwhelmingly Democratic. However, contrary to Chen and Rodden, as the red line implies, when the Republican party has a similar 55% vote share, they too receive a disadvantage from clustering. In which case, clustering has the effect of improving Democratic seat share against the Republican majority.

However, as the second plot of Figure 2.7 makes clear, asymmetric Democratic clustering affects the representation of Republicans and Democrats differently. While both parties lose seats due to clustering when they hold the majority of the vote, Democrats lose more seats than Republicans. Therefore, asymmetric clustering has asymmetric partisan consequences. This leads to the second hypothesis.

H2: Asymmetric clustering - where Democrats cluster more than Republicans - has the effect of reducing the seat share for Democratic voting majorities more than it does for Republican voting majorities.

Formally, under asymmetric clustering, the seat loss for Democratic majorities is greater than the seat loss for Republican majorities, $\int_{.5}^{1} f_{asym}(V_{Dem}) - f_{unif}(V_{Dem}) < \int_{.5}^{1} f_{asym}(V_{Rep}) - f_{unif}(V_{Rep})$. Asymmetric Democratic clustering has the effect of bending the votes-seats curve such that the return in seats for any given share of the vote will differ depending on the party that receives that share of the vote. In particular, when Democrats hold a majority of the vote, asymmetric Democratic clustering will reduce the number of Democratic seats more than it would reduce the number of Republican seats for Republicans holding the same majority. This effect is displayed in the second plot of Figure 2.7. If the majority party held 55% of the vote, asymmetric Democratic clustering would reduce the seat share for Democratic majorities more than Republican majorities. Therefore, the model implies $f_{asym}(.55_{Dem}) - f_{unif}(.55_{Dem}) < f_{asym}(.55_{Rep}) - f_{unif}(.55_{Rep})$. Therefore, asymmetric Democratic clustering will penalize Democratic majorities more than Republican majorities.

2.3.5.2 Clustering Reduces Electoral Responsiveness

As Democrats continue to locate in dense urban areas, not only will the majority vote share translate into fewer seats, but there will also be a reduction the number of seats gained per additional vote. In other words, the slope of the curve will flatten, reducing what Tufte (1973) called the "responsiveness" of the electoral system. A flatter curve means that a party's seat share is less "responsive" to a change in vote share. We see that under a clustered environment, a gain in votes translates into fewer additional seats than in a non-clustered environment. For example, in New York, the density with which metropolitan New York City Democrats cluster tend to waste valuable Democratic votes that could be used to win districts elsewhere. Moreover, as Democrats continue to improve their vote share in a state like New York, their return in seats for every additional vote is much lower if the votes continue to be urban votes. As long as their votes join the cluster of urban voters, their seat gain will be small compared to a less clustered environment. This leads to the third hypothesis.

H3: Clustering reduces the electoral "responsiveness" for both parties by reducing the slope of the curve. Therefore, as clustering increases, a unit increase in vote share returns fewer additional seats.

We can see from the model that a party gains fewer seats under a clustered environment than a non-clustered environment when it moves from a 50% vote share to a 55% votes share. Formally, this can be expressed as

$$f_{symm}(.55_P) - f_{symm}(.50_P) < f_{unif}(.55_P) - f_{unif}(.50_P)$$

$$f_{asym}(.50_P) - f_{asym}(.55_P) < f_{unif}(.55_P) - f_{unif}(.50_P)$$

Moreover, if the type of clustering is asymmetric, there are different consequences for the two parties. In particular, the seat share achieved by Democratic majorities will be less responsive to an increase in vote share than Republicans in the same position. This asymmetric effect is stated in the fourth hypothesis.

H4: Asymmetric Democratic clustering reduces the electoral "responsiveness" of Democratic majorities more than it does for Republican majorities.

In an asymmetrically clustered environment, Democrats have less to gain from increasing their vote share than Republicans do in similar positions. We can see from the model that a party gains fewer seats under a clustered environment than a non-clustered environment when it moves from a 50% vote share to a 55% votes share. Formally, this can be expressed as

$$f_{asym}(.55_{Rep}) - f_{asym}(.50_{Rep}) > f_{asym}(.50_{Dem}) - f_{asym}(.55_{Dem})$$

The asymmetry of the votes-seats curve produced by asymmetric Democratic clustering reduces the slope of the curve for Democratic majorities more than it does for Republican majorities. Therefore, in states where Democrats hold a majority of the vote (and given that there are still seats to be won), asymmetric Democratic clustering has the effect of reducing the efficiency with which additional votes translate into additional seats. As a result, the asymmetric residential patterns create conditions where Democratic majorities have less of an incentive to win additional votes per seat than Republican majorities.

2.3.5.3 Asymmetric Clustering Produces Pro-Republican Bias in Close Elections

Finally, as Chen and Rodden (2013) find, the results of the model suggest that in close elections, the asymmetric clustering of Democrats improves Republican seat share over the non-clustered counterfactual. This allows Republicans to achieve a majority of the seats without a majority of the vote. Therefore, this gives the fifth hypothesis generated by the model.

H5: In close elections, asymmetric clustering reduces Democratic seat share, allowing Republicans to gain a majority of the seats without a majority of the votes.

The final hypothesis suggests that asymmetric clustering produces electoral bias toward Republicans. In Figure 2.6 we can see this bias by observing how the pink line passes below the 50%-50% intercept. Therefore, in states where Democrats are asymmetrically clustered, Republicans can achieve a majority of the seats without a majority of the vote. Formally, $f_{asym}(.50_{Rep}) > .50$.

2.3.6 Policy Implications of the Model

Given that map-makers are constrained by geographic principles like contiguity and compactness, the model reveals a number of predictions for how residential patterns of partisan voters affect partisan representation in the United States. These predictions provide important policy implications for both the Democratic and Republican Parties. Because of this, parties must pay attention to how their partisans are located spatially. And they must pay attention to how partisan platforms can affect the spatial distribution of their voters, especially in light of the continuing spatial divide between Republicans and Democrats.

Where Democrats have clustered asymmetrically, they can find themselves with a number of challenges. First, Democrats will have trouble winning the majority of seats with marginal majorities of the vote. Unlike the other forms of clustering, the asymmetric clustering causes the votes-seats curve to dip below the 50%-50% intercept, biasing the system in favor of Republicans. Therefore, in competitive elections, the asymmetry of partisans causes Democrats to inefficiently waste votes by packing most of their partisans into a few districts and spreading the rest too thinly across the other districts. The result is that Republicans gain a natural seat advantage in the legislature.

We see this in states like Florida and Pennsylvania, where toss-up elections will naturally produce Republican congressional delegations. Because districts in Miami and Philadelphia produce overwhelmingly Democratic majorities while districts in the periphery produce marginal Republican majorities, Democrats lose seats that they might not otherwise have lost. For example, although Obama won 54% of the vote in Pennsylvania in 2008, a majority (10) of the 19 districts supported McCain over Obama. The asymmetry in the distribution of votes across the districts was clear. All but two of the McCain-majority districts supported McCain with less that 55% of the vote while only two of the Obama-majority districts supported Obama with less than 55% of vote. In McCain's two most supportive districts, he won 56% and 63% respectively. While in Obama won nearly 90% of the vote in both of his most supportive districts located in the heart of Philidelphia. The asymmetric distribution of the votes was at the root of Pennsylvania's Republican delegation.

A second consequence of asymmetric clustering is that, like symmetric clustering, it reduces the majority party's seat share as well as the rate at which the majority party can pick up seats with additional votes. However, unlike symmetric clustering, it has the effect of disadvantaging Democratic majorities more than it does Republican majorities. Therefore, where Democrats receive voting majorities, asymmetric residential patterns will be detrimental to the party's legislative seats share. Democratic majorities will be worse off than Republicans in the same position and they also have far less to gain by increasing their popular support.

Therefore, in Democratic states Democrats have the incentive to reduce the spatial clustering of their votes. The overwhelming urban support for Democrats does little to advance Democratic seat share in these situations. Instead, Democrats would prefer to swap urban votes for non-urban votes. By improving their support in the periphery, they are more likely to win back the marginally Republican seats in the state. As a result, there is much to gain from de-clustering.

On the other hand, when Democrats find themselves in a state where they hold the minority of the vote, they can make partisan gains from doing the opposite. In these cases, Democrats can use the spatial clustering of partisanship to their advantage. When Republicans hold a strong majority, clustering tends to help save Democrats from steep losses to their seat share. Therefore, to improve Democratic seat share, Democrats can target policy that favors metropolitan areas in Republican states. This can have the effect of producing seat gain where they might not otherwise receive it. By packing Democrats into a single location, Republicans are simply unable to break the Democratic majorities without explicitly drawing oddly-shaped, non-compact districts. Strong metropolitan support, therefore, advances Democratic seat share when statewide support is generally low. We see this effect in Texas, for example, where Democrats not only pick up seats from densely packed Democratic voters in metropolitan cities like Dallas, Houston, and San Antonio, but the strongly Democratic Texas South, where the Hispanic vote is difficult to dilute even without VRA protections. The clustering of the Democratic vote in Texas is potentially explains why Democrats receive at least a third of the seats in Texas despite a significant minority of the vote.

Moreover, the model reveals another potential solution for Democrats to improve their representation in these Republican states. The solution is to induce symmetry within the spatial distribution of the partisan vote. While asymmetric clustering is an improvement for Democrats compared to a non-clustered environment, it does not deliver the same return in seats as symmetric clustering does. In other words, the non-urban Democrats that join the Republicans on the periphery - which is the cause of the asymmetric clustering - have the effect of improving the ability for Democrats to win seats in states where Republicans hold a majority. But compared to more symmetric clustering, asymmetry is less efficient at doing so. This is because the Democrats that live outside of urban areas do not have the numbers to win non-urban districts. Therefore, these votes would be more useful to Democrats if they were densely concentrated in metropolitan cities, where they might be able to pick up another seat through packing. So, in states where Republicans are in the majority, packing has beneficial consequences for Democrats. They would be better off creating policy that further polarizes voters along geographic dimensions in these states. So, just as Democrats lose seats due to the geographically polarized environments when they are in Democratic states, they gain seats in the same way when they are in Republican states.

An additional consequence of asymmetric clustering is that it has an asymmetric effect on the slope of the votes-seats curve. Because the slope of the curve is lower when Democrats hold the majority, it is much more difficult to gain additional seats from additional votes. On the other hand, when Democrats hold the minority of the vote, there is the opposite effect. The slope of the curve is much greater, which means an additional vote translates into a greater number of additional seats. Therefore, there is greater incentive to target supporters in states with Republican majorities. By increasing vote share in these states, Democrats can make great improvements to their seat share in the legislature.

In either case, the model generates the following expectation: Even in the face of redistricting, partisan clustering affects how partisans are distributed across legislative districts in such a way that any party holding a non-marginal majority of the vote will likely lose legislative seats. This includes the Republican party.

2.4 Conclusion

Obtaining a greater share of the vote is a major goal for parties. Yet the efficiency with which votes translate into seats is perhaps of greater concern. This is why the votes-seats curve is important to scholars. Since it is theoretically possible to achieve a wide ranging share of the seats given any share of the vote, parties will always be interested in improving their votes-seats relationship. Changing the curve in a way that plays to a particular party's advantage means altering the playing field on which parties compete for power. The consequences can be major. Therefore, it is in the best interest for parties to attempt of the change this curve if they are able to.

Because of this incentive, when partisan favor is observed in an election, many point the finger at gerrymandering. By manipulating district boundaries, parties are effectively able to change the votes-seats relationship. And since political parties are often unchecked in the districting process, the accusations of gerrymandering are common. Simply observing a votes-seats curve that appears favorable to one party over another triggers the assumption that the partisan favor was intentionally designed by the boundary-makers.

However, recent research by Chen and Rodden (2013) suggests that partisan favor might not be the work of parties at all. Instead, the favorable votes seats curve might be attributable to the geographic distribution of partisan voters. They argue that boundary-makers are constrained by geographic principles like compactness and contiguity when constructing districts. And because they adhere to these principles, they allow for the geographic distribution of voters to influence the votes-seats relationship. They find that the tendency for Democrats to cluster their vote in dense urban areas, gives Republicans a natural seat advantage in legislatures, even in the presence of redistricting. In particular, they suggest that given a 50-50 split of the vote, geographic clustering would tip the scales to favor Republicans.

Yet, despite their findings, it remained unclear how the clustering of Democrats influenced the full votes-seats relationship. This is because we are unable to observe elections at every split of the vote under various forms of partisan clustering. However, by simulating elections using an agent-based model to segregate partisan voters, I was able to develop expectations about how different types of geographic clustering affects the votes-seats curve across the full spectrum of votes. This provides a set of predictions about the consequences of partisan residential patterns that have been previously unexplored.

For example, assuming that districts are drawn to uphold the geographic principles of contiguity and compactness, the model finds that when Democrats cluster asymmetrically with respect to Republicans, the votes-seats curve bends in an asymmetric fashion. The asymmetry of the curve tends to disadvantage Democrats by reducing their seat share for most spits in the two-party vote. However, when Republicans hold a significant majority of the vote, Democratic clustering can have the opposite effect. Instead of disadvantage Democrats, clustering can disadvantage Republicans. In states with strong Republican support, the geographic concentration of Democrats forces Democratic seats that might not otherwise have existed. In states like Tennessee, for example, it is difficult to design a set of nine compact and contiguous districts without drawing Democratic districts in Memphis and Nashville. The very nature of the residential patterns of partisans in these two metropolitan cities gives Democrats a boost in their seat share, effectively reducing Republican representation.

The findings of the model provide an important connection between partisan geography and representation. Simply because legislative districts are linked to geographic jurisdictions, there are major representational consequences to something that is so seemingly inconsequential to politics as residential location. As partisanship divides along the urban-rural line, for example, the partisan composition of the legislature can change without changing the overall partisan vote. Representation is therefore conditional on the geographic manner in which partisans differentiate themselves rather than the extent of partisan support. Because of this, scholars must pay closer attention to how partisan divisions translate into geographic divisions.

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CHAPTER III

Geography or Gerrymandering:

Empirically Testing the Relationship Between Geography and Representation

Abstract

The previous chapter uses a computational model to make predictions about how the asymmetric geographic clustering of Democratic voters affects the votes-seats relationship in U.S. legislative elections. In particular, it predicts that the asymmetric geographic clustering of Democratic voters will lead to the flattening of the votes-seats curve, thereby reducing the seat share of the majority party. Moreover, it predicts that the curve will flatten asymmetrically, reducing the seats more for Democratic majorities than for Republican majorities. In either case, the predictions imply that partisan spatial patterns are, in theory, an important determinant of the votes-seats relationship. In this chapter, I provide empirical support for this claim so as to validate the model's theoretical predictions. First, I show that the current Congressional districts are similar in partisan composition to a set of hypothetical districts drawn using the same geographic parameters as the computational model that produces those theoretical predictions. Second, I show that the distribution of the two-party presidential votes across Congressional districts from 1972 to 2004 tends to correlate with the urban/non-urban division in partisanship, implying that geographic polarization creates district polarization. And third, I show that the effect of this geographic polarization is that it bends the votes-seats curve in a way that is consistent with the first and second hypothesis established by the second chapter.

3.1 Introduction

The function that translates a party's vote share into its seat share is important to democratic legislative representation. Normatively, the democratic ideal would be for the partisan composition of the legislature to reflect the partisan composition of the constituency. Therefore, vote share and seat share would have a direct 1-to-1 relationship. While proportional rule systems are designed to achieve this ideal by directly linking seat share to aggregate constituency vote share, single member district plurality-rule systems - like that which is used in the United States - establish partisan seat share through a more indirect process. Rather than linking legislative seats to aggregate partisan votes in the U.S., seats are instead determined at the district level. Therefore, the function that links votes to seats depends on a complex electoral process where the population is divided into separate geographically contiguous constituencies in which parties are elected by achieving the plurality vote in those constituencies. As a result, a party's representation depends not only on the share of votes it receives but also on how those votes are distributed across the districts.

And it is this distribution of the votes that explains, to a large extent, how parties are represented in U.S. legislatures. In contrast to proportional representation where a predetermined rule always translates a 60% vote share into approximately 60% seat share, the electoral system in the U.S. can translate a 60% vote share into wide range of potential seat shares. For example, in a hypothetical ten district election, the party that receives 60% of the vote can receive anywhere between 20% and 100% of the seats depending on how those votes are distributed across the districts. This range of possible outcomes for a given share of the vote simply highlights the importance the distribution of votes in single member district systems. It plays a major role in linking votes to seats. Yet, what explains this distribution of a party's votes across the districts in the first place?

One hypothesis that has recently gained traction in political science research is that the distribution of partisan votes across the districts is a function of how those votes are distributed geographically. This hypothesis suggests that the Republican seat advantage that we see in Congress today is less a result of gerrymandering than it is a result of the fact that Democrats tend to live in dense urban centers (Erikson, 1972; Chen and Rodden, 2013; Goedert, 2014). Because of this tendency, Democrats inefficiently pack their votes into urban congressional districts, reducing their ability to win districts in non-urban areas. Therefore, it is partisan geography that explains the distribution of votes across the district and determines how votes translate into seats.

In the previous chapter, I develop a set of expectations under the assumption that geography explains partisan representation. In particular, I show that the geographic clustering of partisans tends to flatten the votes-seats curve in way that makes the majority party worse off. Moreover, if partisan votes cluster asymmetrically - where Democrats cluster more than Republicans - then the effect of partisan clustering is that it *asymmetrically* flattens the vote-seats curve. This generates three major expectations. First, Democratic majorities will tend to lose more seats than Republican majorities. Second, Democratic majorities will tend to have less to gain from additional votes than Republican majorities. And third, Democrats will tend to lose toss-up elections.

These expectations, however, rely heavily on two major assumptions. First, real-world districts must be drawn to be geographically compact, contiguous, and equally apportioned. This means that the set of districts that can be designed by the boundary-makers are limited to ones that have the tendency to contain geographically dense populations rather than geographically disparate ones. And second, the model assumes that partisan influence on the design of the districts is limited. Rather, gerrymandering plays only a minor role in determining the votes-seats curve. If both of these assumptions hold, then districts will tend separate voters based on whether they live in dense urban areas versus sparse suburban or rural communities. Therefore, the clustering of partisanship along that dimension will likely generate the results produced by the computational model in first chapter.

However, these assumptions are not obvious ones. One can easily point to a number of districts that have wildly non-compact shapes. Illinois' 4th district, for example, is commonly called the "earmuffs" district as it circuitously wraps around the periphery of eastern Chicago forming an earmuffs-like half-circle around the city. Moreover, boundary-makers are commonly accused of advantaging their party through gerrymandering. In Florida, for example, the Republican legislature drew a set of districts in 2012 that produced a strong Republican delegation with only a margin of the vote. Hence there is reason to be skeptical of the model's result.

Therefore, in this chapter I attempt to provide some empirical validation for the model. I do this in three ways. First, I show that the current Congressional districts are similar in partisan composition to a set of non-gerrymandered hypothetical districts drawn to be compact, contiguous, and equal apportioned. In other words, by drawing districts according the same rules as those used in the simulations, I am able to replicate the partisan results of real-world districts. Second, I show that the distribution of the two-party presidential votes across Congressional districts from 1972 to 2004 tends to correlate with the urban/non-urban division in partisanship, *even in the presence of gerrymandering.* This implies that the geographic clustering of partisans determines the distribution of partisan votes across the districts. And third, I show that the effect of this geographic polarization is that it bends the votes-seats curve in a way that is consistent with the first and second hypothesis established by the model. This means that 1) the geographic clustering of partisans has the effect of reducing the seat share of the party that holds the majority and 2) the reduction is greater for Democratic majorities than for Republican majorities.

3.2 An Argument for Partisan Geography over Partisan Gerrymandering

Every decade, state governments are responsible for drawing and redrawing legislative districts in the United States. They determine where the districts are located and, as a result, they determine who is assigned to which districts. This means that, through districting, a state can redistribute voters across the districts in a way that produces any number of electoral outcomes. Those who control the districting process are able to potentially control the partisan results of a legislative election.

Hence, when election outcomes overrepresent a particular party, gerrymandering is often the first to blame. Through gerrymandering, parties can redesign districts in a way that improves their seat share without improving vote share. They can shift their status in a district from the minority to the majority simply by altering the boundaries. And because of this, gerrymandering is a major concern for Democratic representation in the United States. Yet, to what extent is gerrymandering actually occurring across the states? And to what extent does it explain electoral outcomes?

Political scientists have attempted to isolate the effect of gerrymandering on legislative outcomes for years. There is a long line of research employing a number of empirical techniques that attempt to observe its role on representation. For example, many scholars have found that gerrymandering produces significant partisan seat gain (Abramowitz, 1983; Squire, 1985; Niemi and Winsky, 1992; Born, 1985; King and Browning, 1987; Gelman and King, 1994; Cox and Katz, 2002). Others have found that gerrymandering advantages incumbents and produces safer districts (Mayhew, 1974; Tufte, 1973; Cain, 1985). And some have linked gerrymandering to to an increase in Congressional polarization (Fiorina, Abrams and Pope, 2005; Carson et al., 2007).

However, while most scholars would agree that gerrymandering has an effect on representation, many have argued that the effect is limited. For example, there are a number of redistricting institutions that constrain partisan control of the districting process. And without full control over the process, it is difficult for parties to achieve their desired results. Some states have divided government, where districting plans that show partisan favor are likely be vetoed. Other states have attempted to remove redistricting authority from the legislature altogether. They do this in a couple ways. Either they outsource the districting process to independent bipartisan or nonpartisan commissions or they outsource the process to the state's judiciary. In either case, the design of districts is intended to be independent of legislative influence. And, for the most part, these institutional constraints have been shown to be effective at curbing partisan advantage (Gelman and King, 1994; McDonald, 2004; Campagna and Grofman, 1990; Goedert, 2014). At the very least, gerrymandering is made more difficult by these procedures.

Moreover, some states explicitly prohibit gerrymandering. Arizona, California, Delaware, Hawaii, Idaho, Iowa, Nebraska, Oregon, Rhode Island, and Washington all have legislated against some form of partisan or incumbent favoritism (Levitt, 2015). For example, Article 3 §1(a) of the Florida Constitution declares that "no apportionment plan or district shall be drawn with the intent to favor or disfavor a political party or incumbent." And Article 21 §6(e) of California's constitution explicitly states that "Districts shall not be drawn for the purpose of favoring or discriminating against an incumbent, political candidate, or political party." Therefore, in these states, legal action can be taken against the government if suspected of gerrymandering. This develops a legal incentive for states to refrain from partisan discrimination.

One additional reason why gerrymandering may be limited is that boundary-makers are constrained by geographic factors. For example, a number of states require that districts be geographically contiguous and compact. In other words, they are required to draw districts around dense communities in order to keep people who are geographically proximate to each other under a single representative. Take Michigan for example. The state has explicitly legislated that "district lines shall be drawn to achieve the maximum compactness possible" (Michigan Code §3.63(vi)). Moreover, the legislation adds that "Congressional district lines shall break as few county boundaries as is reasonably possible" (Michigan Code §3.63(ii)) and "as few city and township boundaries as is reasonably possible"(Michigan Code §3.63(iv)). In other word, by law, Michigan districts must be designed to uphold the geographic integrity of communities and counties as much as possible. And by adhering to this principle, boundary-makers are limited in their ability to assign any voter to a district in order to strategically achieve a desired outcome.

Because of the limitations on gerrymandering and because of the geographic principles with which districts are drawn, geography becomes relevant to partisan representation. If districts are being drawn around clustered populations, then the political preferences of those clusters will influence elections. Erikson (1972) noticed this effect years ago. Prior to reapportionment, urbanization shifted large portions of the population into urban districts. Because these urbanized voters tended to vote Democrat, valuable Democratic votes were wasted in overwhelmingly Democratic districts. As a result, Congress was heavily biased toward Republicans.

However, this geographic bias seemed to vanish after 1965 once *Westberry vs. Sanders* (376, U.S. 1) ruled that the Constitution required states to partition their voters into equally apportioned districts. The wave of redistricting that occurred as a result of this ruling in the 1960's adjusted districts so that they would no longer pack urban voters into a single district. As a result, the partisan geography argument became less relevant to scholars as they focused on a growing trend toward incumbency advantage.

Recently, though, the partisan geography argument has made a comeback. Today the urban-suburban differences in presidential voting is at its highest point (Nall,

2015) and many scholars have begun to reference the effect residential patterns have on partisan outcome of elections (McDonald, 2009, 2010; Erikson, 2002; Jacobson, 2003). For example, in a recent study, McCarty, Poole and Rosenthal (2009) execute a number of tests that find that gerrymandering provides little explanation for polarization in Congress. Instead, they find that the geographic differences in partisanship across districts and across states are a much better predictor of ideological variation in Congress. More recently, Chen and Cottrell (2015) make a similar argument about Florida. They find that the actual districts in Florida are not much different from ones that are designed impartially by a computer.

In providing empirical support for the computational model, I essentially continue this line of argument. The goal of this chapter is to present evidence that the votes-seats relationship is explained by the underlying partisan geography of the state. To do this, I begin by establishing a link between partisan geography and district partisanship. First, I attempt to convince the reader that it is safe to assume that districts are designed to be compact. I do this by showing that a set of districts that have been drawn to be nothing more than equally apportioned, contiguous, and reasonably compact tend to replicate the results of the actual districts in both Tennessee and Texas. This suggests that the number of Democratic districts in these states are simply a "natural" result of drawing districts over the state's unique geographic distribution of partisans.

I then show that the distribution of the two-party presidential votes across Congressional districts from 1972 to 2004 tends to change as the underlying distribution of partisans tend to change. This effect holds *even when controlling for redistricting.* This implies that the geographic clustering of partisans determines the distribution of the partisan vote across the districts.

In the last section, I test whether a change in partisan geography has the predicted effect of changing the votes-seats curve. Using the same presidential data I show that partisan clustering bends the votes-seats curve in a way that is consistent with the first and second hypothesis established in the previous chapter by the computational model. Ultimately, the analysis provides some support for the claim that partisan geography has an important role in representation in the United States.

3.3 Empirically Linking partisan geography to district partisanship

The computational model of the previous chapter makes predictions about the votes-seats relationship under various types of partisan clustering. However, the model's predictions rely on an important and potentially controversial assumption: that the boundaries of legislative districts are largely determined by the underlying geographic distribution of the population rather than the political ambitions of boundary-makers. In other words, it is geography - not gerrymandering - that is mostly responsible for determining how votes vary across districts and, thus, translate into seats. And it is with this assumption that the model generates predictions about *how* geography affects the link between votes and seats.

The assumption is that, by principle, legislative districts are drawn to be geographically contiguous and reasonably compact even in the face of partisan motivations. This principle acts to constrain the discretion of boundary-makers by limiting the set of potential districts they can achieve through gerrymandering. The rules are simple. Contiguity simply requires that one is able to travel from any location in the district to any other location in the district without crossing a boundary. Everyone in a particular district is, therefore, circumscribed by the same border. Compactness, although somewhat ambiguous in meaning, generally requires that the component parts of a district are closely packed together (Niemi et al., 1990). In other words, districts are designed to contain people and places that are in the same proximate location.

The principles of contiguity and compactness reduce some of the flexibility in designing far-reaching and oddly-shaped districts. Since there is a normative belief that geographically cohesive constituencies are desirable for representation, districts that violate contiguity and compactness are likely to be perceived as illegitimate. Because of this, drawing compact and contiguous legislative districts is a way to maintain the integrity of the districts and legitimize the districting process. This is why many states formally require that boundary-makers draw their district boundaries according to these principles. To be precise, 23 states formally require that their Congressional districts be contiguous and 19 states require that they be compact(Levitt, 2015). Take Idaho for example. Idaho statute, like that of many states, restricts redistricting commissions from drawing districts that violate these geographic principles. The statute explicitly states that the commission "should avoid drawing districts that are oddly shaped" and that the districts should be "composed of contiguous counties" (Idaho Code §72.1506). Therefore, there is a legal obligation to drawing compact and contiguous districts.

It is this contiguity and compactness of the districts that make partisan geography relevant to representation, which is the basis for the predictions of the computational model. By placing these geographic limitations on the districting process, districts will have the tendency to be drawn in a way that contains dense residential clusters such that geographically cohesive communities will remain undivided. Simply put, voters who live next to each other will be more likely to share a district than voters who live far apart. And as a result of this tendency, district composition becomes a function of voter location. Thus, geography is theoretically linked to representation.

If this link holds empirically, then the spatial patterns of partisans should determine how votes are distributed across the districts and translated into seats. This should bring legitimacy to the predictions made by the computational model about the way in which such spatial patterns change the votes-seats curve. This section is an attempt to establish this legitimacy. I provide empirical support for the argument that the distribution of partisan voters across the districts is a function of the underlying geographic distribution of partisans.

I do this in two ways. First, l replicate the sampling procedure used in the computational model on real-life data. Using a combination of precinct-level presidential returns and census-level population data, I use the same computer algorithm that I used in the computational model to randomly draw equally apportioned, contiguous, and compact districts across Tennessee and Texas, as well as a number of other states. I then compare the two-party presidential vote of the simulated districts to the two-party vote of the actual districts in order to show the striking similarities between the two outcomes. Although it is difficult to claim that boundary-makers are constrained by partisan geography and that the spatial distribution of partisans *causes* the distribution of votes across the districts, I am able to show that the simulated districts drawn under such constraints tend to replicate the real-world districts fairly accurately. While gerrymandering is observable, I show that geography explains a large extent of the variation across the districts.

To provide further support, I then run a second test that compares the underlying partisan differences between urban and non-urban counties to the standard deviation of partisanship across congressional districts in presidential elections from 1972 to 2004. The results of the test show that that as urban and non-urban counties divide in partisanship, so too does the division between congressional districts. This is further evidence that partisan geography influences the partisan distribution of votes across districts.

3.3.1 Simulating Districts

For the first test, I simply attempt to replicate the computational model of the first chapter using actual data on the geographic distribution of voters. The purpose of the test is to observe whether the computational model, which relies on simulating districts using simulated data, has real-world empirical validity. In particular, the model produces predictions about how geography affects the votes-seats curve under the assumption that districts are drawn according to geographic principles that are required for this relationship between geography and representation to exist in the first place.

A counter-argument to this assumption is that boundary-makers have the discretion to design any set of districts they please. Therefore, it is the boundary-makers that determine how votes translate into seats and not geography. And if geography is irrelevant to a district's partisan composition, then the predictions generated by the computational model would have no meaning. Therefore, one must be convinced that boundary-makers are not at their full discretion in designing districts. Instead, for the predictions to hold, boundary-makers must be constrained to drawing districts that are geographically contiguous and compact, allowing for partisan geography to be a determinant of electoral outcomes.

If partisan geography does in fact determine electoral outcomes, as the computational model assumes, then the real-world districts of a legislature should be consistent with the set of potential districts that are drawn under geographic constraints. Therefore, if I randomly sample from the set of compact, contiguous, and equally apportioned districts in any given state and compare the sample to the actual districts in the state, the outcomes should be similar. At the very least, this would suggest that the actual districts are no different than ones achieved by drawing maps that are made to only consider voter geography.

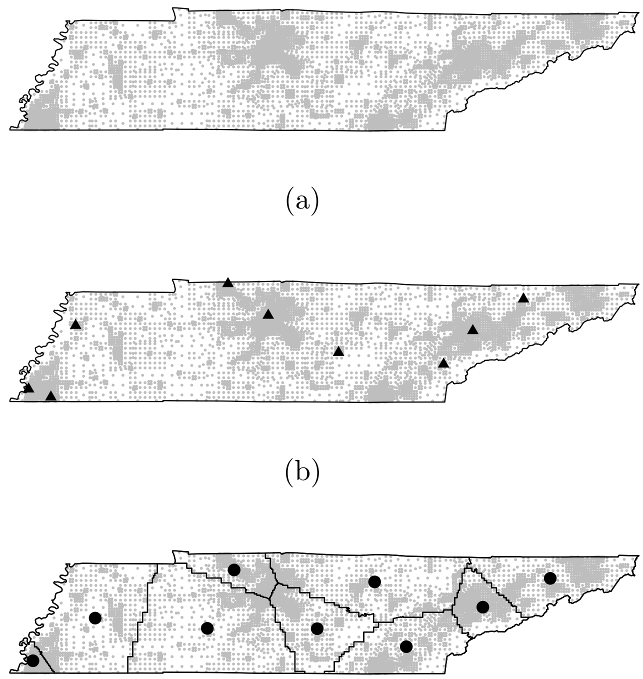
3.3.1.1 Tennessee

Take Tennessee for example. After the 2010 Census, Tennessee partitions its 6,346,105 residents into nine Congressional districts. Each district is designed to be approximately equal in population. The population in Tennessee is distributed across the state in a pattern common to most states. A large majority of the population resides either in urban centers or the peripheral suburbs. In Tennessee, around 4 of the 6.3 million people live in one of the four major metropolitan areas in the state. Each of the four - Memphis, Nashville, Knoxville, and Chattanooga - has more than 500,000 individuals. Yet three-quarters of the individuals either live in Memphis or Nashville. Moreover, these metropolitan areas are geographically distant from each other, such that they nearly occupy the four corners of the state. Therefore, the geographic distribution of the state's population can be characterized by the dense residential clustering of individuals within multiple, geographically-distant city centers, while the remaining population resides in smaller-town rural communities.

The residential patterns in Tennessee can be observed visually in Figure 3.1(a). The state has been divided into a grid of over 8,000 square polygons that have been constructed from 2010 Census block data to contain small sets of the population.[1] The average square contains just over 700 individuals, while a majority of the squares contain between 350 and 1000 individuals. The centers of each square polygon are marked by a grey dot and the distribution of these dots give a visual of where Tennessee residents live. Again, the spatial clustering in metropolitan areas is made clear.

The question posed in this section is whether this spatial distribution of Tennessee residents determines district composition in the state. In other words, are districts a function of the underlying spatial distribution of partisan voters? To test this, I

[1] Data was generously shared by Jowei Chen, who aggregated the Census blocks of each of the states into a more manageable grid of small geographic units that contain roughly equal populations.



(a)

(b)

(c)

Figure 3.1: The figure displays the steps of the simulation procedure used in Tennessee. Once the geographic location of Tennessee's population has been established on the grid using 2010 Census block data (a), an algorithm is used to randomly generate 9 compact and contiguous districts of roughly equal size. It accomplishes this by choosing nine blocks at random from the grid as the initial centers of the districts, where voters are assigned to the nearest center (b). Then, to correct for malapportionment, the gradient-step method iteratively moves the centers in a direction that makes small improvements in the apportionment of the districts. The iterations stop when the centers are positioned so that a roughly equal number of voters (within 1% of the target population) are assigned to each (c).

simply draw districts that I know to be a function of the geographic distribution of voters and compare them to the actual districts in the state. If the actual districts are, in fact, a function of geography, then there should be similarities between the two sets of districts.

To draw a sample of districts in Tennessee as a function of geography, I simply follow the same procedure as the computational model. I devise an algorithm that randomly chooses points on the grid to be the centers of districts. These centers are distributed across the state to be geographically distant from each other, so as to cover the full extent of the state's disparate geographic populations. Every point on the grid is assigned to its nearest center, which makes the districts contiguous and at least somewhat compact. Then the centers are adjusted by an algorithm where the square polygons on the borders of the districts are shuffled between the districts until the districts are roughly equal in population. In other words, the algorithm randomly searches the grid for a set of compact, contiguous, and equally apportioned districts.[2] It is a variant of the weighted k-means strategy. The procedure for Tennessee is described in the following steps (See Figure 3.1 for a visual of the procedure):

Step 1 Randomly generate a set of 9 seeds using k-means++, where the first seed is assigned to the location of any voter on the grid with uniform probability. Then the second seed is randomly assigned to the location of any voter on grid with a probability proportional to the distance from that voter to first seed. Then third seed is randomly assigned to the location of any voter on grid with a probability proportional to the distance from the voter to the nearest seed to that voter (voters who are most distant from a seed are most likely to chosen). This process repeats until all seeds have been set. The seeds will be the centers of the nine districts. See Figure 3.1 (b).

Step 2 Assign all voters to their nearest center, thereby partitioning them into districts.

Step 3 For each district, count the number of voters that have been assigned to it. Continue only if any district population is more or less than 1% of the mean population.

Step 4 Marginally change the location of the district center along the gradient that best reduces the variance of the population across the districts. Repeat this

[2]The algorithm leverages a similar approach used in Fryer Jr and Holden (2011).

step until all districts are within 1% of the mean population.

Step 5 The voters are assigned to their nearest centers (the black dots in Figure 3.5 (c)) forming nine contiguous, compact, and equally apportioned districts (separated by the black lines in Figure 3.5 (c)).

Using this procedure, I am able to assign each of the square polygons to one of nine districts in the state using only the location of the population in Tennessee to inform the assignments. No rule in the algorithm pertains to partisanship directly. Therefore, the assignments are unaffected by political ambitions as they might be in real-world districting. Instead, they represent a random sample of equally apportioned, contiguous, and compact districts that have been generated *naturally* from the underlying geographic distribution of voters. Yet it is unclear to what extent these "naturally" generated districts reflect the reality of the districting process in Tennessee. Surely, there are other factors that contribute to the design of districts in the real-world process. But if these other factors produce only small differences between the actual and simulated districts then it is likely the case that both sets of districts were generated under geographic constraints. To find out, I simply compare the partisan composition of the natural districts to the composition of the actual districts.

Following Chen and Rodden (2013) and Chen and Cottrell (2015), I use the two-party presidential vote from the 2008 general election as a measure of partisanship. This is a particularly useful measure because the 2008 votes have been collected, geocoded, and released publicly at the precinct level (Ansolabehere and Rodden, 2012). Since precincts are the most geographically precise level at which votes are tabulated, they can be used to calculate the partisanship of any district with precision. By projecting the votes onto the smaller square polygons that have already been assigned to both the actual and simulated districts, the votes can then be aggregated at the district level so that actual and simulated districts can be compared.

Figure 3.2 gives a visual of this process in Tennessee. In the first map of Tennessee (a), the centers of each square polygon have been marked with a dot. The color of each dot reflects the difference in the McCain-Obama share of the vote for the voters within that polygon. Dots that are more red represent polygons where McCain is favored. And dots that are more blue represent polygons where Obama is favored. The result is a visual display of the spatial distribution of partisan voters in Tennessee.

Common to most states, partisanship in Tennessee is spatially clustered. While we see that voters tend to reside in and around metropolitan areas like Memphis (in the southwest corner), Nashville (in the north-central part of the state), Chattanooga (in the southeast corner), and Knoxville (in the northeastern part of the state), it is the the dense urban cores of these metropolitan areas that tend to vote Democratic. This is in deep contrast to the red Republican clusters that surround the cores in the suburban periphery. The Republican vote is more sparsely distributed, thinning as it extends outward beyond the suburbs and into ex-urban and rural communities. The spatial pattern of partisans is clearly marked by this urban/non-urban division in Republicans and Democrats.

In the aggregate, Tennessee is a conservative state. It has had two Republican senators since 1994 and it has supported all but two Republican candidates in presidential elections since 1972 (Carter and Clinton are the exceptions). Even Al Gore - a Tennessee native and long-time representative - lost the state to George W. Bush in 2000. So although Obama won the densely populated urban cores of Memphis and Nashville, McCain received a significant majority of the two-party vote across the state in 2008. To be precise, McCain carried the state by almost an 8 point margin - a solid Republican victory that would repeat again in 2012 for Romney. Yet, given a 58% vote share, how do these votes translate into seats?

This question is at the heart of the paper. Hypothetically, districts can be designed to obtain a range of partisan outcomes. In fact, Republicans could design the

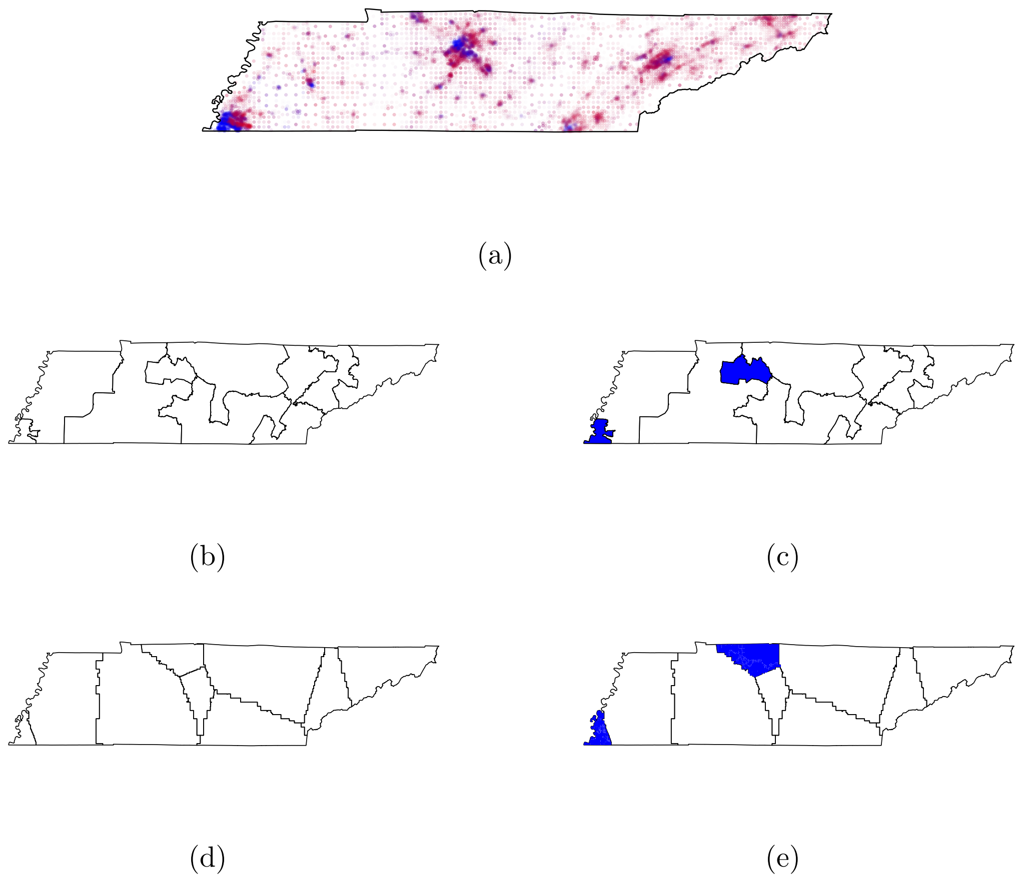


Figure 3.2: (a) The projected partisanship of each of the 8,488 VTD subunits in Tennessee. Obama supporters in blue and McCain supporters in red. McCain received approximately 58% of the vote. (b) The boundaries of Tennessee's actual Congressional districts. (c) The two actual Congressional districts where Obama supporters outnumbered McCain indicated in blue. (d) The boundaries of one of the fifty simulated districting plans. (e) The two simulated Congressional districts where Obama supporters outnumbered McCain indicated in blue.

district boundaries such that McCain would have carried 58% of the vote in each of the districts. Such a margin would likely secure every district in Tennessee for the Republican party. This would certainly have been a favorable partisan outcome for the Republicans. And it was not beyond their ability to make it happen given that the party was in control of the state's districting process in 2012. Yet the argument being made here is that the number of seats Republicans will receive in Tennessee given a 58% share of the vote depends largely on the geographic distribution of Democrats and Republicans. Although 100% seat share may be desirable for Republicans, the reason why we don't see Republicans taking all of the seats in Tennessee is simply because it is difficult to draw nine geographically contiguous and compact districts that assure Republican victory.

This is particularly the case in Tennessee because of the dense clustering in Memphis and Nashville. Half of the population of Tennessee lives in either of these two metropolitan areas. The cities have the largest urban centers in the state and are home to most of its Obama supporters. It is these two cities that are potentially responsible for maintaining Democratic districts in Tennessee. They make it difficult for Republicans to create Republican districts in those areas without seriously reducing the compactness of the districts. Because the Democratic clusters in Memphis and Nashville are large enough, dense enough, and geographically distinct enough from each other they potentially force the hands of Republicans to draw at least two Democratic districts in the state.

Figure 3.2(b) displays the boundaries of the nine post-2010 Congressional districts in Tennessee and Figure 3.2(c) highlights the two districts that received a majority Obama vote in 2008 in blue. Sure enough, of the nine districts in Tennessee two emerge as Democratic districts. And, as expected, these two Democratic districts emerge from Memphis and Nashville, where Democrats reside in dense urban clusters. Moreover, the simulated districts tend to produce the same outcome. Figure 3.2(c) and 3.2(d) display the result of a single simulated set of districts in the state. While the boundaries of these districts have been drawn at random they produce two Democratic districts in Memphis and Nashville just like the actual districts.

This outcome was common among the 50 randomly generated districts. As Figure 3.3 displays, all of the simulated districts generate at least one Obama-majority district. And about 40 of the 50 simulated districts generate two Obama-majority districts. Therefore, we would expect about two Democratic districts to emerge from

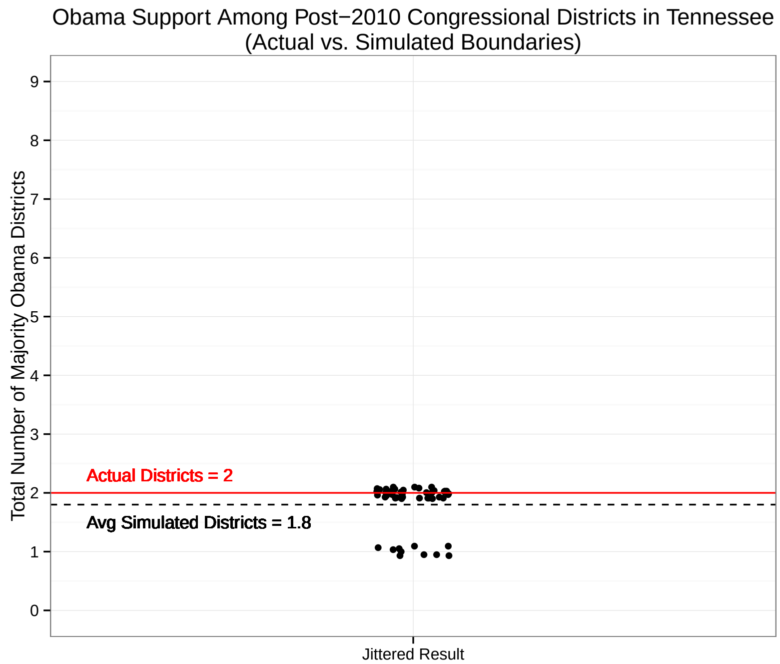


Figure 3.3: The figure plots the partisanship of Tennessee's Congressional delegation for each of the 50 simulations. It displays the number of Obama-majority districts in Tennessee that result from the 50 simulated boundaries randomly generated by the districting algorithm. And it compares them to the number of Obama-majority districts that result from the actual post-2010 boundaries. The results of the 50 simulations are indicated by the black dots arranged along the y-axis and randomly "jittered" along the x-axis for visualization purposes. The average simulation produced 1.8 Democratic districts, as indicated by the dotted line while the actual districts produced about 2 Democratic districts, as indicated by the red line. Therefore, the simulated districts do a fairly good job at predicting the actual districts

Tennessee as a "natural" outcome of drawing equally apportioned, contiguous, and compact districts in the state. Moreover, this "natural" outcome tends to replicate the true number of districts that supported Obama over McCain in the actual post-2010 districting plans. While this does not prove that the actual districts were generated using the same rules as the simulations, the similarity in the outcomes are consistent with the hypothesis that they were at least affected by geographic constraints just as the simulations were.

To further deconstruct the differences between the actual and simulated districting plans, we can compare the partisan vote share district-by-district. To do this, I arrange the nine districts in each of the simulated districting plans from most Republican to least Republican. Then I average the Obama vote share across the simulations for each of the districts, starting with the most Republican district, then the second-most Republican district, and the third-most Republican district, and so-forth until an average vote share for each of the nine districts is obtained. Then I arrange the actual districts from most Republican to least Republican and match them, as ordered, to their simulated counterpart. The scatter plot in Figure 3.4 displays the results.

Each district is arranged along the x-axis according to its simulated Obama vote share and along the y-axis according to its actual Obama vote share. Therefore, the extent to which the simulations match the actual districts is reflected in the extent to which the districts fall on the dashed line indicating a 1-to-1 relationship. We can see from the correlation that the partisan distribution across the districts is very similar between the actual and simulated districts. While the correlation is not perfect, it is certainly close. Both produce seven majority-McCain district and two majority-Obama districts. Both produce an overwhelmingly Democratic district where around 75% of the voters supported Obama (this is the Memphis district). Both produce a weak Democratic district with just over 50% of the vote. And both produce a set of Republican districts whose Obama vote share ranges from 30% to just over 40% of the vote. So the partisan distributions are strikingly similar to one another, which is especially significant considering that the simulated districts were drawn randomly according to only a few simple rules that districts be compact, contiguous, and equally apportioned.

However, while there are similarities, it is important to point out that there are differences between the two distributions as well. And these differences are potentially the result of gerrymandering. This is evidenced by the fact that both of the Democratic districts in Tennessee are more Democratic that their simulated counterfactual, while most of the Republican districts are more Republican than their

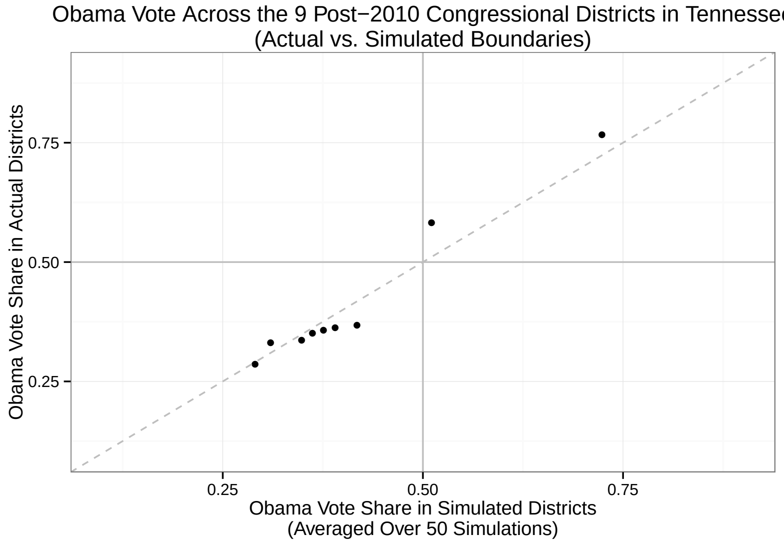


Figure 3.4: The figure compares the simulated Obama vote share across districts in Tennessee to the actual vote share. The Obama vote share for each of the nine post-2010 districts in Tennessee are ordered from least to most liberal. Then the Obama vote share for each of the nine simulated districts are ordered from least to most liberal and averaged across the fifty simulations. The actual and simulated districts are then matched according this order and their vote share is plotted above. The points are arranged along the x-axis according to their simulated Obama vote share and arranged along the y-axis according to their actual Obama vote share. The strong correlation between the two suggests that the actual districts and simulated districts have similar distributions.

simulated counterfactual. Take the two most liberal Republican districts for example. In the simulations, these districts achieve at least a 40% Obama vote share. But in the actual plans, these districts stay under 37% Obama vote share. Therefore, the districts are safer for the respective majority parties than they would have been under a set of districts that might have emerged through more “natural” conditions.

Because of this, it is possible that Tennessee’s Republican state legislature, which controlled the districting process in 2012, designed the districts so that seven of the nine would remain safe Republican seats. Therefore, they conceded the two Democratic seats in Memphis and Nashville, packed them with slightly more Democrats than the districts might otherwise have contained, and used the extra Republican votes to pad the other seven districts for safety. Therefore, one might argue that

Tennessee simply exemplifies that a state's districts are a function of gerrymandering and not geography.

However, although gerrymandering might have taken place in Tennessee, the results are not inconsistent with a geography story. It is still very likely that the boundary-makers were geographically constrained. For example, if the goal of the Republicans was to make seven safe Republican districts by sacrificing two Democratic districts, why not overwhelmingly pack *both* of those Democratic districts to the full extent possible? If geography was no constraint, Republicans could easily draw district boundaries around Democratic voters in a way that would overwhelmingly pack the two Democratic districts. Then they could reassign the extra Republican voters to the Republican districts and improve the safety of a Republican victory in those districts.

Yet, they did not do this. Instead, the distribution of partisanship across the state's nine districts seems to closely follow the distribution of partisanship achieved by the simulations. While it is just one example, it is consistent with the assumption that geography affects the votes-seats relationship. In Tennessee, the geographic clustering of Democrats in Memphis and Knoxville establishes two Democratic districts in a state where Democrats are in the minority.

3.3.1.2 Texas

Another example of a state where Democrats likely win seats due to Democratic clustering is in Texas. With over 25 million people declared in the 2010 Census, Texas was allocated 36 congressional districts in 2012. In a state where McCain was favored by just over 5 points and Romney was favored by just over 7 points, Republicans managed secure exactly two-thirds of the seats in 2012. While some might perceive that this is a direct result of gerrymandering, I provide evidence that the result is much more natural than it appears. I conduct the same procedure in Texas as I did with

Tennessee to provide further evidence that this underlying geographic distribution of partisans in Texas has power in explaining partisanship across the state's districts.

Figure 3.5(a) displays the geographic distribution of the 2008 Obama-McCain vote in Texas. Like Tennessee, Texas is marked by a largely Republican population where residents cluster into a handful of cities that are spread out across the state's disparate geography. Over 4 million people live in Harris County (Houston) on the easternmost part of Texas, while another 4 million people live over 200 miles northwest in Dallas and Tarrant counties (the Dallas-Fort Worth area). El Paso, on the other hand, is tucked remotely into the state's western corner between Mexico and New Mexico and is over 500 miles from the nearest major Metropolitan city, San Antonio. At the cores of these cities are dense Democratic populations, with strong Republican suburbs at the peripheries. The spatial patterns of partisans in Texas seem to be consistent with those of Tennessee.

However there are some differences. In Texas, some major cities appear to be more partisan than others. For example, El Paso County - with over 800,000 residents and marked by a large Hispanic population - overwhelmingly supported Obama with nearly two-thirds of the vote in 2008. Yet Houston's Harris County was less supportive of Obama, having split the vote between the two presidential candidates nearly 50-50. Moreover, not all rural areas in Texas support McCain over Obama. Though it may be difficult to observe in the figure, rural communities located south of San Antonio are actually strong Obama supporters. These are predominantly Hispanic communities that carry a significant Democratic vote and they add a unique twist to the already complex geographic distribution of Texas partisans.

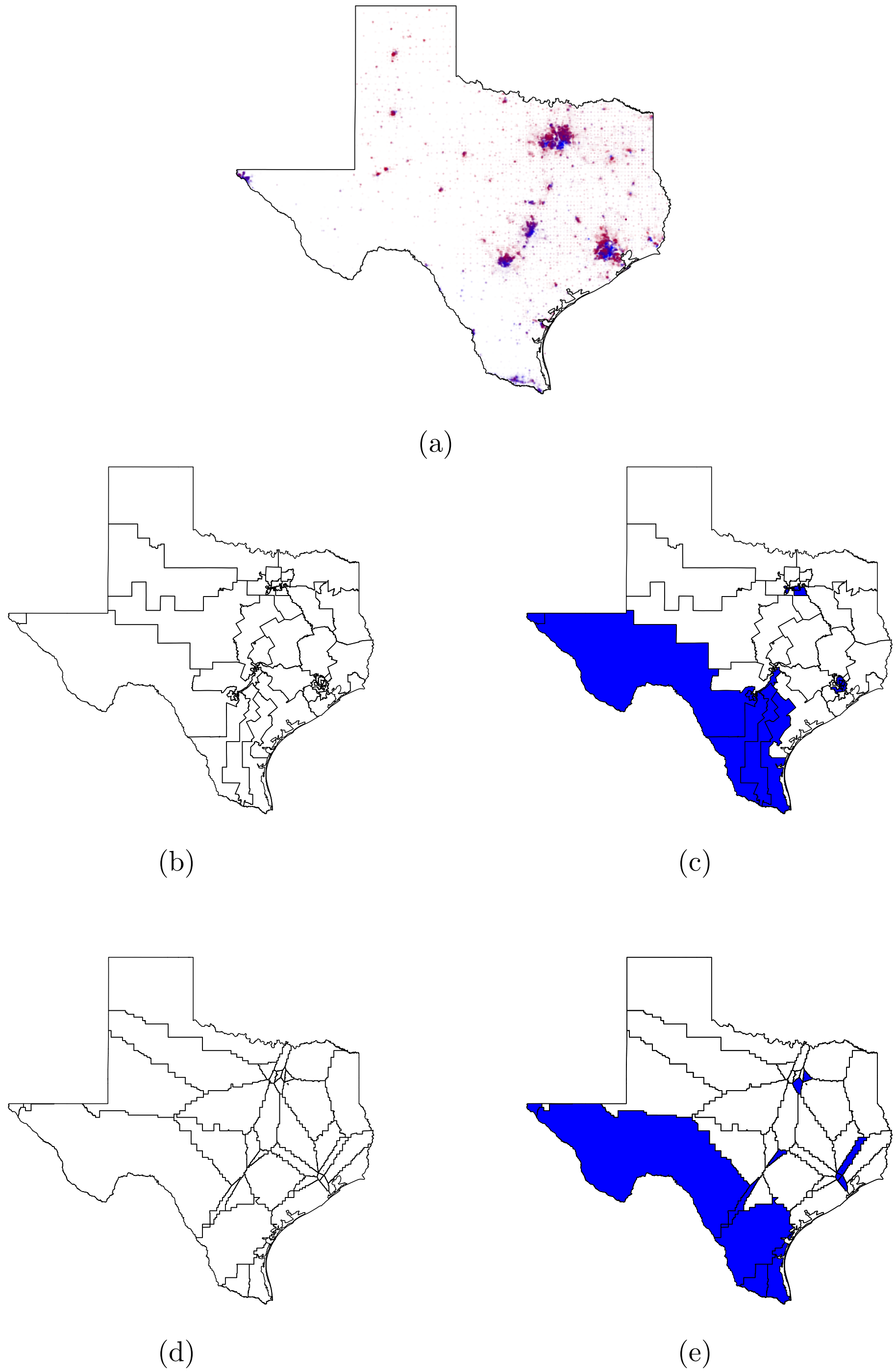


Figure 3.5: (a) The projected partisanship of each of the 54,401 VTD subunits in Texas. Obama supporters in blue and McCain supporters in red. McCain received approximately 55% of the vote. (b) The boundaries of Texas' actual 2012 Congressional districts. (c) The 12 Congressional districts where Obama supporters outnumbered McCain indicated in blue. (d) The boundaries of one of the fifty simulated districting plans. (e) The 12 simulated Congressional districts where Obama supporters outnumbered McCain indicated in blue.

Yet, although the partisan distributions in Texas and Tennessee have their differences, partisan geography still appears to explain a lot of the variation in the partisan composition of the districts. We can see that the actual districting plans in Figures 3.5(a) and 3.5(b) produce very similar Obama-majority districts as the simulated districting plan displayed in Figures 3.5(c) and 3.5(d). Both have a total of 12 Obama-majority districts and 24 McCain-majority district. Moreover, in both plans, the Obama-majority districts seem to emerge in nearly identical locations. Both have Democratic districts that extend across the southern part of the state from El Paso in the West to the very southern tip of the Texas-Mexico border in East, extending up toward Corpus Christi and into southern San Antonio. And both have multiple Democratic districts that emerge from Houston and Dallas, as well as the San Antonio-Austin area. The similarities between the real-world districts and the simulated districts are striking.

Figure 3.6 displays the partisan outcomes of all fifty simulated districts that were run in Texas. Once again, the simulations tend to replicate the outcome of the real-world districts fairly well. Most of the simulations produced either 12 or 13 districts while average simulation produced 12.4 districts. Therefore, one could expect between 12 and 13 Democratic districts to emerge from Texas as a natural result of the districting process. By drawing 36 equally apportioned, contiguous, and compact districts over the unique geographic distribution of voters in Texas, Democrats will naturally win between 12 and 13 seats. And sure enough, this number almost perfectly estimates the actual outcome in the state, suggesting that geography once again played a significant role in the determining partisan seat share in Texas.

Moreover, we can look at a district-by-district comparison for Texas in Figure 3.7. The figure shows that, much like Tennessee, compact, contiguous, and equally apportioned districts drawn at random from the underlying population do a pretty good job at predicting the partisan composition of each of the actual districts. Most

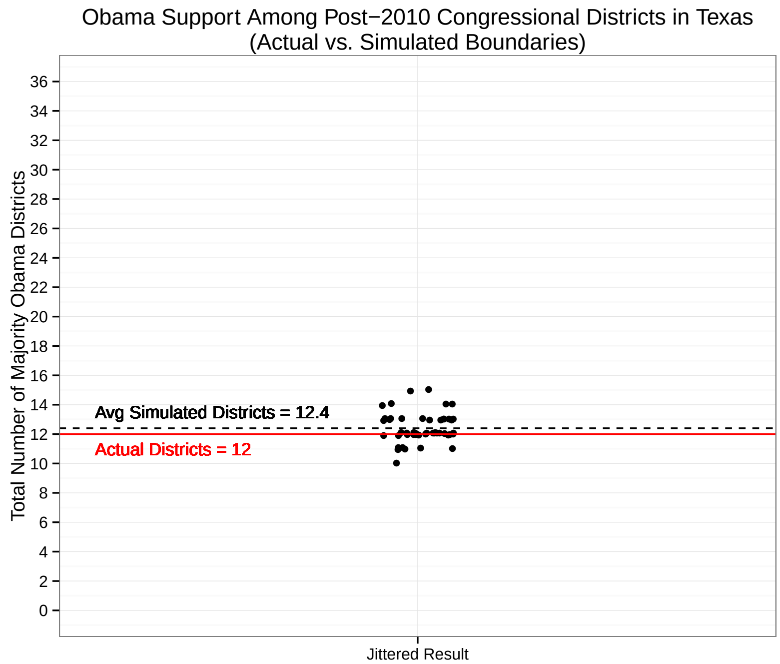


Figure 3.6: The figure plots the partisanship of Texas' Congressional delegation for each of the 50 simulations. The average simulation produced 12.4 Democratic districts while the actual districts similarly produced 12 Democratic districts. McCain won two-thirds of the districts with 55% of the vote and, although some might suggest that this is the product of gerrymandering in the state, the simulations show that the outcome is likely the "natural" outcome for Texas. This is especially the case given that the simulated districts do a fairly good job at predicting the actual districts

of the districts fall on the 1-to-1 line. Both the simulated and actual districts range from around 25% to around 75%. Both have many more Republican districts than Democratic Districts, meaning that in both cases the distribution of Democratic votes are skewed toward Republicans. The similarities between the two distributions imply that geography plays a role in the districting process.

Yet there are clear differences between the actual and simulated distributions. And much like in Tennessee, these differences imply gerrymandering. The strongest indicator of this is that districts tend to fall off the 1-to-1 line as they approach the simulated 50-50 split. As a result, the districts that should be competitive under a natural districting process are less competitive under the actual districting process. What is occurring is that most of the Democratic districts in Texas are even more

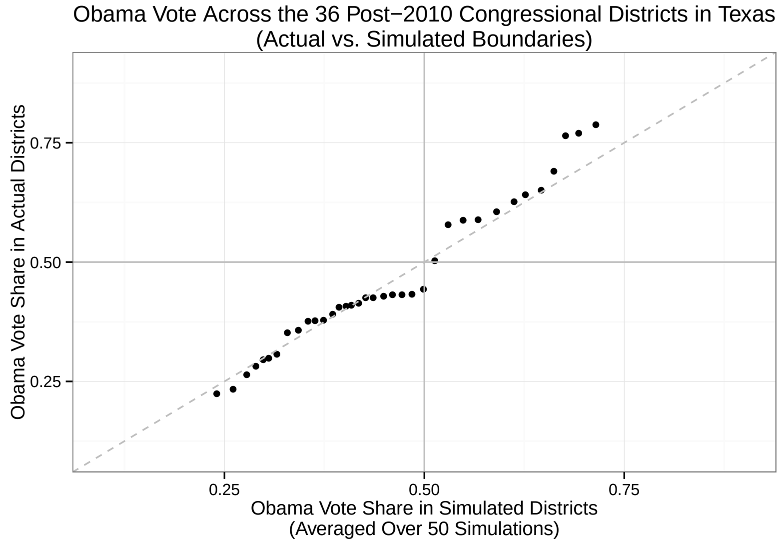


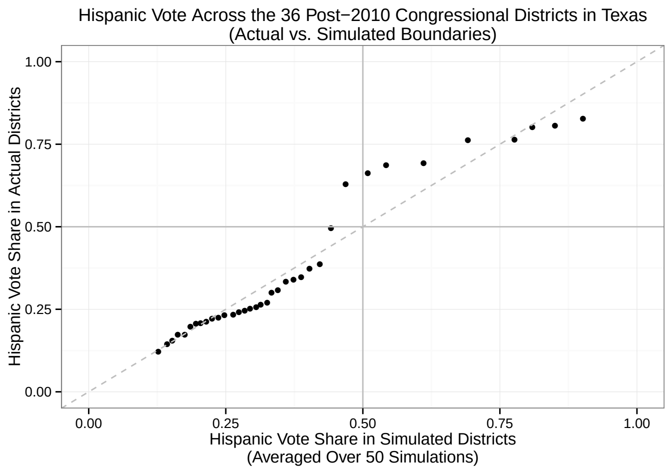
Figure 3.7: The figure compares the simulated Obama vote share across districts in Texas to the actual vote share. The 36 actual Congressional districts are plotted against the average simulated district. The strong correlation between the two groups suggests that the actual districts and simulated districts have similar distributions. The implication is that the distribution of partisan votes across Texas districts is a function of drawing compact, contiguous, and equally apportioned districts over the the complex partisan geography in the state. Moreover, the discontinuity at 50% vote share suggests that although geography plays a role, so does gerrymandering.

extreme than they should be under a randomly drawn districting plan. The Republican voters that should be in those districts are being distributed into the more marginally Republican districts so as to bolster the safety of those seats. As a result, the marginally Democratic and marginally Republican seats are safer than their counterfactual, reducing the likelihood that the districts will change parties given a swing in the partisan vote share.

Moreover, gerrymandering in Texas has a strong racial component. Since 1975, Texas has been a pre-clearance state under Section 5 of the Voting Rights Act. This means that the districting plan for the state must be approved by the Department of Justice to ensure that the minority vote is not diluted. And while the Republican-controlled Texas legislature designed official maps for the state, these maps were eventually adjusted by a federal three-judge panel in San Antonio. The panel made changes to the map that would improve the voting blocs for Hispanics and blacks in a number of districts (Fernandez, 2012). We can see the affect of this in Figure 3.8. The first plot in Figure 3.8 compares the Hispanic populations of each district in the state to the Hispanic populations of the simulations. The second plot does the same for black populations. Clearly, there are a number districts where Hispanic and black populations exceed that which would be expected under a random draw of the districts. Therefore, Texas exemplifies a state where districts are drawn to intentionally improve the voting strength of racial minorities.

Still, racial gerrymandering has partisan consequences. Since Hispanics and blacks vote overwhelmingly Democratic, packing their vote into a few districts can create an inefficient distribution of Democratic voters across the districts. And, as we saw in Figure 3.7, Republicans have used this Democratic packing to redistribute Republican voters to marginally Republican districts, creating the discontinuity mentioned above. Therefore, it is clear that Texas districting is not a purely natural process. There is no doubt that gerrymandering is present. We have observed the partisan advantage being adopted into the plan. And we have observed the legal influences on a district's racial composition. Both of which cause the redistricting plan in Texas to deviate from a more natural result in which partisan geography determines districts composition.

Nonetheless, the results do not overturn the hypothesis that partisan geography is a determinant of district composition. On the contrary, the similarities between the simulated and actual districts are consistent with the assumption that partisan geography is influential. For example, the simulated districts - that are drawn only according to geography - tend to replicate the partisan outcomes of the actual districts quite well. They provide a simple answer to the question: "Given a 55% McCain vote share, why is McCain favored in 67% of the districts in Texas?" The simulations suggest that this is the natural outcome of drawing compact, contiguous, and equally apportioned districts. While gerrymandering may cause the deviation from



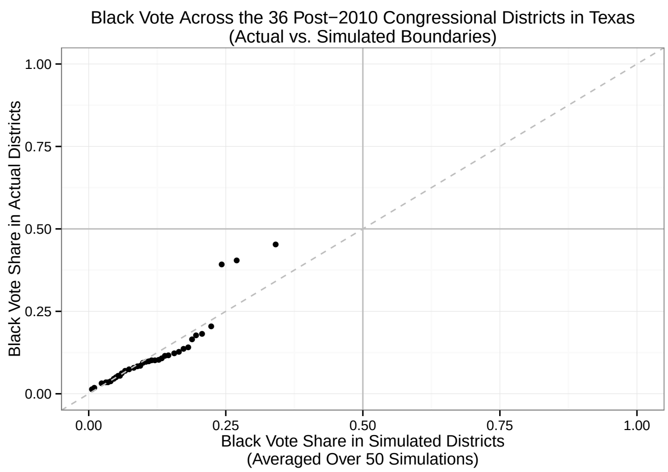
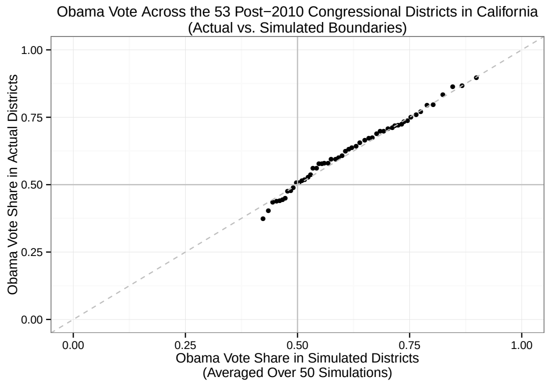


Figure 3.8: Comparing the Hispanic populations (top) and black populations (bottom) between each of the actual and simulated districts. Racial gerrymandering is clearly present in Texas, where the voting blocs of racial minorities are protected under Section 5 of the Voting Rights Act. Both Hispanics and blacks are packed into districts where they achieve stronger voting blocs that they would have under a more “natural” set of districts.

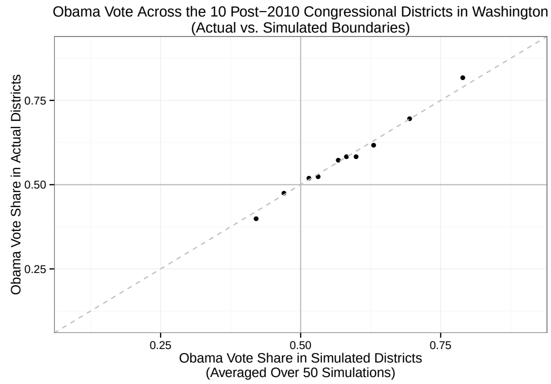
this natural outcome, the deviations are not major.

3.3.1.3 Additional States

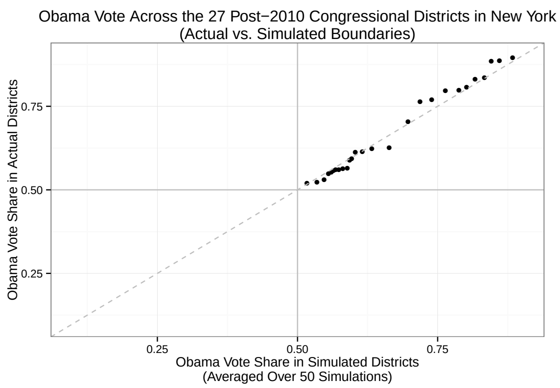
In order to provide further support for the hypothesis that districts are a function of partisan geography, I have performed similar simulations on four additional states. This time, instead of using states that favored McCain, I use states that favored Obama. In particular, I analyze the two largest Democratic states in the west, Cali-



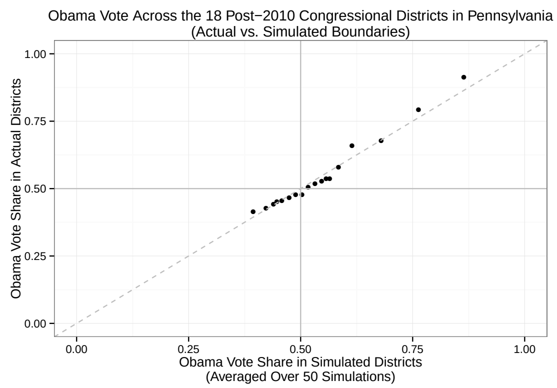
(a) California



(b) Washington



(c) New York



(d) Pennsylvania

Figure 3.9: A comparison of the actual and simulated districts for four large Democratic states. The figure plots California (61% Obama vote share), Washington (57% Obama vote share), New York (63% Obama vote share), and Pennsylvania (54% Obama vote share). The figures provides more support for the hypothesis that representation is influenced by the underlying geography of voters. In each state, the simulated districts -which only consider voter geography - are nearly identical to the actual districts.

fornia and Washington, as well as the two largest Democratic states in the East, New York and Pennsylvania. There are 108 districts across the four states, representing a fourth of the the total number of districts in Congress. Although it is not an analysis of every state, it covers significant a portion of Congress.

I have simulated 50 different districting plans for each of the states, just as I did for Texas and Tennessee. And I have similarly plotted the Obama vote share for each district against its simulated counterpart in Figure 3.9. The result of this exercise is clear. Almost every actual district across the four states is predicted by the simulated districts with precision. Both the range and variance of the districts in the two groups are nearly identical to each other. The correlation in each state is almost a 1-to-1 mapping. Most striking are the 53 districts in California, where we can see that only a few districts deviate from perfect linearity. The distribution of votes across the Congressional districts in the state is thoroughly explained as a function of drawing compact, contiguous, and equally apportioned districts over the partisan geography of California.

The relationship between the simulations and the actual districts provide justification for the assumption that partisan geography affects representation. The distribution of votes across the districts in a state is determined by the clustering of Democrats and Republicans. When constrained to draw compact, contiguous, and equally apportioned districts over a complex geographic distribution of partisans, the districts will be more likely to contain clusters of Democrats and clusters of Republicans. This has the effect of changing the relationship between votes and seats. And this is the basis of the computational model set out in Chapter 1.

3.3.2 The Relationship between District Partisanship and County-level differences in Partisanship

In this section, I use historic presidential data to provide further evidence that the underlying geographic distribution of partisans is, in fact, associated with how partisans are distributed across Congressional districts. This is the major assumption made by the computational model of the previous chapter and the purpose of the empirical section thus far. Specifically, I test whether an increase in the geographic clustering of partisans creates a subsequent increase in the polarization of partisanship across Congressional districts. Therefore, I am testing if the way in which partisanship is distributed geographically in a state is connected to the way in which partisan votes are distributed across its districts. Once again, this builds a connection between partisan geography and the composition of Congressional districts. Then, once I have established this link, I will use the next section to show that the increase in partisan clustering produces an effect that corresponds with the hypotheses generated by the computational model. Specifically, partisan clustering tends to distribute partisans across legislative districts in such a way that would reduce the seat share of any party that would hypothetically hold a 55% majority of the vote. Moreover, it would reduce the seat share for Democrats more than Republicans. In other words, partisan clustering distributes partisans across districts in such a way that disadvantages the party with the majority vote, but has the effect of disadvantaging Democrats more than Republicans because of the tendency to cluster.

I use the two-party presidential vote from 1972 to 2004 aggregated at the congressional district level and at the county level. The presidential vote works as a proxy for partisanship at both the subnational and subdistrict levels. The Congressional district-level aggregation, for example, indicates how partisanship is distributed across each state's district. And the county-level aggregation allows me to measure how partisanship is distributed geographically. There are 3,143 counties in the United States, which produces a much finer view of the geographic landscape than the 435 Congressional districts. Moreover, unlike Congressional districts, counties stay in the same place, making them independent of district borders. Therefore, where partisans tend to cluster in urban areas, we should expect to see the division between urban and non-urban partisanship increase. As a result, the difference between the urban and non-urban Democratic vote share works as a proxy for the geographic polarization of partisans. Although imperfect, it should give a relatively good measure of how partisans cluster within and across states.

To measure the division in partisanship between urban and non-urban counties in each presidential election, I simply identify those counties that are more than 50% urban according to the most recent Census to each election. For example, I used the 2000 Census to identify urban counties in the 2004, 2000, and 1996 elections, I used the 1990 Census to identify urban counties for the 1992 and 1988 elections, and so on. Then I simply added the two-party vote across the urban counties and across the non-urban counties for each state and took the absolute difference in their partisan vote share. The presidential two-party vote share is assumed to be a good proxy for partisanship at the state, district, and sub-district levels for which it is being used.[3]

Again, the difference between the urban and non-urban presidential vote is intended to capture partisan clustering. And if geographic partisan clustering affects the distribution of the partisan vote across Congressional districts, then as this division increases - and as partisan clustering increases - there should be a corresponding increase in the distribution of partisans across Congressional districts. In other words, as Democratic clustering goes up, so too should the standard deviation in Democratic vote share across a state's Congressional districts. If this is the case, then it can be said that the geographic polarization of partisan votes similarly affects the the deviation in the district-level vote, thereby tying the geographic distribution of partisanship to the district-level distribution of partisanship. This is a crucial step in connecting geography to the votes-seats curve since the distribution of partisanship across districts is what determines how votes translate into seats.

Figure 3.10 displays this relationship between the urban/non-urban difference in a state's Democratic vote share and the standard deviation of that state's Democratic vote share for each of the presidential elections from 1972 to 2004. As we can see, in each election there is a clear, positive correlation between the urban/non-urban difference and the district-level standard deviation. States like New York, California,

[3]While it is not perfect, and is susceptible to presidential tides, county-level presidential vote data is perhaps the best measure for assessing partisan clustering at the sub-district level, where data is scarce.

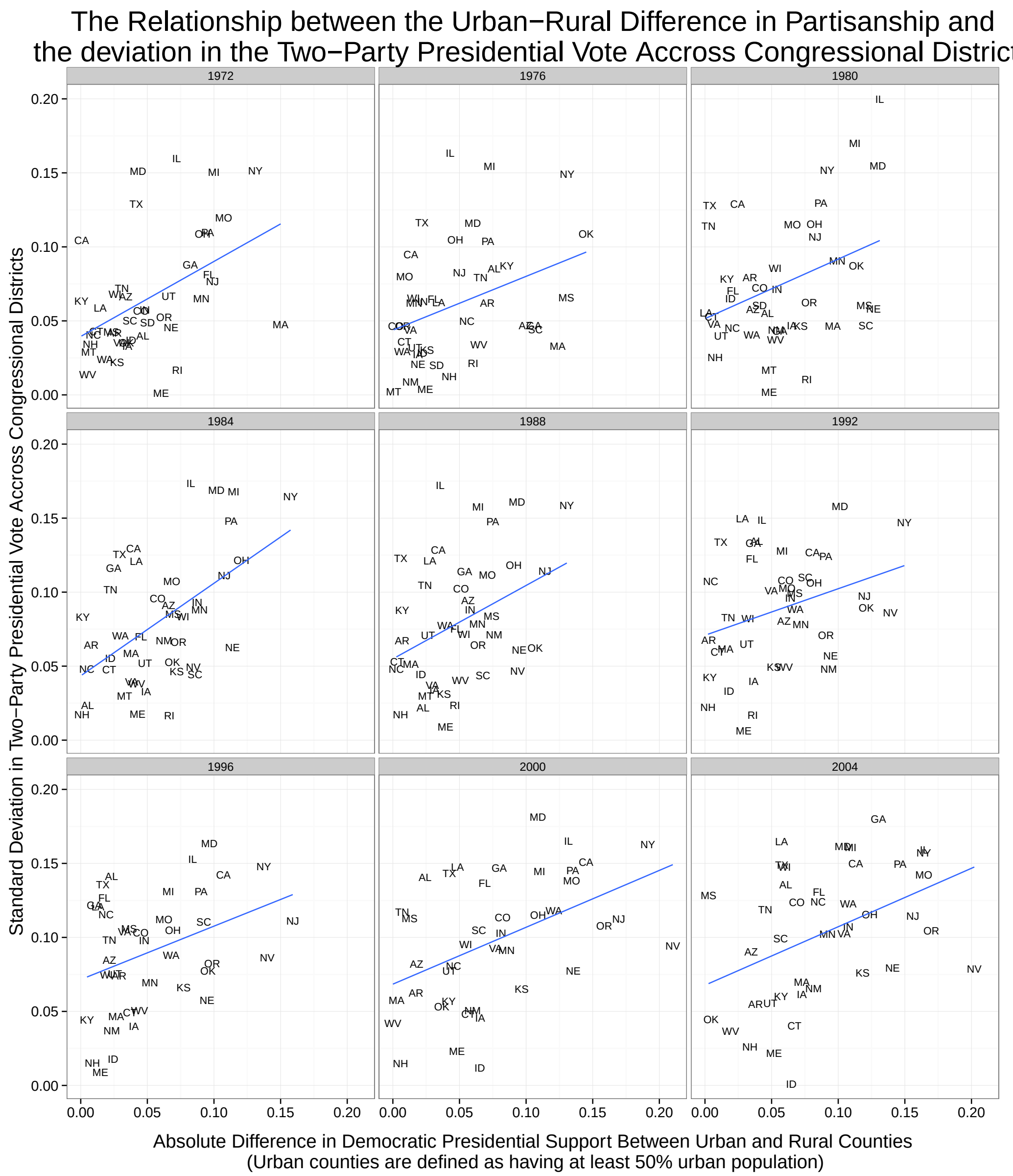


Figure 3.10: The relationship between the division in the two-party vote share between urban and non-urban counties and the dispersion of the partisan vote across Congressional districts for each presidential election from 1972 to 2004.

Pennsylvania, and New Jersey consistently show strong differences between urban and non-urban presidential vote. And, as a result, they also show a high degree of deviation in district-level partisanship. On the other hand, states where there is less of an urban/non-urban division - like Arizona, Massachusetts, Kentucky, and Utah - show a much lower degree of deviation in district-level partisanship.

This cross-state analysis presents a clear relationship between geographic-level polarization and district-level polarization across the states. It suggests that congressional districts are designed in such way that divides the districts according to urban/non-urban geographic divisions. Rather than split up urban clusters and combine them with non-urban communities, districts are designed, instead, to contain them. This is why district partisanship is so responsive to urban/non-urban differences in the vote.

While these scatterplots show cross-state relationships between districts and their underlying partisan geography, Table 3.1 displays this relationship using within-state variation. It sets up a basic multivariate OLS regression model where the dependent variable is, again, the standard deviation of the Democratic presidential vote share across a state's congressional districts over the nine elections from 1972 to 2004.[4] The primary independent variable is the absolute difference between urban and non-urban counties. States that have held less than two districts for any of the elections are excluded, making it it a thirtyfive state regression. State-level fixed-effects are added so as to capture within-state variation. This eliminates a lot of the noise in the cross-state relationship due to differences in the underlying geographic distribution of partisans as well as differences in the number of districts in a state.

The first model (1) of Table 3.1 establishes that there is a significant within-state relationship between the urban/non-urban divide and the district-level standard deviation of partisanship. This suggests that as the urban/non-urban divide increases in a state, on average, the partisan differences across that state's congressional districts increase as well. Therefore, district partisanship is a function of urban/non-urban partisan divisions. As a result, geographic polarization creates district-level polarization, which is consistent with the assumption made by the computational model of Chapter 1.

[4] I begin at 1972 because it is the first election where every district has been designed to be equally apportioned under the law.

Table 3.1: Estimating the average state-level relationship between the urban-rural difference in the Democratic presidential vote share for a state and the associated standard deviation in the vote share across the state's congressional districts. A significant relationship suggests that the distribution of Congressional district partisanship is closely connected the geographic clustering of the partisan voters. This data uses the two-party presidential votes in nine elections from 1972-2004. Only the 35 states with three or more Congressional districts are included

	Dependent variable:				
	District-level Std. Dev. of Democratic Presidential Vote (1972 - 2004)				
	(1)	(2)	(3)	(4)	(5)
				(South)	(Non-South)
Urban-Non Urban Difference	0.276^{***}	0.255^{***}	0.231^{***}	-0.060	0.307^{***}
In Democratic Vote Share	(0.040)	(0.045)	(0.044)	(0.133)	(0.034)
Redistricting Occurred		0.012^{**}	0.010^{**}	-0.001	0.009^{**}
		(0.005)	(0.005)	(0.011)	(0.004)
Urban-Non Urban Difference X		-0.017	0.019	0.432^{**}	-0.036
Redistricting Occurred		(0.062)	(0.061)	(0.210)	(0.050)
Total Number of Seats			0.003^{***}	0.005^{**}	0.001^{**}
			(0.001)	(0.002)	(0.001)
	State Fixed-Effects	State Fixed-Effects	State Fixed-Effects	State Fixed-Effects	State Fixed-Effects
Observations	315	315	315	99	216
R^2	0.740	0.755	0.766	0.451	0.903
Note:OLS Regression with State Fixed Effects					$^{*}p<0.1$; $^{**}p<0.05$; $^{***}p<0.01$

However, the expectations of the computational model is that partisan clustering will affect the votes-seats relationship even under partisan redistricting. The assumption is that districts are drawn to be equally apportioned, contiguous, and generally compact, which limits the set of possible boundaries that can be drawn to favor a particular party. This is an important assumption because it has the effect of making geography relevant to election outcomes since districts will tend to contain compact geographic clusters rather than extend to far reaching areas to include distant voters. Yet for this assumption to hold, the effect of partisan geography should be independent of redistricting. Therefore, the second model in Table 3.1 attempts to control for the effect of redistricting by adding a dummy variable for the years when redistricting occurred and an interaction variable between redistricting years and urban/non-urban difference. The purpose of this interaction is to observe whether the effect of the urban/non-urban difference variable is different in redistricting years. However, its insignificance in the model suggest the effect of the urban/non-urban difference variable is not diminished by redistricting and the average within-state effect of clustering on county-level partisanship remains. Although, given the significance of the redistricting variable, the model does suggest that redistricting does play a role in polarizing the district, but the effect is independent of the effect of geographic clustering measure. In other words, the geographic clustering of partisanship remains an important force in determining the distribution of partisanship across districts, even with redistricting.

Additionally, in the third model, I control for another potentially confounding variable: total number of districts. Since the total number districts likely has an effect on the standard deviation of Democratic votes across the districts (especially since it changes the denominator of the measure), I attempt to isolate its effect using it as a control variable. Model (3) shows the result. We can see that the variable is positive and significant, suggesting that adding a district to a state has the effect of increasing the standard deviation of partisanship across its districts. This is somewhat counterintuitive because one might expect a decrease in the standard deviation as a result of increasing the denominator in calculating the standard deviation measure. However, when adding a district over a non-uniform spatial distribution of partisan votes, the relationship between the number of districts and the standard deviation is further complicated. In fact, by adding another *compact* district to a geographically polarized state the districts have the potential to polarize themselves. Nonetheless, as we can observe from the model, the urban/non-urban effect remains even when holding the number of districts constant.

However, this effect is lost when the model is run on southern states only. As we can see from the fourth model, by reducing the observations to include only the eleven former Confederate states, the effect of the urban/non-urban difference variable is eliminated.[5] There are a number of potential explanations for this. One likely explanation is that in most Southern states, the geographic distribution of partisans is different than the geographic distribution of partisan elsewhere. In particular, partisan division and presidential voting in the South is much more aligned along racial dimensions than the non-Southern states (Valentino and Sears, 2005). And unlike the non-Southern states, this racial divide is not necessarily an urban/non-urban divide. Rather in deep-south states - ranging from East Texas to North Carolina - blacks tend to reside in a rural agricultural region that has come to be known as the"black belt." Although, the "black belt" creates a certain partisan spatial pattern, it is different from the urban/non-urban pattern observed in non-Southern states. Because of this, the urban/non-urban difference measure likely fails to capture the type of clustering going on in the South.

Moreover, the districts in these Southern states are subject to DOJ pre-clearance

[5] Although the interaction term is still significant, I assume that this is a spurious effect. There is little theoretical reason why urban/non-urban geographic difference have an effect in redistricting years but not in others.

under Section 5 of the Voting Rights Act. This means that boundary-makers are restricted from drawing districts that dilute the black vote. As a result, these states have intentionally designed non-compact districts that combine rural and urban black voters so as to achieve majority-black voting blocs. Therefore, these states are consistently engaging in racial gerrymandering. They violate the geographic principle of compactness to meet the legal requirements set out by the VRA. Therefore, geographic clustering would not have the same effect on the standard deviation of votes across the districts as it would have in non-southern states.

Nonetheless, the relationship between partisan geography and district composition does seem to hold for most states. We see that the polarization of the districts tend to increase as partisanship tends to cluster geographically. And, moreover, this relationship holds even in the presence of redistricting. Therefore, providing empirical validity for the computational model, I have established that distribution of votes across the districts is a function geography.

3.3.3 Linking partisan geography to the votes-seats curve

Although this does not necessarily mean that Congressional districts will change as a result of the changing partisan polarization of districts, it does mean that geography and trends in geography are a component of changing district composition. And when district composition is lopsided across the districts in such a way that it packs Democrats into a few districts but not others, then it naturally alters the opportunity for Democrats to win those districts compared to what they would have won without such packing. When Democrats cluster geographically, they cram their votes into a few large dense areas. And if those dense areas are dense enough and are populated enough, they can create Democratic districts where they might not otherwise have received them.

Given that there is a link between partisan geography and the variance of district partisanship, I can proceed to show how that connection translates votes into seats. The goal of this section is to test the validity of the computational model. Specifically, I test the first and second hypotheses to simply observe whether partisan clustering has the effect of (1) flattening the votes-seats curve and (2) does so in a way that affects the parties asymmetrically. By testing the first and second hypothesis, we can begin to observe whether the districts are affected in a way that is predicted by the computational model in Chapter 2. The first hypothesis states that *the geographic clustering of Democratic voters has the effect of reducing the seats for the majority party, regardless of which party is in the majority.* However, as the second hypothesis predicts, *Democrats should experience a greater reduction of seats than Republicans.*

In order to test these hypotheses, I want to observe what the average effect of partisan clustering is on a Congressional election in a state where Democrats hold a significant majority of the vote compared to when Republicans hold a significant majority of the vote. Unfortunately, to isolate the effect of geography on the votes-seats curve is a challenge. One would need to observe the same legislative election occur under two different geographic concentrations of partisans and observe the differences under a Democratic majority and under a Republican majority, while all else is held equal. Since such a case does not exist, I attempt to leverage the variation in geographic concentrations of partisans within states over time. Using the presidential elections above allows me to observe the Democratic vote share for a state and its congressional districts and to measure the geographic clustering of its partisans using the urban-rural difference measure above. Ideally, I would observe a state where Republicans hold a 55% majority of the presidential vote in each election and observe how the party's difference changes as the underlying urban-rural difference in partisanship changes over time. Then I would observe that same state where Democrats hold a 55% majority in each election and similarly make the same observation. Therefore, I would be observing the effect of geographic clustering on seat share while holding vote share constant, both when Republicans hold the majority and when Democrats hold the majority.

Since a state's vote share changes over the course of nine elections, I would not be able to hold the vote share constant. Nor would I be able to observe the same state where one party has the same vote share in the same election. However, to get a sense of what such an occurrence might look like, I induce this hypothetical situation for each state using uniform statewide swings. Therfore, I adjust a state's election results to a 55% Republican majority and to a 55% Democratic majority by uniformly shifting the vote share of each district by the difference needed to adjust the statewide vote share to 55% in either direction. For example, a state with a Democratic vote share of 51% can be adjusted to a 55% Democratic vote share by adding 4 points to each of its district's Democratic share of the vote. This gives me two versions of the same state: one where the Democrats hold a majority and one where the Republicans hold a majority for each election. With these two versions of the same state I can observe changes to their seat share given the changes in the underlying urban-rural partisan differences.

In order to calculate seat share for the majority party for each state in each year, I calculate the percent of districts that have a majority of that party's presidential votes. I do this for the whole spectrum of the potential vote share under the uniform swing to get a votes-seats curve for each state. Then I use a LOESS smoother to smooth the curve, allowing for a marginal change in vote share to correspond with a marginal change in seat share at every percentile of votes. This eliminates the discontinuity of the vote-seats curve, in which a single vote can potentially turn a party's seat share from 0% to 25% in a 4-district state. Instead, a single vote gradually increases the propensity for the seat share to change. In other words, it gives an expected value of that seat share for every percent of the vote share. This is equivalent to the smoother used in displaying the vote-seats relationship of the 10-district state in the computational model, where the curve allows for every share of the seats to correspond with a unique share of the votes.

Using the 35 states that have had no fewer than 3 districts since 1970, I estimate the average effect of an increase in the urban-rural difference in partisanship - the same variable used above - on the majority party's projected share of the seats, given a hypothetical 55% vote share.[6] Each model uses fixed effects to capture the within-state variation. The first model (1) of Figure 3.2 suggests - as expected - that urban-rural differences in the partisanship of voters has the average effect across the states of decreasing the majority party's expected share of the seats. The effect occurs regardless of the party in the majority. Therefore, one can expect non-marginal majorities to lose seats as their votes become clustered.

The second model in Figure 3.2 makes two additions to the first model. First, it adds a control for the total number of seats in the state. Although the hypothesis assumes that this number is held constant, real-world districts gain and lose seats with fluctuations in their population. So, controlling for this effect is the best I can do. Interestingly enough, the variable is significant and negative, suggesting that the addition of a seat creates a reduction in the majority party's seat share, all else equal. This implies that, on average, we can expect an additional seat to vote against the majority party. This is counterintuitive, and I do not have a good explanation for why this is. But it may have something to do with underlying geographic distribution of voters making it difficult to add an additional majority party seat.

Second, I have added an interaction variable. The variable interacts the urban-rural difference measure with a dummy variable indicating whether Democrats (1) or

[6]The projected seat share uses presidential voting data rather than Congressional voting data. It assumes that Democrats win the Congressional seat where the Democratic presidential candidate receives a majority of the vote. Moreover, the estimated seat share at a hypothetical 55% vote share is determined by estimating the votes-seats curve for every state. To do this, I used uniform swings to get a prediction of the seat share at every split of the two-party vote. I then used a LOESS smoother to achieve a smoothed continuous curve across across the full set of votes. Therefore, the seat share recorded in the data is the LOESS prediction at a 55% Republican seat share and at a 55% Democratic seat share

Table 3.2: Estimating the effect of Democratic clustering on the Majority Party Seat Share

	Dependent variable:				
	Predicted share of the seats in a state where the majority party receives a majority of the presidential Vote given a given a hypothetical 55% vote share (under state uniform swings)				
	(1)	(2)	(3)	(4)	(5)
			Redistricting Years Only	Southern States Only	Marginal States Only
Urban-Non Urban Difference in Democratic Presidential Vote Share	−0.729***	−0.449***	−0.580***	−0.166	−0.352***
	(0.086)	(0.099)	(0.199)	(0.270)	(0.124)
Democratic Majority		−0.006	−0.029*	−0.019	0.002
		(0.009)	(0.017)	(0.018)	(0.012)
Total Number of Seats		−0.004**	−0.002	−0.011***	−0.001
		(0.002)	(0.004)	(0.004)	(0.002)
Urban-Non Urban Difference Democratic Majority		−0.531***	−0.458**	−0.404	−0.801***
		(0.116)	(0.207)	(0.344)	(0.148)
	State Fixed-Effects	State Fixed-Effects	State Fixed-Effects	State Fixed-Effects	State Fixed-Effects
Observations	315	315	315	99	216
R^2	0.775	0.791	0.803	0.563	0.890
Note:					*p<0.1; **p<0.05; ***p<0.01

Republicans (0) hold the hypothetical 55% majority. This tests whether the average effect of Democratic clustering is different for Democrats than it is for Republicans. The second hypothesis of the computational model expects that if the clustering is asymmetric, the reduction of seats should be greater for Democrats than for Republicans. The significant negative effect suggests that it is. While both majority parties lose seats due to Democratic clustering, one can expect the Democrats to lose more than the Republicans. In other words, the average effect of Democratic clustering across the states is one that likely produces asymmetric seat gains and losses for the party. Figure 3.11 plots the interaction effect. The x-axis is the difference between the two-party presidential vote between and urban and non-urban counties. The y-axis is the projected seat share of the average state. The red and blue lines represent the linear relationship between the two variables for Republican majorities and Democratic majorities respectively. Therefore, given a hypothetical 55% vote share, both Democrats and Republicans would lose seats from partisan clustering. However, Democrats would lose more seats than Republicans would lose.

Ultimately, the result makes a basic point that how votes translate into seats is connected to the geographic polarization of voters. As voters polarize geographically the votes-seats curve will experience a change. In particular, the tendency for Democratic votes to cluster in urban areas has an effect of creating an asymmetric votes-seats curve that mostly harms Democrats. Compared to a less clustered environment - for most shares of the two-party vote - Democrats lose legislative seats through clustering. However, Democrats can find this type of asymmetric clustering favorable for cases when they hold a non-marginal minority of the vote. Therefore, Democrats can make partisan gains from clustering in Republican controlled states.

In the third model, I test whether the effect holds even in the presence of redistricting. There is the potential that the effect of partisan clustering on the votes-seats curve is lost once parties redraw district boundaries. Therefore, the parties redraw

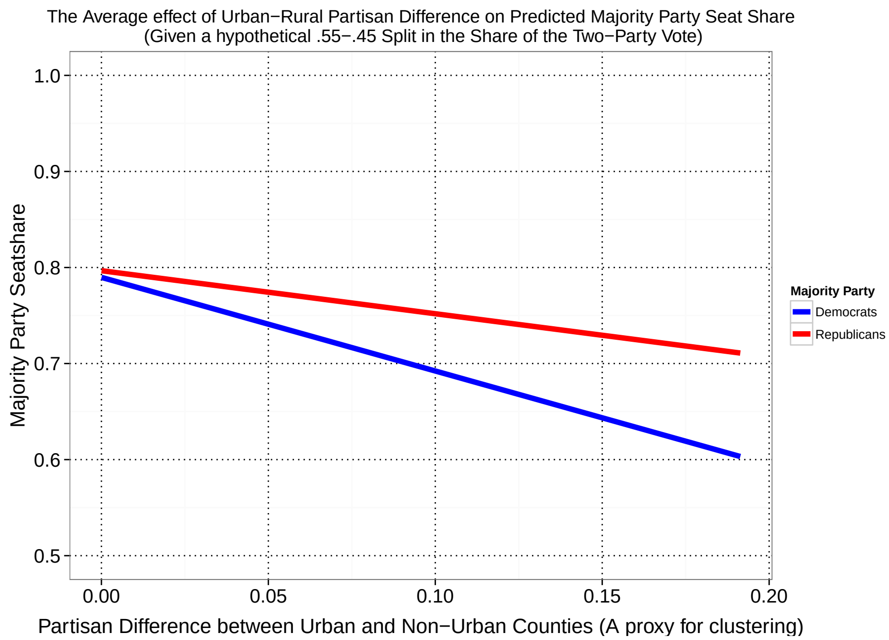


Figure 3.11: Interaction Effect: The effect of the Urban/Non-urban partisan difference on the Majority party's seat share, conditioned on whether Republicans or Democrats hold a 55% majority.

the boundaries to produce a set of districts that eliminate the negative affect of partisan clustering. Therefore, I reduce the set of the observations to include only those elections immediately following a redistricting cycle. These elections consist of newly-minted districts where boundary-makers have recently been given the opportunity to alter disadvantageous districts. Yet still, the same effect of partisan clustering persists. It distributes the partisan vote across the districts in a way that harms the majority party, but asymmetrically harms Democrats more than Republicans. Therefore, partisan clustering changes the votes-seats curve despite presence of gerrymandering.

In the fourth model, I test whether the effect holds in the former Confederate South. As mentioned above, the South has a very different partisan landscape than the rest of the country. For example, as a result of the black belt, there is a large population of non-urban Democratic voters in the deep South, which is unlike the partisan clustering we see elsewhere. Moreover, every state in the deep South is subject to pre-clearance by the DOJ. This results in serious racial gerrymandering, where minority-majority districts are intentionally designed to maintain black representation. Hence, partisan clustering is likely to have a very different effect on partisan seat share across Southern states. Sure enough, we see that the significance of both the urban/non-urban difference variable and the interaction variable falls out for the South.

In the fifth model (5), I address a potential point of criticism that the test uses some states that are unlikely to swing from 55% Democrat to 55% Republican. Currently, I am making inferences about what would occur in a state if the majority switched from Democrat to Republican (or vice-versa). One might argue that this is not a credible scenario for the states that are consistently Democrat or consistently Republican. Therefore, the conclusions might not hold in more moderate states where such a switch is more likely to occur. To correct for this, I reduce the observations to "marginal" states only. These are states that are, on average, within 3 percentage points of a toss-up election. Therefore, we can assume that these are states that might credibly switch from Republican to Democrat in the presence of a partisan tide. Still, the effect holds. Even in marginal states, where partisan vote share is most likely to swing from one party to the next, partisan clustering along the urban/non-urban dimension has the same effect of asymmetrically flattening the votes-seats curve.

3.4 Conclusion

The previous chapter develops a model that produces a set of theoretical expectations about how partisan geography influences partisan representation in the United States. In particular, the model suggests that the geographic clustering of partisan voters determines the shape of the votes-seats curve. As Democratic voters tend to cluster in dense metropolitan areas, their votes will pack into a few districts, increasing the dispersion of votes across the districts and leading to a flatter votes-seats curve. And, if this clustering is asymmetric - where Democrats cluster more than Republicans - then this curve will flatten asymmetrically. A flatter curve means that partisan clustering has the effect of reducing the majority party's share of the seats And the asymmetry of the curve means that Democratic majorities will lose more seats than Republican majorities.

In this chapter, I have attempted to provide some empirical validation for the model and its expectations about the votes-seats curve. I have done this in three ways. First, I have shown that the current Congressional districts are similar in partisan composition to a set of districts that have been drawn in a way that only considers the underlying geography of the state's population. The composition of the current districts deviate only marginally from the set of hypothetical districts drawn to be compact, contiguous, and equal apportioned. In Tennessee and Texas, for example, the average hypothetical districts produce the nearly the same number of McCain-majority districts as the actual districting plans in those states. Despite being states where McCain received a strong majority of the votes, the geographic density with which Democrats cluster in these states lead to Democratic seats. It is difficult to draw compact and contiguous districts in Tennessee without drawing two Democratic districts around the densely packed Democrats in Memphis and Nashville. Therefore, the Democratic clustering in those cities produce Democratic seats in Tennessee. And this phenomenon exists even as gerrymandering in those states is used to protect incumbents.

Second, I show that the standard deviation of the two-party presidential votes across Congressional districts from 1972 to 2004 increases as the urban/non-urban division in partisanship increases. Therefore, districts tend to be aligned with the urban/non-urban geographic divisions. Thus, as Democrats tend to cluster in urban areas, they pack themselves into a few districts causing Democratic districts to become more Democratic and Republican districts to become more Republican. The implication is that the geographic clustering of partisans changes the distribution of partisan votes across the districts, thereby changing how votes translate into seats.

And lastly, I show *how* this geographic clustering affects the votes-seats curve. In particular, I show that partisan clustering flattens the curve in a way that is consistent with the first and second hypothesis established by the model of the fist chapter. This means that the geographic clustering of partisans reduces the seat share of the party that holds the majority and that the reduction is greater for Democratic majorities than for Republican majorities.

Therefore, does partisan geography influence partisan representation in U.S. legislatures? In this chapter, I have provided empirical evidence to suggest that it does and that it does so in a way established by the computational model of Chapter 1.

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CHAPTER IV

Regulating in a Federal System:

Exploring federal and state implementation of OSHA regulation

Abstract

To accomplish the formidable task of enforcing federal health and safety standards in millions of workplaces across the country, OSHA must delegate and devolve inspection authority to lower-level federal and state bureaucrats. The agency not only enlists its regional offices to carry out inspections, but it also grants some states the authority to enforce federal health and safety standards on its behalf. I examine whether this delegation and devolution results in policy drift, where state inspection activity becomes unresponsive to the central preferences of Congress and the president. Using a rich dataset recording the results of each of the approximately four million inspections conducted by OSHA from 1972 to 2013, I examine federal and state influences on OSHA enforcement activity. I find that where states carry out their own inspections through federally approved state-plans, health and safety standards are less stringently enforced than in states where inspections are conducted by federal agents. Moreover, I support this finding by leveraging the geographic precision of the dataset to observe geographic discontinuities in OSHA enforcement across boundaries of state and federal jurisdictions.

4.1 Introduction

Institutional studies of policy-making at the federal level tend to focus on how various political actors - primarily those within Washington, D.C. - shape the outcome of national policy. These studies concentrate mostly on the political behavior of the highest-level policy makers within the three branches of government at the center of the federal political system. They are interested in how policy change is affected by the pivotal members of both chambers of Congress (Krehbiel, 1998; Binder, 1999; Tsebelis, 2002), by the committees that set the legislative agenda (Cox and McCubbins, 2005; Shepsle and Weingast, 1987), by the president and his appointed leaders within the executive branch (Lewis, 2008; Howell, 2003; Neustadt, 1960), and by the justices on the bench of the Supreme Court (Shipan, 2000; Segal, 1997). When explaining federal policy creation and change, the predominant focus is on these centralized political actors.

However, such analyses of political institutions fail to capture the political system in its entirety. They ignore the full extent of the political process from policy construction to policy implementation and, as a result, are likely to miss some of major determinants of policy change. While it is important to understand how these centralized actors affect policy, it also important not to overlook the fact that many decisions and actions responsible for shaping policy occur outside of Washington's political center. When having to implement federal policy at the local level, for example, those at the top must delegate or devolve authority to those at the extremities of the political system. Implementing federal policy across the extensive, diverse, and geographically disparate population of the United States is a substantial undertaking which requires political decision-makers at the center of the system to employ others to execute the task on their behalf. They delegate authority to more decentralized agents who are able to ensure that all individuals in the United States are held equally accountable to federal standards - whether those individuals are from industrial cities in California or farming communities in Vermont.

With delegation, however, there is the potential for the loss of control. Any directive made by the center of the political system must filter through a series of delegations until it is applied at its most decentralized point. And as policy makes its way down the hierarchical ladder, its potential to deviate from the original policy increases at every rung. Since lower-level agents can make influential decisions and alter policy away from its original intent, it is important to question whether the political principals at the top of the hierarchy lose control to the various agents at the bottom.

Scholars have long studied this principal-agent problem with respect to bureaucratic delegation(McCubbins and Schwartz, 1984; Epstein and O'Halloran, 1994; Ferejohn and Shipan, 1990; Krehbiel, 1998; Wiseman, 2009). Both Congress and the president rely on delegating tasks to bureaucrats. However, the relationship between these central authorities and the bureaucracy is not the only principal-agent relationship that affects the execution of federal policy. Congress and the president also rely on the *states* to implement federal policy on their behalf.

Although this relationship receives less scholarly attention, it is not uncommon for the federal government to delegate authority to the states (McCann, 2015). We see this, for example, with the implementation of Medicaid. To administer the program, states receive incentives from the federal government through matching grants. This way, the federal governments provides aid to low income families by essentially compensating the states to provide the services on their behalf. It is a form of delegation that allows the federal government to accomplish its goal of provide aid by outsourcing it to the states.

A similar type of delegation occurs with the implementation of federal health and safety standards. With the passage of the Occupational Safety and Health Act in 1970 under the Nixon administration, the federal government became responsible for maintaining and enforcing federal health and safety standards across all workplaces in the United States. However, to help the accomplish this goal, states were given the option to construct their own administration that would allow them to implement federal standards. The federal government would provide a matching grant as incentive, but the state would be required to maintain a program that is at least as effective as the federal government's. As a result, just under half of the states implement federal OSHA standards in their territory on their own. The state agencies are fully administered by the states themselves. The inspections are governed by a state-level agency, executed by state-level inspection officers, and adjudicated through a state-level judicial system. The federal government has the responsibility to revoke a state plan's status. However, it has yet to exercise this threat.

In this chapter, I attempt to explore the consequences of this devolution. In particular, I ask whether such devolution has forced the federal government to lose control over their responsibility to ensure workplace safety and health standards. To answer this question, I analyze inspection logs collected by the Occupational Safety and Health Administration going back to 1972. By observing individual inspections carried out on local establishments by federal OSHA and various state safety and health agencies, I show that the delegation has potentially led to less stringent inspections. By comparing the stringency with which safety and health standards are implemented across state and federal agencies, I am able to observe how devolution leads to a a lack of control.

4.2 Review of Bureaucratic Control

In order to implement the laws it creates, Congress must engage in delegation. It tasks agencies with the responsibility to carry out the rules and regulations that it designs. Because of this, political scientists have long questioned whether such delegation creates a loss of control to the agencies. With major informational asymmetries between Congress and the bureaucracy, it is easy to suspect that agencies are able to act independent of congressional preferences. Many have argued that in the delegation process, agencies have gained a striking level of autonomy (Carpenter, 2001; Niskanen, 1975). If this is the case, the disconnect between the elected legislators and the non-elected implementers has grave implications for our democracy.

However, many institutional studies of the bureaucracy have found evidence to the contrary. Although the agency is given discretion over the implementation of law, it is constrained by various political forces. And despite the need for delegation, Congress is capable of reducing bureaucratic drift by reducing informational asymmetries through active and passive monitoring (McCubbins and Schwartz, 1984), by applying ex-post punishments to bureaucrats through public shaming in Congressional oversight hearings (Kiewiet, 1991), by limiting the agency's budget (Carpenter, 1996), by legislating rules and procedures limiting bureaucratic discretion (McCubbins, Noll and Weingast, 1987; Huber and Shipan, 2002), and by checking the president's appointment powers (Wood and Waterman, 1991). Thus, Congress has a number of tools for keeping a leash on bureaucratic behavior.

These studies suggest that in order to determine policy outcomes in the United States, we must look across the branches and observe the system as a series of interactions between them. A comprehensive analysis must not just focus on the preferences of the principals, but also at the behavior of their various agents. This perspective has led scholars to try to incorporate the full set of players into their analysis on policy change, from the president and Congress to the committees and bureaucrats. To better predict policy movement, one must identify the ideological placement of the relevant committees in Congress, the pivotal voters in the House and Senate, the president, the Supreme Court, and the agency altogether (Ferejohn and Shipan, 1990; Shipan, 2004).

Still, these studies are limited to inter-branch relationships. They explain policy change by observing the behavior of those at the center of the federal government in Washington. To the extent that they examine delegation, their focus is on bureaucratic delegation. Yet delegation to the bureaucracy is not the only way in which Washington executes its laws. Some policy require more complex forms of delegation. This is particularly the case when implementing federal policy at the local level. The political center must delegate to multiple agents that are spread out across the country. They not only do this through through bureaucratic delegation but they do this through federal-to-state delegation as well.

The federal government often leverages the states to do its bidding. For example, it uses intergovernmental grants to encourage states to regulate air pollution, manage Medicaid programs, and provide job training for the economically disadvantaged. Instead of executing federal policy using federal agencies, it essentially pay states to do it on their behalf.

Whether it is through bureaucratic delegation or through federal-to-state delegation, those who are at the center of the political system must delegate extensively in order to carry out large-scale, local-level policy across the United States. Therefore, as the government attempts to apply its policy regionally, it must rely more heavily on others to do its bidding. Agents administer permits and carry out inspections, assess compliance, and issue penalties. And each of these tasks represents the end of a long chain of decisions that carry a directive from its origin in Washington to its ground-level execution. And as this distance increases, so too does the potential for bureaucratic drift. Therefore, to what extent are the street-level decisions responsive to central-level politics? Is the implementation of federal law uniformly carried out according to the wishes of central political actors in D.C., or does delegation make policy vulnerable to regional pressures?

In this chapter, I explore whether such regional enforcement of federal policy leads to a loss of control by the federal government. In particular, I explore whether the implementation of federal health and safety standards has drifted away from federal preferences as a result of delegating enforcement authority to the states.

4.3 Implementation of federal inspections: the case of OSHA

The Occupational Health and Safety Administration in the Department of Labor is responsible for ensuring safe working conditions by enforcing health and safety standards established under the OSH Act of 1970. They have a number of regional offices where they engage in about 100,000 regional inspections of business establishments each year. For a number of reasons OSHA is a good test case for exploring regional variation in the implementation of federal law.

First, the implementation of OSHA standards are local. Inspectors show up at the door of local businesses across just about every county of every state. This includes nearly 100,000 private sector establishments that employ over 12 million employees nationwide. Having such strong local presence across the nation allows one to potentially compare OSHA activity in Fairbanks, Alaska to the activity in Portland, Maine.

Second, in order to implement these inspections regionally, OSHA divides itself into regional hubs and delegates authority to subordinates within these regions to carry out central directives. The agency's delegation process, which is both vertical and horizontal, provides numerous instances where OSHA subordinates use their discretion to apply federal standards. For example, to inspect a fertilizer plant in Texas, OSHA calls upon its 6th regional office that covers four contiguous central-southern states. The regional office then calls upon the area office in Texas responsible for the jurisdiction that covers the fertilizer plant. And the area office sends a federal inspector to make an assessment of the plant's compliance to federal laws.

Third, OSHA implementation is controversial. Pro-business Republicans and pro-labor Democrats contentiously disagree over its costs and benefits. Thus, there is reason to suspect both national and regional opposition to OSHA agency activity where either pro-business interests or pro-labor interests dominate.

Fourth, OSHA allows states to adopt their own plans for enforcing federal health and safety standards. In order to regulate workplace health and safety more efficiently and effectively, the federal government entrusts primary authority over the inspection process to some of the fifty states. Other than being monitored through an annual review, state OSH are given almost full discretion over the implementation of federal inspections. This is a unique feature of OSHA implementation and the major focus of this paper. Since the federal government formally devolves inspection authority to some states and not others, we can compare the two programs to explore the effect of devolution on implementation. In this paper specifically, I assess the differences in inspection stringency between federal and state plans.

Lastly, OSHA inspections are recorded in detail. The dataset is large and can be cut and analyzed in a number of ways to identify variation in inspection behavior.

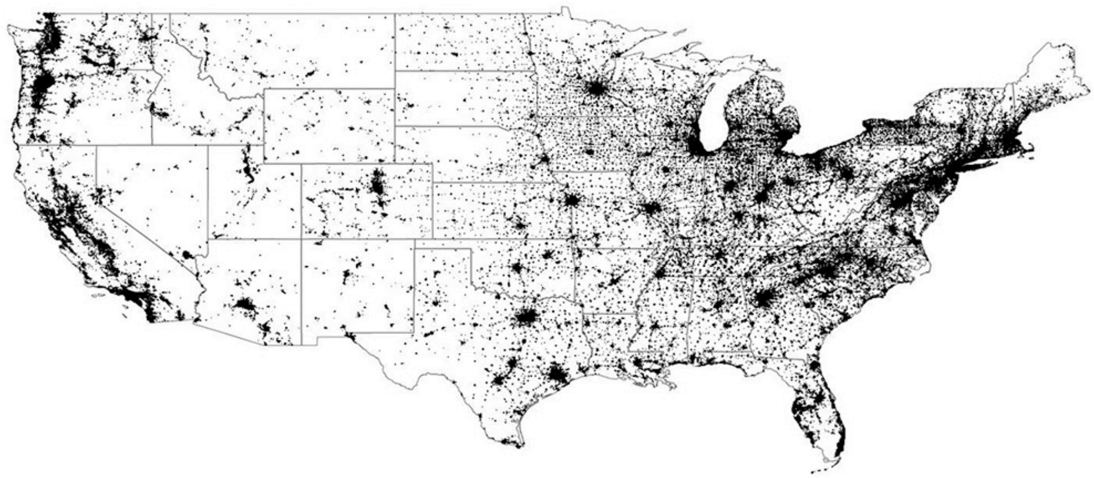
4.4 Exploring the Data

As part of President Obama's Open Government Initiative, the Department of Labor (DOL) recently launched a webpage dedicated to making DOL enforcement data publicly available and easily searchable online.[1] Through this website, I was able to access OSHA's inspection database, which contains records of every inspection conducted by the agency since the first inspection in 1972. As of January 1, 2014, OSHA had conducted 4,077,338 inspections across the country, issued a total of 11,119,827 citations, and collected 4,758,681 penalties for a total of $3,554,041,378 in fines paid (nominal dollars). Each of these inspections is documented in detail, down to the name and address of the establishment being inspected.

Figure 4.1 demonstrates the varied geographic distribution of these worksite in-

[1] http://ogesdw.dol.gov

Figure 4.1: Map of Geocoded OSHA Inspections



I geocoded the address of as many of the inspection sites going back to 1972 that could be matched in the ArcGIS database of US addresses. About 60% of all the inspection addresses matched total. This number was closer to 70% in the last decade. All of them are plotted on the map above, reflecting the geographic concentration of inspections.

spections. It displays every inspection carried out by OSHA, geocoded down to the address of each establishment where the inspection took place. As expected, inspections are carried out in all regions - rural and urban - across the United States. They are densely clustered in populous areas where a large number of workplaces are located. And they are disproportionately located in high industrial areas where workplace hazards are more likely to be present, such as the rustbelt in the northwest and the major manufacturing areas in the South.

4.4.1 Enforcement Effort

Moreover, we can observe trends in OSHA's inspection activity over time. Figure 4.2 shows the number of inspections recorded by OSHA since its first recorded inspection in 1972. These include all inspections of all types conducted by the agency. Immediately, we can see that there is a major jump in recorded inspections at the beginning of the Reagan Administration. Unfortunately, this is an artifact of the

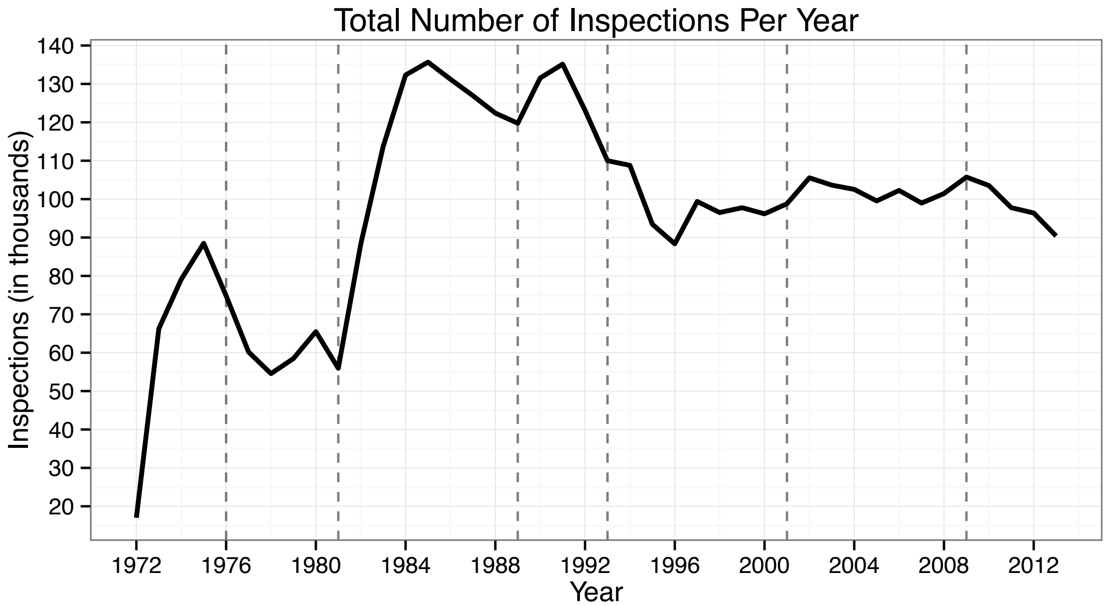


Figure 4.2: The above figure shows the number of inspections recorded in the database by year. The vertical dashed lines in gray indicate president turnover. Notice that there is an alarming jump in recorded inspections from 1982 to 1984. This jump reflects the migration of states with initially approved state-plans to the federal Integrated Management Information System (IMIS), such that after 1984 all inspections are recorded in the database. For this reason, when observing inspection trends across all states, it is important to limit the analysis to the period after 1984. Thus, pre-1984 represents only federal, while 1984 on represents state and federal plans.

database and the way OSHA keeps records. Prior to 1984, record keeping had not yet been standardized and states that were conducting inspections under an approved state-plan had their own system for recording inspection activity. Until 1982 did these states begin transitioning to OSHA's Integrated Management Information System, a centralized and uniform database that would collect and record information on all inspections conducted by both state and federal officials. Therefore, inspection totals displayed in Figure 4.2 prior to 1984 consist of inspections that were conducted by federal OSHA only.

Since 1984, the total number of inspections has been in a decline. And the trends in this change appear to be consistent with administrative effects. As one might expect from a Republican administration, both Reagan and Bush administrations saw declines in inspection number. During their tenure inspections fell from approximately 130,000 in 1984 to approximately 110,000 inspections by the end of the Bush Administration in 1993 for a 15% reduction. This is consistent with what we might expect from a pro-business, Republican agenda, where efforts are taken to reduce the regulatory burden on businesses.

However, the decline continues on into the Clinton administration where we see even greater reductions in the annual inspection total. Indicating the decline in regulatory efforts, this reduction by the Clinton Administration is often criticized by pro-labor Democrats as being lax on enforcing workplace health and safety (Lurie, Long, and Wolfe 1999). This decline coincides with Vice President Gore's "Reinventing Government" campaign, which focused efforts on making the federal government more effective and efficient. The campaign directed agency heads to reinvent their agency so that it would not only work better but also cost less (Gore, 1993). In response, Labor Secretary, Robert Reich hired Joseph Dear to administer OSHA's reinvention. Under Dear, the OSHA offices were directed to measure themselves on the quality of inspections rather than quantity. And as a result, OSHA's inspection numbers were reduced by approximately 10,000 annual inspections and remained at a steady 100,000 annual inspections for the next couple decades - with some variation.

It is easy to see presidential effects on inspection totals here. But perhaps this measure is noisy. Not all inspections are conducted under the same protocol. In fact, OSHA conducts six types of inspections. The most common are programmed or planned inspections. These are proactive inspections that are predetermined by the agency to target potential violators and are used as way a to actively audit high-hazard business establishments. Some of these inspections are predetermined by lottery while others are predetermined by formula. In order to deter business establishments from violating federal OSHA standards, they are all executed without advanced notice so as to maintain the threat of a potential inspection.

The other five types of inspections are conducted in response to 1) imminent danger situations, 2) fatalities and catastrophes, 3) complaints, 4) referrals, and 5) previous violations. These inspections are very different from programmed inspections in that they are reactionary in nature. They are triggered by an external event rather than conducted through the regular auditing procedures.[2]

In order to reduce the noise in the data, I focus on the subset inspections that are planned or programmed. I choose to focus on these inspections rather than unplanned inspections for two reasons. First, they are substantively different from the other types of inspections because they are performed as a standard audit rather than a reaction to a potential violation. The unplanned inspections are likely to ebb and flow by chance, whereas the planned inspections are potentially more political. Second, planned or programmed inspections are the standard inspection conducted by the agency. They represent the bulk of inspections carried out by OSHA. For example, in 2010, planned or programmed inspections made up more than 60% of the total number of inspections. The next most common type of inspection was in response to a complaint. These inspections made up only about 17% of the total number inspections in 2010. The third most common type of inspection was a result of referrals from other agencies (around 10%). Accidents, fatalities and catastrophes, imminent danger situations, and follow-up inspections were each no more than about 3% of the total number of inspections.[3]

Figure 4.3 displays the counts for only those inspections that are programmed or planned. I have also limited the observations to include only those inspections from 1984 to 2013 so that each observed total is an aggregate sum of inspections

[2]See U.S. Department of Labor Program Highlights, Fact Sheet No. OSHA 2098, "OSHA Inspections."

[3]Since I have decided to focus on planned or programmed inspections, the analysis does not necessarily generate expectations about unplanned inspections. It is possible that an analysis of unplanned inspections might generate different results. However, there is a strong correlation between the median planned and unplanned inspections at both the state and federal level. Although, as one might expect, the unplanned inspections tend to result in slightly larger median non-zero penalty than the planned inspections

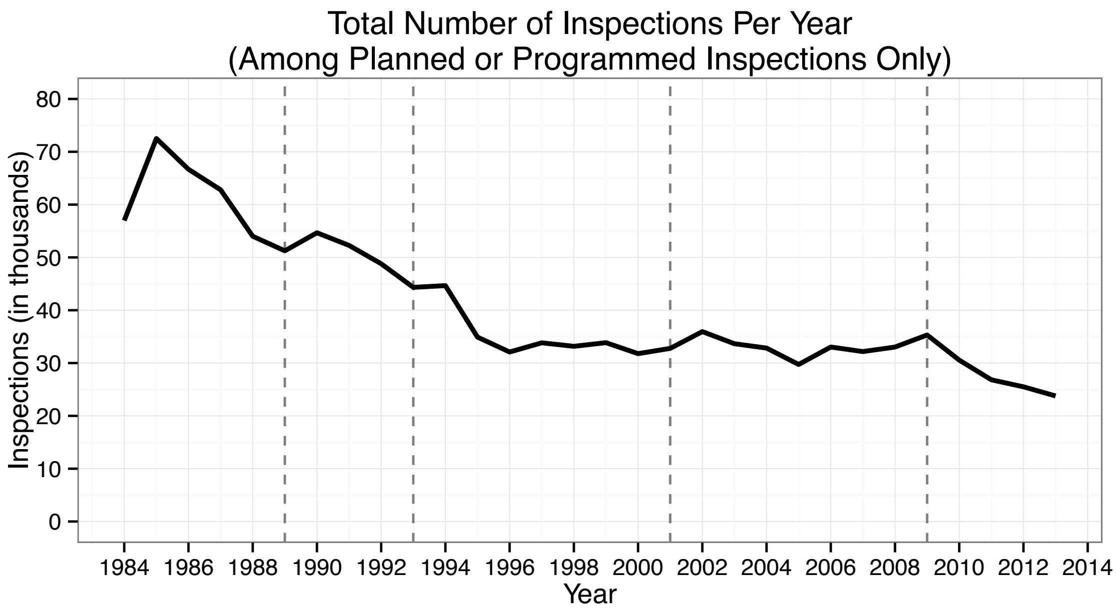


Figure 4.3: The above figure shows the number of planned or programmed inspections recorded in the database by year. The vertical dashed lines in gray indicate president turnover. Any reactionary inspections (inspections that are responding to a complaint) are excluded.

conducted by both federal and state officials. This seems to reduce a great deal of the noise associated with unplanned, reactionary inspections. Still the same trend seems to emerge. There is a steady decline with Reagan and Bush and an immediate decline under Joseph Dear's leadership. The inspection trend then basically flat-lines by the end of the Clinton Administration at just over 30,000 programmed inspections a year.

4.4.2 State Plans

As I mentioned above, this is the aggregate sum of inspections made by federal and state officials. It is a measure of total levels of OSHA enforcement across all states. However, it is important to note that OSHA enforcement authority in some states has devolved to state agencies. Though federal safety and health standards are determined by Congress, the responsibility for implementing those standards falls in the hands of the state-level occupational safety and health administrations for 21 of the 50 states. Since its inception in 1970, federal OSHA has approved these 21 states to administer federal occupational safety and health regulations on their own, acting as virtually independent state agencies. However, these states are never fully immune to federal supremacy because Section 18 of the OSH Act - the section that conceives these state plans - gives the general requirement that these states maintain an enforcement of occupational safety and health standards at least as effective as the federal government's enforcement.

Therefore, in many ways this is an instance of where the federal government delegates enforcement authority not just to its lower-level agencies but also to the state agencies themselves. The federal government benefits from this for a couple reasons: not only does it share the cost of these inspections with the states, but the states are also more attuned to the industries of their regions and are in a better position to regulate more efficiently and effectively. The states, on the other hand, might gain in the independence from federal regulators and the ability to tailor enforcement efforts to be more appropriate for the industries unique to their regions. Nonetheless, the legal independence is only partial since they must meet the condition of Section 18. Moreover, these states are subject to federal oversight through annual reviews.

Table 4.1 gives a list of the states that have been granted operational status as of 2013.[4] They are a smattering of both Republican and Democratic states, high and low industrial states, and states from all regions of the US. Although all of these states applied for the approval of a state plan just after the OSHA Act was passed in the early 1970's, most were not given full operational status until the early 1980's, a full decade later. Not until a state gains full operational status does federal OSHA suspend its authority to conduct inspections in that state. Once operational status is approved, the state-level office of occupational health and safety operates

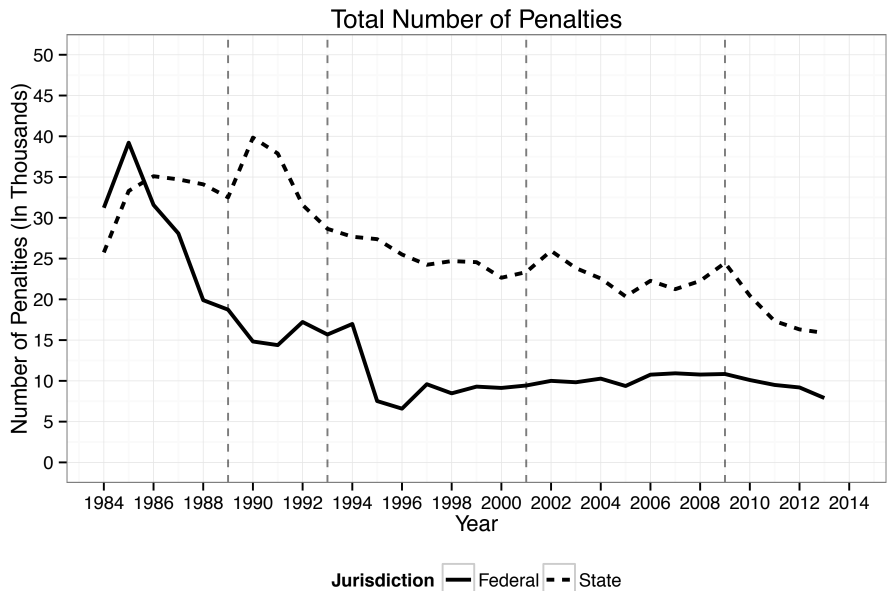
[4]information for this table was taken from the OSHA website in February 2014. `https://www.osha.gov/dcsp/osp/faq.html#oshaprogram`

Table 4.1: States with State-Plan Status

	State	Initial Approval	Certified	Final Approval	Operational Status
1	Alaska	1973	1977	1984	1984
2	Arizona	1974	1981	1985	1985
3	California	1973	1977		1977
4	Hawaii	1973	1978	1984	1984
5	Indiana	1974	1981	1986	1986
6	Iowa	1973	1976	1985	1985
7	Kentucky	1973	1980	1985	1985
8	Maryland	1973	1980	1985	1985
9	Michigan	1973	1981		1981
10	Minnesota	1973	1976	1985	1985
11	Nevada	1973	1981	2000	2000
12	New Mexico	1975	1984		1984
13	North Carolina	1973	1976	1996	1996
14	Oregon	1972	1982	2005	2005
15	South Carolina	1972	1976	1987	1987
16	Tennessee	1973	1978	1985	1985
17	Utah	1973	1976	1985	1985
18	Vermont	1973	1977		1977
19	Virginia	1976	1984	1988	1988
20	Washington	1973	1982		1982
21	Wyoming	1974	1980	1985	1985

the enforcement of health and safety standards in that state. This means that these states determine not only which establishments to target and to inspect, but this also means that the states are in full control of a large portion of the adjudication process. Thus, these states own a portion of the appellate procedure for contestation. Therefore, in these states, contested penalties go through a state-level appeals process in which penalties can be thrown out or abated. However, eventually an appeal can make its way to a federal review commission or administrative law judge or even the Supreme Court. So again, the states are not fully independent.

Given that inspection authority is decentralized to the state governments it makes sense to disaggregate the inspection numbers in Figure 4.3 to compare the number of inspections between state and federal entities. We can then ask if there are differences in the enforcement level between these two groups. Specifically, we can observe whether the state plans are responsive to federal preferences in the same way that federal inspections are.



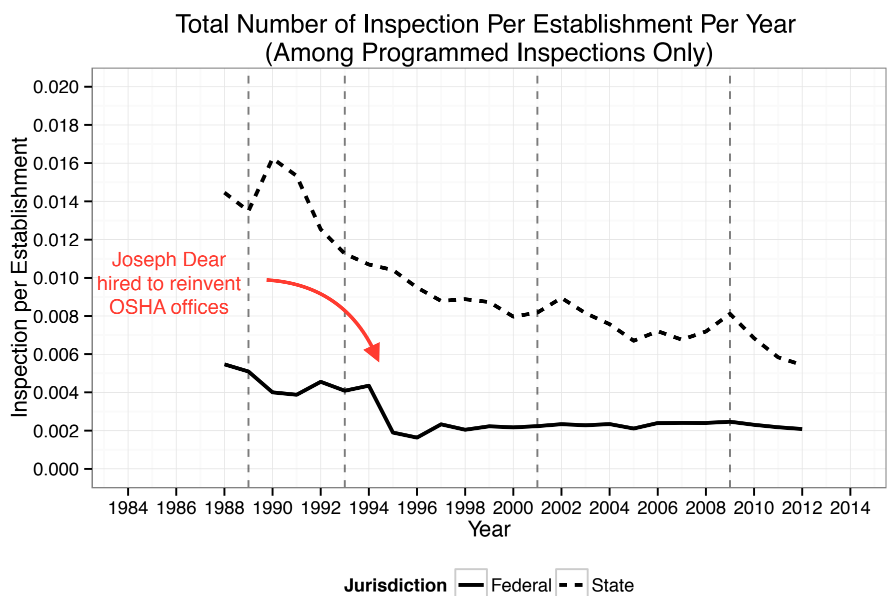


Figure 4.4: The first plot displays the total number of programmed inspections per year that are carried out by federal (solid line) and by state (dashed line) offices. The second plot does the same except that the total number of inspections are divided by the total number of establishments that are covered under each jurisdiction, as indicated from Census data of business patterns from 1988 to 2012. State plans not only conduct more inspections, but they also conduct more inspections per establishment in their state. Moreover, we can see the Joseph Dear's reforms during Clinton's administration in 1994 has significantly reduced the number of inspections for federal OSHA but not for the state plan states. This suggests that the state plans were unresponsive to the federal reinvention strategy

Figure 4.4 contains the same inspections as Figure 4.3, except the totals are disaggregated to display the sum of inspections conducted by state plans and the sum of inspections conducted by federal OSHA. In the first plot of Figure 4.4, the total number of inspections are displayed while in the second plot of Figure 4.4, I have divided total number inspections by the total number of establishments in each jurisdiction (the establishments from the Census and spans the years from 1988 to 2012) . Therefore the second plot controls for size of the jurisdiction.

There are a couple main points that can be drawn from these plots. First we can see that most occupational health and safety inspections are conducted by state OSHA offices. In fact, in most years state-level offices conduct more than twice as many inspections as federal offices despite the fact that they are being conducted in a minority of the states. Second, the change in inspection levels differs between federal and state-level plans. We can see that the gap between federal and state inspections has increased since 1984 and that the trend line for federal inspections seems to be more responsive to the presidential administrative agendas discussed above. For example, federal inspection numbers experience a steep decline from the Reagan administration through the Clinton administration, whereas the state inspection numbers experience a more gradual decline.

Moreover, we can see that Joseph Dear's reinvention strategy had a significant effect on federal OSHA inspections. There is a sharp decline in the number of inspections that the federal offices conducted after he arrives in 1994. The strategy was to reduce the regulatory burden set out by the federal government. The same effect is not present among state-level inspections.

The differences in the inspection trends suggest that states with state plans are less responsive to central administrative initiatives. These states seem to have successfully achieved a level of autonomy that protects them from federal-level partisan tides or federal-level agendas. Although this figure fails to shed light on whether state-plans are upholding safety and health standards at least as effectively as federal OSHA (something we cannot tell from the sheer number of inspections across jurisdictions that might contain very different numbers of hazardous industries), it does tell us that there is a disconnect between federal agendas and state level agendas. These trends suggest that the federal government has lost control of policy administration in those states with state plans.

4.4.3 Enforcement Stringency

To further explore whether state plans are responsive to federal standards or whether they act fully independent of them, we can look at how stringently they enforce those standards compared to their federal counterpart. One way to measure enforcement stringency is to use the size of the penalty awarded by the inspection officer after an inspection is conducted. There is a degree of discretion that is given to inspectors in identifying violations and assessing the penalty size for that violation. So an inspector that enforces health and safety standards more stringently would be one who observes more violations in an inspection, classifies more violations as being serious violations, and then assesses a larger penalty for those violations. Therefore, in states where health and safety standards are more stringently assessed, violators would be required to pay more for their transgressions than in states where the same standards were less stringently assessed.

An inspector conducting an inspection makes a number of decisions in observing a potential violation. She can decide to issue no penalties whatsoever, or she can decide to simply issue a citation without a penalty, or she can issue citation with a penalty. Therefore, there are number of variables we can observe indicating the stringency of an inspection. For example, we can observe whether or not an establishment has been cited. And given that it has been cited, we can observe how many citations have been issued. And given that citations have been issued, we can observe whether or not the

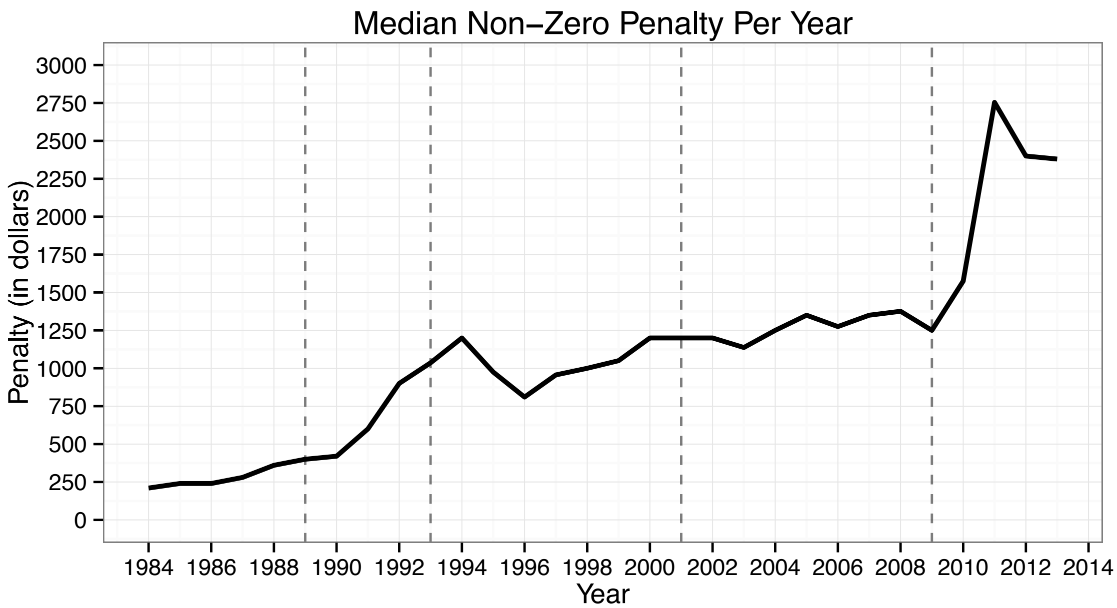


Figure 4.5: The plot attempts the gauge the stringency with which OSHA punishes health and safety violators over time by measuring the non-zero penalty in which the average inspection results. While the increase in the average penalty is partly attributable to inflation, there are a few major changes in the average penalty that have occurred. The first occurs under the Bush administration, where Congress passes a bill in 1990 that raises the maximum penalty per violation. This gets reduced in 1994 under Clinton as Al Gore spearheads an attempt to reduce the regulatory burden on small businesses - an attempt that is well supported by the Republican majority in Congress. Then in 2010, through unilateral executive action, Obama drastically increases the fine for safety and health violations.

establishment has been penalized. And given that it has been penalized, we can also observe the size of the total penalty.

For ease of analysis, I have decided to focus only on the last variable. Therefore, I am limiting the observations only to those inspections that resulted in an initial penalty. By excluding all inspections where no action was taken or where an establishment was cited without penalty, I am able to compare penalties across all inspections where penalties were issued. Hence my variable of interest is penalty size, which is a non-zero value.

Figure 4.5 displays the median non-zero penalty for every inspection conducted in each year since 1984. The median non-zero penalty measures the stringency with which inspectors punish violators *given* that the inspector has decided to issue a penalty in the first place. I have chosen to ignore prior decisions - like the decision to inspect the establishment and the decision give a citation - so as to focus solely on the decision about the size of the penalty to give.[5]

We can see here that the while total inspection numbers have been on the decline since 1984, the median penalty per inspection has been trending upwards. Most notably this trend begins in 1990 when Congress passes a bill that raises the maximum penalty allowed for a number of particular infractions. Because of this we see steep increases in the median penalty assessed from 1990 until Joseph Dear's leadership during the Clinton Administration beginning in 1993. The agency's reinvention during that time not only saw steep declines in the number of inspections but it also saw steep decreases in the size of the penalty assessed. This effect was part of Dear's strategy to reduce the regulatory burden on employers by working with employers to reduce hazards rather than threaten them with fines.

Additionally, this figure shows the enormous penalty hikes that coincide with the Obama Administration's effort to incentivize workplace compliance to OSHA

[5]One could choose to expand the scope of the analysis to include inspections that resulted in zero penalties. In the current analysis, such an inspection is taken out of the sample and disregarded when estimating inspector stringency. A major reason for doing this is that there are a large number of inspections that result in no penalty whatsoever. Under George W. Bush's administration, for example, about 30% of federal inspections resulted in no initial penalty. The large number of zeros in the data has the tendency to bias the median penalty size toward zero, reducing valuable variation in the variable of interest. Since I am primarily concerned with how the median penalty varies across jurisdictions, I choose to drop the zeros from the analysis. In doing so, I limit the analysis to variation in penalties among inspections where penalties are issued.

However, one might argue that an inspector's decision to avoid issuing a penalty is an indicator of leniency and there may be systematic differences in the number of zero-penalties across state and federal jurisdictions that are responsible for the results in the paper. It would be especially troubling for the current analysis if federal OSHA averaged more zero-sized penalties than state-run OSHA. In which case, the paper?s finding that state-run OSHA was less stringent than federal OSHA may be attributed to the difference in zero-sized penalties dropped from the analysis.

Yet, this is not the case. While federal OSHA issues zero penalties in about 30% of its inspections, state-run OSHA issues them about 50% of their inspections. Therefore, while there is a systematic difference between them, the difference suggests that state OSHA is even less stringent than the current analysis suggests. Hence, the results of the paper should hold.

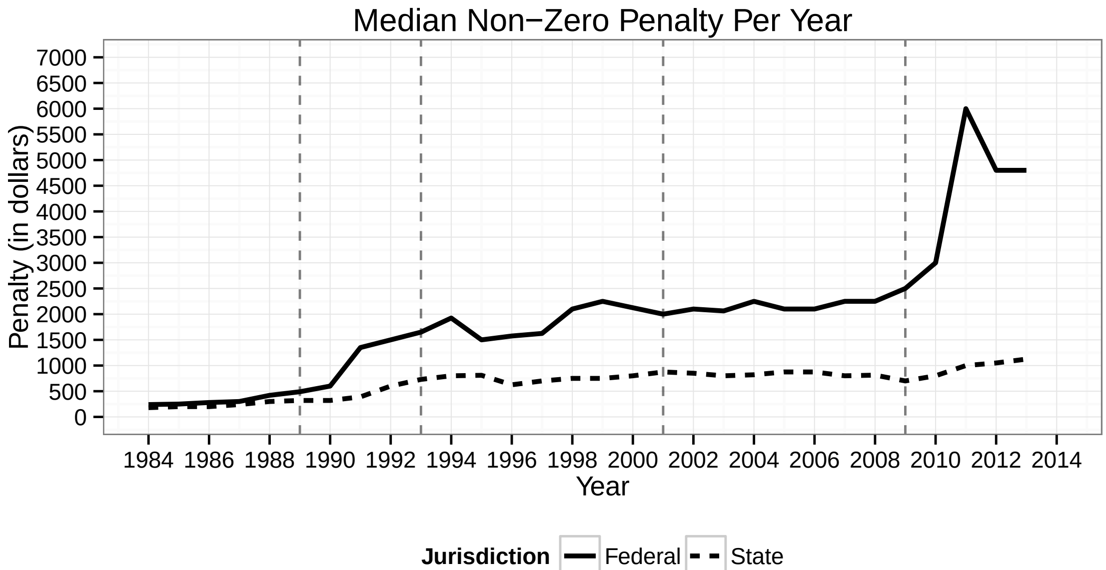


Figure 4.6: The figure shows that inspections carried out by federal OSHA result in larger penalties than inspections carried out by state-run OSHA. Moreover, this figure shows that state-level OSHA penalties are almost non-responsive to federal preferences. For example, Obama's push to levy greater penalties in 2010 only has impact among states where federal officers carry out inspections. There is almost no response among inspections carried out in states that deliver their own inspections

standards. By drastically increasing the penalties handed out per inspections the Administration intended to a take a hard stance against violators. Spearheaded by OSHA's director, David Michaels, the Obama Administration has made a point to use steep penalties to severely punish transgressions.

Figure 4.6 disaggregates the median non-zero penalties per inspection displayed in Figure 4.5 into those performed in states covered by federal OSHA and those performed in states covered by state-plans. This allows us to compare enforcement stringency across the two groups over time. This leads to a couple main observations. First, there is a noticeable difference in the median penalty levied by the two groups. Today, a fine levied by Federal OSHA will likely cost an establishment $5,000, whereas a fine levied by a state plan will likely cost an establishment $500. And second, this difference has generally increased over time. While those penalties assessed by federal

OSHA have responded to federal initiatives (i.e. Congress enacting legislation in 1990 to increase penalty sizes, Dear in 1994 to decrease penalty sizes, and Obama in 2010 to drastically increase penalty sizes) those penalties assessed by the state plans have not responded in kind. Rather the penalties have remained fairly low and the changes have remained fairly flat.

Figure 4.7

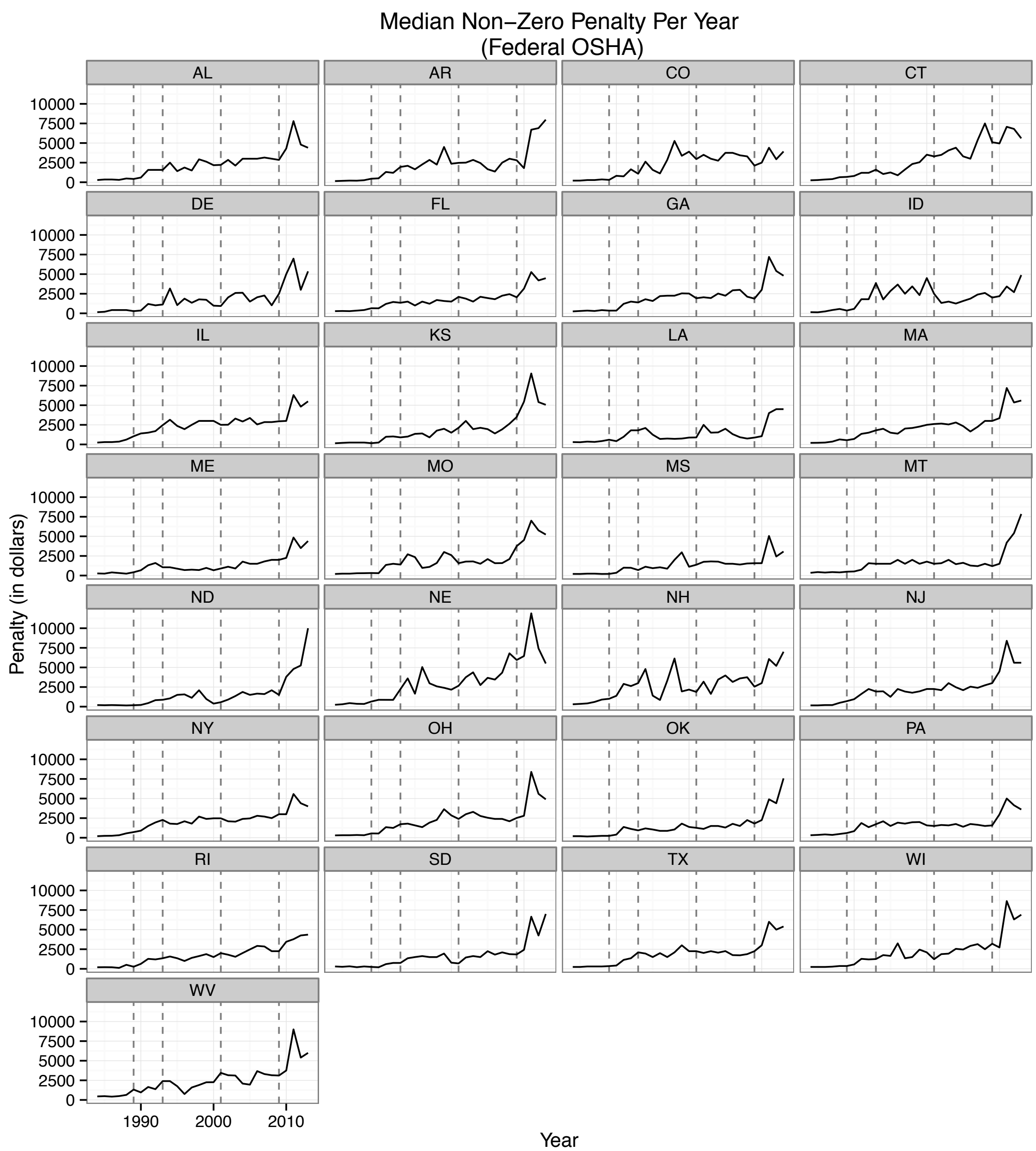
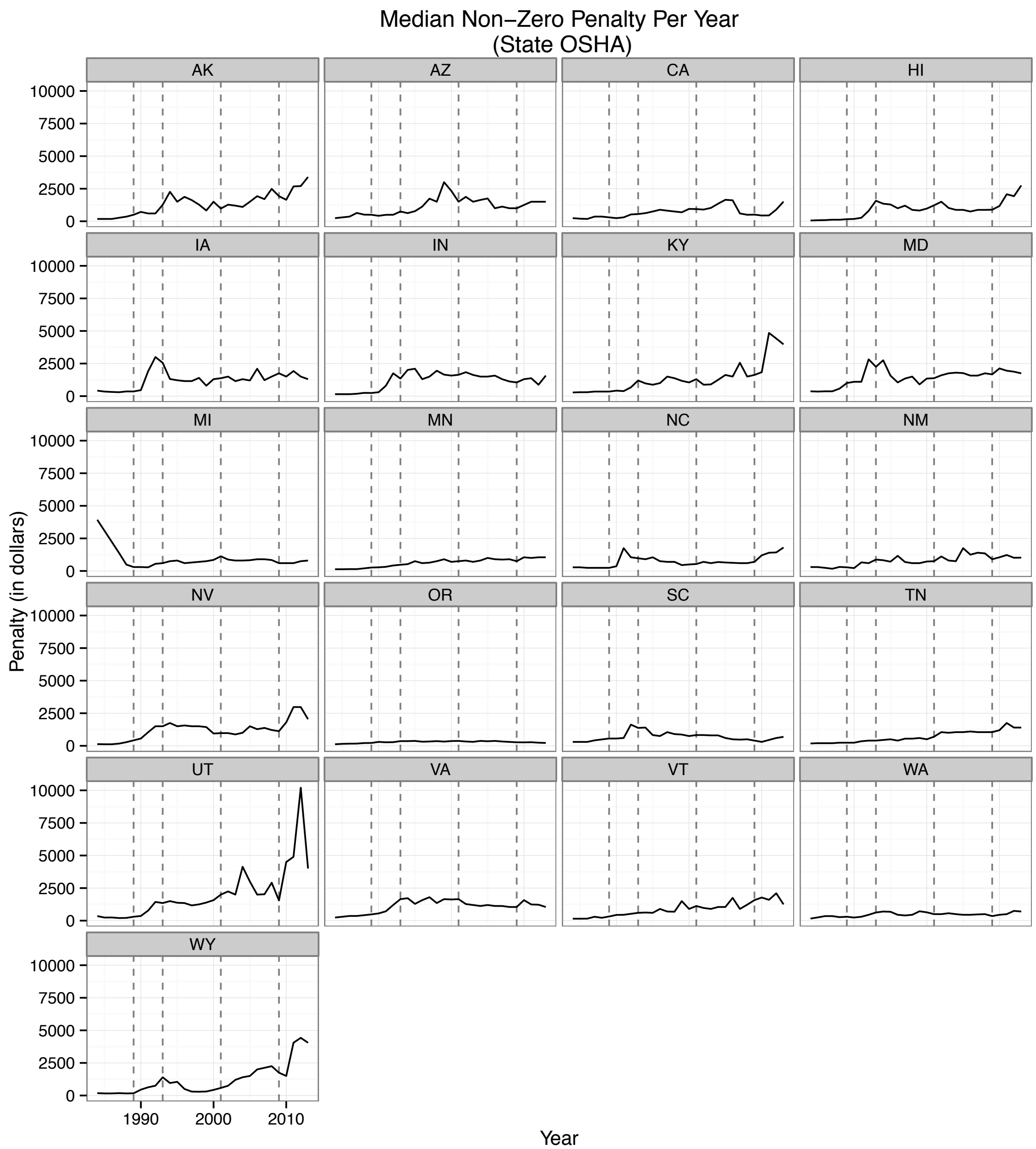


Figure 4.8



Disaggregating these trends by states can emphasize this point further. I have displayed the state-level trends in the size of the median penalty in Figures 4.7 and 4.8. Figure 4.7 displays those states that are covered by federal OSHA while Figure 4.8 displays those states covered by state-plans. Although there are differences in the penalty size across the states, the trends are pretty consistent within each group. Each of the states covered by federal OSHA respond similarly to presidential initiatives. For example, it is clear that each state can be seen to drastically increase penalty sizes in 2010. However, such a trend is not present across most states with state plans. Those states experience fairly flat trend-lines. Moreover, all but a few of these states seem to be unresponsive to to the Obama's hike in penalties.

4.5 Does devolution lead to a loss of political control?

I have shown that state plans enforce health and safety standards differently than federal OSHA. And I have shown that they are less responsive to federal partisan tides. But has this led to a loss of political control? In other words, with devolution, might it be the case that states covered by state plans are able to sway federal occupational safety and health standards toward their own partisan agendas?

Figure 4.9 attempts to answer this question. This figure takes Figure 4.6 and disaggregates it further into two more groups representing partisanship. The solid lines reflect median penalties among inspections conducted by federal OSHA and the dashed lines represent the median penalties among inspections conducted by state plans. I have then further grouped these into states with Republican governors (in red) and states with Democratic governors (in blue). This allows us to observe whether the stringency with which inspections are conducted differs based on the partisanship of the state's governor. While we might not expect a difference in inspection stringency between Republican states and Democratic states where federal OSHA conducts its inspections, we might expect differences in state-plan states. This would suggest that devolution has resulted in a loss of control, and that states curb its stringency according to regional partisanship.

However, as we can see from Figure 4.9, this does not appear to be the case. Instead, there appears to be little difference in the stringency with which inspectors punish violators. The evidence suggests that a governor's partisanship, regardless

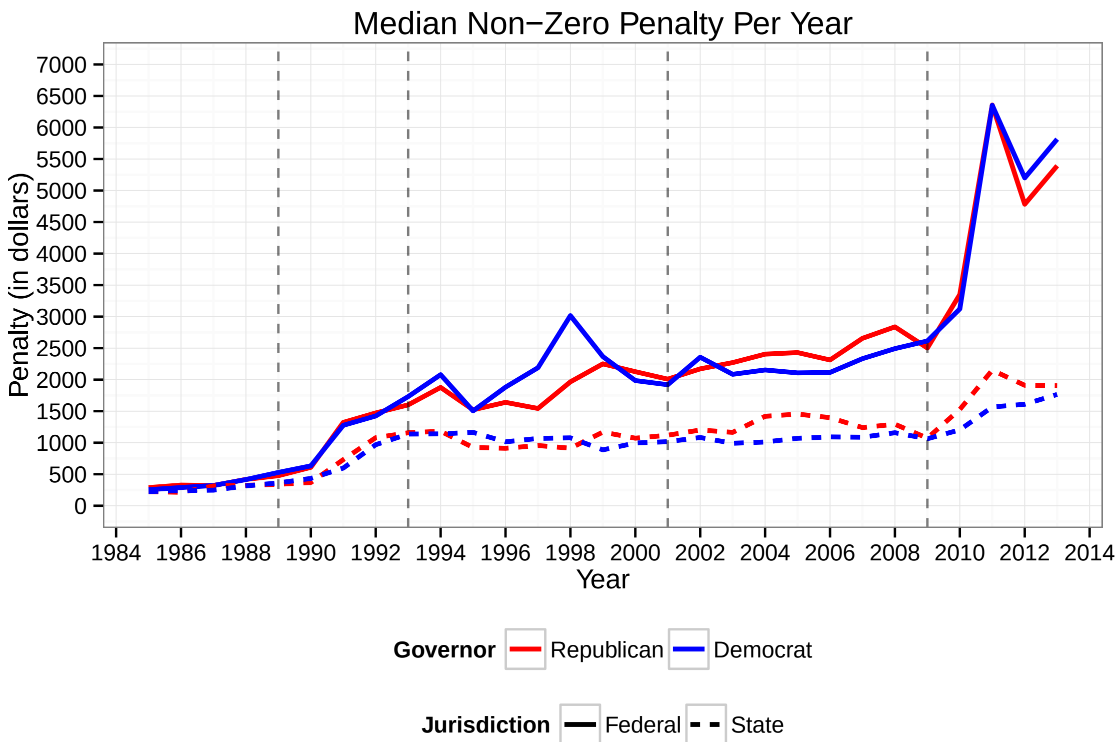


Figure 4.9: This plot disaggregates the median non-zero penalty per year by governor partisanship. The purpose is to observe if there are systematic differences between Democratic and Republican states that emerge as a result of devolving regulatory authority. However, the similarities between states with Democratic governors and states with Republican governors implies that the devolution of authority does not result in a loss of political control.

of jurisdiction, has no effect on penalties. Even despite the devolution of authority, partisan governors do not seem to systematically manipulate the penalty size according to their expected partisan preferences. State-plans run by Democrats levy fines similarly to state-plans run by Republicans.

Here I provide a more detailed test of whether the implementation of federal health and safety standards are influenced more by centralized political actors (such as the president and Congress) or by decentralized political actors (such as state leaders) and I test whether this influence is conditioned on devolution (whether the inspection is conducted by federal OSHA or by states with state plans). To do this, I set up the following two simple linear models where a state's median penalty size in each year from 1984 to 2013 is the dependent variable and federal and state political actors that might influence the penalties as the independent variable. The basic idea of this setup is to test whether OSHA inspections are responsive to central or regional political forces and to test whether this responsiveness is different depending on whether states control the inspection process or whether federal OSHA controls the inspection process. Not only can we observe the differences in coefficients between federal and state-level influence, but we can also observe if those differences change depending on whether the inspection is devolved or not.

To set up the test, I conduct two simple OLS regressions: one on federal inspections and one on state inspections. Each regression contains potential federal-level influences and potential state-level influences on the size of the median penalty for each state-year observation. Therefore, if devolution leads to a loss of control, then the state-level predictors should significantly predict the penalty size in state-plans rather than federal plans, whereas the federal-level predictors should not. On the other hand, if the federal government successfully maintains control despite devolution, then state level predictors should be insignificant for both models. Only the federal-level predictors should significantly predict penalty size.

Among FEDERAL OSHA Inspections:

$$\text{Median Nonzero Penalty}_{fed} = \beta_{0,fed} + \beta_{1,fed}\text{Federal Level Influences} + \beta_{2,fed}\text{State Level Influences} + e_{fed} \quad (4.1)$$

Among STATE OSHA Inspections:

$$\text{Median Nonzero Penalty}_{state} = \beta_{0,state} + \beta_{1,state}\text{Federal Level Influences} + \beta_{2,state}\text{State Level Influences} + e_{state} \tag{4.2}$$

INDEPENDENT VARIABLES OF INTEREST

The independent variables are used to measure two levels of possible influence on OSHA inspection activity. At one level, there are indicators of federal influence. These are basic variables that intend to measure the effects of president and congressional preferences.

Federal-level Influences

President Dummies - A dummy for each president from 1984 to 2013. This attempts to capture the influence of presidential administrations. It is expected that under Democratic presidents, OSHA will increase the stringency of its enforcement, while under Republican presidents the stringency should be reduced.

Democratic Congress - A dummy indicating years when Democrats control a majority of the House. It is expected that under Democratic Congresses, OSHA will increase its enforcement activity.

State-level Influences

Democrat Governor - A dummy variable indicating years where there is a Democratic governor. If state partisanship influences inspection behavior in that state we should expect that in those states where there is a Democratic governor there would be more stringent enforcement (Klarner, 2003).[6]

Divided Government - A dummy variable indicating years when one party fails to control all three branches in the state legislature. It is interacted with Democratic governor as way to indicate when governors are less influential as a result of an

[6] Data from Klarner website at http://www.indstate.edu/polisci/klarnerpolitics.htm

opposing legislature. Therefore, divided government should reduce the effect of the governor.[7]

4.6 Results

The results of the OLS regressions can be found in the Table 4.2. The first first and second column are the result of the models run on federal and state OSHA respectively. The third and fourth column are the same as the first and second, but with state-level fixed effects. Generally the tests verify the conclusions drawn by the preceding figures. There is evidence of significant presidential effects on both federal and state inspections. However, these presidential effects are much more limited in the states with state plans than in states with federal plans.

Moreover, the state-level variables are not significant in states where federal OSHA conducts inspections. However, for state OSHA, a Democratic governor is expected to significantly reduces the size of a penalty in the state. While the significance of the variable corresponds with the hypothesis that state plans allow states to ideologically affect inspections, the direction of the sign is unexpected. Assuming that Democrats prefer stricter inspections than Republicans, we would not expect Democratic governors to decrease the size of the penalty. Moreover, in the next set of models using state fixed-effects to capture within-state variation, the Democratic governor variable falls out of significance. Therefore, the significance in the first model was likely spurious.

The model does validate a couple results observed above. First, across all presidential administrations state OSHA penalizes violators less than federal OSHA. State OSHA is simply less stringent than Federal OSHA when doling out fines. Despite their legal mandate to be "at least as effective" as Federal OSHA, states are nowhere near as stringent when it comes to fines.

[7]Data from Klarner website at `http://www.indstate.edu/polisci/klarnerpolitics.htm`

	Median Non-Zero Penalty			
	FEDERAL	STATE	FEDERAL	STATE
FEDERAL VARIABLES				
Reagan	265.5	157.5	750.8***	180.8
	(168.4)	(119.3)	(232.6)	(128.9)
Bush I	855.7***	349.2***	1,343.2***	357.8***
	(168.7)	(120.6)	(233.9)	(130.5)
Clinton	1,487.6***	654.9***	1,978.6***	678.9***
	(86.8)	(68.2)	(193.1)	(101.5)
Bush II	1,976.0***	927.4***	2,469.0***	938.8***
	(82.2)	(66.1)	(190.1)	(101.2)
Obama	3,752.2***	1,092.5***	4,212.5***	1,148.7***
	(171.0)	(121.1)	(229.9)	(129.3)
Democratic Congress	−139.5	61.6	−107.4	35.3
	(139.9)	(92.8)	(129.3)	(76.2)
STATE VARIABLES				
Democratic Governor	35.2	−205.9***	−99.4	74.4
	(98.8)	(72.6)	(122.4)	(86.8)
Divided State Government	7.5	−176.9**	−128.3	140.8*
	(89.7)	(70.5)	(113.7)	(78.7)
Democratic Governor X Divided Government	−177.1	120.7	8.1	−152.3
	(133.2)	(92.4)	(185.3)	(109.0)
State Fixed Effects	No	No	Yes	Yes
Observations	756	565	756	565
R^2	0.808	0.576	0.844	0.727

*p<0.1; **p<0.05; ***p<0.01

Table 4.2: An OLS regression estimating the median non-zero penalty. Model uses state-year observations from 1984 to 2013. The dependent variable is the median non-zero penalty for each state in a particular year. The results in the first and third column are constrained to inspections under federal OSHA, whereas the results in the second and fourth column are constrained to inspections in states where there is a state plan.

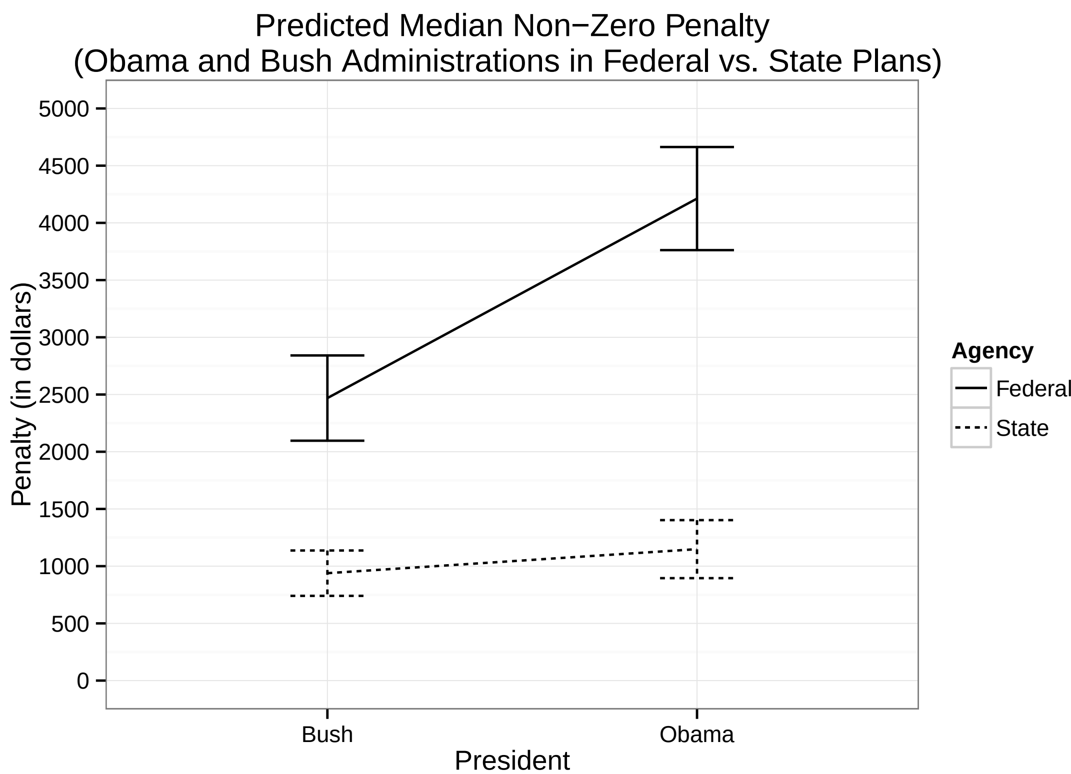


Figure 4.10: The Obama Effect: Median Non-Zero Penalty by Agency

And second, when the Obama administration sought to discourage health and safety violations by increasing the penalties levied on violators, state OSHAs were nearly unaffected. Figure 4.10 shows the predictions from the fixed-effects models for the size of the penalties in the Bush administration versus the Obama administration (assuming a Republican Governor, a Republican Congress, and a unified state legislature). In both administrations, the size of the penalties for state OSHA is smaller than the size of the penalties for federal OSHA. However, when moving from the Bush administration to the Obama administration, there is a major increase in the penalty size for federal OSHA but not state OSHA. Therefore, as mentioned above, state OSHA was nearly unresponsive to Obama's push to increase enforcement.

4.7 Controlling for Geography: Matching Neighbors

Despite enforcing the exact same health and safety standards, it appears that federal OSHA fines violators more than state OSHA does. Although this might suggest that devolution allows for states to engage in less stringent inspections, it is also possible that those establishments that are subject to OSHA standards are different in federal jurisdictions than those in state jurisdictions. Because industries vary geographically, it is plausible that it is simply the geographic location of state-plan states that determine their difference in levied penalties. For example, violations in state-plan states like California, Oregon, and Washington are different from federal states like Maine and New Hampshire because they deal with different types of establishments and industries that tend to correlate with their difference in geographic location. The deep south, for example, is almost fully covered by federal OSHA, and may not be comparable to the state-plan states that cover most of the west.

To infer that the difference in inspection jurisdiction (state or federal) is what is causing the difference in levied penalties, we would hypothetically observe the outcome of two inspections, identical in every way other than the jurisdiction of the officer that carries it out. Therefore, the difference in outcome can be attributed to the difference in jurisdiction.

Unfortunately, such a hypothetical cannot be observed. A difference in the jurisdiction of the officer already implies that the inspections take place in different states and, therefore, in distinct geographic locations. And since the geographic location of the inspection correlates with a host of variables that might have a systematic effect on the outcome, it is difficult to conclude that the difference in outcome is the result of a difference in jurisdiction rather than a difference in location.

However, we can attempt to minimize this bias caused by geography by finding inspections that are geographically similar to each other, but differ in the jurisdiction of the inspection officer. In other words, we can try to control for the effect of geography (and the variables that are associated with it) by comparing inspections that share in location but differ in jurisdiction. The next part of the analysis attempts to do just this. By matching similar inspections on the borders of state-plan states to neighboring inspection on the border of federal OSHA states, we can assume that the marginal difference in geography (and, thus, the marginal difference in the variables that are associated with geography) is not the cause of any difference in outcome. Instead, we can begin to attribute the difference in penalty to the difference in OSHA inspection jurisdiction.

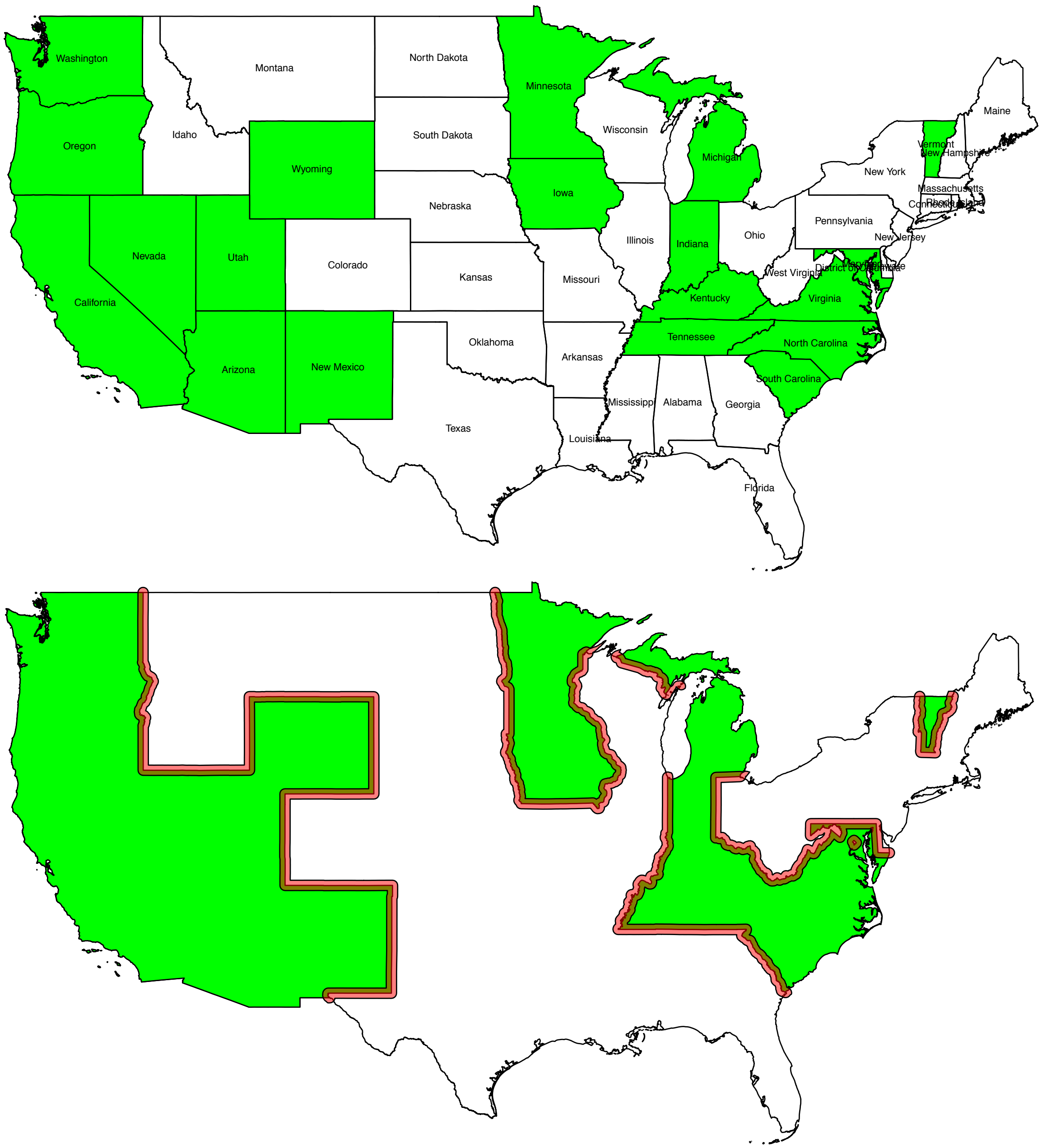
The following is an attempt to test whether the implementation of federal health and safety standards are influenced by its partial devolution to state authority by controlling for the geographic location of the inspection. So far, there is evidence that state inspections result in smaller penalties than those conducted by federal inspectors. However, since state and federal inspections occur in geographically distinct locations, the variables associated geography may be responsible for this difference. To control for geography, I set up a test that finds inspections that occur on borders between state and federal jurisdictions. This allows me to match a single state inspection with its closest neighboring federal inspection. The basic idea of this setup is to compare two similar inspections that occur in the same basic location, but differ in the jurisdiction of the inspector. Ideally, this will isolate the effect on levied penalties that is attributable to federal-state differences and nothing else.[8] The test takes the following steps:

Step 1: Isolate the border between state and federal jurisdictions

Since OSHA records the address of every establishment that it inspects, we can identify the exact location of the inspection. Having geocoded these records, I am able to precisely locate any inspected establishment relative to any other inspected

[8]I follow the approach to analyzing geographic discontinuities used by Keele and Titiunik (2014).

Figure 4.11: Establishing the Borders Between State and Federal Plans



establishment. Moreover, I can locate these establishments relative to its state border. For the purpose of this analysis, I want identify all establishments that are marginally close to a border between state and federal OSHA jurisdictions. These are the establishments that we can compare to their neighbors on the other side.

To do this, I first specify the location of the border between state and federal jurisdictions. The first map in Figure 4.11 is a map of the United States that identifies states that have established a state-OSHA program. They are marked in green. Inspections in these states are conducted by state officers, whereas those in the other states are conducted by federal officers. The boundary between these federal and state inspections is created using a GIS techniques that eliminate all the state borders between identical jurisdictions. What remains are only the borders between different jurisdictions. The result is displayed in the second map of Figure 4.11, where a set of borders divide state and federal jurisdictions.

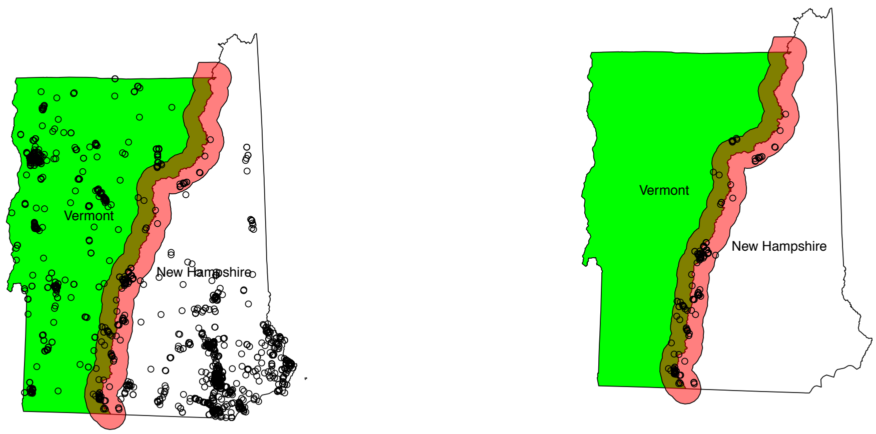
The next step is create a buffer zone that circumscribes any point that is marginally close to that border. This will be used to isolate the set of inspections that are within a specific maximum distance from the border. Every inspection that will match with a neighboring inspection across the border with be contained in this set. Specifically, the buffer zone indicated in Figure 4.11 includes every point that is within 10 miles of the border.

Step 2: Only keep similar inspections within the buffer zone

I then remove any inspection that is outside of this buffer zone, leaving only those inspections that are within 10 miles of this border. These are the inspections that will be candidates for matching. However, because I will only match inspections that are within 5 miles of each other, the 10 mile buffer zone is an overestimate of the sample I am interested in. Nonetheless, it effectively subsets the data to contain all potential matches.

In sum, the subsetting process works as follows. First, I begin with the universe of inspections that have been recorded by OSHA since its inception. There are over four million in total. Then I whittle those inspections down to a relevant subset of generally similar inspections. These are planned or programmed inspections (non-complaints) conducted only on the construction industry during the eight years of the George W.

Figure 4.12: Example: Inspections in VT and NH



(a) All Inspections in VT and NH

(b) All Inspections in 10 miles from the border

Bush administration. This allows for the inspection type, industry type, and president to be held constant. Further, this set of inspections is cut down to only include those that have been successfully geocoded to their street address. The downside of this geocoding process is that it removes about 40% of the inspections. However, I assume that the removal process is random with respect to location and, therefore, inconsequential. The last step is to remove all inspections outside of the buffer zone. What remains are 8,776 geocoded inspections on the construction industry conducted between 2001 and 2008 that are within 10 miles of a boundary between state and federal jurisdictions.

Take, for example, the border between New Hampshire and Vermont in Figure 4.12. The first map locates every inspection in our sample across the two states. The second map removes those inspections that are conducted outside of the 10 mile buffer. The remaining inspections are candidates for matching, in that a subset of these inspections will match with a nearest neighbor across the border that is within 5 miles of itself. This allows us to compare the outcomes of those inspections that are marginally close to each other, but are divided by a state boundary.

Step 3: Geographic Matching Algorithm

For the third step, I match inspections within the buffer zone that are conducted under state jurisdiction to the nearest inspection conducted in federal jurisdictions. I then only keep those matches that are within 5 miles of each other. In other words, if the nearest match is over 5 miles away I remove that pair from the sample. The matching algorithm is defined as follows:

1. Begin with all the inspections within the buffer zone

2. Divide these into two groups according to their state and federal jurisdictions

3. For each inspection within the state jurisdiction measure its distance in miles from every inspection conducted under federal jurisdiction and record the inspection that minimizes that distance.

4. Once every inspection has a match, drop those pairs where the minimum distance between them is more than 5 miles

This procedure creates a set of state-level inspections that are paired with its nearest federal-level inspection up to 5 miles. Of the original 8,776 inspections within the buffer zone, there are 2,424 matched pairs. Ninety percent of these pairs are within 1.75 miles of each other and fifty percent are less than a mile apart.[9]

For each inspection, I have recorded the dollar amount of the initial penalty that was levied. Then I took the difference in penalties between the pairs by subtracting the penalty of the state inspection from the penalty of the federal inspection. The result is a set of 2,424 differences. If the stringency of state inspections are no different

[9] I did not match on exact year, so it is possible that an inspection in 2001 is compared to an inspection in 2008. However, the average difference in year between the pair is less than a year. Therefore, there is no significant systematic difference between the years of the penalties.

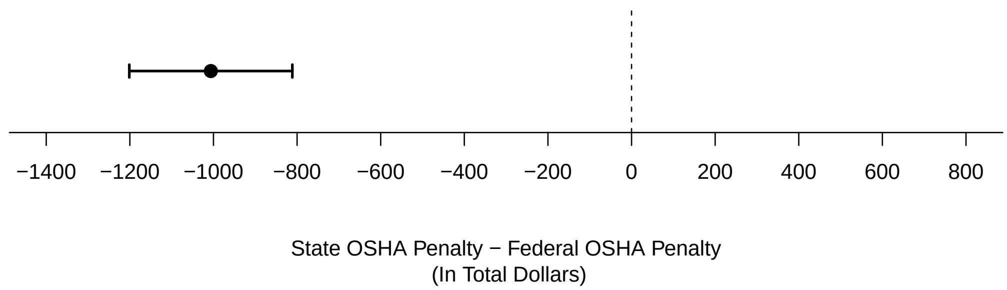


Figure 4.13: Matched Establishments: Federal-state difference in penalty amount between federal and state inspections of geographically similar construction sites between 2001 and 2008. The negative difference suggests that even when comparing geographically similar inspections, an establishment located in the state jurisdiction can expect a smaller non-zero penalty than if it were located in federal jurisdiction.

from the stringency of federal inspections, there should be no difference between federal and state penalties on average.

Figure 4.13 summarizes the differences. I have plotted the average dollar difference along with its 95% confidence interval. The average difference in penalty is about $1000. This means that even given similar inspections located marginally close to each other, we can expect that federal OSHA will fine about $1000 more than its state-level counterpart.

While the matching analysis has been used up to this point to test whether there is a systematic difference in regulatory behavior between federal and state jurisdictions, it can also be used to test whether political variables also affect this behavior. For example, as hypothesized above, it is possible that the devolution of regulatory authority to the states allows those states to inject political influence into the regulatory process. While the regression tests failed to reveal such political influence, it is possible that the null effect was the result of comparing establishments that are dissimilar. Instead, by comparing establishments that are alike - both in kind and in location - the matching approach may be able to uncover political influence produced by devolving regulatory authority to the states.

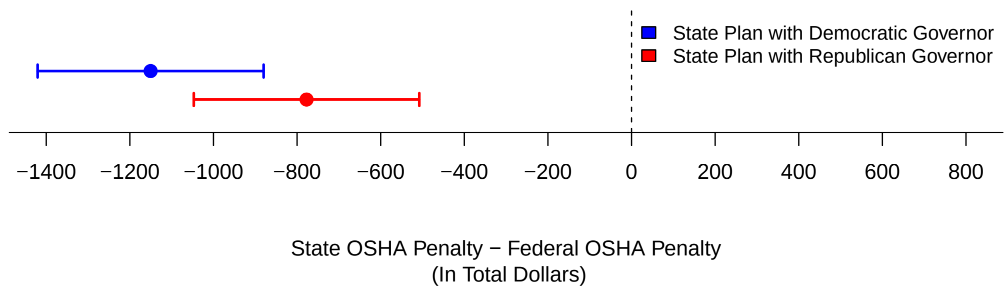


Figure 4.14: Matched Establishments: Federal-state difference in penalty amount between federal and state inspections of geographically similar construction sites between 2001 and 2008 separated by the partisanship of the governor of the state jurisdiction. The interval in red represents the state-federal difference when the state jurisdiction is governed by a Republican. The interval in blue represents the difference when the state jurisdiction is governed by a Democrat. The difference between the two samples suggests, contrary to expectations, that Republican states are more stringent than Democratic states. However, a two-sample t-test reveals that the difference is not quite significant at the .05 level and suggests that the governor's partisanship does not systematically affect the penalty difference between state and federal jurisdictions.

In which case, the state-federal difference in penalties (displayed in Figure 4.13) would differ depending on which party controls the inspection carried out under state jurisdiction. Therefore, while state inspectors may be less stringent than their federal counterparts, perhaps this difference in stringency changes as the partisan ship of the state changes. We might expect for inspections carried out in Democratic states to be more stringent than those carried out in Republican states. In which case, the negative state-federal difference in penalties, which we observe in Figure 4.13, would be greater if Republicans controlled the state than if Democrats controlled the state.

In Figure 4.14, I have separated the matched state-federal pairs into two groups based on the partisanship of the governor in the state jurisdiction. Of the 2,424 matched pairs 1,468 had state-run plans where a Democratic governor was in power, while the rest had a state-run plan where a Republican was in power. An average of the difference in each group is plotted along with its 95% confidence interval.

The interval in red represents the state-federal difference when the state jurisdiction is represented by a Republican. The interval in blue represents the difference when the state jurisdiction is represented by a Democrat. The difference between the two samples suggests, contrary to expectations, that Republican states are more stringent than Democratic states. Yet this is likely a spurious difference, since a two-sample t-test reveals that the difference is not quite significant at the .05 level. Therefore, as we observed in the regression results above, there does not appear to be much of a difference in regulatory behavior between Democratic and Republican states.

4.8 Conclusion

There are two primary sources for a political analysis of OSHA inspections. Scholz, Twombly and Headrick (1991) argue that OSHA enforcement is determined by both central and regional political pressures, while Huber (2007) has countered that claim arguing that the enforcement is primarily determined by central, but not regional actors. Huber claims that OSHA enforces its health and safety standards by engaging in what he terms strategic neutrality. He argues that OSHA standards are enforced uniformly and neutrally across the various geographic arms of the agency. Thus, the decentralized field-level bureaucrats are insulated from the political environment at the ground level and are tightly tethered to the commands of central leadership. As a result, he argues that we are not likely to observe regional variation of OSHA enforcement.

In this paper, I find evidence that both theories might have empirical truth. On one hand, I find that inspections are not responsive to regional political pressures as Huber contends. On the other hand, with an analysis of state plans, I find that some states are not in lock-step with federal pressures as Scholz might contend. Thus, it appears that the federal government loses some control over the implementation of occupational health and safety standards by devolving its authority to the states. However, it does not appear that there is significant ideological drifting occurring within those states.

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CHAPTER V

Conclusion

The goal of the dissertation is to explore how geographic boundaries play a role in shaping the American political system. I do this in two contexts. First, I analyze how electoral district boundaries interact with partisan geography to determine partisan representation. And second, I explore how geographically defined administrative district boundaries change the way people experience policy. In both cases, I show how geography is made relevant to politics through the existence of geographic boundaries.

In Chapter 1, I explore how partisan geography influences representation. Using a computational model to simulate elections I am able to improve upon previous research by Chen and Rodden (2013) who provide evidence of a link between Democratic clustering and electoral bias. I develop this link more thoroughly by designing a computational model that simulates the process of electing representatives from a geographically distributed set of partisan voters. By observing the results of hypothetical elections across a range of state-level partisan support and under multiple types of Democratic clustering, I show exactly how Democratic clustering affects the votes-seats curve in single-member district systems.

The results of the model provide a number of implications for research on Democratic representation. First, the model develops a new understanding of the votes-seats curve that is entirely based on the geographic distribution of voters. While others have used the votes-seats curve to measure representation in the United States, the curve has conventionally been assumed to be some variation of an exponential function. However, I develop a conception of the curve that doesn't fit a conventional functional from, but is rather determined by the complex geographic distribution of voters that underlies the system. Therefore, the seat share of a party doesn't simply depend on an increase in electoral support, but it also depends on the geographic location of those new supporters.

Second, I show that Democratic clustering can take on multiple formations which affect the votes-seats curve in different ways. Democrats can concentrate symmetrically with respect to Republicans or they can concentrate asymmetrically with respect to Republicans. Both are cases of Democratic concentration, but are shown to have drastically different electoral effects. Specifically, as Democrats cluster the votes-seats curve flattens, reducing the seats of the party that holds a majority electoral support. Therefore, there are conditions under which either party can lose seats due to Democratic clustering. However, as the clustering becomes asymmetric the votes-seats curve flattens asymmetrically. This means that while both majority parties will lose seats, Democrats will lose more seats than Republicans in the same position.

The findings of Chapter 1 suggest that the relationship between Democratic concentration and electoral bias is much more complex than Chen and Rodden conclude. There is more to consider about the geographic nature of partisan spatial patterns when analyzing its effect on representation. For example, in analyzing the effect of Democratic concentration one must also consider the spatial patterns of Republicans, as wells as the number of clusters that occur, and the location of the clusters. Each of these can change the distribution of votes across the districts and, hence, alter the votes-seats curve.

After developing exceptions about how geographic clustering affects the votes-seats curve in Chapter 1, I test those expectations in Chapter 2 by giving empirical support for the model. I do this by establishing that districts are designed in such a way that partisan geography influences the distribution of partisans across the districts, which is a major assumption of the theoretical model. First, I show that districts designed by a computer, which uses nothing more than the geographic distribution of voters to guide it in drawing the districts, do a pretty good job of replicating the partisanship of real-world districts. This is evidence that the real-world districts depend similarly on voter geography. And second, I show that when partisanship increasingly divides along the urban/non-urban dimension, the distribution of partisan votes similarly divides across the districts in such a way that produces asymmetry in the votes-seats curve.

While Chapter 2 provides some convincing evidence that the districts are designed in such a way that makes partisan representation dependent on voter geography, there is more than can be done in future research to convey this point. For example, while the use of county-level data in the historical analysis of presidential elections may capture some of the variation in partisan geography, it is a very imprecise measure. Counties that cover large metropolitan areas like Houston and Dallas fail to capture the intricacies of how Democrats and Republicans tend to segregate between urban and suburban areas. To better measure such segregation, one must use more geographically detailed data that can better capture within-county variation in partisanship.

While precinct-level data has not been systematically collected, aggregated, and merged with geo-coded Voting Tabulation Districts across the U.S. other than in 2008, collecting this data for previous years could help researchers to understand precisely how partisanship has clustered over time. Although such a task may not be feasible, one could potentially estimate local-level partisanship across the states using Census demographic variables as an alternative. Accurate estimates could prove invaluable to research on political geography and gerrymandering by developing an historical account of how geography plays a role in Congressional representation.

For example, the simulations performed in Chapter 2 could be extended back through previous years to see if geography has consistently been a major influence in determining elections. One could observe how within-state changes in the type of partisan clustering has affected representation. And with more precise geographic measures of partisanship, I am better able to measure the complexities of partisan clustering. With recent developments in sophisticated measures of segregation, I can move beyond the blunt measurement of urban/non-urban partisan difference used in this thesis to provide a more accurate analysis of the various ways in which partisans cluster (Roberto, 2015).

In Chapter 3, I continue the objective of the dissertation by exploring another way in which geographically-defined political boundaries play a role in politics. Specifically, I examine how the enforcement of federal regulatory policy changes as one moves across administrative boundaries. By comparing the administration of federal health and safety standards across geographically separate federal and state jurisdictions, I find differences in the stringency with which state and federal inspectors penalize business establishments. Therefore, if an establishment is located in a jurisdiction where they are inspected and subsequently penalized by a state officer rather than a federal officer, that establishment is likely to pay a greater fine than they would if they were located in a federal jurisdiction.

The result implies that the process of devolving federal regulatory authority produces systematic differences in the way that policy is executed across geographic space. Consequently, the existence of geographically-defined administrative boundaries have the potential to create geographic disparities in governance.

Altogether, the previous three chapters provide an analysis of the way in which political districts affect politics. Specifically, I show how electoral districts interact with partisan geography to skew representation and I show how geographically-defined administrative districts create geographic discontinuities in the execution of policy.

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