The Spatial Variation of Geographic Political Polarization

By

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Abstract

How does the "rural-urban divide" vary across the United States? This project describes the variation of geographic political polarization across time, space, and policy area. Using mass survey and census data, I develop a novel technique to measure geographic polarization by first estimating public opinion along the rural-urban continuum within each state. I then employ this technique to compare the degree of polarization across states and across political issues. I find that states with a lower total population, states with a relatively uniform population distribution, and states in the Midwest tend to be the most polarized. There is rarely a dominant issue that divides rural and urban residents in all states; instead, the public appears to respond to the local political environment, rather than relying on national cues or partisan identification. I also measure the change in polarization over time, finding that the polarization of individual issues ebbs and flows, but the total level of polarization within each state remains relatively constant. I conclude the project by demonstrating how this new measurement technique and the resulting polarization estimates can be used for causal inference, in order to better understand geographic polarization's causes and effects. These results can inform future empirical work on the intersection of geographic and mass polarization, as well as normative theories of federalism and representative democracy.

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Chapter 1: Introduction

Geographic political polarization has received increased attention in recent years from journalists, political commentators, and political scientists. Much of the discourse regarding geographic polarization discusses differences between rural and urban residents solely at the national level, such as remarking on the "widening political divergence between cities and small-town America" (Badger, Bui, and Pearce 2016). While these observations no doubt reflect general trends in American politics — on average, rural people really are more conservative/right-wing/Republican than urban people — they may also obscure sub-national variation. California may be a highly polarized state, while Florida's urban and rural residents have very similar political opinions. Perhaps gun control is a geographically polarizing issue in New York, but not Wyoming. Texas may be divided over immigration, while Utah is split over abortion. These kinds of inter-state variation are masked when examining geographic polarization only at a national level.

In contrast, the relatively small literature that examines geographic polarization at the sub-national level often lacks sufficient scope. For example, a single paper may explore the relationship between geography and political opinions only in a particular state or metropolitan area. While these individual studies can be read together to form a patchwork understanding of how geographic polarization varies over space, they do not collectively cover the entire country nor do they investigate the same policy issues.

In fact, many studies of geographic polarization do not measure polarization over policy at all. Most existing work relies on data on voting behavior or partisan identity (Scala and Johnson 2017; D. A. Hopkins 2017; Mettler and T. Brown 2022). Again, while such work is valuable in developing a rough understanding of polarization generally, it glosses over potential variation across issues. For example, a state's rural and urban residents may be divided over abortion but not gun control, which could not be measured simply by examining electoral data.

My dissertation aims to address these shortcomings in the academic literature. I examine the spatial variation of geographic polarization while maintaining a national scope, so that

I can make comparisons across states. I do so by estimating polarization over a variety of public policy topics, in order to discover more granular differences between states. Because I am primarily interested in accurately estimating polarization, and illustrating how it varies over space, my project is principally descriptive (rather than theoretical or causal). Basic scientific research, as found in chemistry and biology, is much too rare in the social sciences. I started this project with no pet theory nor expected results in mind, meaning the order, type, and number of analyses I conducted were uncontaminated by ulterior motives. Rather than start with a theory and try to find evidence to support it, the scientific method ought to start with a description of the natural world. Judea Pearl, one of the greatest influences in the modern causal revolution, favorably quotes one of Galileo's two primary maxims: "description first, explanation second — that is, the 'how' precedes the 'why' " (2009, p. 404).

I do not disparage theory or causal research in general, as they are a necessary part of the scientific process. But they ought to be informed by — and therefore preceded by — descriptive research that lays the epistemological groundwork. My view may be influenced by recent political events. As members of a polity, we often struggle to agree on the base-level facts. Before we can attempt to argue about the causes of facts, we have to agree on what the facts are. I hope to contribute to this preliminary discussion by describing what people believe, rather than why they believe it. In accordance with this view, the first four substantive chapters of my dissertation are focused on description, while the final two Chapters demonstrate how to use the descriptive findings for causal identification and theory building.

Uncovering the spatial variation of geographic polarization is important both inside and outside of academia. This project is important to political science because it addresses a heretofore unfilled hole in the literature. If political scientists believe geographic polarization is an important concept — and they do, judging from the amount of work devoted to it — they ought to at least have an accurate picture of what it looks like. Until now, much of the research on geographic polarization has been national in scope, describing rural-urban polarization across the entire country. The few sub-national studies of geographic polarization describe polarization for a single area, such as a state or city. My project describes the degree of geographic polarization in each state, which will allow for comparisons across states. Un-

like a national scope, I can identify the places that are relatively polarized and non-polarized. The existing studies that examine geographic polarization at the national level may under and overestimate the degree of polarization in certain areas. For example, if California is highly geographically polarized while Texas is not, a national-level scope will underestimate polarization in California while overestimating it in Texas. My study captures this kind of variation, which will lead to a greater understanding of the actual polarization on the ground.

While my study is highly descriptive — attempting to illustrate the nature of polarization in different places — its results can be extended for causal research. As demonstrated in Chapter 7, social scientists can leverage my polarization estimates to empirically assess possible causes of polarization. My method of polarization estimation provides estimates across states, years, and issues, which provides additional variation that does not exist when estimating polarization at the national level with electoral data. Political scientists have spent decades formulating theories of the causes of geographic polarization; I have provided additional data to evaluate those theories.

This project may also have implications outside of academia, impacting federalism and public policy. Federalism is built upon the idea that geography is correlated with political beliefs. We assume that individuals within a sub-national unit are more politically similar to one another than they are to individuals in other sub-national units. A Texan is more similar to other Texans than he is to Californians. In addition, we assume that smaller geographic units are more politically homogeneous. A Texan shares more political beliefs with his neighbors than with other Texans and shares more with Texans than with other Americans. My research can inform the validity of these assumptions. Perhaps the variation of opinion is greater within states than it is between states. If rural New Yorkers have more in common with rural Nebraskans than they do with urban New Yorkers, why do rural and urban New Yorkers share a sub-national government while rural New Yorkers and rural Nebraskans do not? By producing opinion estimates for each state-location pair, I can determine the variation between states and between rural-urban categories. If, for example, rural residents across the country have more in common with one another than they do with the urban residents in their respective states, the theory and practice of federalism may be questioned.

Relatedly, this research also has implications for public policy. It can reveal which issue areas are highly polarizing and therefore politically contentious and unlikely to see policy change. State legislatures could use this information to pursue relatively non-polarizing issues that have buy-in from different geographic areas. Of course, there are other social cleavages (beyond geography) along which a population may be politically divided. These too could stymie policy change, but my research could identify the issue areas that are highly geographically polarized and therefore unlikely to see policy change in the first place. Another way in which this research could affect public policy is to identify areas for policy delegation. States with consistently high polarization scores on certain issues may want to delegate the authority to address these issues to a lower level of government. For example, preliminary analyses indicate that taxes are a highly geographically polarizing issue in Virginia. This suggests that the state government may want to allow localities to set tax policy for themselves. Clearly, different areas have different beliefs about taxes and ought to be granted the ability to pursue their citizen's interests. Of course, this approach is not perfect, as some policy approaches have wide-ranging externalities (such as lax environmental policy), which negatively affect other geographic areas. However, my research could reveal which sets of issues have the potential for delegation.

While less relevant to academic social scientists, this project also has applications in the private sector. My polarization estimation technique can be modified to answer business-related questions by a company's data science team. For example, my use of multilevel regression with poststratification could be used to estimate the spatial variation of consumer interest in an unreleased product. In this case, past sales data may not be predictive of the new product's performance, so estimates of opinion toward the new product could guide decision-making. A company could combine an internal survey with demographic and geographic information to identify geographic markets most receptive to their new product. Just as my dissertation uses survey data to measure support for a policy issue, a corporate data scientist could measure interest in a new product, feature, brand, or marketing strategy. A company that manages multiple brands might also use my polarization estimation technique to identify areas where it is most advantageous to lean into one of their constituent

brands. If, for example, Budweiser found that its Stella Artois brand is geographically polarizing within the Midwest, it could allocate marketing dollars only to the major media markets of Milwaukee, Chicago, and Indianapolis. While these kinds of applications are less likely to end up in the academic literature, they could nonetheless have real world impacts.

The spatial variation of geographic polarization is clearly an important issue, both for political science and American politics generally. My project begins with Chapter 2, which reviews the existing literature on geographic polarization, highlighting the gaps and my contributions towards filling them. Chapter 3 then describes my method of turning raw survey data into geographic polarization estimates for each state for a single issue in a single year. In short, I create a hierarchical Bayesian model to estimate the opinion of each rural-urban area in each state, then find the intra-state variation across opinion estimates to calculate the state's level of polarization. Chapter 4 employs this technique to estimate polarization in each state across seven policy issues and compares the issues' results to one another. Chapter 5 uses these results to construct "state polarization profiles," in which I describe the nature of geographic polarization within each state. Chapter 6 employs the polarization estimation method to create polarization values for each issue in each state across eight years, which allows me to describe how polarization has changed over time. The final substantive chapter provides vignettes to demonstrate how these polarization estimates can be used to probe existing theories of polarization, develop new theories, and establish causal relationships. The final chapter reviews the results and discusses their implications inside and outside of academia.

Chapter 2: Literature Review

Academics have spent decades studying polarization, which I conceptualize as measurable differences between social groups. This concept can be investigated across a variety of dimensions and from many different angles. This chapter aims to situate my contribution to the academic literature among this vast scholarly landscape. In order to clearly define the boundaries of my study, I walk through six ways to divide the literature, whittling down the epistemic territory to only the most relevant, related research. This will clarify the abstract concept I am most interested in — geographic political polarization — while also identifying unanswered questions in the existing literature that I address throughout the remainder of the project.

Political vs. Non-Political Geographic Polarization

The first and broadest dimension along which I divide the academic literature is political vs. non-political geographic polarization. "Geographic polarization" indicates that the social groups are defined by their location in physical space, whereas the "political"/"non-political" modifier relates to the subject being measured. Technically, this non-political category could include non-sociological phenomena, such as differences in weather or topography across space, but I (like the overwhelming majority of social scientists) use the term "polarization" only in reference to human behavior.

While there are certainly many academic disciplines that measure non-political differences across geographically-defined groups of people, two that study these differences similarly to political science are economics and medicine. Economists have developed a rich literature on economic polarization over the last decade, with a particular focus on the geographic distribution of income. For example, VanHeuvelen and Copas (2019) investigate where high and low income people reside and how this spatial distribution has changed since the 1950s. Reardon and Bischoff (2011) examine the relationship between income segregation and income inequality, at various geographic levels and by race. Along similar lines, Thiede et al. (2020) and Peters (2013) measure income inequality by county over time, and then

analyze patterns across the rural-urban continuum. While economists occasionally use the label "polarization" to describe these differences, the terms "segregation" or "convergence" are more common, though they reflect the same basic idea of differences between groups. Economic convergence, for example, refers to the trend of shrinking economic differences between places over time, due to the flow of labor and capital, which is simply the inverse of my definition of polarization (Ganong and Shoag 2017).

In addition to economics, there is extensive research in the medical literature regarding differences in medical access and use by geographically-defined groups. For example, Rigg and Monnat (2015) measure differences in opioid abuse in urban and rural areas in order to develop locally tailored drug policies. Medical researchers have investigated rural-urban differences in many other health-related topics, including depression and suicide (Rost et al. 1998; Probst, Laditka, et al. 2006), ambulatory care (Larson and Fleishman 2003; Probst, Moore, et al. 2002), mortality rates (Cross, Califf, and Warraich 2021), psychiatric disorders (Blazer et al. 1985), and nursing home care (Gessert et al. 2006). Despite investigating different subject matter, this work broadly mirrors that in political science, in terms of approach and empirical method.

Some interdisciplinary work straddles the line between political and non-political geographic polarization, such as a study by Baxter-King et al. (2022) that measures how mask wearing during the COVID-19 pandemic differed by the partisan composition of one's neighborhood. However, for the vast majority of studies, the substantive topic clearly falls into either the political or non-political category. Within the political category, scholars have measured geographic polarization in terms of issues, identification, and voting, as I discuss later in this chapter.

Geographic vs. Non-Geographic Political Polarization

The second way in which I divide the literature is geographic vs. non-geographic political polarization. Geographic political polarization focuses on political differences between groups of people defined by their position in physical space; non-geographic political polarization focuses on differences between groups defined by some other characteristic, such as age,

race, sex, or party affiliation.

Within the geographic political polarization literature, the conceptualization and measurement of "differences between groups of people defined by their position in physical space" has varied, but there is nonetheless a common spatial theme. For example, some authors measure geographic polarization in terms of "partisan sorting," or the decreasing competitiveness of elections within geographic boundaries (Lang and Pearson-Merkowitz 2015; Klinkner and Hapanowicz 2005). Recent work has developed the related concept of partisan segregation, or the degree to which partisans are spatially separated from one another. For example, J. R. Brown and Enos (2021) develop a measure of individual-level partisan segregation for 180 million registered voters, calculating the degree to which each person is exposed to people registered with the other party.

In contrast to these geographically-defined attributes, non-geographic political polarization refers to political differences in groups of people that are defined by characteristics other than geography, such as age (P. Fisher 2008; P. Fisher 2010), race (Fraga 2018; Philpot 2018; Junn and Masuoka 2020), and sex (Edlund and Pande 2002; Atkeson and Rapoport 2003; Kaufmann 2006). Most often, however, the term "political polarization" refers to differences between groups defined by ideology or partisanship (i.e. differences between liberals and conservatives or Democrats and Republicans). Researchers have measured differences across a range of dimensions, such as opinions toward the other party (R. Hartman et al. 2022; Mason 2015), ideology (Lelkes 2016; Abramowitz and Saunders 2006), policy preferences (Houston 2021; Fiorina and Abrams 2008), moral attitudes (Hetherington and Weiler 2009; Graham, Nosek, and Haidt 2012), and psychological profiles (Sweetser 2014; Cooper, Golden, and Socha 2013; Carney et al. 2008).

Some research on non-geographic political polarization refers to geographic-related issues/policies, but does not describe differences between physical areas per se. For example, Jensen et al. (2021) use conjoint survey experiments to measure the partisan polarization of national vs. local issues; i.e. the degree to which Democrats and Republicans disagree over local development policies in their city. This area of inquiry concerns both polarization and geography, but not geographic polarization as I define it.

Recent research in the non-geographic polarization literature has paid particular attention to partisan differences in attitudes toward the other party, often referred to as affective polarization. Because strong negative feelings toward an outgroup are often viewed as normatively objectionable, scholars have dedicated copious work to understanding the causes of these feelings (Finkel et al. 2020; Iyengar et al. 2019) and ways to ameliorate them (Stanley et al. 2020; Huddy and Yair 2021). In contrast, there is much less interest in reducing the degree of geographic political polarization. This may be because the presence of political differences by geography is an accepted part of American democracy, and is in fact supported by our federalist institutions. Or perhaps, the lack of interest in reducing geographic polarization is due to the difficulty in doing so; if geographic polarization is due to voluntary relocation decisions, it is unclear how an intervention could systematically reverse or mitigate the preference to live near one's co-partisans. Regardless, the extant literature tends to see geographic polarization as less of a problem than non-geographic polarization, avoiding normative or prescriptive claims, in favor of descriptive ones. I adopt a similar position throughout this project, for the same reasons.

Rural-Urban vs. Sectional/Regional Geographic Polarization

Having pared the literature down to works concerning geographic political polarization, I now divide this into sub-categories depending upon how the geographic groups are defined. The vast majority of research, particularly in recent years, divides its research subjects into rural-urban groups (whether as a simple binary or continuum). I survey this sub-literature later in this chapter so I will not dive into details here, but suffice to say that many of these studies measure some political variable (e.g. vote choice) for rural and urban areas, and then compare the location measures to one another to estimate geographic polarization. The conceptualization and operationalization of "rurality" varies — with some recent work critiquing the most popular measures (Nemerever and Rogers 2021) — but the notion of a rural-urban divide is shared.

However, there are other possible ways to define groups by their positions in physical space. For example, many classic works in American political science examine regional or

sectional differences in political behavior, very often comparing the North and the South. Key's seminal work, *Southern Politics in State and Nation*, (1949) focuses on the politics of the South, but does so by comparing its characteristics and developments to those in the North. This approach has been adopted by follow-up studies of Southern politics, such as that of "the New South" several decades later by E. Black and M. Black (1987). More recent work has examined how interactions between regions affect the level of polarization between them, such as McKee and Teigen (2016), which measures how migrants from Northern states have turned areas in the South more Democratic in recent presidential elections.

Other studies go beyond the North/South dichotomy when describing regional differences, often building on the "realignment" literature, in which some polity changes its political orientation over time, either gradually (secular realignment) or suddenly (critical realignment). For example, Bullock III, Hoffman, and Gaddie (2006) identify realignments in six geographic regions since the end of World War II, arguing that different regions experienced different kinds of realignment at different times. McKee and Teigen (2009) measure the effects of sectionalism and rural-urban location on voting in the 2000 and 2004 presidential elections, finding that voters in the South are the most Republican while those in the Northeast are the least Republican. Ulbig and Macha (2012) measure regional variation in the sources of support for the Tea Party, for example, finding that anti-immigrant attitudes drove support for the Tea Party in the Western region, but not in the South or Midwest. All these examples provide additional granularity by increasing the number of regions under study, but fundamentally they all lump states together in order to compare/contrast the geographic groups' political attributes.

Another way to measure differences by geographic group is to compare the political attributes of individual states. While examinations of individual states are fairly common (Davidson 1992; Hyink and Provost 2016), comparisons of many states in order to measure the polarization among them is relatively uncommon. Gimpel and Schuknecht (2009) examines "sectionalism and political change" by examining and describing the parochial politics of twelve individual states. P. I. Fisher (2016) finds that political culture explains states' differing levels of support for Donald Trump in the 2016 nominating process, in which more

individualistic states were more likely to support Trump than moralistic states. While my empirical analysis compares values of different states, I am always focused on rural-urban polarization; that is, measuring some variable for rural and urban locations and then computing the dispersion of those values.

Issue vs. Identity vs. Electoral Polarization

As mentioned previously, researchers have measured geographic polarization using a number of different political variables, which I group into three distinct categories: issues, identity, and voting. The first category, geographic polarization over issues, refers to the idea that where one lives is associated with what one thinks about public policy. Early studies, such as those by Glenn and Hill (1977), found significant differences in the attitudes and behavior of rural and urban Americans, sometimes operationalized as farm and non-farm (Beers 1953). Glenn and Hill also find that city residents with rural backgrounds are more likely than other city residents to share similar political beliefs with current rural residents, suggesting some degree of rural identity. Similarly, Kauder (1993) reports that rural residents are less likely to support gun control legislation, a finding echoed by later research. Rural residents appear to be less supportive of environmental protection regulations (Lowe and Pinhey 1982) and less supportive of increased immigration (Burns and Gimpel 2000). C. J. Kinsella, McTague, and K. Raleigh (2019) examine how geography impacted vote choices on same-sex marriage ballot initiatives in the Cinicinnati, Ohio metropolitan area. The authors find that, while there is a strong relationship between partisanship and issue position, the relationship is altered by geography. For example, voters in the inner city strongly supported Democrats, but voted for a ban on same sex marriage, while voters in the eastern suburbs voted Republican but against the marriage ban. Similarly, Francia and Baumgartner (2005) use county-level and individual-level data to argue that George W. Bush's conservative stance on gay marriage helped him win rural votes in the 2004 presidential election. Strickler (2016) uses Pew Center data to investigate how values and policy opinions differ among residents of Democratic and Republican "landslide" counties (those where one party won by a margin of 20 points or greater). While he does find statistically significant differences for *average* opinions of the

two groups, Strickler points out that there is still substantial overlap in the full distribution of opinion. This adds nuance to the basic theory of stark differences between rural and urban groups.

A second understanding of the geographic political divide is identity. While there is some work to suggest that one's geography is itself an aspect of individual identity (Cramer 2016), much of the scholarly work examines how partisan identities differ across space. For example, McKee (2008) uses ANES data from 1952 to 2004 to investigate how the percentage of rural voters who identified as Republicans changed over time. He finds a large gap between the North and South until the 1990s, when the number of rural residents identifying as Republicans became essentially the same in the two regions. The overall share of rural residents who identified as Republican also increased during this time. This suggests that there was a national trend in which rural people became associated with or identified with the Republican Party. Recent work by Gimpel, Lovin, et al. (2020) finds significant differences in the geography of political identifiers. On average, Republicans live 20 miles from a city of at least 100,000 people, while Democrats live only 12 miles away. Similarly, the average Republican lives in a place with 585 people per square mile, while the average Democrat lives in a place with 1195 people per square mile. On both measures, independent identifiers fall in between. This work suggests a relationship between how one identifies and where one lives.

The third way scholars have conceptualized the geographic divide is through elections and voting. This aspect of the geographic divide has received the most attention from academics. In order to make comparisons across the country, researchers often use presidential election data. Scala and Johnson (2017) find that Democrats perform best in counties with an urban core and worst in counties far from metropolitan centers. Similarly, Oberhauser, Krier, and Kusow (2019) use Iowa as a case study and find that the "rurality" of a county is correlated with its propensity to support Donald Trump in the 2016 presidential election. Research also suggests that an electoral divide has increased in recent years. Examining the support for Democratic presidential candidates, Johnston, Manley, and Jones (2016) find increasing geographic polarization at the level of census regions, states, and counties. Using the concept

of "landslide counties," Darmofal and Strickler (2019) investigate national geographic polarization from 1828 to 2016. They find increased polarization since 1976, but claim that current levels are not outside the historical range. Other research has examined the exceptions to the geographic divide. Morrill, Knopp, and M. Brown (2007) examine counties that acted as "anomalies" in the 2000 and 2004 presidential elections; nonmetropolitan counties that voted for the Democrat or metropolitan counties that voted for Bush. While their findings suggest that these anomaly counties differ in important ways from others in their class, the evidence nonetheless supports the claim that, in general, counties vote differently based on their geography. Another area of research concerns the effect of the geographic divide. Chen and Rodden (2013) find that, because of Democrats' tendency to cluster in urban centers, Republicans enjoy an electoral advantage in the legislature, an effect they name "unintentional gerrymandering." In sum, there is substantial evidence of a relationship between geography and voting.

Levels of Geographic Polarization

In addition to the topic of polarization, research on geographic political polarization can also be divided by the level of analysis. Most of the extant research examines geographic polarization at the national scale, such that data for all rural residents in the country is aggregated, for example. This approach ignores potential sub-national heterogeneity and may over/understate polarization in different places. However, there is some work exploring this variation. When examining the relationship between political beliefs and geography below the national level, researchers look at the region, state, or local level. I make these categorizations based on the level at which the author analyzes the relationship between geography and political behavior, not the unit of analysis to actually measure the behavior. For example, whether the authors use individual-level, precinct-level, or county-level data is irrelevant; it is the level at which they compare the relationship between geography and behavior. Over time, research has become more fine-grained, generally moving from higher levels to more local analyses.

The first level of geographic polarization is regional. While many classic works examine

how regions differ politically, fewer examine how the relationship between geography and politics differs across regions. For example, how has the electoral divide between rural and urban residents grown differently across the country? Johnston, Manley, and Jones (2016) attempt to answer this question, arguing that polarization has not occurred homogenously across the country. Using estimated median odds ratios for states and counties, the authors find greater polarization change in the Mountain West and Southwest relative to New England and the Mid-Atlantic.

The second level of analysis is at the state level, in which researchers examine how rural-urban differences affect particular states. Myers (2013) examines the case of Texas and finds growing geographic polarization over the last two decades. Democrats do well in the major metropolitan areas, while Republicans do better in smaller cities and rural areas and this pattern cannot be entirely explained by differing demographics. Sussell (2013) uses registration data and presidential election returns in California to assess the claim of growing geographic polarization, concluding that, since the early 1990s, polarization has grown significantly. Extant research on the variation of geographic polarization at the state level often relies on case studies, looking only at a single state. This is where my contribution to the literature is the greatest. By examining the relationship between geography and political opinion in each state, I increase the scope and can compare states to one another.

Additional research has examined geographic polarization at the local level, often finding that the significance of geography has grown over time. For example, K. E. Walker (2013) studies electoral data of the Twin Cities between 1992 and 2012 and finds significant, and growing, differences between the city center and the exurbs. Similarly, Kinsella et.al. use presidential election precinct-level data from Cincinnati and find "an increased concentration of partisan behavior and…a local residential pattern of geographic polarization" (2015, p. 404). I take inspiration from and build upon these studies, by estimating geographic polarization within each state, in order to develop a fuller picture of rural-urban polarization across the entire country.

Causal Mechanisms of Geographic Polarization

While many political scientists agree that rural and urban Americans are politically divided, the causes of the divide remain up for debate. While my project is purely descriptive, its results are driven by underlying causal processes. The project's substantive results may lend credence to one or more of the popular causal theories. For example, geographic polarization may be consistently higher in states with greater rural-urban migration, lending credence to the idea that residential sorting is the driving force behind polarization. My results may also contribute to the development of new theories. Because I examine geographic polarization across several different policy issues, unlike many other studies, I could develop a causal theory that relies upon issue characteristics. For example, perhaps geographic polarization increases as state politicians increase the salience of particular issues. Because my project can inform existing work and potentially lead to the creation of new causal theories, it is thus important to understand the extant theories of geographic polarization.

Residential Sorting

One of the most popular explanations of geographic political polarization is that individuals sort themselves into politically homogenous communities by moving to areas that are populated by people like them. Bishop (2009) initially proposed the sorting hypothesis, arguing that Americans now choose where to live based on politics. Conservatives prefer the privacy of rural life, while liberals prefer the diversity and density of large cities. Over time, the effect is compounded, as Republicans move toward their co-partisans and Democrats toward theirs. This hypothesis has received some support in the broader literature. Motyl et al. (2014) analyzed observational survey data and found that the degree to which a respondent feels like they "fit in" ideologically with their community is associated with a desire to stay in that community. Examining the geographic polarization in California, Sussell argues in favor of the sorting hypothesis, stating that "these results are consistent with Bishop's original claim of a gradual geographic realignment of liberals and conservatives in the United States (2013, p. 773). Further support for the Big Sort hypothesis comes from McDonald (2011), who uses

data from the 2006 Cooperative Congressional Election Study and the U.S. Postal Service to determine if people move to places that match their stated political beliefs. McDonald finds that respondents did indeed move to congressional districts that matched their ideological views and that the effect applies to both parties. Tam Cho, Gimpel, and I. S. Hui (2013) also find that partisans prefer to live near one another, though their relocation decisions are primarily driven by the income and population density of their destination. Gimpel and I. Hui (2017) also support the sorting hypothesis, arguing that growing political homogeneity is the result of two kinds of sorting: inadvertent and intentional. The former is when an individual moves to a place for reasons that are correlated with, but separate from, partisanship. Intentional sorting is when partisanship is directly considered in the calculus of where to live.

While the sorting hypothesis has received some support since its inception in 2009, on balance the evidence is mixed. Mummolo and Nall (2017) conduct survey experiments and find that Democrats and Republicans do differ in their stated preferences on where to live; however, Democrats and Republicans do not actually sort themselves into more politically homogenous communities, due to their shared preferences such as safety and affordability. Thus, the authors argue, simply asking partisans if they would like to live near people of the same party is not confirmation of the theory. Similarly, Martin and Webster (2020) use voter registration data to track the movement of voters over time and find that individuals sort into politically homogenous neighborhoods, not because they explicitly seek out co-partisan neighbors, but because their partisan preferences correlate with their non-political neighborhood preferences. They conclude that the traditional story of partisan sorting has the causal arrow pointing backwards; location impacts political preferences, not vice versa. While both Republicans and Democrats prefer living around co-partisans, this preference is relatively small and not the primary factor when deciding where to live, contradicting the Big Sort hypothesis (I. Hui 2013).

Cultural Differences

While residential sorting is the most common reason given for geographic polarization, in both the academic and popular press, other scholars have argued that core cultural characteristics of a place drive residents' political behavior. Gimpel and Karnes (2006) argue that rural residents are more likely to vote for Republicans because the cultural and economic aspects of rural America align with the ethos of the Republican Party. For example, rural people tend to be more religious and traditionalist than city dwellers. They are also more likely to own their own home and run their own business. Likewise, Gimpel, Lovin, et al. (2020) argue that geographic differences stem from the lack of interaction between rural and urban populations. They find that these differences remain even after accounting for demographic differences. DellaPosta, Shi, and Macy (2015) use simulation experiments to show how a lack of personal interaction can create separate political cultures, such that self-reinforcing cycles lead to greater social and geographic clustering. This is similar to the concept of "localized entrenchment," introduced by Wing and J. L. Walker (2010), in which citizens are pulled toward the majority opinion in their geographic area by a variety of social processes. Kelly and Lobao (2019) draw on the sociology literature to understand the roots of Republican support in rural areas. They find that differences in social status and sociocultural values undergird the differences in vote choice between rural and urban residents.

Structural Factors

The final set of explanations for geographic polarization refers to structural factors, in which a large-scale, seemingly unrelated change has ripple effects that cause diverging politics among rural and urban populations. For example, Nall (2015) argues that geographic polarization is not a result of individual choices on where to live, but is due instead to public policies. He posits that the interstate highway system divided cities and suburbs politically by drawing white, affluent residents (i.e. Republicans) out of urban centers. Not only did this make the suburbs more Republican, it also made cities more Democratic. Similarly, Sorens (2018) argues that local zoning laws impact the partisan composition of a city, and thus ge-

ographic polarization generally. He finds that jurisdictions that adopt more housing supply restrictions tend to become more affluent, educated, and Democratic. This mirrors work done by Williamson (2008) which finds that suburban sprawl (and associated neighborhood characteristics like reliance on the automobile) is associated with greater Republican support.

These competing theories of geographic polarization are not mutually exclusive; reality is likely not mono-causal. While some of these theories are more persuasive than others, it is not necessary that I firmly subscribe to one for this descriptive project. However, the mechanisms of geographic polarization may be useful when interpreting my final results and when building upon this work in the future.

Chapter 3: Estimating Geographic Polarization

To begin my empirical analysis, I present my novel research design of estimating the spatial variation of geographic polarization. I first introduce the method of opinion estimation, multilevel regression with post-stratification (MRP), describing what it is and how it works. I then describe my three data source: CES survey data, Census Bureau data, and USDA county rural-urban classification data. Finally, I apply MRP to produce opinion estimates, which can then be used to impute the level of polarization of each state.

Multilevel Regression with Post-Stratifcation

Throughout my project, I rely on a methodological technique known as multilevel regression with post-stratification (MRP). MRP is a relatively new technique, first developed by Gelman and Little (1997) two decades ago and popularized by the work of Park, Gelman, and Bafumi (2004). This model-based approach allows social scientists to estimate sub-national public opinion using national-level surveys. Past research demonstrates the efficacy of MRP for this purpose. Lax and Phillips (2009) use MRP to estimate state-level attitudes regarding gay marriage, comparing public opinion to state laws to measure "policy responsiveness." MRP has also been used to estimate climate change opinion in Canada at the provincial level (Mildenberger et al. 2016) and in the United States at the state, congressional district, metropolitan, and county levels (Howe et al. 2015). Kastellec, Lax, and Phillips (2010) use MRP to determine if state-level public opinion toward Supreme Court nominees affects the voting decisions of Senators. MRP has also been used outside of the political domain, estimating group-level characteristics other than political opinion. For example, Howe (2018) uses survey responses to estimate the geographic variation in disaster preparedness.

MRP has also been used to forecast election results. Researchers use survey data which asks respondents who they will vote for in the election and then apply MRP to estimate candidate support in each state. When describing the mechanics of MRP, Park, Gelman, and Bafumi (2004) validate the method by predicting state-level election results for the 1988 and 1992 presidential elections. Similarly, Kiewiet de Jonge, Langer, and Sinozich (2018) use MRP

to forecast results of the 2016 presidential election. They use ABC News/Washington Post tracking poll to successfully predict the results in 50 of 51 jurisdictions. Wang et al. (2015) use survey responses from the Xbox gaming platform to forecast the 2012 presidential election, to demonstrate the accuracy of MRP estimates even with non-representative polls. Unlike estimating public opinion, forecasting elections provides a clear way to validate MRP. The estimates can be compared to actual election results to get a sense of the utility of the method. Ample research shows that MRP estimates generally perform better at predicting election results than simple disaggregation, suggesting that they are also accurate at estimating public opinion.

MRP, as the name suggests, works in two steps. First, the researcher creates a multilevel regression model to predict respondent opinion based on demographic and geographic factors. Common predictors include age, gender, education, race, state of residence, and region of the country. Explanatory variables are often dichotomous, such as two-candidate vote choice or supporting/opposing a particular policy. The multilevel (logistic) regression model produces predicted probabilities for each demographic-geographic respondent type. The second step of MRP is post-stratification, in which the researcher applies weights to the predicted probabilities based on that respondent type's actual share of the population. By summing the weighted predicted probabilities within each geographic area, the researcher produces an opinion estimate for each area.

Data Sources

MRP requires two kinds of data, one for each step of the process. Survey data is used to construct the regression model and population-level demographic data is used to post-stratify the model predictions. For the former, I will use public opinion survey data from the Cooperative Election Study.[1] Most of my analyses rely on the 2018 Common Content data set, a nationally representative sample of 60,000 respondents. Later analyses that examine change in polarization over time use the cumulative CES data set, which aggregates responses from the Common Content portion of all surveys since 2006. I use the CES because its size ensures that

[1]Formerly known as the Cooperative Congressional Election Study.

there is enough demographic and geographic variation to produce precise estimates. From the many demographic variables recorded in the data set, I use respondent age, gender, race, Hispanic ethnicity, state of residence, and county of residence. When walking through the estimation process in this chapter, I use the seven-point party ID variables (a typical Likert scale from "Strong Democrat" to "Strong Republican"). Throughout the rest of the project, I use binary response variables that ask respondents if they agree or disagree with a particular policy. I combine these binary response questions by topic (abortion, gun control, immigration, etc.), in order to create ordinal scales. As Buttice and Highton (2013) observe, binary response variables are typical in the extant MRP literature. I can use these responses, along with the demographic predictors, to construct a model that produces predicted probabilities.

The second data set required for MRP is population-level demographic data. Census data is used to weight respondent types by their actual share of the population. The census data comes from the US Census Bureau's "County Characteristics Resident Population Estimates" file. This data set contains estimates of the number of people within several demographic category combinations for each county in the United States from 2010 to 2019. The demographic categories include age, gender, race, and Hispanic ethnicity. For example, this data set contains the number of white, non-Hispanic women aged 30-34 in Dane County, Wisconsin. Unlike a random sample of census data, as some MRP studies use (Krimmel, Lax, and Phillips 2016), this data set provides real-world counts of actual residents, so I do not need to estimate demographic distributions. The disadvantage of this approach is that I am limited in the number and kinds of predictors I can include in the model. Using this information, I can post-stratify the model results by the respondent type's actual share of the population in order to estimate opinion in each rural-urban location in each state.

This project also relies upon a third data set that is not required for MRP generally, but is necessary for my application. Because I am interested in rural-urban polarization, I need to categorize respondents on a rural-urban scale. I use the USDA's 2013 Rural-Urban Continuum Codes, which classify all 3143 counties in the United States into nine geographic categories as shown in Table 1. On one side of the continuum are counties in metro areas with a population of at least one million, and on the other side are completely rural counties with less than 2500

urban residents. I use this data set to group respondents in the same state by the "rurality" of their home county. I am not interested in opinion at the county level per se, but instead at the level of rural-urban category. For the sake of brevity and clarity, I often refer to rural-urban category as "location" throughout the project.

Table 1: Rural-Urban Continuum Codes

Code	Description
Metro Counties	
1	Counties in metro areas of 1 million population or more
2	Counties in metro areas of 250,000 to 1 million population
3	Counties in metro areas of fewer than 250,000 population
Non-Metro Counties	
4	Urban population of 20,000 or more, adjacent to a metro area
5	Urban population of 20,000 or more, not adjacent to a metro area
6	Urban population of 2,500 to 19,999, adjacent to a metro area
7	Urban population of 2,500 to 19,999, not adjacent to a metro area
8	Completely rural or less than 2,500 urban population, adjacent to a metro area
9	Completely rural or less than 2,500 urban population, not adjacent to a metro area

I choose to use county-level data, as opposed to data based on some other geographic unit, for practical and theoretical reasons. First, I face data limitations. Both of my data sources provide information at the county level. In order to conduct MRP, the geographic units of the survey data and the census data must match. The CES provides each respondent's county of residence and the census data provides the demographic make-up of each county. If I instead used zip codes, for example, the two sources would not match. The CES asks respondents for their zip code, but the U.S. Census Bureau does not provide a repository of demographic data at the zip code level. In contrast, I could instead use census blocks, as the Census Bureau provides demographic data at that level; however, the CES does not ask respondents for their census block of residence. I could conceivably impute these data using standard GIS techniques, but that would introduce additional uncertainty. Even then, I would have to devise a rural-urban classification scheme for the zip code areas or census blocks, rather than rely on a widely used classification system created by a large government agency (like

the USDA). Sacrificing certainty and validity for marginally finer spatial granularity is not a worthwhile tradeoff.

The second reason I rely on counties is theoretical. Critics might claim that counties are too large and diverse to be assigned a single rural-urban category; for example, a city in the center of the county might be surrounded by rural areas. I concede that counties are likley more heterogeneous than smaller geographic units, such as zip codes, but it is not necessarily the case that one's "lived environment" is the smallest possible area around their home. Throughout daily life, people travel substantial distances, interacting with the political and cultural forces that accompany the changing geography. When thinking of "where you are from," people likely picture more than their immediate neighbors, perhaps also including their church, grocery store, school, and place of business. These places may be quite far from their home, especially as Americans commute further than in decades past (Ingraham 2019). Thus, the county is not the smallest possible geographic unit, but it is roughly the scale at which people commonly experience their physical environment while still being sufficiently granular to allow for intrastate comparison.[2]

Estimation Process

I now turn to the actual process of estimating geographic polarization. For this demonstration, I estimate polarization using a single survey question. The question asks respondents for their partisan identification on a seven-point scale, from strong Democrat to strong Republican. Later analyses combine multiple policy questions with binary responses to construct topic indices, but the starting position is fundamentally the same; respondents are placed on an ordinal scale from left-wing to right-wing. I am primarily interested in polarization of opinion on policy topics, but begin with party ID because it will act as a baseline with which to compare the policy results. If the polarization of policy issues is smaller than the polarization of partisanship, we can infer that partisanship is the primary factor driving issue positions.

The first step of estimating the geographic polarization of this partisanship question is to

[2]For further discussion regarding the validity of using county-level data, see Section A1 of the Appendix.

prepare the data. I clean the survey data by selecting and recoding the variables of interest. I also identify the rural-urban category of each respondent by merging the CES data set with the USDA Rural-Urban Continuum data set by respondent county of residence. I then create an ordered logistic regression model to predict partisanship based on respondent age, sex, race, Hispanic identity, state, and rural-urban location:

$$log\left(\frac{P(Y \leq j)}{1 - P(Y \leq j)}\right) = \beta_0 + \beta_a^{age} x_a + \beta_g^{sex} x_g + \beta_r^{race} x_r + \beta_h^{hispanic} x_h + \beta_s^{state} x_s + \beta_l^{location} x_l,$$
$$\text{for } j = 1, \ldots, J-1$$

where

$$\begin{aligned}
\beta_a^{age} &\sim normal(0, \sigma^{age}), \text{ for } a = 1, 2, 3, 4 \\
\beta_g^{sex} &\sim normal(0, \sigma^{sex}), \text{ for } g = 1, 2 \\
\beta_r^{race} &\sim normal(0, \sigma^{race}), \text{ for } r = 1, 2 \\
\beta_h^{hispanic} &\sim normal(0, \sigma^{hispanic}), \text{ for } h = 1, 2 \\
\beta_s^{state} &\sim normal(\beta_l^{location}, \sigma^{state}), \text{ for } s = 1, \ldots, 50 \\
\beta_l^{location} &\sim normal(0, \sigma^{location}), \text{ for } l = 1, \ldots, 9
\end{aligned}$$

In this model, Y represents an individual's (unobserved) position on the latent continuous distribution, whereas $P(Y \leq j)$ is the cumulative probability of Y less than or equal to a specific category j, such as "Strong Democrat". In this demonstration, $J = 7$ because the outcome variable is based on the seven-point party ID scale. The log odds of being less than or equal to a particular category is dependent upon the six predictor variables. The coefficients for the predictors are assumed to be distributed normally with mean zero, except β_s^{state}, which is influenced by $\beta_l^{location}$ in order to capture the hierarchical structure of state and rural-urban location.

I use a Bayesian model because it allows for partial pooling across states and location categories, which means that I can estimate opinions for areas with few (or even zero) survey

respondents. Previous research indicates that partially pooling responses across geographic categories performs better than not pooling at all (running a regression for each location's respondents separately) or pooling across all respondents (using only demographic predictors) (Park, Gelman, and Bafumi 2004; Lax and Phillips 2009). This is important because I am estimating 14,400 predicted probabilities, one for each respondent type.[3] As Gelman explains, "classical statistics tends to focus on estimation or testing for a single parameter or low-dimension vector, whereas Bayesian methods work particularly well when the goal is inference about a large number of uncertain quantities" (2014, pp. 26–27). Rather than a traditional model with many interaction terms, my Bayesian model creates several thousand opinion estimates via partial pooling.

I built my hierarchical model via Stan, a relatively new programming language created specifically for Bayesian inference (Gelman, Lee, and Guo 2015). Traditionally, parameters of a large model like this would be estimated via Markov Chain Monte Carlo (MCMC), a mathematical procedure that iteratively samples from each parameter's posterior distribution. While MCMC tends to produce accurate parameter estimates, it requires substantial computational power, increasing with model size and complexity. Using remote computing resources from the UW-Madison Social Science Computing Cooperative, my initial model consisting of four Markov chains (each 50,000 iterations) took more than a week to finish sampling.[4] Using MCMC throughout the course of this project (across every issue and every year), would require approximately nine months of constant computing time. Fortunately, there is a faster method of producing parameter estimates, known as variational Bayesian inference (Blei, Kucukelbir, and McAuliffe 2017). This is a machine learning technique that approximates the parameter posterior distributions via stochastic optimization. Unlike MCMC, variational inference does not (asymptotically) guarantee samples from the target distribution; but because it uses optimization, it can quickly produce estimates for large data sets and complex models. In addition to these advantages, my resulting opinion estimates from

[3]The number of respondent types is equal to the number of combinations of predictor variables. Age group (4) × sex (2) × race (2) × Hispanic (2) × state (50) × location (9) = 14,400.

[4]In practice, attaining parameter estimates for a single model generally took even longer than a week. Due to my model size and the shared nature of the remote computers, my program often crashed after hitting memory limits which required starting again from scratch.

variational inference mirrored those from full MCMC sampling for the model presented in this chapter.[5] Therefore, I employ variational inference throughout the rest of the project.

After running the model, I proceed to the second step of MRP: post-stratification. I multiply the model predictions by each respondent type's share of the state-location population. For example, the prediction for white, non-Hispanic women aged 30 to 44 in non-metropolitan Wisconsin is multiplied by the share of the population in non-metropolitan Wisconsin that is composed of white, non-Hispanic women aged 30 to 44. This is repeated for all possible demographic combinations in all state-location pairs. The weighted predictions for all respondent types are then summed within the state-location pair to produce an estimate of aggregate opinion in that state-location.

This process is repeated 1000 times, once for each iteration of the variational inference algorithm, producing an array with 450,000 values ($9 \times 50 \times 1000$). Each state-location pair has 1000 opinion estimates, which form its posterior distribution. I compute the mean of this distribution to summarize the opinion estimates and report a portion of the results in Table 2. NA values represent location categories that do not exist within that state, such as metropolitan counties in Wyoming or extremely rural counties in New Jersey.

While Table 2 contains useful information, it is difficult to compare locations and states to one another, so Figure 1 transforms these values into a plot, after standardizing across all 450,000 opinion estimates.[6] The points are the means of the opinion estimates of each state-location pair and the horizontal bars are the standard deviation across the 1000 samples. Greater Democratic identification is further to the left and greater Republican identification is to the right. Figure 1 suggests that, in general, more metropolitan areas (represented by lower location categories) are more Democratic than more rural areas. For example, the most urban counties in Indiana and Michigan are further to the left than their rural counterparts. This relationship is not universal, however; for example, Mississippi and New Mexico display no relationship between rurality and partisanship. This may be due to the presence of rural minorities, like blacks or Native Americans, who tend to identify as Democrats, thus pulling

[5]For further comparison between variational inference and MCMC, see section A2 of the Appendix.

[6]Standardizing the opinion estimates is not strictly necessary here, but will be in the following chapter when comparing issues with differing numbers of survey questions.

Table 2: Mean Party ID Estimates

	County-Level Rural-Urban Categories								
	1	2	3	4	5	6	7	8	9
Alabama	0.962	0.816	1.185	1.259	NaN	1.18	0.979	0.999	1.017
Alaska	NaN	0.99	1.276	NaN	1.077	NaN	1.503	1.338	1.089
Arizona	1.113	0.89	1.141	0.89	NaN	0.881	0.985	NaN	NaN
Arkansas	0.852	0.98	0.818	1.341	1.404	1.104	1.625	1.423	1.493
California	0.428	0.779	0.991	0.753	0.418	0.971	1.077	0.875	NaN
...	...	...	...	...	...	...	...	...	...
Virginia	0.4	1.274	0.798	0.879	1.351	0.891	1.581	0.679	1.301
Washington	0.315	0.684	0.956	0.904	0.807	0.766	1.292	0.937	0.861
West Virginia	0.41	0.667	0.557	0.424	1.266	1.246	0.605	0.921	0.652
Wisconsin	0.814	0.241	0.663	0.962	NaN	0.916	1.151	0.668	0.675
Wyoming	NaN	NaN	1.193	1.207	0.92	1.324	1.071	NaN	1.394

the aggregate partisanship of these locations to the left. If these states contain more liberal rural populations, we should expect to see similar results in later analyses of policy issues. Also note that Figure 1 shows that the dispersion of opinion estimates for rural locations is greater than for urban locations, likely because of fewer rural survey respondents. With fewer respondents, the opinion estimates are naturally less precise. For example, the standard deviations of opinion estimates in Wyoming are relatively large compared to those in other states.

After creating the opinion estimates, the next step is to transform them into polarization values. Because geographic polarization refers to differences between geographic locations, I simply find the variance of opinion estimates within each state. For example, the geographic polarization of Alabama is the variance across the eight values in the first row of Table 2. However, rather than finding the variance across the *means* of the opinion estimates, I find the variance across the opinion estimates in each slice of the estimate array. This produces 50,000 polarization estimates (50×1000), 1000 for each state. The distribution of each state's polarization values is displayed in Figure 2. In addition to the distribution, Figure 2 also includes the mean polarization value of each state, indicated by the vertical red line.

The results from Figure 2 suggest that partisan identification is most polarized in Oregon, followed by Virginia and West Virginia. These states' polarization distributions are relatively

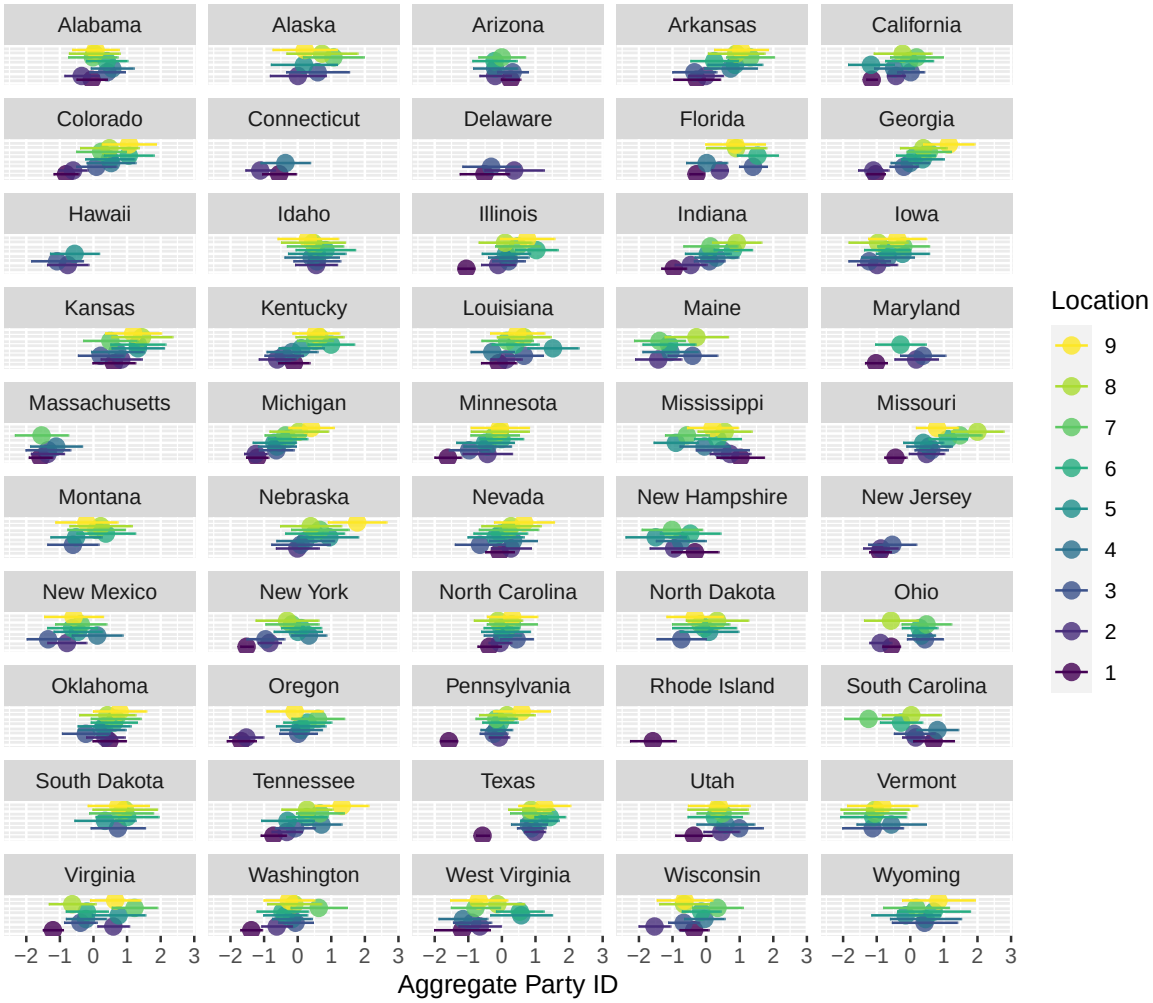

Figure 1: Party ID Opinion Estimates

flat, compared to those of states like Alabama and Texas, suggesting that there is greater uncertainty regarding their values. New Jersey, Arizona, and Hawaii are among the states least geographically polarized by partisanship. Their polarization distributions have mean values near zero (and also tend to have little dispersion).

In order to better understand how geographic polarization varies over space, I map the mean polarization value of each state in Figure 3. This figure shows that polarization tends to be higher in Western states, such as Oregon, Colorado, and Nebraska, and relatively lower in Midwestern states, such as Ohio, Kentucky, and Michigan. Southern states show no clear

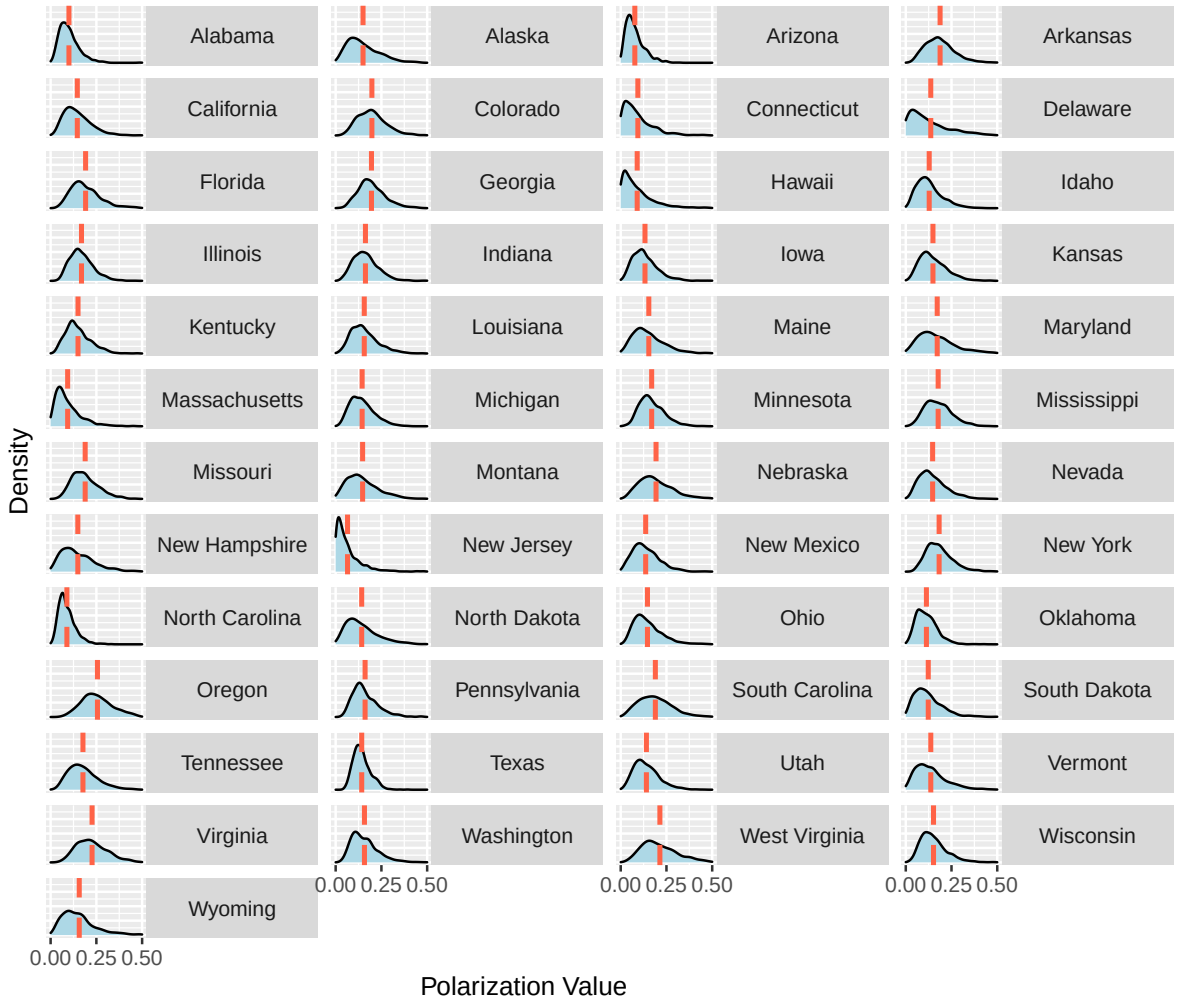

Figure 2: Distribution of Polarization Estimates

pattern, with some, like Georgia and Florida, quite polarized, while others, such as Texas and Alabama, are non-polarized. We can compare Figure 3 with Figure 1 to better understand where each state's mean polarization value comes from. For example, Oregon's high polarization is a result of its two most urban areas being much more Democrat than the rest of the state. Virginia's high polarization value, in contrast, is due to opinion variance among all of its rural-urban location categories. The states with the lowest polarization scores (New Jersey, Connecticut, Hawaii) tend to have few location categories that all have similar partisan identification.

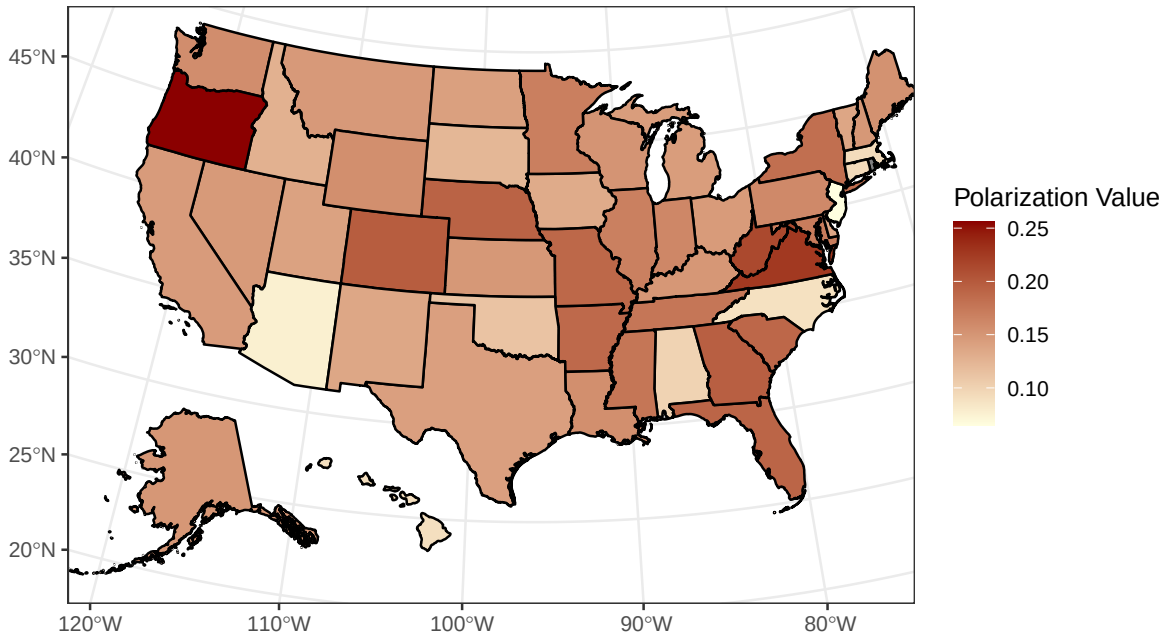

Figure 3: Map of Mean Polarization Estimates

The previous analyses compute polarization as the variation of the opinion estimates across a state's geographic locations, weighting all locations equally. However, weighting the location opinion estimates by population may better align with our conception of geographic polarization. For example, consider a hypothetical state A, in which 95% of the population lives in a highly metropolitan county and the remaining 5% lives in a rural county. The two locations have starkly different political views. Is this state just as polarized as state B, in which the population is split 50/50 between rural and urban locations (and the political opinions of these locations are identical to those in state A)? If we conceive of geographic polarization as the ideological distance between *places*, there is no meaningful difference between these two hypothetical states. The divide between the rural area and the urban area in state A is just as wide as that in state B. If, however, our conception of geographic polarization ought to account for the number of individual people in each location, state A is less polarized than state B, as 95% of its residents share similar political beliefs.

Figure 4 recreates Figure 1 while taking population into account. The point estimate of

each location's opinion estimates is scaled to the location's share of its state's total population. For example, the urban areas of Hawaii and Maryland constitute a relatively large share of their state's population, whereas the population distribution is much more even in Mississippi and West Virginia. This figure demonstrates how weighting by population affects out interpretation of geographic polarization. For example, compare the Illinois subplots in Figures 1 and 4. Figure 1 suggests that Illinois is relatively polarized, as its most urban areas are substantially more Democratic than its more rural areas. But Figure 4 tells a different story; here, it is easy to see that most Illinois residents live in urban areas and generally have high Democratic identification. The rural locations are more Republican, but they represent a small share of the state population. These different interpretations of geographic polarization — whether or not to account for population — will clearly affect the polarization scores.

I recompute the polarization scores for each state in each slice of the opinion array, again producing 1000 polarization estimates for each state. But rather than simply calculating the variance across location opinions, I use weighted variance, weighting by each location's share of its state's populations. Figure 5 displays the distribution of these polarization estimates for each state. These polarization estimates differ substantially from those in Figure 2. By assigning larger weights to larger location areas, the range of the polarization values shrinks. While New Jersey again has the lowest average polarization, the polarization scores for Colorado and Florida fall dramatically. Weighting by population decreases these states' polarization scores because the opinion estimates of their large urban locations are substantially different from those of the other locations in the state. For example, the Colorado subplot in Figure 5 shows that Colorado's two most urban locations are substantially more Democratic than the rest of the state. When all locations are weighted equally, these differences greatly increase the state's variance. But when variance is weighted to account for population share, these two locations dominate most of the effect of the smaller, rural locations.

Similarly, states like North Dakota and Indiana become much more polarized once population share is taken into account. As Figure 5 shows, the location categories in these states

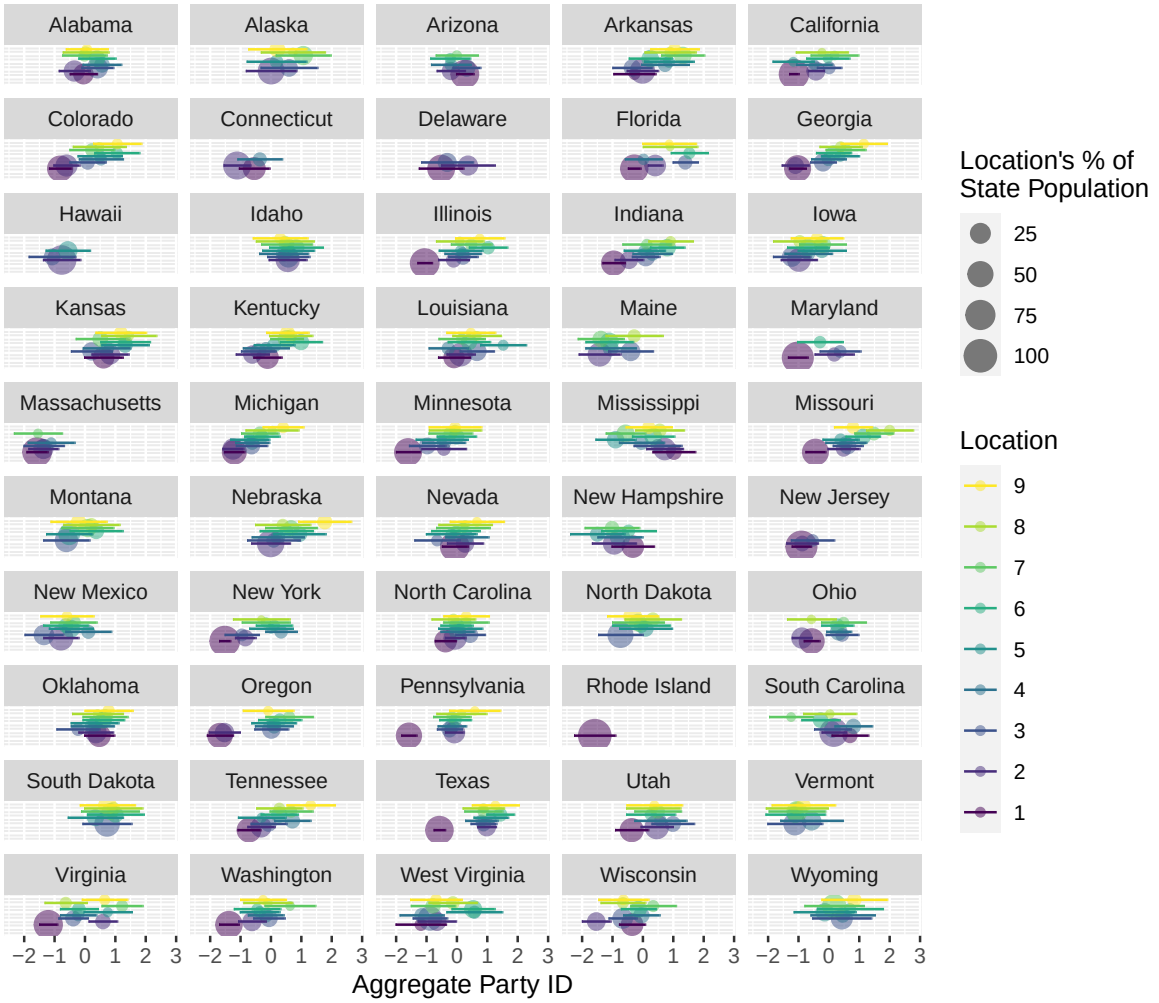

Figure 4: Population Weighted Party ID Opinion Estimates

are much more balanced, so when finding the population weighted variance, the opinions of rural areas are not overwhelmed by those of the urban areas. Weighting by population also decreases the uncertainty of the polarization estimates in large states with large urban areas, such as Nevada and California. Their polarization distributions in Figure 5 contain much less dispersion than those in Figure 2. That is because the polarization values are now primarily based on the opinion estimates of urban areas, which contain very little variance (as shown by the horizontal bars in the large circles of Figure 4).

These results demonstrate that the empirical results are sensitive to one's conception of

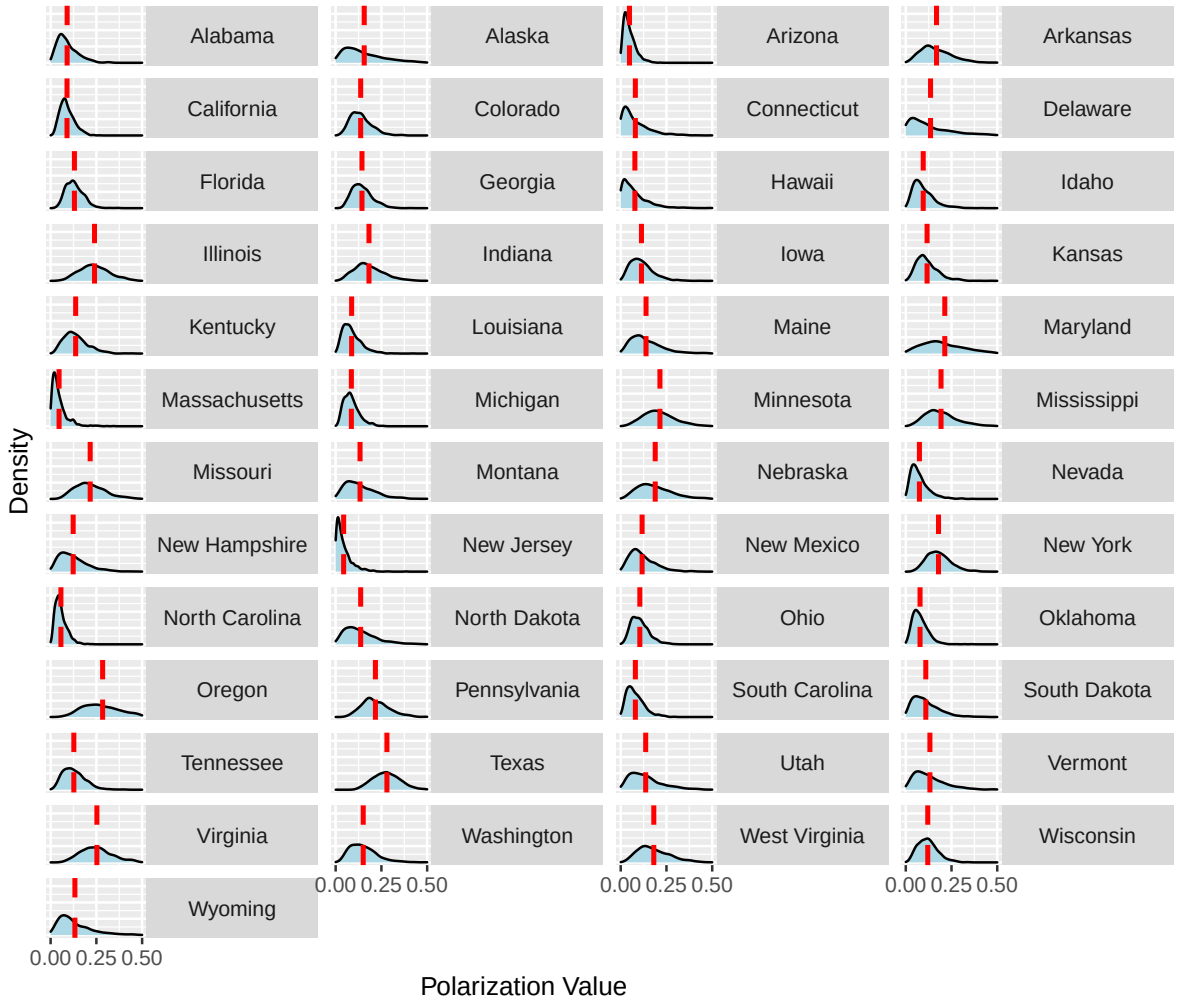

Figure 5: Population Weighted Distribution of Polarization Estimates

geographic polarization. If polarization is about the differences between places, regardless of the size of those places, larger states with uneven population distributions appear more polarized. Their sparsely populated, Republican rural counties are very politically different from their giant, Democratic metropolises. If polarization takes the population of these places into account, these states appear much less polarized. The dissenting opinions of the rural areas are swamped by the large population share in the urban areas. The most polarized states are instead those with relatively even population distributions, where rural areas contain a significant portion of the state population. The location's opinions are just as dif-

ferent as those in large states, but the size of the locations are more similar to one another. While geographic polarization is often discussed in the popular press as the ideological gap between places (i.e. "the rural-urban divide"), I believe that population weighted variance is a more reasonable measure of the concept. Returning to our hypothetical states A and B, it is reasonable to say that state A is less polarized than state B because the polity is composed of residents who overwhelmingly agree with one another. While geographic polarization is indeed about the aggregate opinions of places, the size of those places is not an irrelevant factor. Therefore, throughout the rest of this project, I compute polarization as the population weighted variance of the location opinion estimates in each state.

Chapter 4: Geographic Polarization by Issue

This chapter examines the spatial variation of geographic polarization for six political issues. I employ the same estimation technique described in the previous chapter to create polarization estimates for each state for each issue. I then examine the spatial variation of each issue separately. The next chapter will take these results and compare issues to one another within each state.

I am examining the polarization of issues — rather than votes, ideology, or party registration — for two reasons. First, this provides more texture to the results. It is likely that the degree and spatial distribution of polarization varies across issues. For example, immigration may be a highly polarized issue in Arizona, but not in Nebraska, where instead abortion is polarizing. Examining the geographic polarization of presidential election results, for example, could not uncover this nuance. By using issue positions, I can better understand the nature of polarization as it actually exists, rather than how it is filtered through blunt instruments of participation like party registration or voting. Second, issuse positions help me understand the relative size of the results. It is difficult to determine if a single set of results represents a "high" degree of polarization or not. Comparing polarization results across states addresses this to some extent, but the polarization estimates are difficult to interpret without additional context. For example, there will always be a state that is the most polarized relative to other states, but that does not necessarily imply that the state is highly polarized in the absolute sense; the issue may be non-polarizing in general. By estimating polarization for several issues, I can get a sense of the relative degree of polarization by comparing the issues to one another and to the party ID baseline established in Chapter 3.

This chapter is separated into section by issue area. I employ the data analysis process described in Chapter 3 to produce polarization estimates for each state for each issue. Using the 2018 CES Common Content data set, I select six issue areas: abortion, gun control, immigration, health care, trade, and the environment. I am partially limited by the issues included in the CES, but nonetheless believe that these issues are good candidates for examination. I choose these specific issues because they encompass a wide swath of political

issues. Some are cultural, others are economic. Some are highly salient, while others exist in the background. Some are geographically specific, while others are universal. This variation of issue characteristics provides more opportunity for interpretation after the polarization estimation procedure.

Like party ID in the walk-through in Chapter 3, the dependent variable for each issue takes ordinal values. I construct this dependent variable from the binary response survey questions, which ask respondents if they support or oppose a specific policy.[7] For each issue, I select all of the relevant questions and create an index based on the number of policies the respondent supports.[8] I recode the responses so that the directionality is the same across questions. For example, responses in favor of greater abortion access are assigned a value of zero, while those opposed are assigned a value of one. I then sum these values for each respondent to create an ordinal variable, such that higher values represent more right-wing positions.[9] For example, a respondent who supports greater abortion access on all five abortion-related questions receives an index value of zero, while a respondent who opposes abortion on all five questions receives a value of five. When creating polarization scores for each issue, I also clean the data to remove respondents who did not answer the policy questions related to that particular issue. For example, the respondents who did not answer the immigration-related questions were not included in the estimation of immigration opinion. This should not substantially effect the polarization results for any issue, because only a small percentage of the 60,000 observations are removed.

In order to estimate state-location opinion for each issue area, I employ the same ordered logistic regression model described in Chapter 3. The model uses the same four demographic variables (age group, sex, race, and Hispanic ethnicity) and location variables (state and rural-

[7] A list of selected survey questions can be found in Section A3 of the Appendix.

[8] I do not include all of the potential questions included in the CES because the directionality of the question is sometimes unclear. For example, one of the abortion questions asks respondents if they support or oppose "[permitting] abortion ONLY in the case of rape, incest or when the woman's life is in danger." I do not include this question in the analysis because it is unclear if opposition to this proposal is from an extremely pro-life or an extremely pro-choice position.

[9] I determine the "right-wing" position to be the one generally associated with the Republican Party. The only possible exceptions are the trade-related questions, in which I assign more protectionist positions higher values. Regardless, this does not affect the polarization results, as the variance of the opinion estimates is identical if the index values are reversed.

urban category) to predict attitudes for each respondent type. The model categories are the levels of agreement for each issue area, as represented by the issue index. For example, there are three gun control questions and therefore four total categories (agreement with zero, one, two, or three questions). The Stan model itself is identical for all issues and is simply rerun for each one. After post-stratifying the model predictions, I create plots displaying 1) the estimated aggregate opinion for each state-location pair, 2) the distribution of geographic polarization scores for each state, and 3) a map of the mean polarization value of each state (all weighted by population as described in Chapter 3).

Abortion

The first of my six issues is abortion. The abortion opinion index is composed of five survey questions, which ask about the respondent's support for various abortion policies. Figure 6 displays the abortion opinion estimates for each location in each state, weighted by population. The point is the mean of the 1000 opinion estimates and the horizontal bar is the standard deviation. These results show that, as expected, urban areas tend to have more liberal attitudes toward abortion policy than rural areas in the same state. For example, in Pennsylvania there is a nearly perfect relationship between rurality and opposition to abortion. In nearly every state, the most urban area is the furthest to the left on this issue. In addition, as seen in Chapter 3, the dispersion of opinion estimates tends to be larger for more rural areas and less populated states, likely due to fewer survey respondents.

While there are general trends across the country, Figure 6 also provides insight into differences across states. For example, while metropolitan areas are often the most liberal relative to the other areas in their state, there is significant variation among metropolitan areas across states; urban Mississippi is much more conservative with regards to abortion than urban Maine or urban New Hampshire. Likewise, not all rural areas are staunchly conservative. The most rural locations in Oregon and Washington are roughly in-line with the most urban areas in Tennessee and Kentucky. And as summarized in the following polarization plots, abortion opinion in some states is clustered (e.g. Arkansas and Texas) while it is dispersed in others (e.g. Virginia and Missouri).

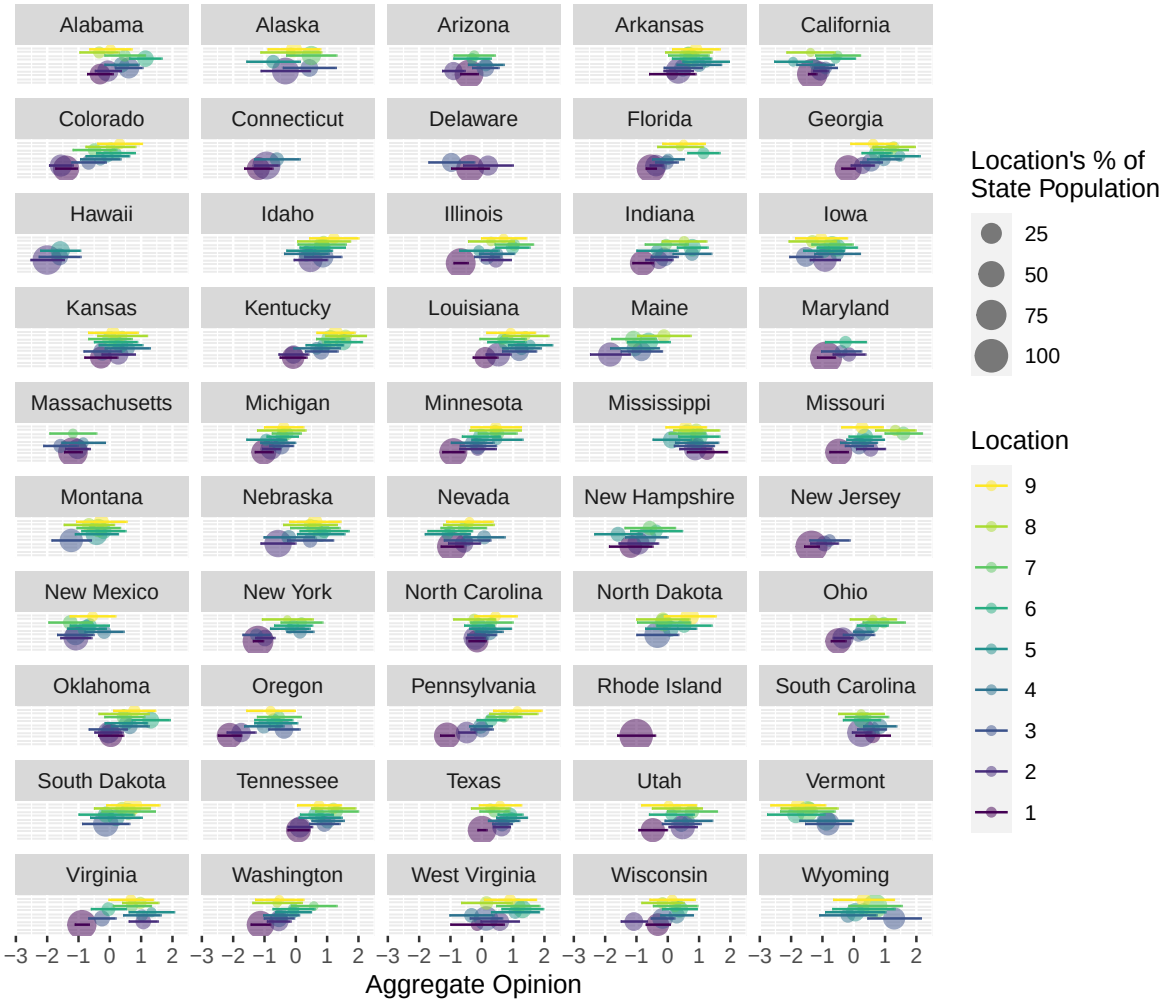

Figure 6: Abortion Opinion Estimates

The distribution of the population weighted variances for each state are displayed in Figure 7. This figure shows that, indeed, states with substantial rural populations, like Maine and Virginia, are relatively polarized. In contrast, states in which a large share of the population lives in a metropolitan area are not highly polarized. For example, in California, there are substantial differences of opinion across locations, but the weighted variance is small because 76% of the population lives in the most urban location category. The polarization distribution of California, as well as that of many other large states, is also very narrow, which should increase our confidence that the polarization estimates reflect reality. In con-

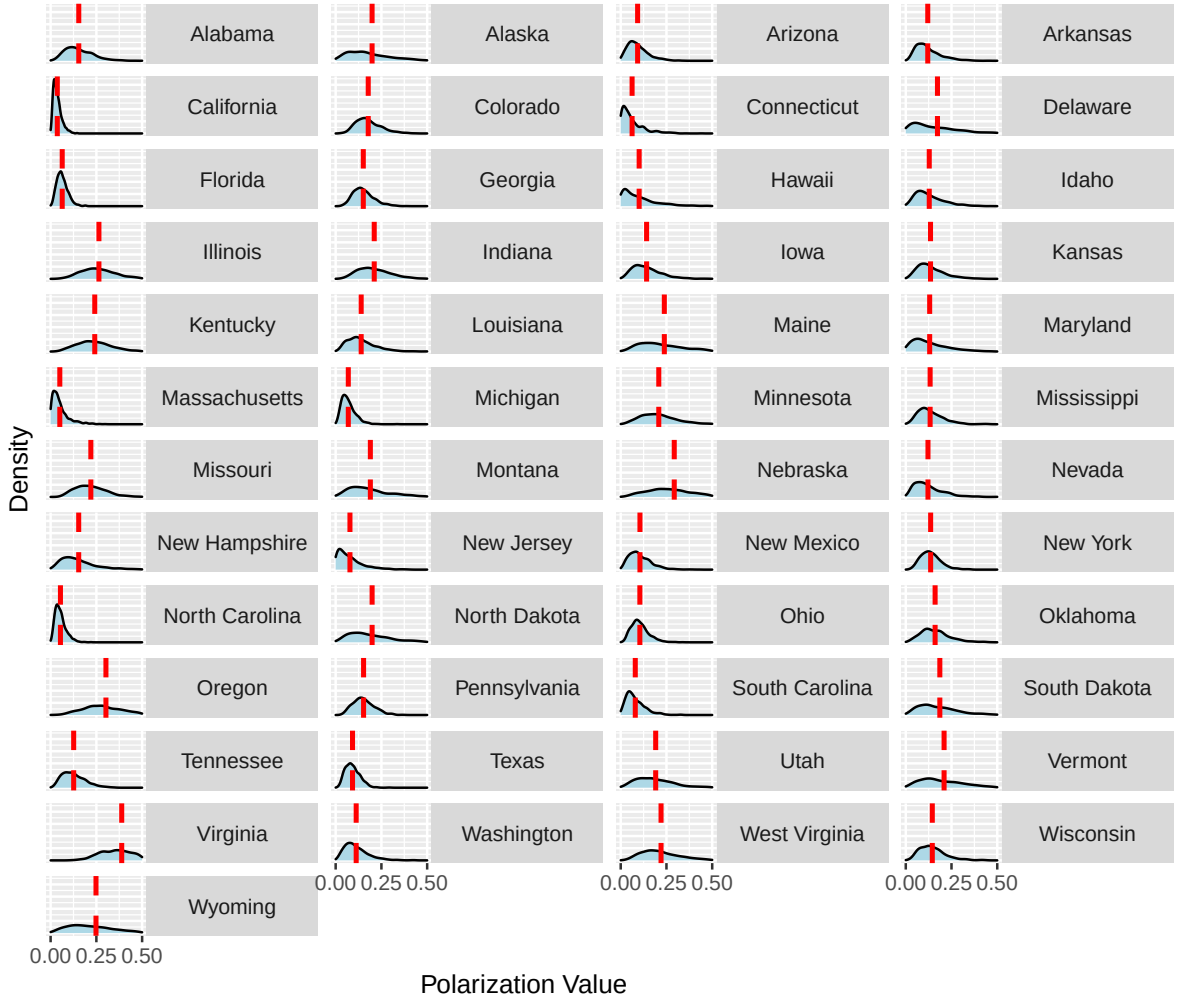

Figure 7: Distribution of Abortion Polarization Estimates

trast, the distributions of smaller states are much wider, meaning that the weighted variances are wildly different from one posterior sample to another. While not ideal, this is simply a limitation of the sparse survey data available in these states.

Figure 8 presents a map of the mean polarization value of each state, in order to better visualize how geographic polarization varies spatially across the country. In general, states in the Plains/Midwest regions tend to be the most polarized, while those in the South and on the East Coast tend to be less polarized, though these spatial patterns are weaker than those of the other issues discussed later in the chapter.

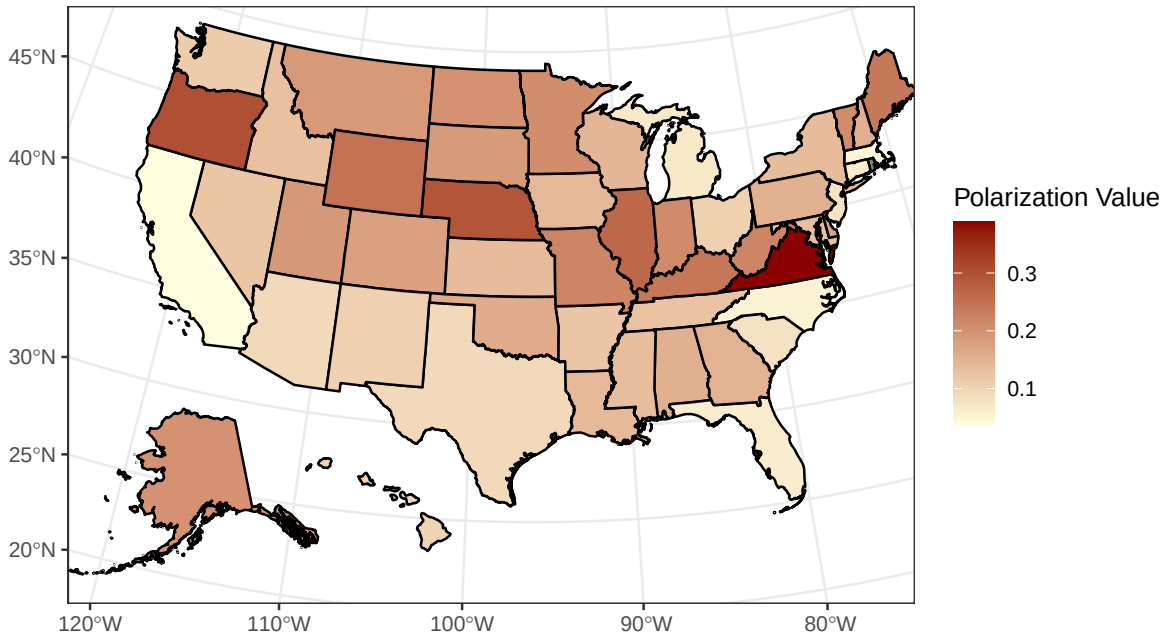

Figure 8: Map of Mean Abortion Polarization Estimates

Gun Control

The gun control index is composed of three questions, which ask about banning assault rifles, increasing background checks, and easing the process of obtaining a concealed carry permit. The estimates of each state-location's gun control opinion are displayed in Figure 9. This figure shows that, like abortion, gun control is polarized both between and within states. Some pairs of states, like Idaho and Connecticut, show no overlap whatsoever across any of their locations. We should therefore expect these states to have low polarization scores, despite their relatively even population distributions. Figure 9 also shows that, again, a state's most urban location is often its most liberal, though there are a few exceptions. For example, urban Mississippi is fairly conservative (relative to its other locations and relative to urban locations in other states) and urban Vermont is still quite liberal but less so than some of its rural locations. Kentucky, Pennsylvania, and Indiana display the expected relationship between location and opinion, such that more urban areas possess more liberal opinions toward gun control.

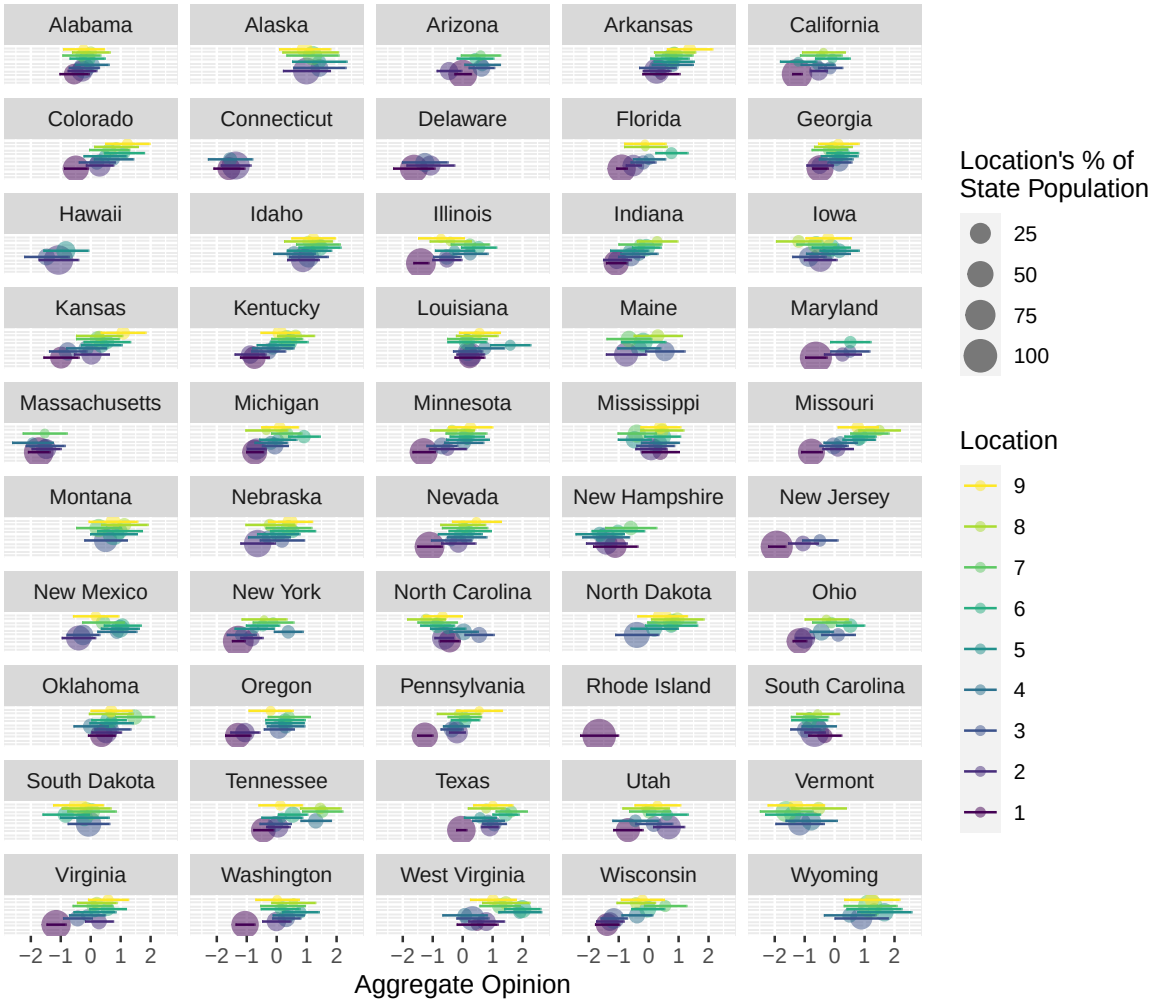

Figure 9: Gun Control Opinion Estimates

Figure 10 plots the gun control polarization distribution of each state. The most polarized states are Missouri, Virginia, and Illinois, all of which display the traditional relationship between rurality and political opinion and have large enough rural areas, such that they are not completely dominated by the urban areas in the weighted variance calculation. The weighted variance of most other states is near zero, likely due to the opinion clustering within each state, as indicated by Figure 9. For example, Wyoming's relatively even population distribution (which increases its polarization score compared to more lopsided states like California, as previously discussed), it is not highly polarized because all of its locations

possess conservative opinions toward gun control. The moderate polarization of states like Washington and Oregon is due to their urban locations' liberal opinions being out of step with the rest of the state.

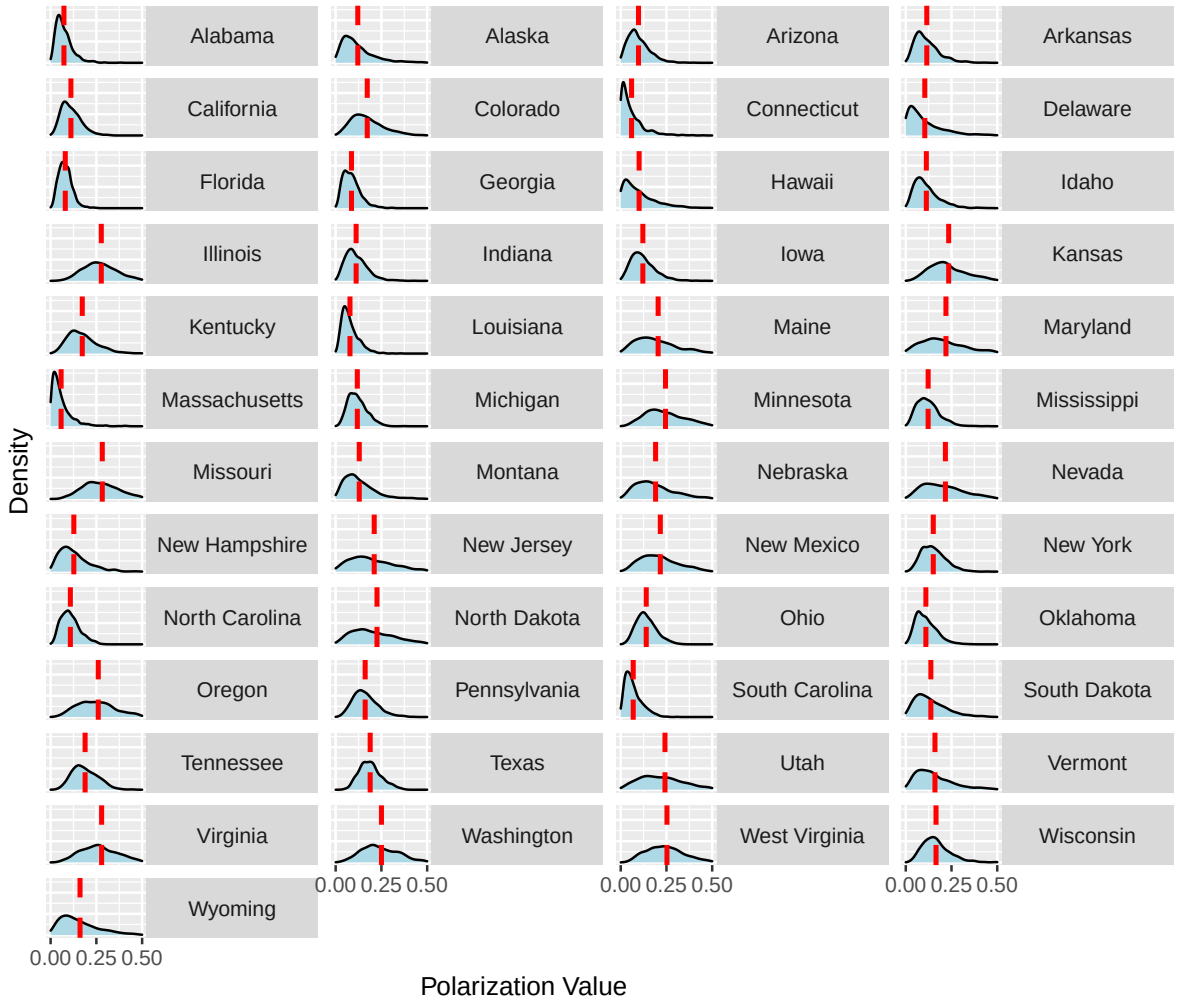

Figure 10: Distribution of Gun Control Polarization Estimates

The map in 11 shows that the spatial distribution of geographic polarization around gun control is more clustered than that of abortion. There are pockets of geographically polarized states (e.g. Washington and Oregon, Missouri and Illinois), which might be explained by connections between locations across states. For example, imagine that residents in Seattle and Portland see themselves as more similar to one another than to their rural neighbors in

their respective states; their opinions may mirror one another, but this increases polarization within the state. This dynamic is reflected in the opinion plot, whereby urban Washington and Oregon are much more liberal on gun control than other areas of their states.

In contrast, states in the Deep South are uniformally non-polarized. South Carolina, Alabama, and Louisiana are among the least polarized states in the country, despite their even population distributions. The opinion plot shows that this is due to the relatively moderate gun control opinions across all of their rural-urban locations.

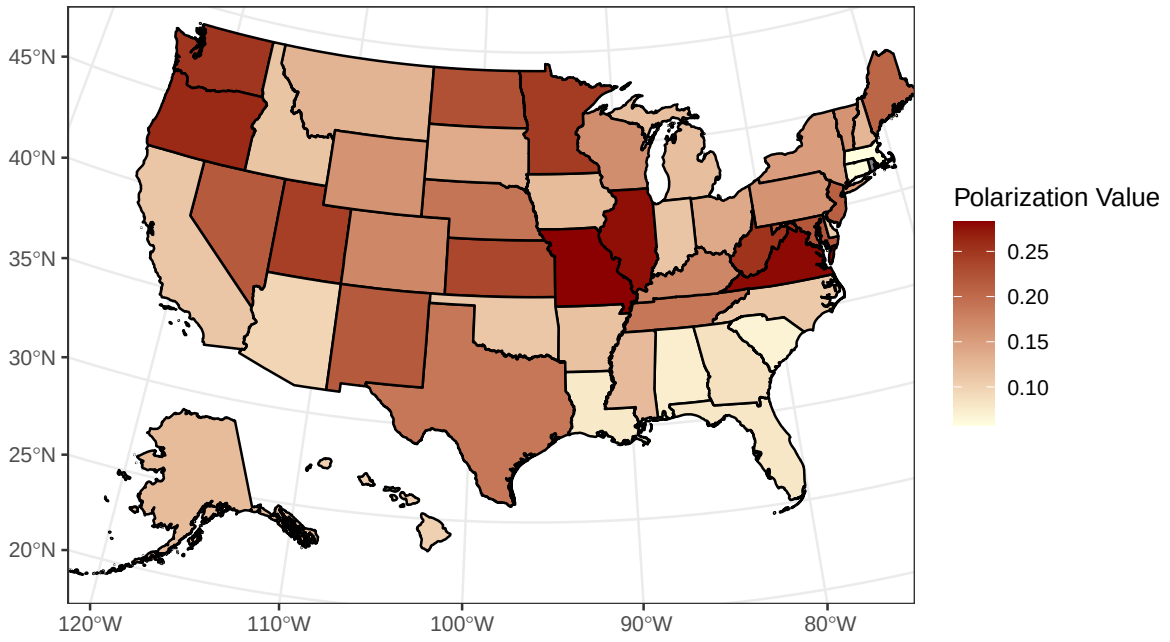

Figure 11: Map of Mean Gun Control Polarization Estimates

Immigration

The immigration index is composed of three questions, which ask about border security and the enforcement of immigration laws. Figure 12 shows the estimated opinion of each location and surprisingly, there is a less consistent urban-liberal relationship than with the previous two issues. In many states, such as Arizona and Oklahoma, the most urban areas hold very similar opinions as the more rural areas. In Mississippi, the most urban location is actually

the most conservative location in the state. In states where the most urban location is still the most liberal, the gaps between its opinion and its neighbors' opinions tend to be smaller (e.g. Texas and Washington). In addition, the differences between states are less stark. With abortion and gun control, the gaps between prototypical liberal and and conservative states were large and consistent (e.g. Idaho and Connecticut do not overlap). Immigration, however, appears to split states less cleanly. For example, conventional wisdom would suggest very little overlap in the opinions of Massachusetts and Montana, yet Figure 12 suggests otherwise.

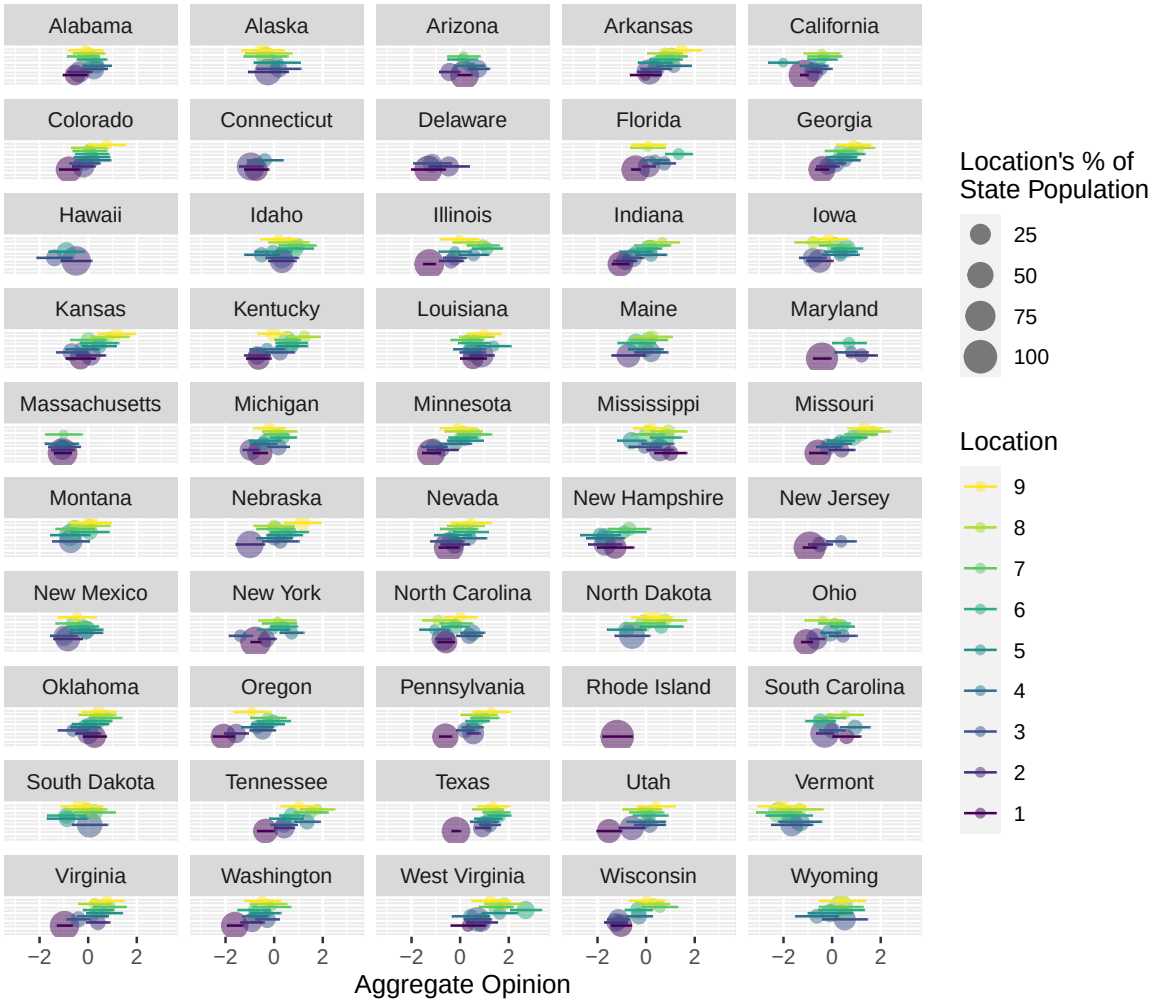

Figure 12: Immigration Opinion Estimates

The polarization distributions in Figure 13 are similar to those of abortion and gun control. Illinois, Nebraska, and Oregon are again some of the most polarized states, due to the gap between their liberal metropolitan areas and conservative rural areas. Surprisingly, smaller states with a larger proportion of rural residents do not appear systematically more polarized. For example, Alaska, Montana, and Wyoming are roughly as polarized over immigration as the average state. The least polarized states are again those with a very large urban population percentage and relatively liberal rural areas, such as California and Massachusetts.

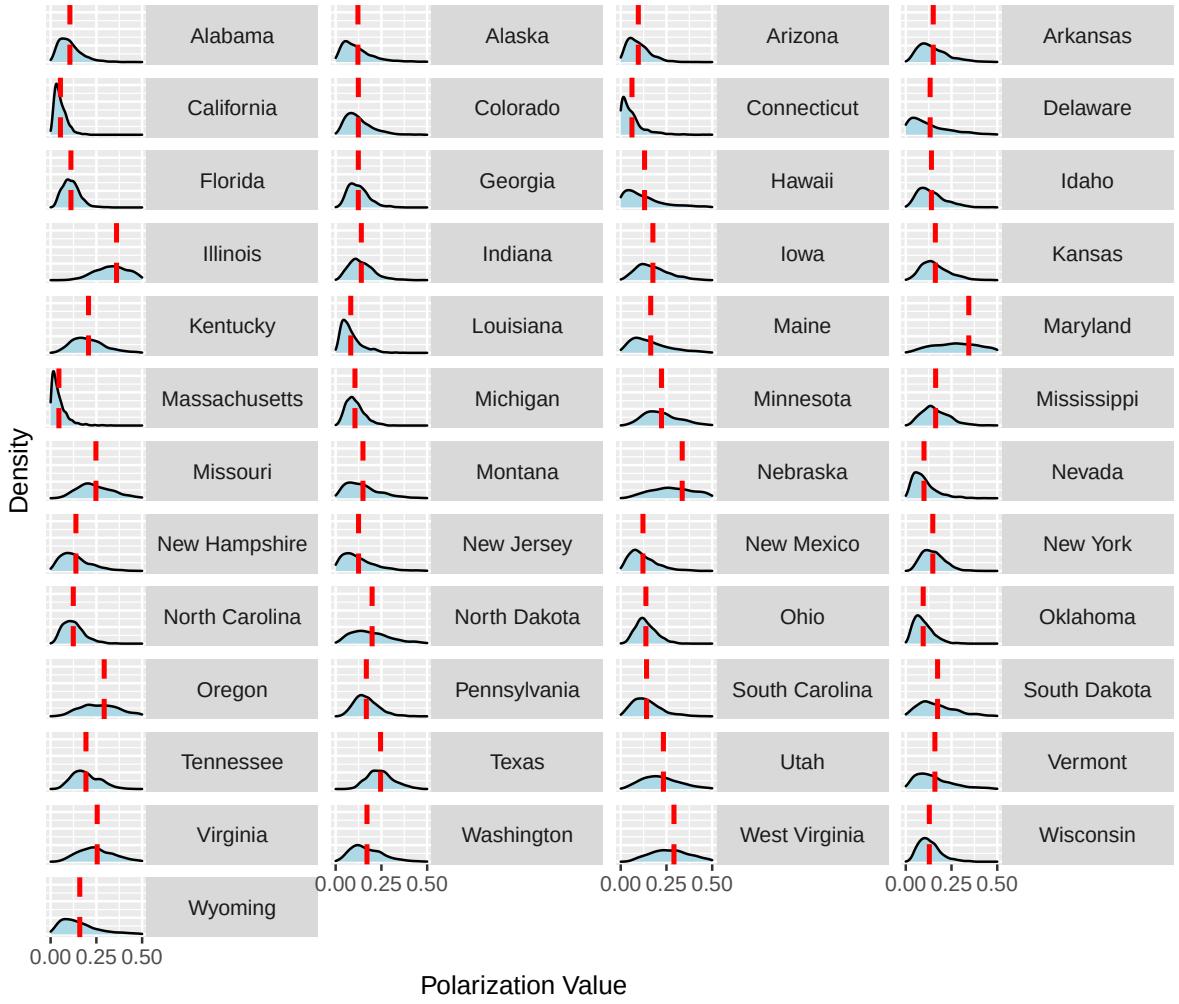

Figure 13: Distribution of Immigration Polarization Estimates

The map of mean immigration polarization values, Figure 14, highlights the handful of

highly polarized states (e.g. Illinois, Nebraska, Oregon) that were also highly polarized over abortion and gun control. In contrast, much of the South and Northeast are non-polarized, despite the states differing from one another significantly (e.g. conservative Louisiana and liberal Delaware). Because immigration is primarily a geographically specific issue — almost always framed as affecting states along the US-Mexico border — it is surprising that California, Arizona, and New Mexico are relatively non-polarized by the issue. Figure 12 illustrates how non-polarization varies across these states. California is non-polarized because the opinion of its large urban population swamps the opinions of the smaller rural populations in the weighted variance calculation. In contrast, New Mexico and Arizona have relatively even population distributions, but their locations have broadly similar, moderate views on immigration policy. Texas, the fourth state to border Mexico, is moderately polarized, due to the more conservative position of all but its most urban areas.

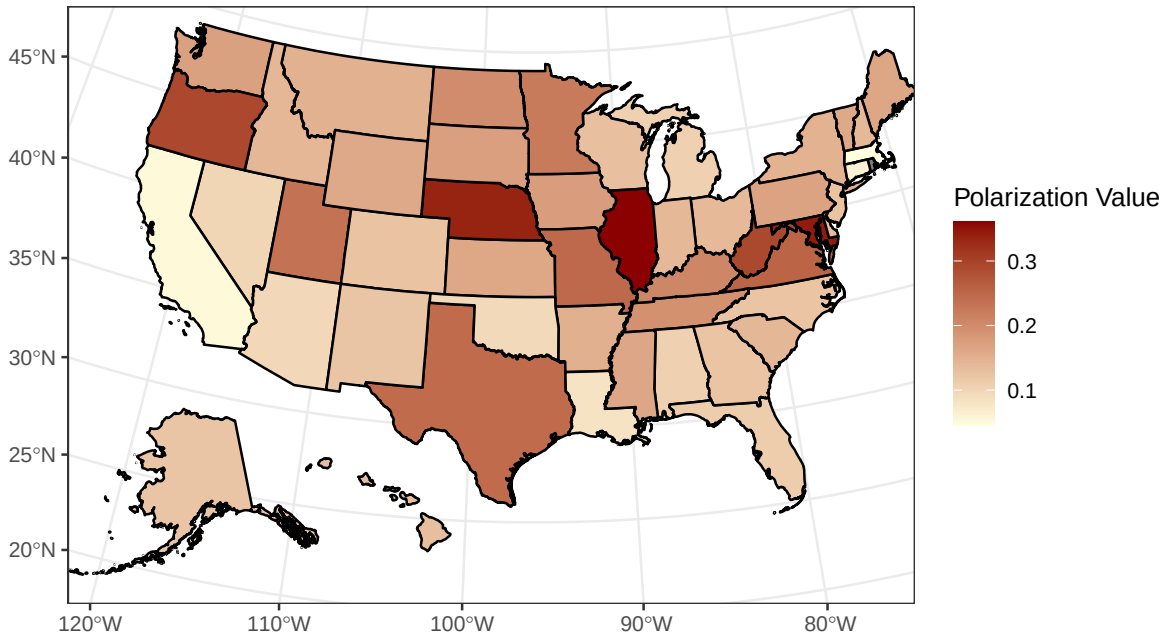

Figure 14: Map of Mean Immigration Polarization Estimates

Health Care

The 2018 portion of the cumulative CES data set contains three health care related questions: one about repealing the Affordable Care Act, one about providing Medicare for all Americans, and one about spending preferences for health care generally.[10] Figure 15 displays the location opinion estimates, which are broadly similar to the results from the first three issues. Again, within a state, rural areas tend to be more conservative than urban areas, though some states like South Dakota and Vermont buck this trend. In addition, health care appears to divide prototypical left/right states less cleanly than the previous issues, particularly abortion; for example, the opinions of locations in Kentucky closely mirror those in New York. While some conventional right-wing states retain their conservative views on health care (e.g. Alaska, Texas, West Virginia), it is unclear what separates these from states like Kentucky that move towards the center.

The polarization distributions in Figure 16 show that most states are moderately geographically polarized, with only a couple (e.g. Nebraska and Utah) as highly polarized over health care as the previous three issues. Liberal states with large urban populations, such as California and Massachusetts, are again the least polarized. However, there are also several conservative states with traditionally liberal metropolitan areas that are less polarized than might be expected. For example, the urban areas in Texas and Georgia (e.g. Austin and Atlanta) are generally regarded as markedly different than the rest of their state. But as the opinion plot shows, they are only marginally more liberal on this issue than their more rural neighbors, leading to less geographic polarization.

The mean polarization values shown in Figure 17 again suggest that Nebraska is one of the most geographically polarized states in the country, joined by Utah, which appeared relatively non-polarized across the previous issues. Otherwise, there are few spatial patterns beyond the continued low polarization scores in the South. This may be because health care is a less nationally geographically specific issue (compared to immigration), because health

[10] The spending question is technically not binary, providing five response options between "greatly decrease" and "greatly increase". However, I dichotomize these response options such that preferring increases are liberal and maintaining or decreasing current spending is conservative. This is in-line with the text of the question, which asks "would you like your legislature to increase or decrease spending [on health care]".

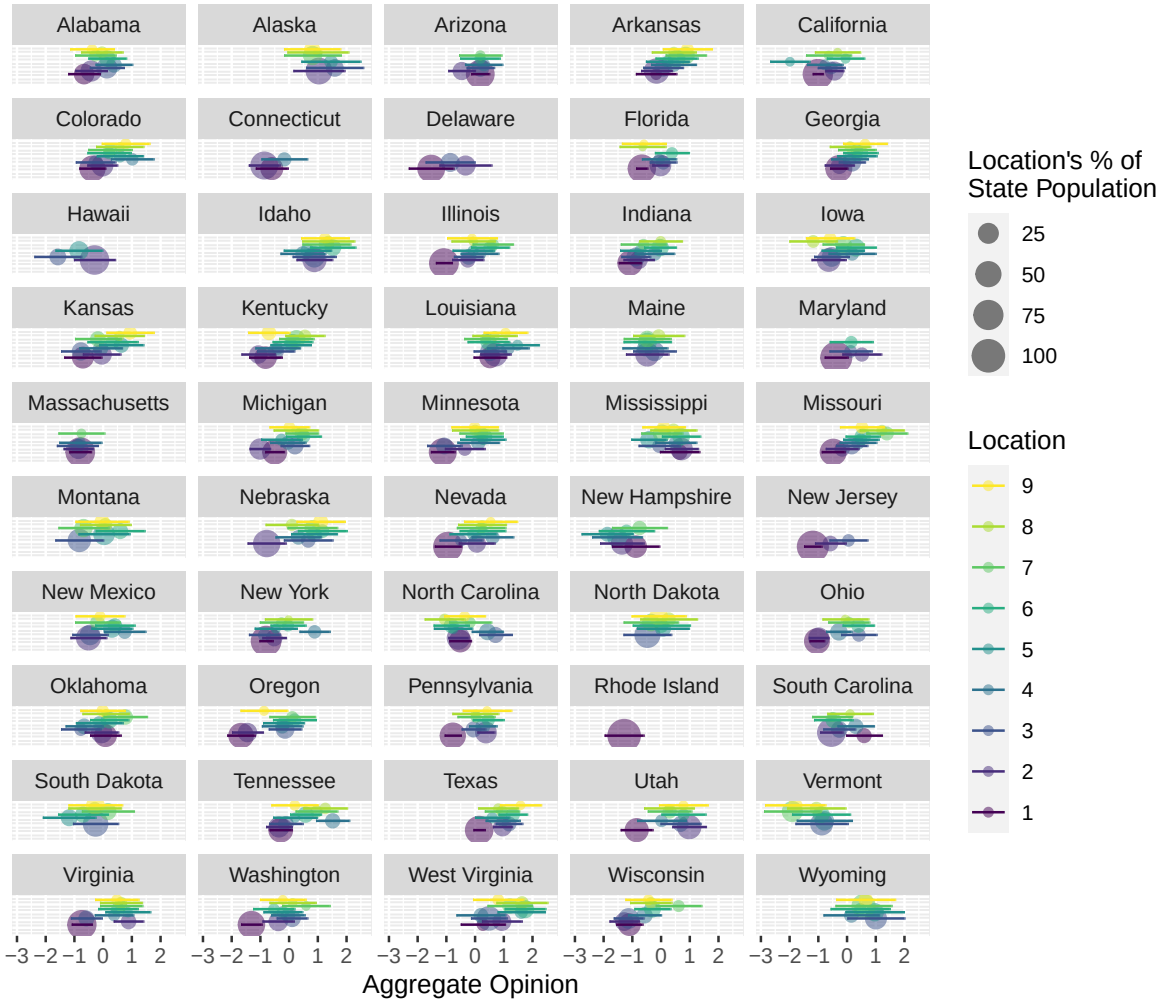

Figure 15: Health Care Opinion Estimates

care is a less rural-urban geographically related issue (like guns/gun control), or because health care is a less divisive issue among the public (compared to abortion).

Trade

The trade index is composed of three survey questions, two asking about trade with Mexico and Canada (a debated topic in 2018) and the other asking about trade with China. I coded the responses such that higher index values represent more protectionist attitudes. While the ideological valence of protectionism and free trade was unclear in 2018, this coding choice

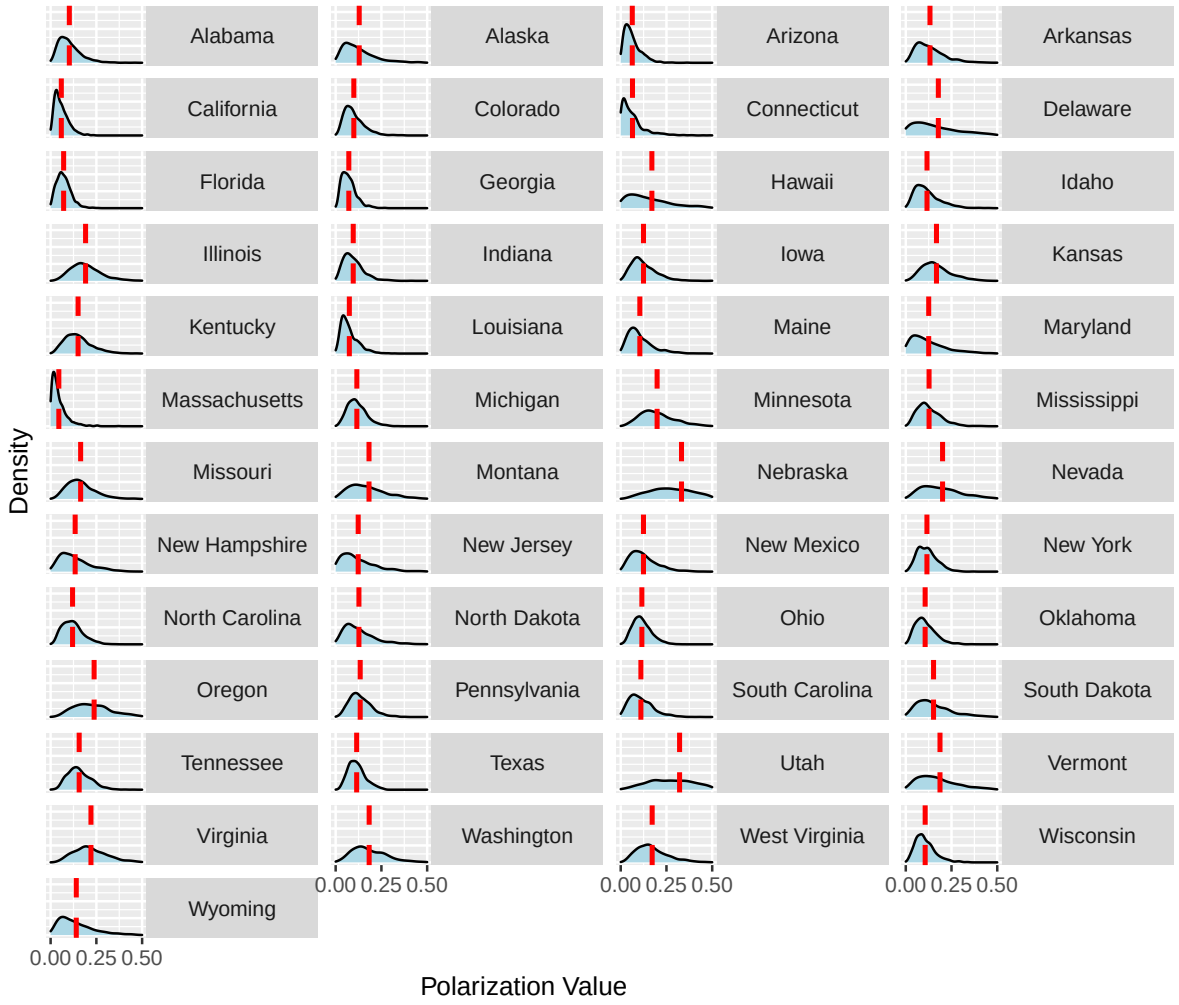

Figure 16: Distribution of Health Care Polarization Estimates

does not impact the polarization estimates because the variance of the opinions is the same regardless of the direction of the index. The estimated location opinions displayed in Figure 18 show that, when differences do exist between rural and urban areas, rural areas tend to be more protectionist (e.g. Michigan and Missouri). However, in many states, there appears to be no relationship between opinion position and rurality, with all locations clustered (e.g. North Carolina and Kentucky) or scattered seemingly at random (e.g. Mississippi and Wisconsin). This issue also seems to break the familiar patterns seen in the previous four issues. For example, metropolitan areas are less different than the rest of their state (e.g. Washington

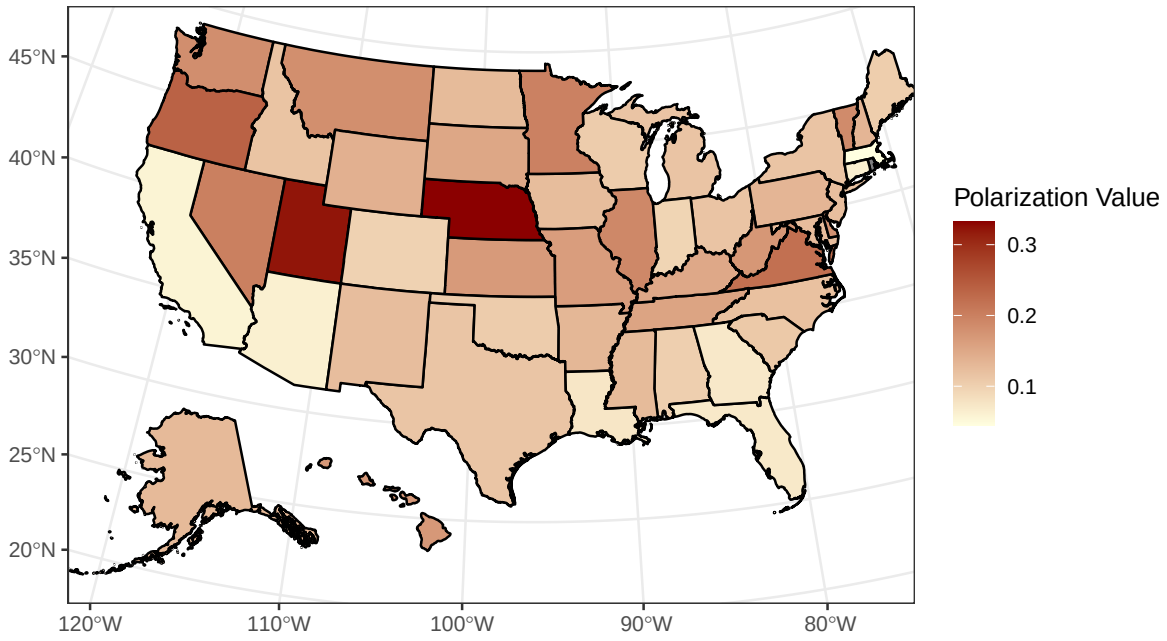

Figure 17: Map of Mean Health Care Polarization Estimates

and Illinois) and there are smaller differences between traditional left-wing and right-wing states (e.g. Connecticut and Idaho). This may be due to trade's lack of salience or its lack of a clear partisan valence. If geographic issue polarization is generally simply a manifestation of underlying partisanship, but positions on this issue are not clearly coded as Democrat or Republican, the opinion differences across geographic areas will be small.

The polarization distributions in Figure 19 show that, on average, the states with substantial rural populations are the most geographically polarized, though their distributions reflect uncertainty in the estimates. There are, however, a few other states with moderately high polarization values. For example, Minnesota and West Virginia have relatively high mean polarization values and decently narrow distributions. The polarization in Minnesota is due to opinion becoming more protectionist as locations become more rural and the large urban areas being substantially more supportive of free trade than anywhere else in the state. In West Virginia, opinion on trade bounces back and forth as rurality increases, increasing the polarization estimates. Surprisingly, states in the Midwest are generally less polarized by

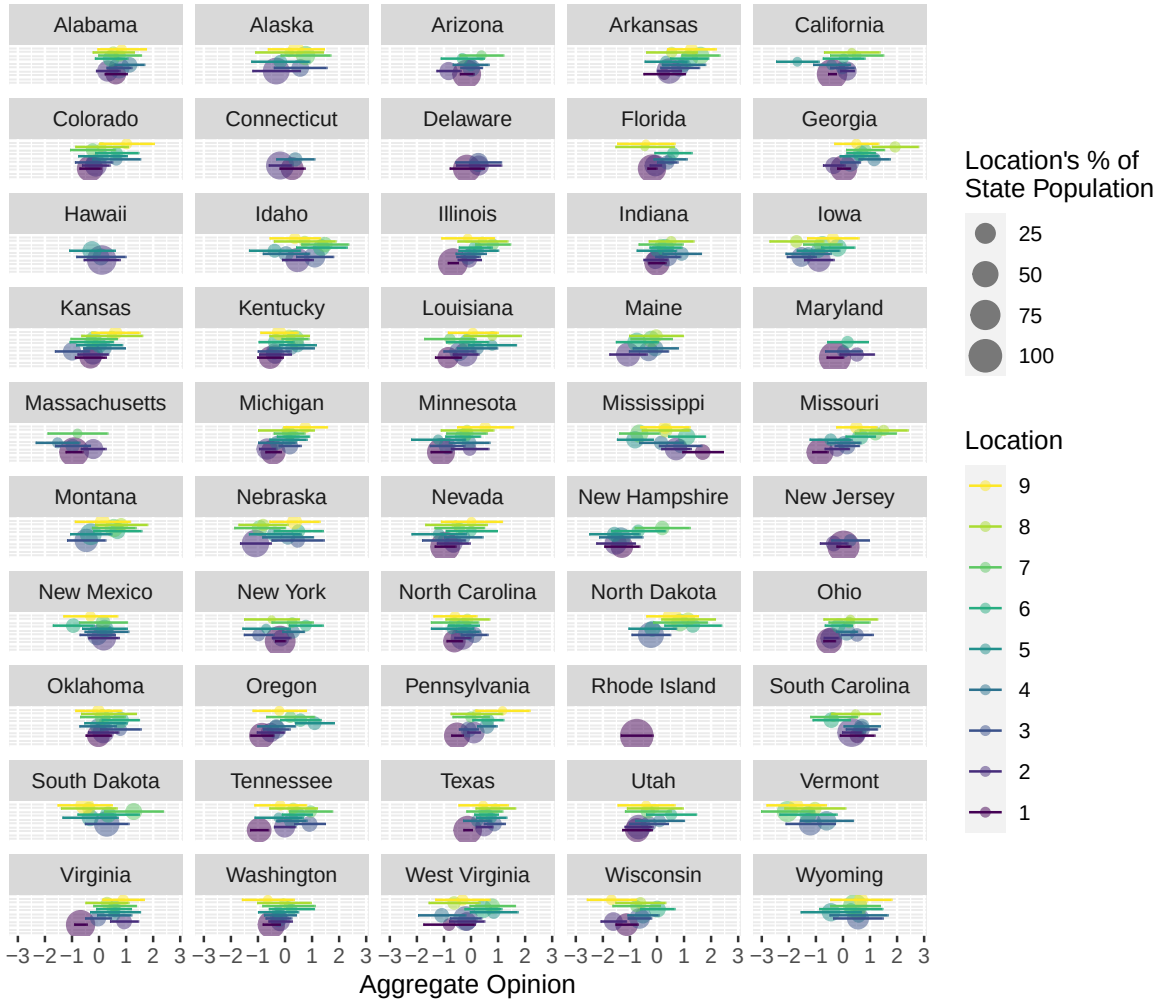

Figure 18: Trade Opinion Estimates

trade. For example, Michigan, Indiana, and Ohio are less polarized than average, due to clustered, moderate opinions on the issue, despite incessant political rhetoric about the deeply polarized "Rust Belt."

The spatial distribution of polarization surrounding trade is presented in Figure 20, which shows that the Plains states are again the most polarized on average, though this is partially attributable to the wide polarization distributions which are driven by these states' small populations. Geographic polarization is once again largely absent in the South, with the possible exception of Mississippi (where protectionism decreases with rurality).

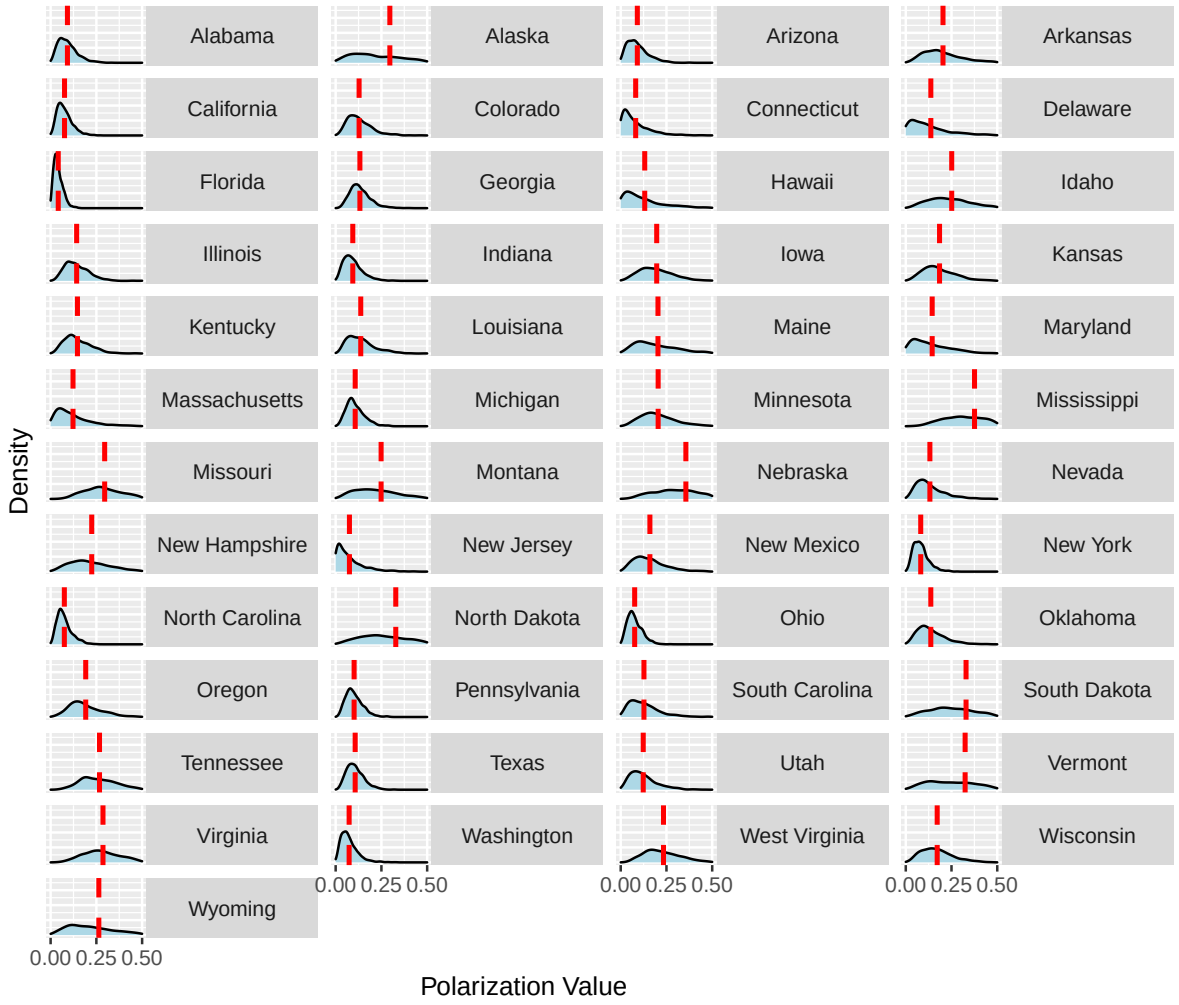

Figure 19: Distribution of Trade Polarization Estimates

Environment

Attitudes toward the sixth and final issue, the environment, are measured via four questions in the 2018 CES, which ask about federal environmental regulation and renewable energy. Figure 21 suggests that the environment differs somewhat from trade and returns to some of the familiar polarization patterns of more hot-button issues like abortion and gun control. For example, several states display the positive relationship between rurality and conservatism (e.g. Indiana, Illinois, Missouri). Metropolitan areas still tend to be the most liberal locations in their state. However, environmental opinions across states tend to overlap significantly,

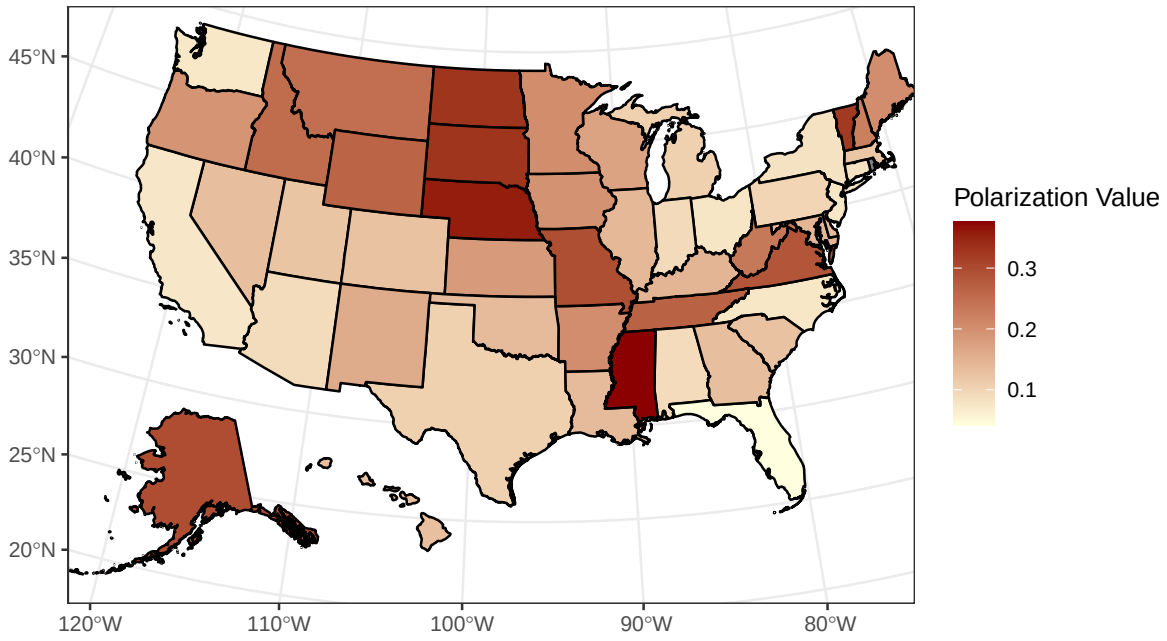

Figure 20: Map of Mean Trade Polarization Estimates

most notably in Vermont and Wyoming, which have been significantly separated on previous issues. This may be due to the similar outdoor culture and respect for nature in the two states.

The polarization distributions in Figure 22 show that the states with the highest mean polarization values are those with the most uncertain opinion values. Like the polarization over trade, this may reflect uncertainty in the underlying opinion estimates and the difficulty modeling opinion when the relationships between demographic predictors and opinions are less consistent. Regardless, it does appear that states with a large share of the population in metropolitan areas (e.g. California and Florida) are frequently less polarized than those with more even population distributions.

The mean polarization values in Figure 23 again show that the South is the least polarized region in the country, followed by much of New England and the Southwest. The Plains states are the most polarized, with the Midwest falling somewhere in between. Overall, the spatial distribution of geographic polarization regarding the environment is similar to that of other issues. While this chapter has informally compared the polarization results for each issue,

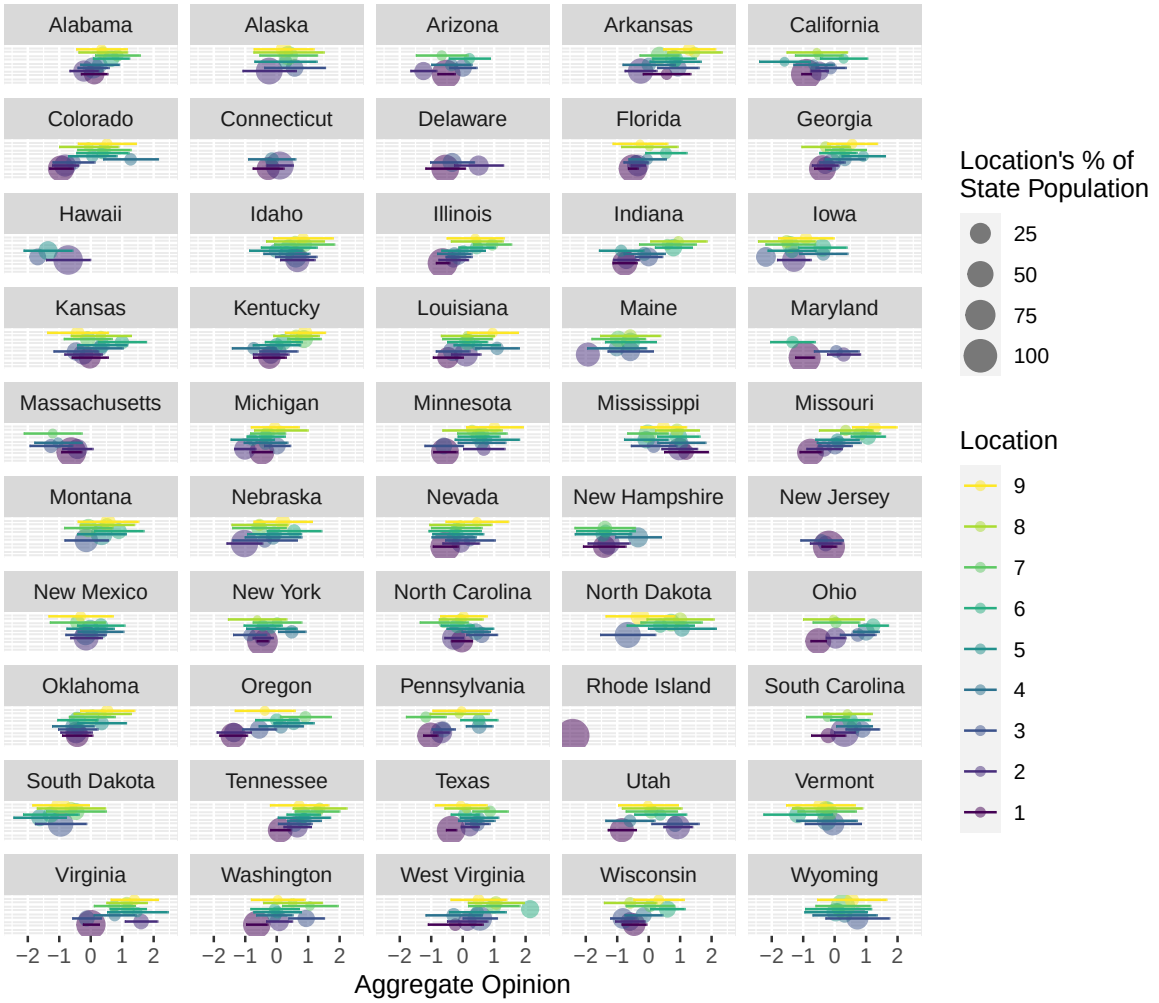

Figure 21: Environment Opinion Estimates

the next chapter will dig deeper by aggregating the issue polarization scores and creating state polarization profiles.

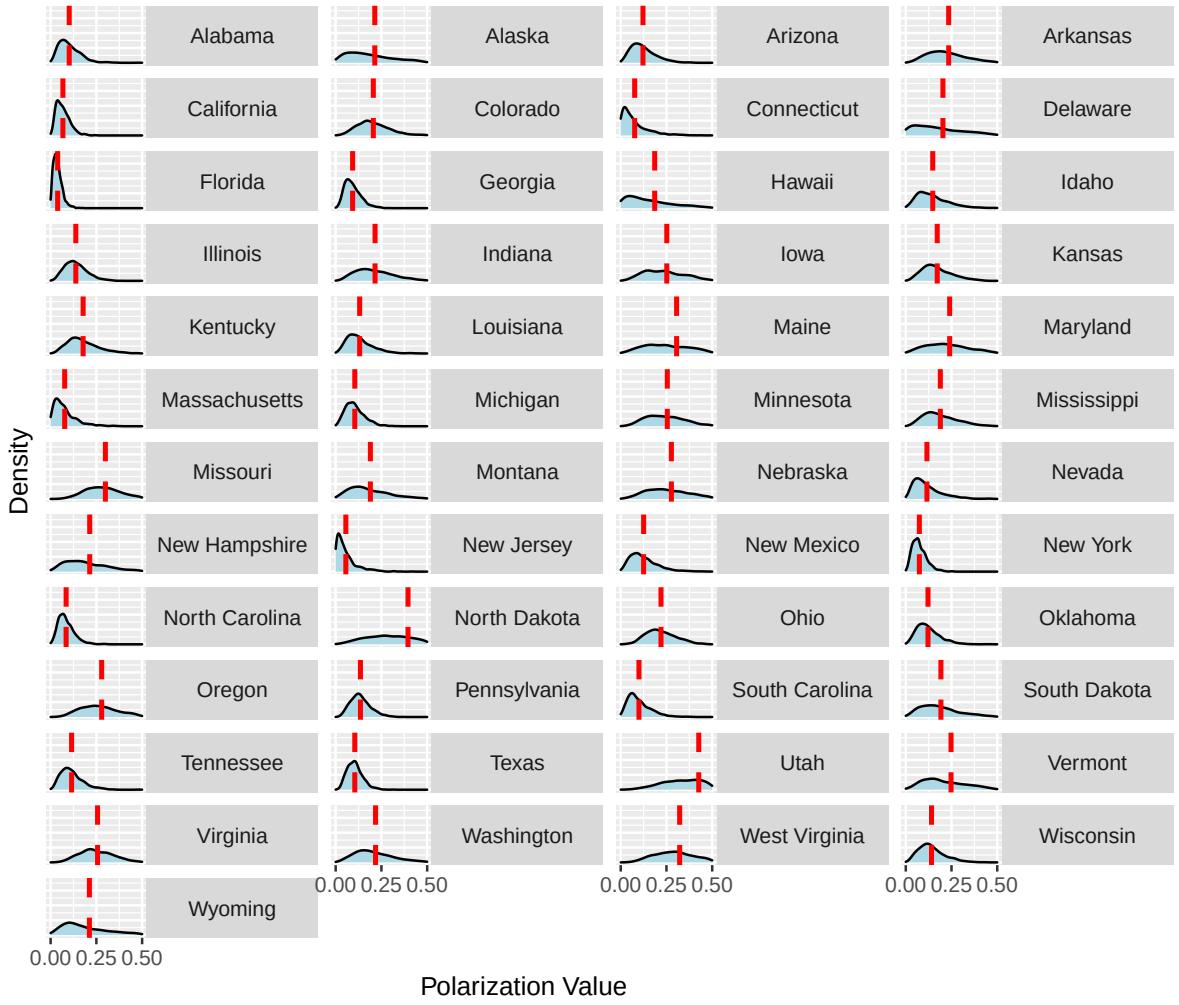

Figure 22: Distribution of Environment Polarization Estimates

Chapter 5: State Polarization Profiles

Creating State Profiles

The first step of creating a polarization profile for each state is to combine the polarization estimates, as shown in Table 3. These are the same average population-weighted polarization scores described in the previous chapter. I do not standardize these polarization scores before joining because the underlying opinion estimates were standardized, meaning that the polarization estimates should be on the same scale.

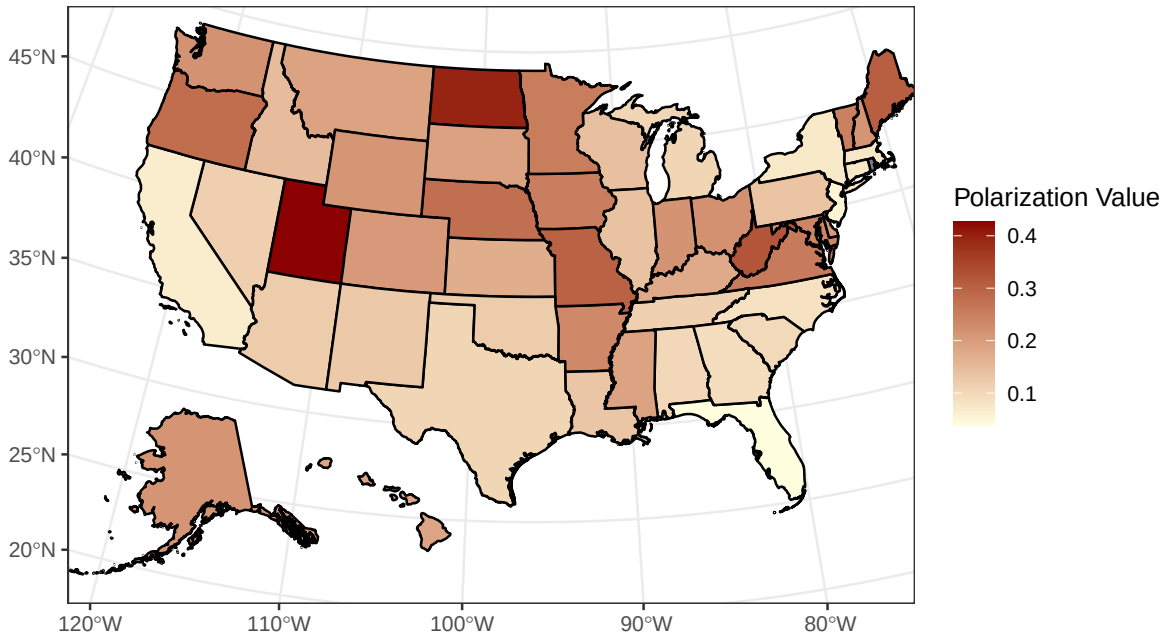

Figure 23: Map of Mean Environment Polarization Estimates

Next, I transform the values in Table 3 into Figure 24, in order to understand the level of polarization for each issue in each state. The main takeaway from this plot is that there is not a single story of geographic polarization, despite popular media coverage (and some academic writing) that assumes polarization is homogeneous across the country.

If issue polarization was merely downstream from partisanship, we should expect Party ID to be more polarizing than the other six topics in nearly all states. If, for example, an individual based his responses to the policy-based survey questions by first considering his partisanship (i.e. "I am a Republican; what is the Republican position on this issue?"), the level of geographic polarization ought to be highest for partisanship, as it feeds the issue positions. This is clearly not the case. In fact, Party ID is the most polarizing topic in only four states. In addition, we would also expect clustering of polarization values within each state; if some factor, like partisan identification or liberal/conservative ideology, was dividing individuals geographically and also driving their position on issues, the amount of polarization should not differ across issues. Some states may have higher polarization values than others, but

Table 3: Issue Polarization Estimates

State	Party ID	Abortion	Guns	Immigration	Health Care	Trade	Environment
Alabama	0.09	0.154	0.073	0.105	0.102	0.092	0.101
Alaska	0.156	0.199	0.121	0.122	0.129	0.296	0.214
Arizona	0.048	0.092	0.097	0.096	0.063	0.091	0.122
Arkansas	0.168	0.12	0.115	0.15	0.132	0.204	0.235
California	0.09	0.037	0.111	0.054	0.058	0.076	0.067
...	...	...	...	...	...	...	...
Virginia	0.253	0.388	0.279	0.255	0.22	0.286	0.257
Washington	0.151	0.112	0.25	0.171	0.183	0.074	0.218
West Virginia	0.181	0.22	0.253	0.291	0.172	0.234	0.322
Wisconsin	0.12	0.145	0.165	0.129	0.106	0.172	0.141
Wyoming	0.133	0.248	0.161	0.159	0.14	0.263	0.212

the polarization values will be consistent within the state (represented by clustered points in Figure 24). But again, this theory is not supported by the data. Remarkably few states (e.g. Connecticut, Michigan) are similarly polarized by all issues. The vast majority of states show a range of polarization values across the seven topics (e.g. Utah, Illinois, North Dakota).

It should be noted that the topics with the highest degree of geographic polarization in a state are not necessarily the most salient or the most electorally important. In fact, it is theoretically possible that highly geographically polarizing issues are the least discussed among elites and the least influential among voters. Consider, for example, immigration policy in Illinois; it is the most highly geographically polarizing in the state, due to the more liberal policy position of the state's urban areas relative to those of its more rural areas. If the geographically-defined districts for members of the state legislature align with these rural-urban cleavages, the issue becomes less important to both candidates and voters. A candidate in Chicago is not going to take a position on immigration that would alienate 90% of her potential electorate. Likewise, a Chicago voter will not care what the candidates on his ballot think about immigration because he can be fairly confident that they will reflect the shared opinion of 90% of their district. Therefore, immigration fades into the background despite being highly geographically polarizing in Illinois. This is reflected by the fact that party identification is often one of the least geographically polarizing topics in a state, despite being one of the most influential factors in vote choice.

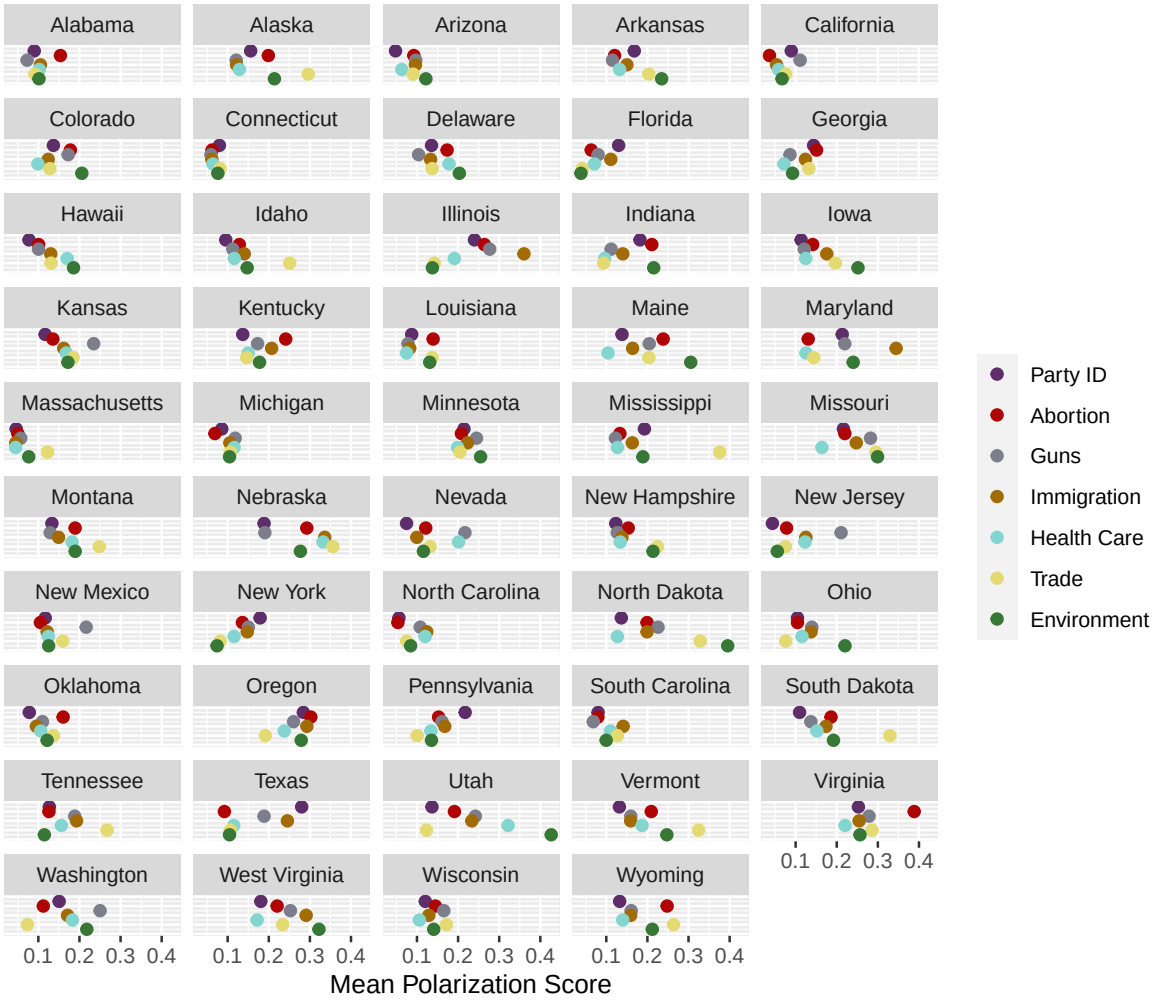

Figure 24: Distribution of Mean Issue Polarization Estimates

There also do not appear to be groups of issues that are frequently polarized the same amount. If there was some mechanism that caused certain types of issues to become polarized, we would expect to see consistent groupings of issues across states (even if the amount of polarization differed by state). There are countless ways to theoretically group issues, but for example, imagine if the degree of geographic polarization of an issue was related to its partisan issue ownership and the overall partisan makeup of the state. Health care and the environment are generally considered Democratic-owned issues and so perhaps they are less geographically polarizing in Democratic states and more polarizing in Republican states. If

this were true, we would expect the polarization values of health care and the environment to be similar within each state (i.e. low in Democratic states and high in Republican ones).

This idea does not appear to be true by looking at Figure 24, but I conduct a series of statistical tests to more formally evaluate it. For every state, I find the polarization rank of each issue — between one and seven — by ordering the issues by polarization score (highest to lowest).[11] I then calculate the Pearson's correlation coefficient of these rankings across all pairs of issues. If two issues move together, their correlation should be positive and significant; when issue A is highly polarized, issue B should also be highly polarized (given the state's overall level of polarization). Figure 25 provides the p-values and signs for these 42 correlations, confirming the absence of any pair of issues that move in parallel. Of the 21 unique pairs, five have a positive correlation, but none of these five are statistically significant. These results suggest that the causal mechanisms behind issue polarization do not operate according to "issue type" or that they vary across states.

Specific States

Before continuing, I will further dig into Figure 24 and more thoroughly describe the results for a few specific states, as this is one of the most important visualizations in the entire project.

As seen throughout Chapter 4, Connecticut is the exemplar non-polarized state, consistently displaying some of the lowest polarization values for all seven topics. This is likely due to Connecticut's small size, its uneven population distribution across rural-urban categories, and its small number of different categories. However, there are several other states with consistently low polarization values that do not possess all of these qualities, including Arizona, California, and Oklahoma. The low polarization in Michigan is particularly striking, given its moderate population size (nearly ten million in 2018), its relatively even population distribution, its number of rural-urban categories (nine, the highest possible), and Detroit's

[11] I use polarization rank within each state, rather than raw polarization value, because I do not want the correlations to be confounded by the overall polarization within a state. I am interested in pairs of issues that are consistently polarized to similar degrees, not states that are equally polarized by all issues.

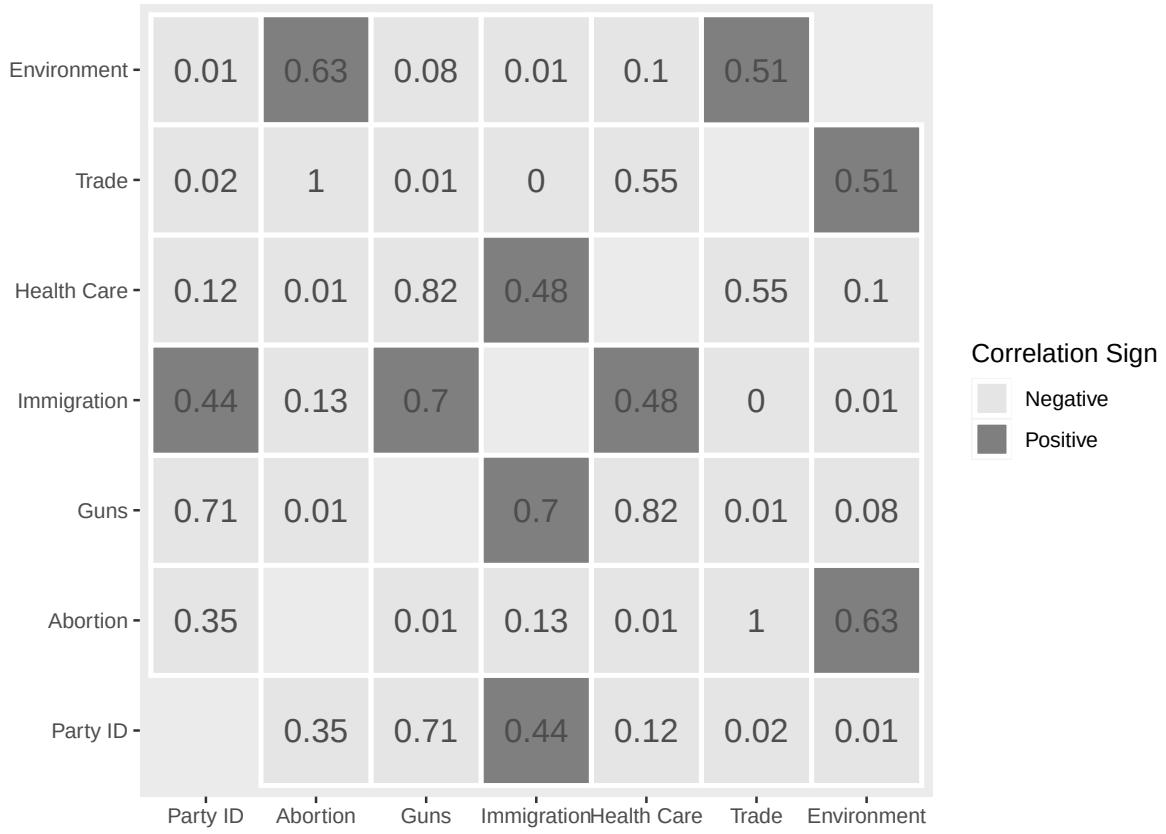

Figure 25: Correlation Significance between Issue Polarization Rankings

reputation as politically distinct from the rest of the state. Compared to neighboring — and in many ways, similar — states Indiana and Illinois, Michigan is much less polarized.

In contrast to these non-polarized states, several states display consistently high levels of polarization across all issues. For example, the least polarizing topic in Oregon, trade, is more polarizing than all seven topics in 15 states. Like Oregon, Minnesota's polarization values are high and are relatively clustered. This suggests that the causal mechanisms behind polarization in these states do not differ by issue or issue type. Whatever causes opinion to differ by rural-urban geography is upstream from the opinions on specific issues. For example, the theoretical connection between culture and geography, as outlined in Chapter 2, may apply in Oregon and Minnesota; perhaps city life in Portland and Minneapolis leads to a more liberal worldview, affecting one's position on policy questions and party identification

(though this would not explain differing results in states with similar cities).

In contrast to both of the above categories (consistently lowly or highly polarized), some states' polarization scores vary widely by issue. Utah is the state with the largest distance between its most and least polarized topics. West Virginia, Illinois, and Maryland also contain a wide dispersion across issues, though the specific ordering of the issues differs between the states. In this case, it is likely that an interaction between some characteristic of the issues and of the states leads to the polarization. For example, perhaps the social ties created by the Church of Jesus Christ of Latter-day Saints in Utah mitigate rural-urban polarization, but is less effective for geographically-specific issues like the environment.

Finally, there are a few states where one issue stands out from the rest, as a polarized or non-polarized outlier. For example, in South Dakota and Mississippi, trade is much more polarizing than any of the other six topics. Unlike cases where polarization scores are widely dispersed across all issues, the mechanism behind this kind of polarization is probably less related to *the type of issue*, but to the specific issue itself. For example, it is not that trade is an international relations issue that makes it polarizing in Mississippi (because immigration is also connected to international relations, yet no more polarized than the others), but that opinions on trade specifically differ by location. Perhaps rural areas have a more liberal view of international trade due to seeing the benefits of foreign investment (such as the Toyota Manufacturing plant in Blue Springs), as suggested by the opinion data in Figure 18. It is impossible to establish this causal relationship with this data alone, but this shows how these results allow for the development of new theories (which can be evaluated with future research).

While Figure 24 provides valuable information at a state-by-state level, it is difficult to uncover the spatial variation across the country. In order to do so, I map the most polarizing issue of each state in Figure 26. Keep in mind, this illustrates each state's most polarizing topic (relative to its other six), regardless of the level of polarization relative to other states. For example, Figure 26 shows that Michigan is most polarized by guns/gun control, but as previously discussed, all seven topics are non-polarized relative to the polarization of other states. Still, this figure can communicate many regional patterns in polarization.

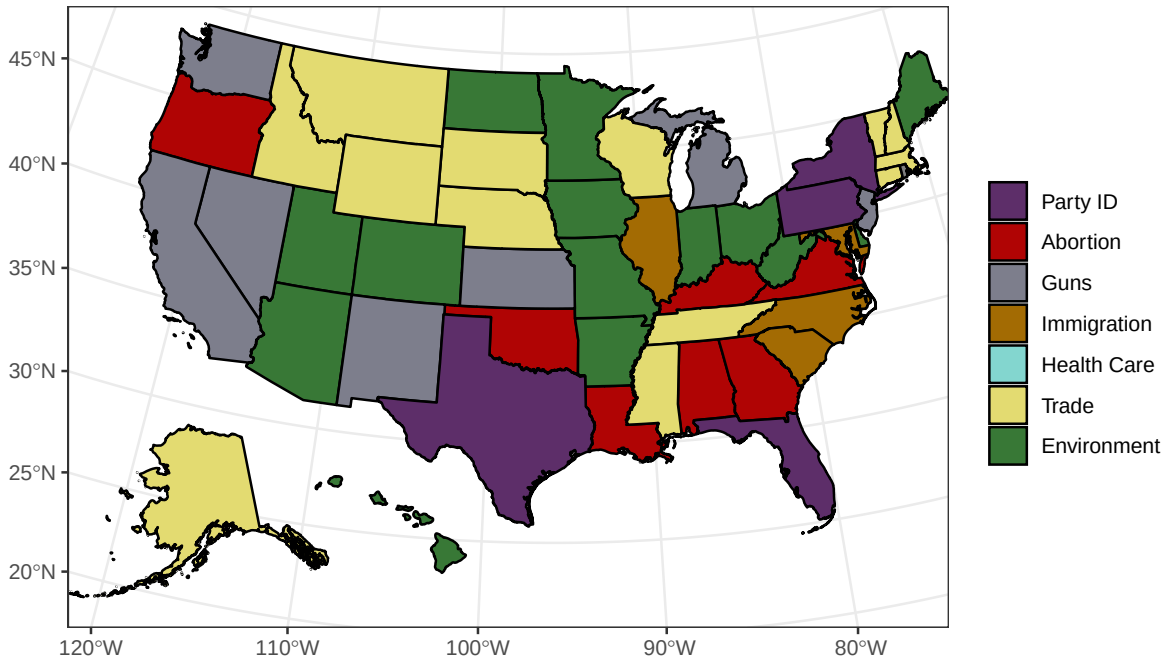

Figure 26: Most Polarizing Issue in Each State

For example, Figure 26 shows that high polarization over abortion is most common in Southern states, though the relationship between abortion polarization and polarization of the other topics in these states varies. For example, Figure 24 shows that abortion is marginally more polarizing than the other six topics in Alabama and Georgia, both of which are lowly-polarized in general. In contrast, abortion is by far the most polarizing topic in Virginia, itself a highly-polarized state.

Polarization over guns/gun control does not display any spatial patterns, as it is the most polarizing issue in states scattered across the country; however, it does appear to be the most polarizing issue in states that tend to be less polarized overall, such as California and New Mexico. This is surprising, given the conventional wisdom that rural areas are supportive of gun rights and have a pro-gun culture more broadly (and vice versa for urban areas).

As noted in Chapter 4, immigration is not the most polarizing topic in any border state (though Figure 24 does show it is Texas' second-most polarizing topic). Though it is only barely the most polarizing topic in North and South Carolina, both of which are relatively

non-polarized generally, immigration is much more polarizing than the other topics in both Illinois and Maryland. It is unclear what could explain this dynamic. Perhaps distance from the border could in fact increase polarization over immigration, similar to the individual-level contact hypothesis (Robinson Jr and Preston 1976), though this would not explain why other states far from the border are not similarly polarized over the issue.

Health care is not the most polarizing issue in any state. This may reflect the declining salience of the issue in 2018 or perhaps this is an example of an issue in which opinion polarization (and the accompanying heated rhetoric) was concentrated among politicians rather than the public.

Trade shows strong regional patterns of polarization, as it is the most polarizing issue in several Plains/Mountain states and New England states. In several cases, it far outpaces the polarization of other topics within the state (e.g. Idaho, South Dakota Vermont).

Like trade, environmental polarization seems to cluster, this time in the Midwest and Southwest. This may be due to the widespread state and federal parks systems in these states, which would affect rural and urban areas very differently and therefore lead to diverging opinion. Interestingly, in states where the environment is the most polarizing issue, polarization over trade tends to be the second-most polarizing issue, and vice versa (e.g. Iowa, North Dakota, Arkansas, Missouri). This supports the idea that environmental polarization is somehow connected to how rural and urban residents interact with land use — and the entities that enforce it — differently.

We can also understand the nature of polarization variation by examining the topics that are least polarizing in each state, provided in Figure 27. Contrary to the theory that issue polarization is downstream of partisan polarization, party ID is the least polarizing topic in the greatest number of states (fourteen). These states tend to be clustered in the center of the country, though there are also a few on the East Coast. Twelve states are least polarized by health care, again highlighting its lack of polarization overall. These states are pretty evenly distributed across the country, suggesting that there is not a regional interaction between one's rurality and health care opinion. This finding holds for the other topics as well, each of which has least-polarized states strewn across the map, with only minor clustering. Immi-

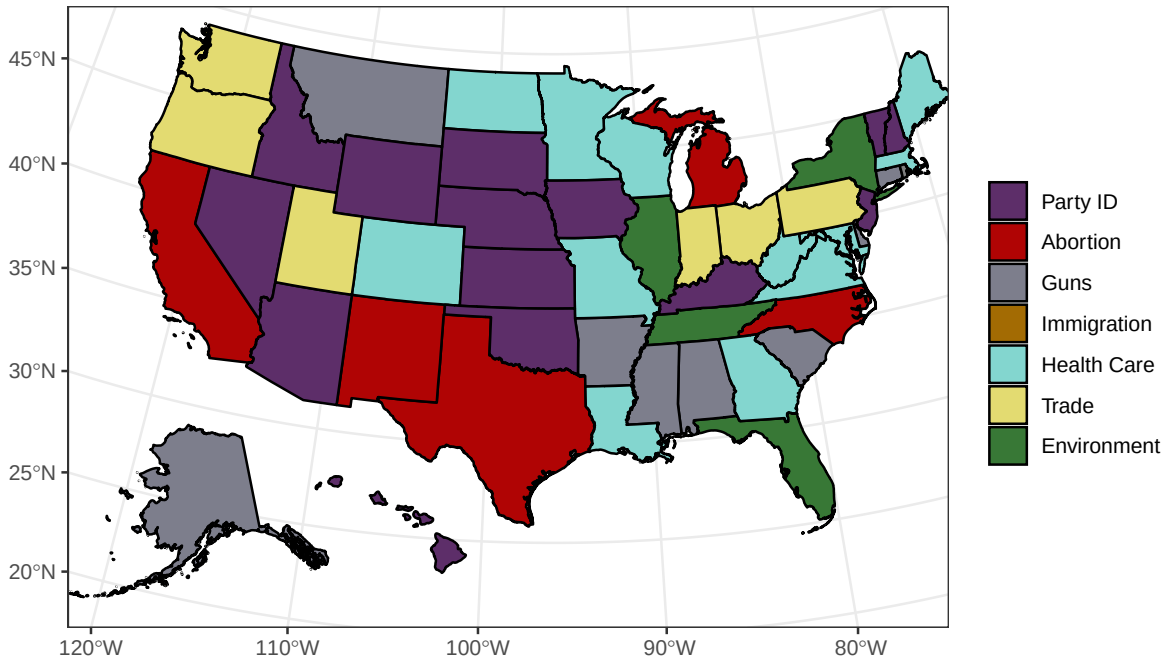

Figure 27: Least Polarizing Issue in Each State

gration is the only topic that is not the least polarizing in any state, suggesting that it divides each state at least to some extent. This may be related to the salience of the issue in 2018, as it was a central policy priority of the early Trump administration. The importance of issue salience will arise again in the next chapter, when looking at polarization over time.

Finally, we can combine the issue polarization scores to create a total polarization value for each state, illustrated in Figure 28. I have normalized these values between zero (the least polarized state, Massachusetts) and one (the most polarized state, Nebraska) to aid interpretation. As seen in the individual issue maps in Chapter 4, Southern states tend to be relatively lowly-polarized, with the exception of Virginia. California also has a low total polarization score, largely attributable to its extremely large metropolitan population. Overall, the Midwest seems more polarized than average, with Minnesota, Illinois, and Missouri all falling within the top ten.

These regional descriptions are quite general and do not apply to every state in every region. In fact, weak regional relationships should not be entirely surprising. The original mo-

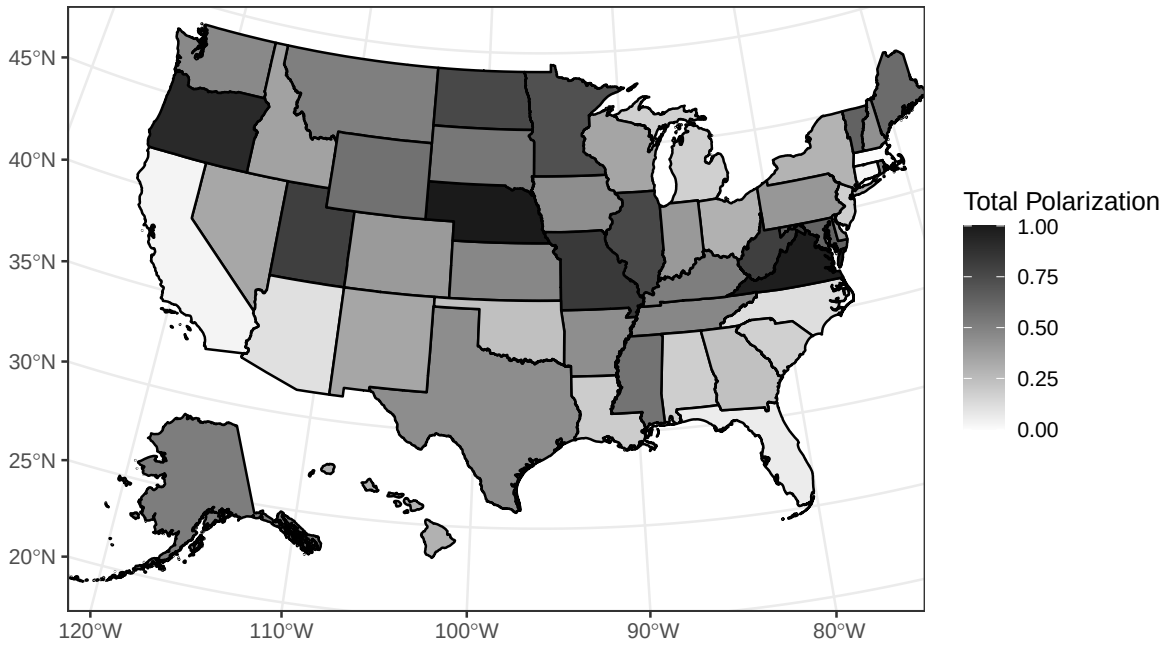

Figure 28: Total Polarization of Each State

tivation for this project was the idea that different places are different, so we ought not treat the country as one homogenous mass. So too with regions. The internal political dynamics of Virginia are likely much different than those in North Carolina, given their differences in history, population, geography, and underlying values. Perhaps we tend to overlook these differences when examining politics at a national level, such that neighboring states all look the same.

Chapter 6: Change Over Time

Due to its flexibility, the polarization estimation procedure can be applied to other waves of the Cooperative Election Study in order to examine how geographic polarization has changed over time. The cumulative version of the CES policy question dataset extends back to 2006, but the consistency of topics and questions increases markedly after 2014, so my analysis runs from 2014 through 2021.[12] Despite this data limitation, this is still a valuable time period to examine, given the dramatic political changes. These eight years span three presidential administrations, during which concern and interest in geographic polarization (and political polarization generally) grew in the popular press and the academic literature. To some, Donald Trump's 2016 presidential campaign inflamed geographic tensions, while others saw it as speaking to previously ignored, abandoned places. Likewise, Joe Biden promised to heal a divided America. Given these events, this time period is suitable for an analysis of the variation of polarization, across states and issues.[13]

I have tried to include as many topics as possible that consistently appear year after year. For example, I did not include questions regarding support for gay marriage, because the questions were only asked in the 2014-2016 waves. Abortion, guns, immigration, health care, the environment, and party ID all appear in all eight waves, though the number and wording of questions varies. Trade is asked about in the 2018-2021 waves and questions regarding military interventionism are asked in the 2014-2016 and 2020 waves.

I use this data to create a separate model for each topic in each year, using the same polarization estimation method employed in Chapters 3 and 4. I again combine the support/oppose binary survey responses to create an ordinal index for each topic (except party ID which is already an ordinal Likert scale) and then use MRP to estimate opinion within each state-location. To estimate state-level polarization, I calculate the variance of these opinions, weighted by the state-locations' share of the state population in the given year. The following eight sections walk through these results for each issue, first examining the state-location

[12] As of this writing, data from the 2022 wave of the CES has not been merged into the cumulative file.

[13] The estimation procedure used here could also be used indefinitely, on future waves of the CES, given similar questions on similar issues.

opinion estimates and then the state polarization estimates. I then compare the issues to one another by plotting the change in polarization for every issue simultaneously and finding the most/least polarizing topics in each state in each year. I conclude the chapter by examining the change in total polarization for each state over time.

Party ID

As before, partisan identification acts as a natural baseline that can later be compared to the other topics. The standardized state-location-year opinion estimates are plotted in Figure 29, with higher opinions representing more Republican identification and larger points representing a larger share of the state's population.[14] We see some familiar patterns, such as the most urban areas reflecting the most Democratic attitudes (i.e. Illinois and Texas) and conventionally right-wing states more Republican than conventionally left-wing states (i.e. Utah vs. Vermont). Most states appear relatively consistent over time, with only minor fluctuations over these eight years. A few states appear to trend in a more Republican or Democratic direction, such as South Dakota or Nebraska, but in general, the partisan position of most states (and most locations within the states) has remained constant.

I next plot the geographic polarization within each state in each year, using the same population weighted variance technique described in previous chapters. Figure 30 shows that polarization over partisan identification has remained constant or even declined since 2014. States like California, Massachusetts, and North Carolina have remained non-polarized throughout this period, whereas others, like Nebraska and Utah, have declined. Several states were most geographically polarized in 2016 (i.e. Hawaii, New Mexico, North Dakota), perhaps due to the contentious presidential election. If the election primed partisan identification, it is possible that rural and urban residents were more likely to identify as "strong"

[14]Because the opinion estimates are standardized within each year in order to account for the changing number of policy questions, a state-location's position on these opinion plots is dependent on the positions of all other state-locations in that year. For example, if everyone suddenly becomes more liberal from one year to the next (by the same amount), everyone's position on the plot will remain the same relative to the previous year. If, however, everyone retains the original opinion position and only one state-location becomes more liberal, they will appear to move downward on the graph, because their position relative to everyone else in that year changed.

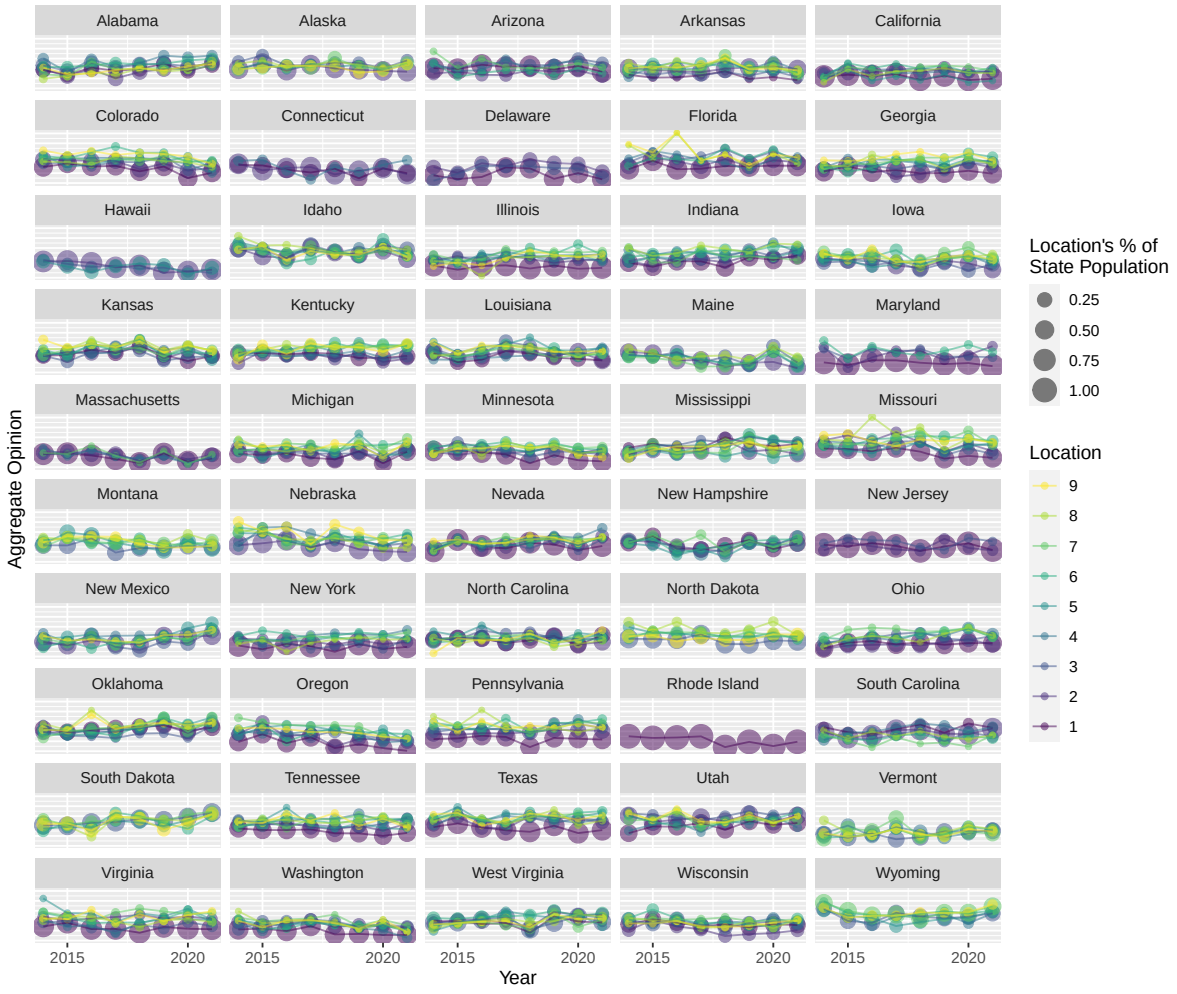

Figure 29: Change in Party ID Over Time

partisans rather than mere “leaners”, increasing the distance between them.

Abortion

The first substantive policy issue is abortion, with the opinion estimates provided in Figure 31. Like Party ID, the opinions are dramatically consistent within states over time. Very few states fluctuate or trend toward in one direction or the other (with the possible exception of South Dakota). There also appear to be fewer differences across states. For example, Idaho is often much more conservative than Hawaii and Illinois, but appears roughly in line with

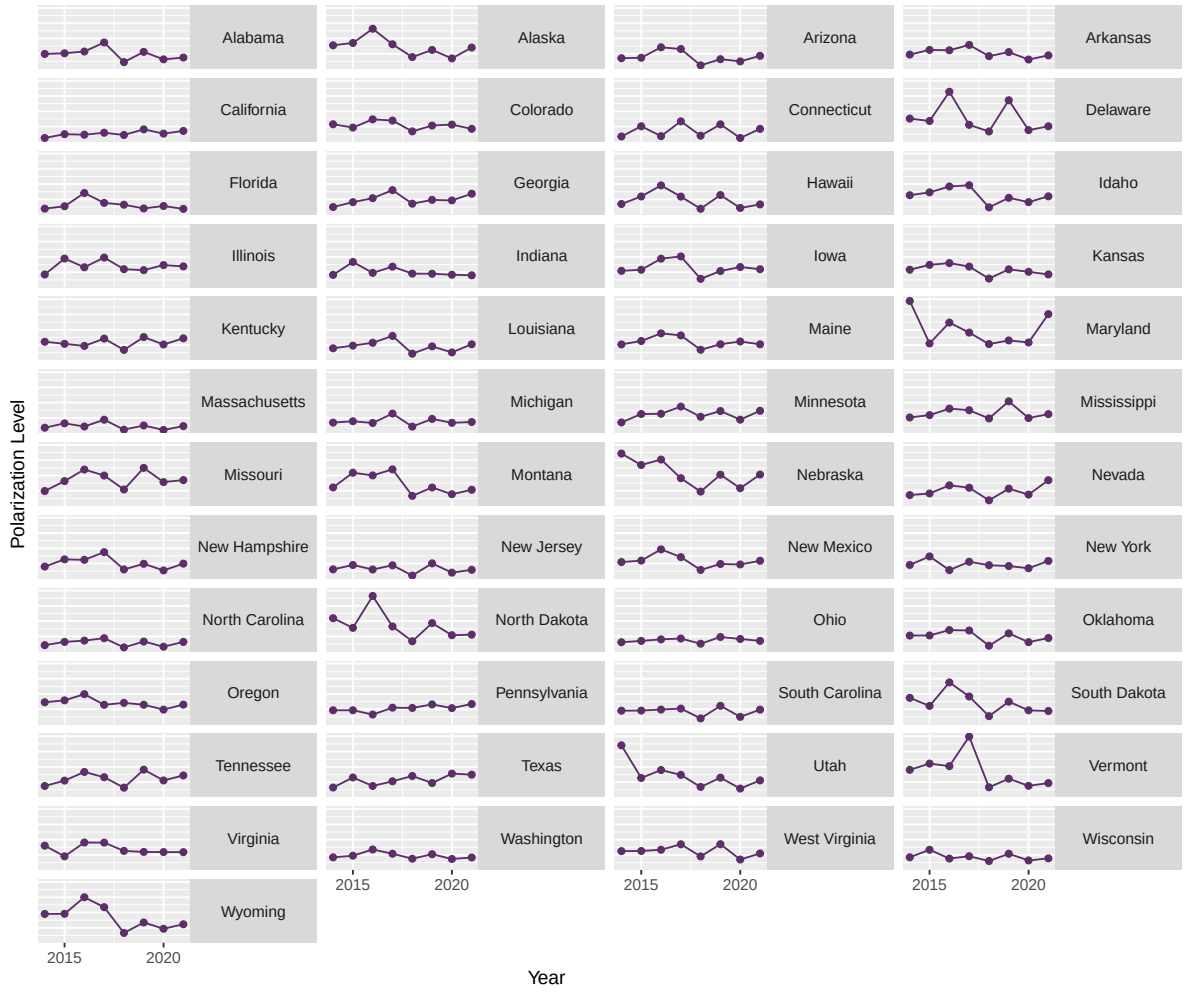

Figure 30: Change in Party ID Polarization Over Time

them on the topic of abortion.

The abortion polarization estimates appear in Figure 32. These estimates suggest that the most polarized states are those with the smallest, most evenly distributed populations, such as Wyoming, Alaska, and the Dakotas. Like party ID, these states have become markedly less geographically polarized over time. Many of the largest states, like California, Florida, and New York have remained non-polarized during this period. Unlike party ID, there is no consistent spike in polarization in 2016; in fact, in nearly all states with varying polarization, it *decreases* in 2016. This cuts against the theory that issue polarization is downstream from partisan polarization. If partisan identity drives individual's issue positions and is primed

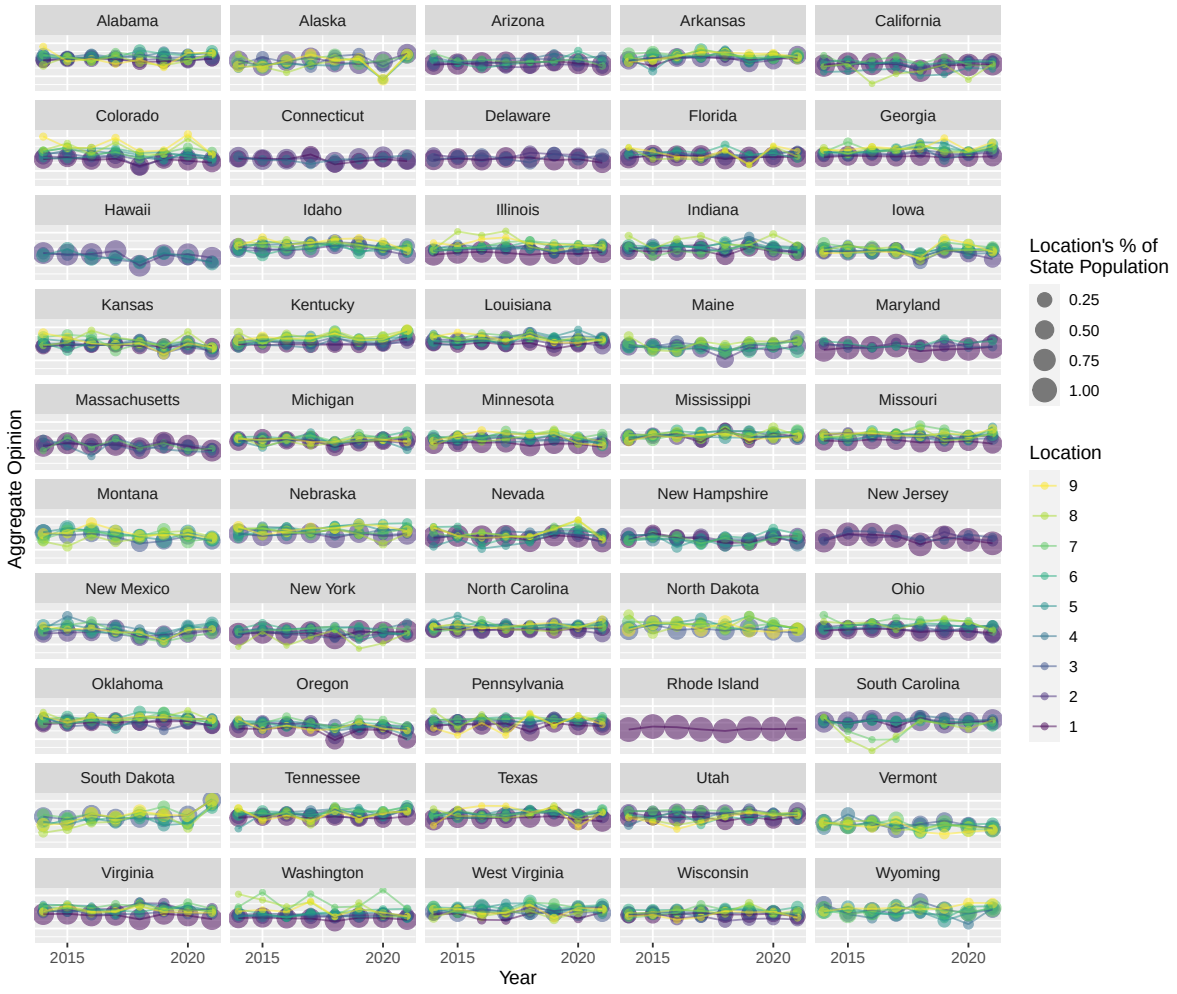

Figure 31: Change in Abortion Opinion Over Time

during an election year, as argued by Achen and Bartels (2017) for example, we would expect polarization over abortion to increase in 2016. The connection between partisanship and issue positions may be weaker than traditionally assumed, or abortion may have been a less salient issue during the 2016 campaign.

Guns

The opinion estimates for the gun rights/gun control policy questions are displayed in Figure 33. Compared to party ID and abortion, this topic appears to contain more variation

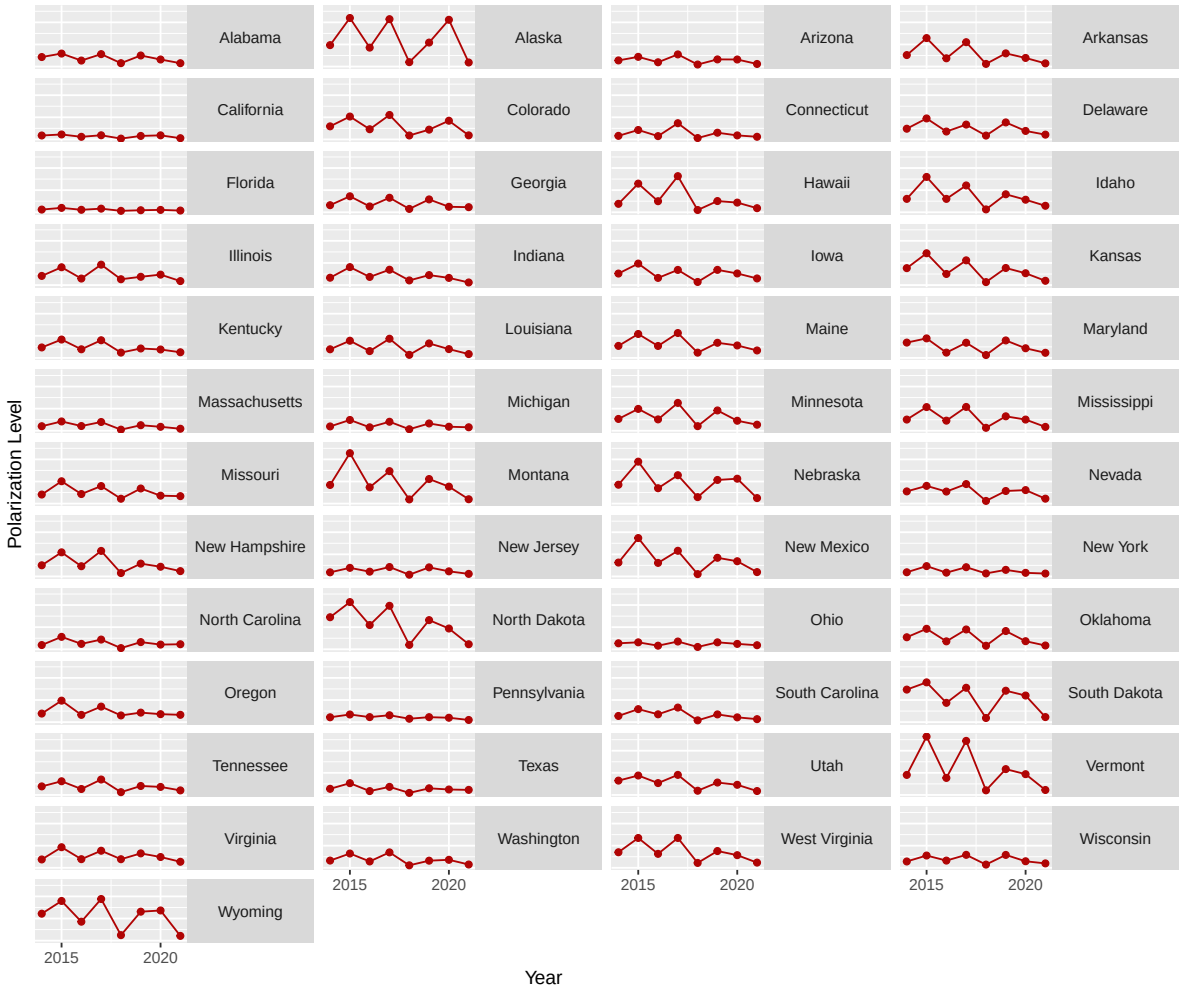

Figure 32: Change in Abortion Polarization Over Time

both within and between states. Some states' opinions fluctuate (i.e. New Hampshire), some states become more conservative (i.e. South Dakota), and some states become more liberal (i.e. Iowa). There are also clearer distinctions between traditionally left-wing and right-wing states, such as Washington and West Virginia. The subsequent polarization results will confirm, but there also appears to be greater variation among the locations within states; for example, the relationship between greater urbanity and liberal opinion is clear in states such as Nevada and Missouri.

Figure 34 shows that geographic polarization over gun policy has tended to decrease over time. Most states that experienced any polarization hit their peak in 2015. By 2020,

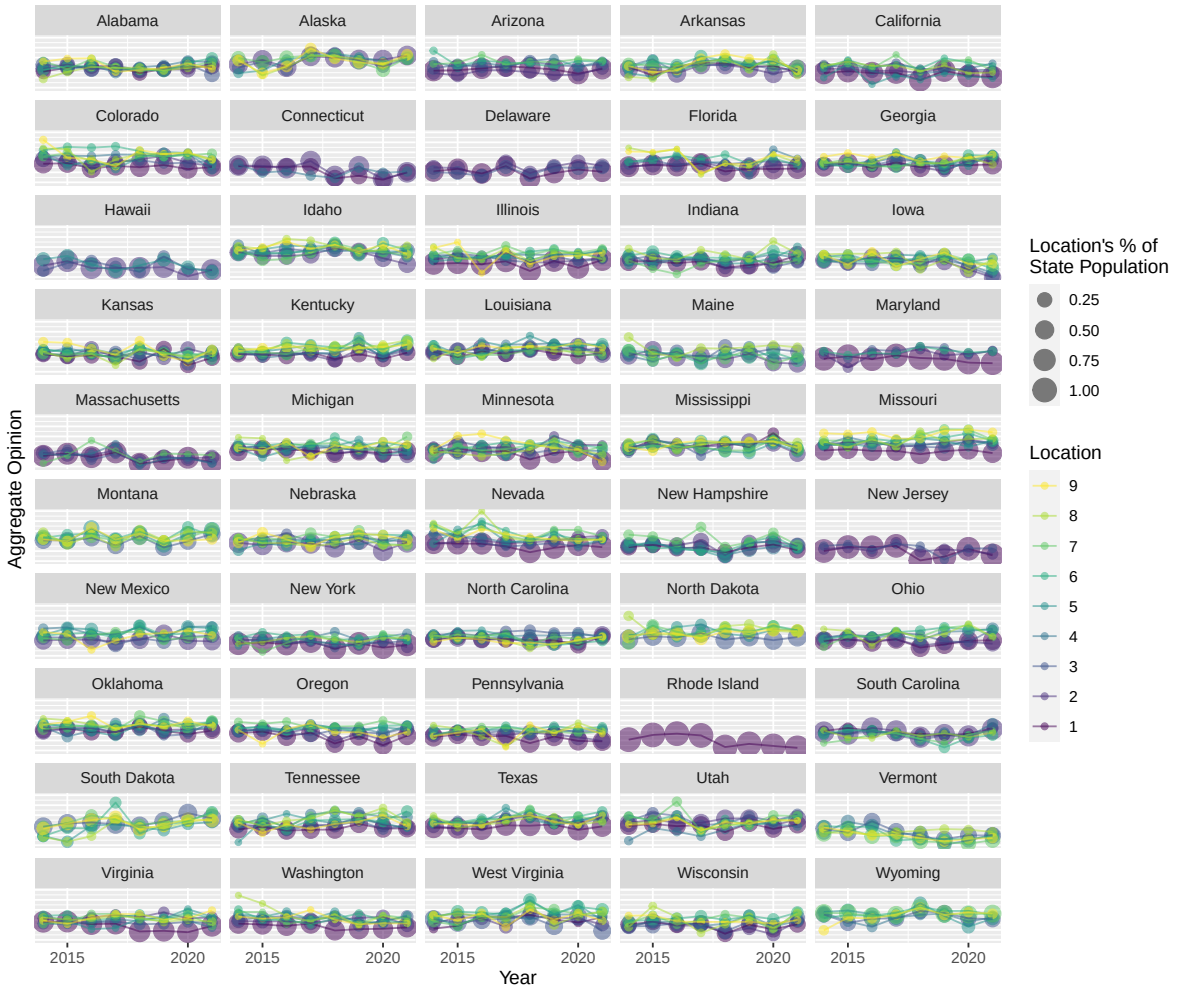

Figure 33: Change in Gun Control Opinion Over Time

their polarization values were on par with those that remained non-polarized since 2014, such as California and Massachusetts. This uniform trend in polarization is surprising given the variation in opinion patterns. While some states became more conservative and others became more liberal, nearly all became less polarized (or stayed non-polarized). This suggests that, while states may be diverging from one another, the locations within those states are becoming more similar. This underscores the problem of describing geographic polarization exclusively at the national level. Like a Simpson's paradox, there may be a large rural-urban political divide when aggregating opinion nationally, but this divide shrinks when examining states individually (Wagner 1982).

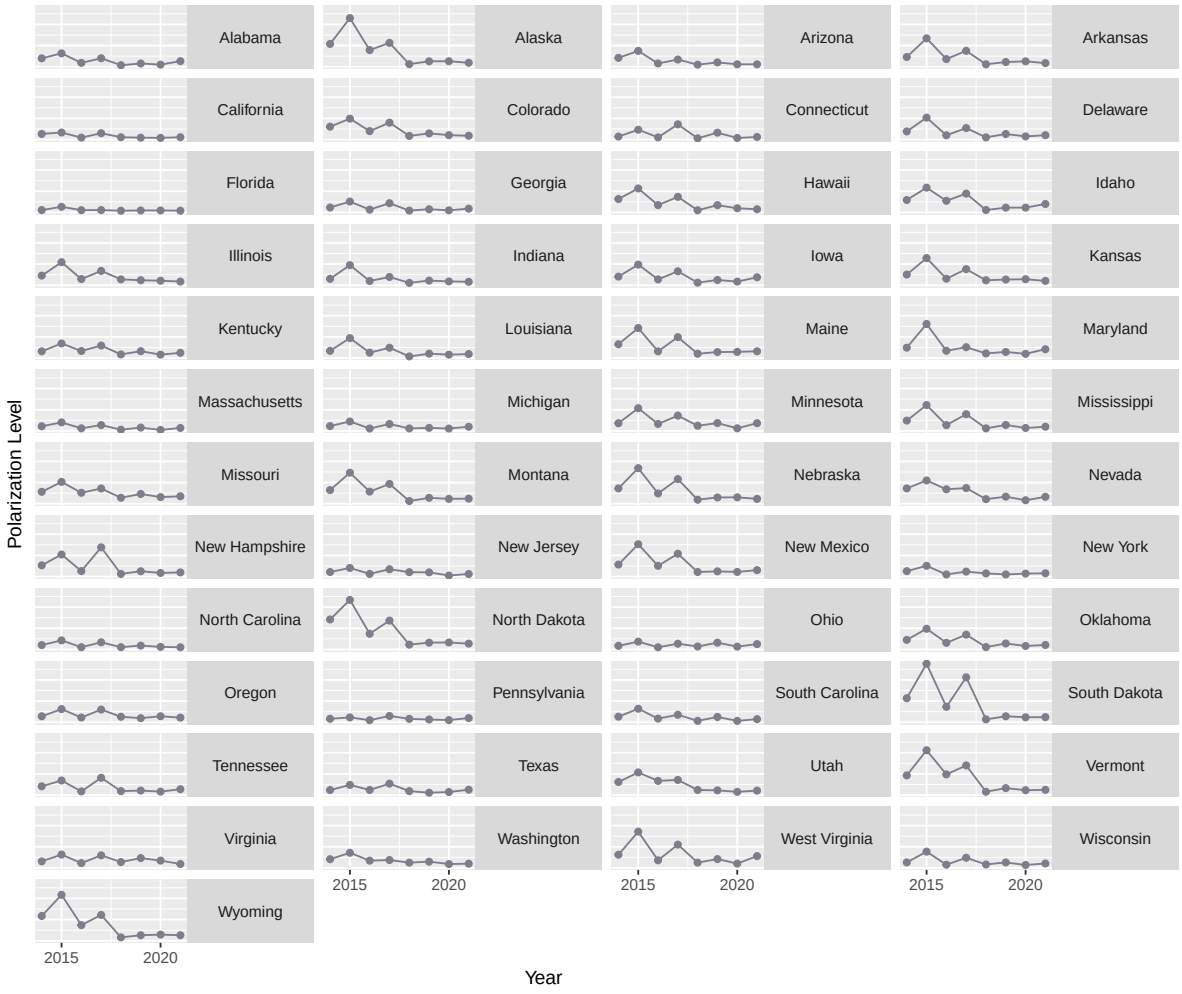

Figure 34: Change in Gun Control Polarization Over Time

Immigration

Figure 35 provides the opinion estimates for immigration. These opinions reflect less change than those concerning gun control, but more than those regarding party ID and abortion. Most states and locations are constant over these eight years (i.e. Mississippi, Alabama), but some display substantial change. For example, rural Colorado has adopted more right-wing immigration positions since 2019, the most urban areas of Wyoming have become more right-wing since 2015, and all locations in Montana became more left-wing in 2018/2019 and then rebounded. In addition, despite being a key pillar of Donald Trump's 2016 presidential cam-

paign, immigration attitudes did not meaningfully change in 2016 or the succeeding years of his administration. West Virginia became more conservative while Delaware and Indiana became more liberal, but changes were otherwise marginal. This suggests that issue salience alone does not drive changes in opinion. Immigration may be such a core issue that most Americans already have a firm position before a candidate like Trump arrives and increases its salience.

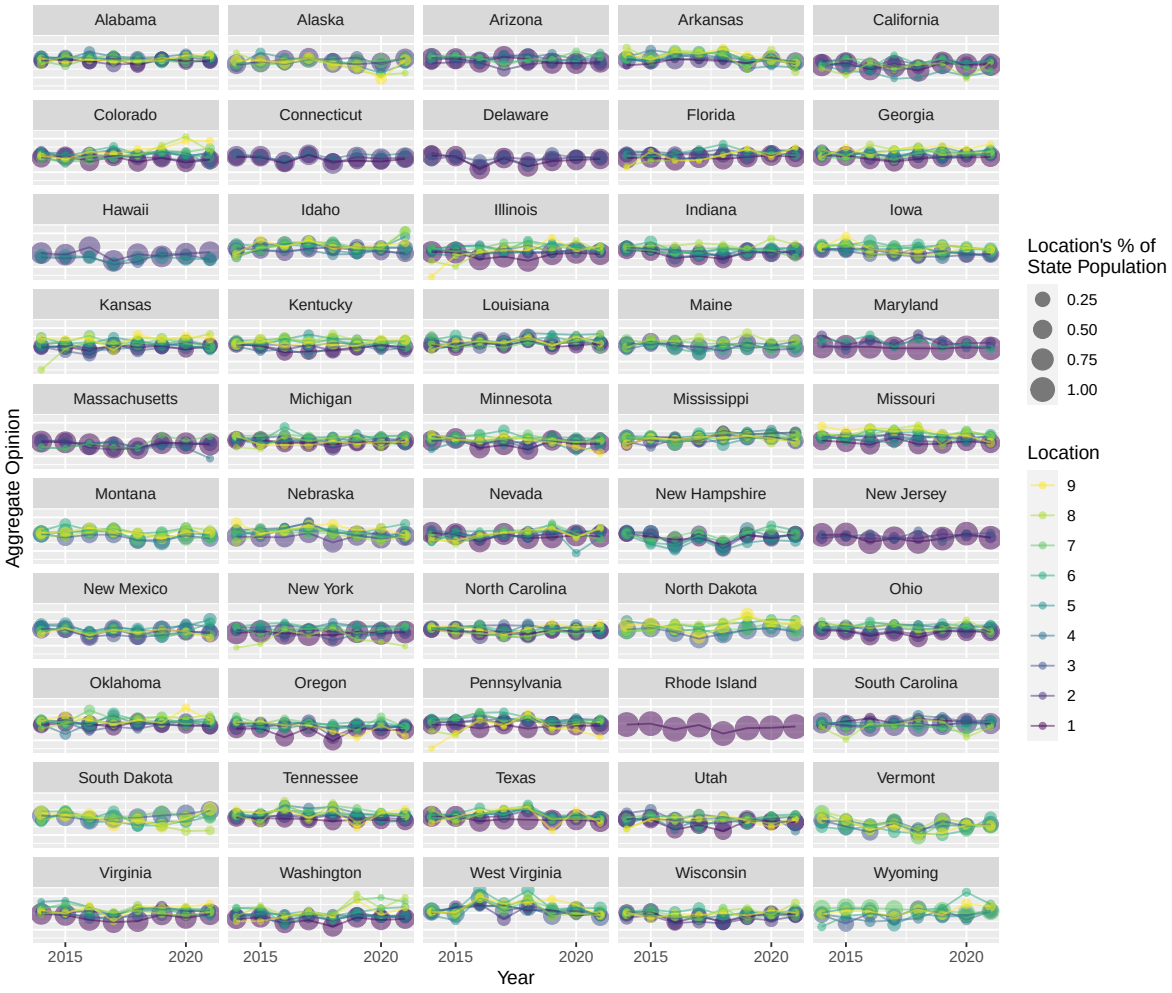

Figure 35: Change in Immigration Opinion Over Time

The immigration polarization estimates, displayed in Figure 36, display different trends than those of the previous issues. While a few states again had high polarization values in 2015 (i.e. Montana and Wyoming), several others saw peaks in 2019 (i.e. Alaska, South

Dakota, Vermont). The least polarized states are again generally non-polarized throughout the entire period, but a few do see slight increases, such as Maine and Lousiana in 2019.

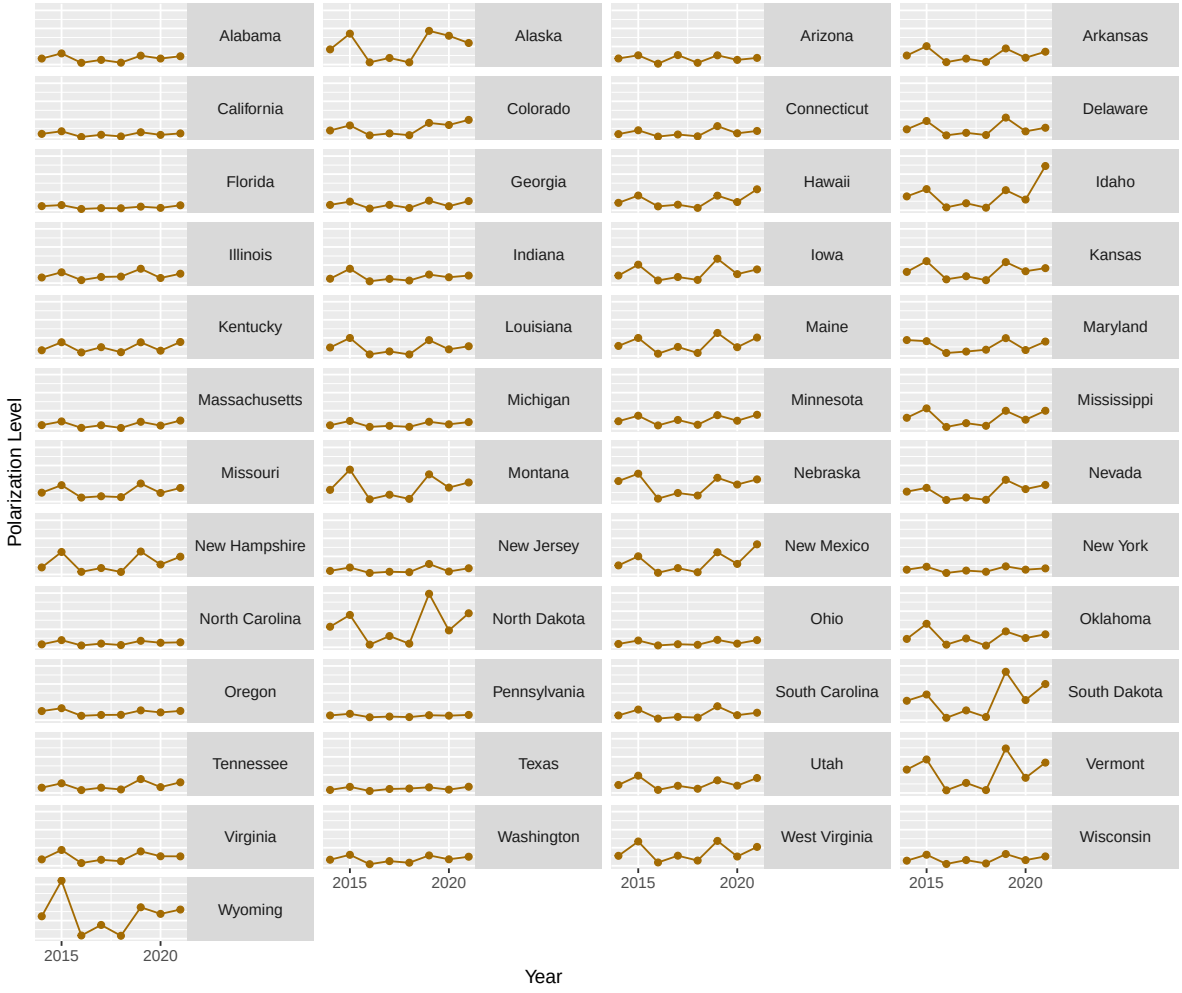

Figure 36: Change in Immigration Polarization Over Time

Health Care

The health care opinion estimates in Figure 37 show greater variation among locations within individual states than previous issues. For example, there is a clear divergence in Wyoming in 2020, as the more urban parts of the state became relatively more liberal. There is also a fair amount of change over time within states overall; for example, Massachusetts becomes

more liberal, particularly from 2014 to 2017, and South Dakota becomes more conservative, especially after 2018.

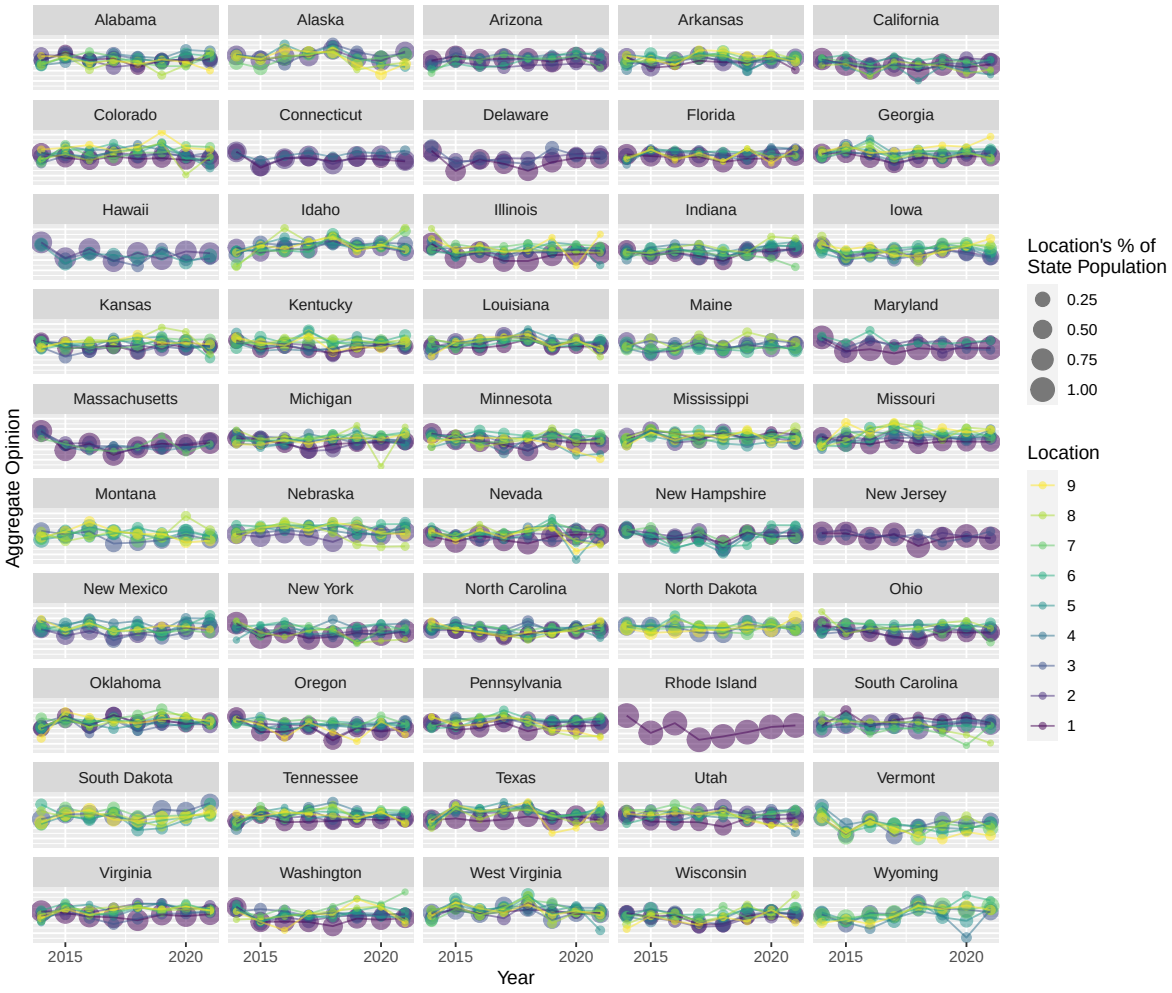

Figure 37: Change in Health Care Opinion Over Time

The polarization trends in Figure 38 are completely different from the previous issues. There is relatively little geographic polarization in *any* state from 2014 to 2017, which is confirmed by revisiting Figure 37. While some states experienced slight changes in health care opinions during these first four years, their constituent locations tended to move together. For example, all areas in Vermont became more liberal from 2014 through 2017, but grew apart thereafter. In the states were health care became geographically polarized, the polarization arose in 2019 and remained at roughly the same level through 2021. Health care

also appears to have polarized several states that were much less polarized over previous issues, such as Hawaii, Iowa, and Delaware. The timing of these polarization spikes are surprising, given the effort to repeal the Affordable Care Act (ACA) failed in 2017 and the issue faded from the national spotlight. It is possible that these results partially reflect a change in the underlying data; beginning in 2018, the CES began asking if survey respondents support/oppose a policy to "provide Medicare for all Americans." It is possible that this specific proposal is driving the spikes in polarization around the time of its introduction, while support for the ACA is as non-polarizing as before. However, the question was introduced in the 2018 survey wave and nearly all of the polarization spikes do not appear until 2019, so there is likely an additional cause.

Trade

As mentioned previously, the cumulative CES data set only contains trade questions after 2018, so I only provide opinion estimates for the last four years. Due to this change, it is difficult to informally compare trade to the other issues, but Figure 39 does seem to indicate that trade opinions are more varied within individual states. For example, rural Georgia is consistently more protectionist than the more urban parts of the state. Most within-state changes occur when smaller, rural areas shift their opinions, whereas the urban areas tend to be more consistent. For example, urban Virginia remains fairly supportive of free trade over these four years, while rural Virginia moves from protectionism to free trade.

The trade polarization estimates in Figure 40 are reminiscent of the health care results. In the most polarized states, polarization increased markedly in 2020. While Donald Trump raised the salience of trade policy, these results likely not an effect of his campaign, as trade was much less of an issue in 2020 than in 2016 and the increases in polarization tended to continue in 2021. Like previous policy issues, Figure 40 shows that polarization remained flat in large, urban states like Florida and New York. However, trade seems to have polarized several states that were less polarized over previous issues, such as Mississippi and Oklahoma. Later in this chapter, I directly compare the issues to one another to better understand which issues are most polarizing in each state over time.

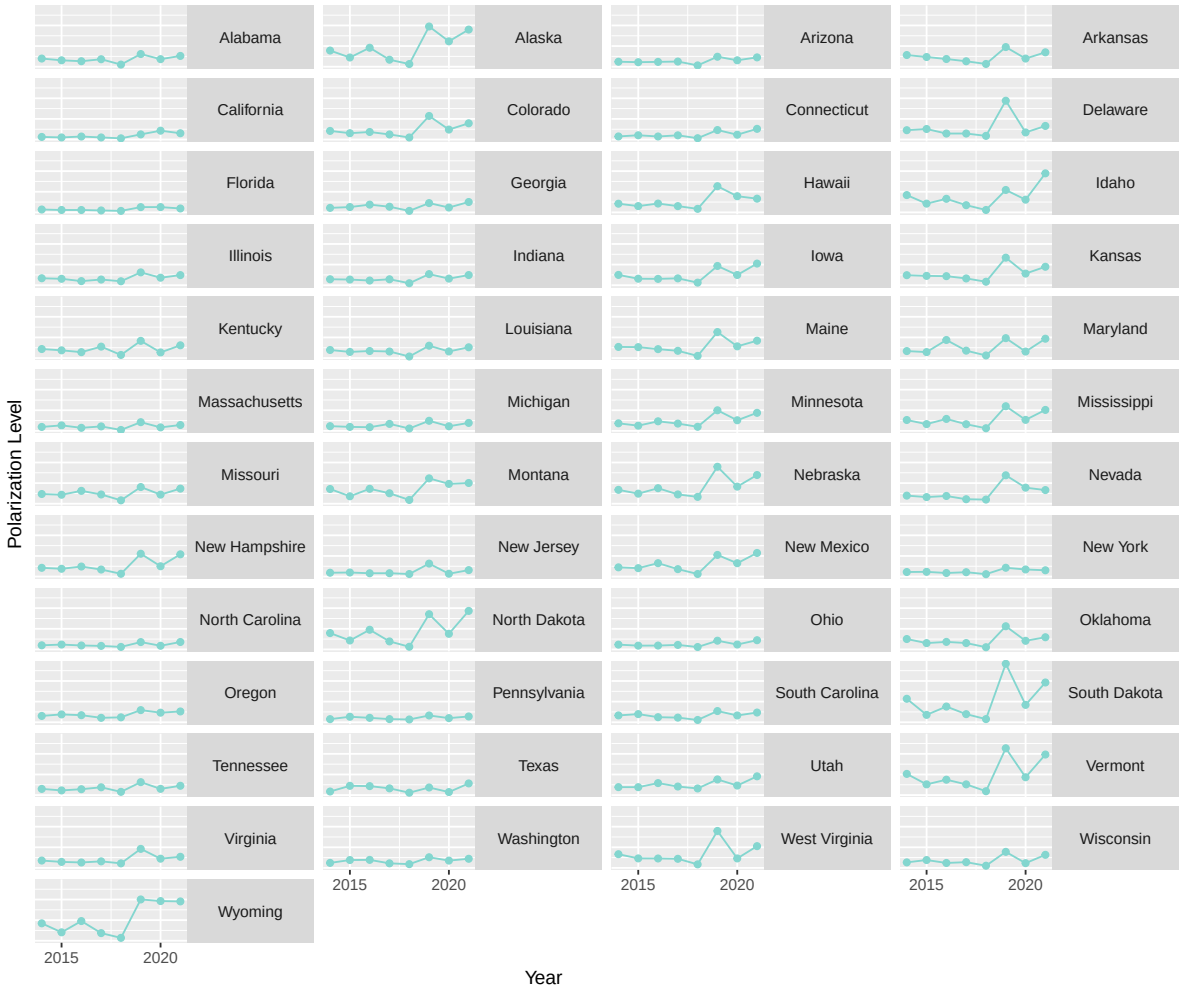

Figure 38: Change in Health Care Polarization Over Time

Environment

Environmental policy opinion estimates are displayed in Figure ??. This plot shows a fair amount of variation within states. For example, rural Oregon is consistently more conservative than urban Oregon, even as the state as a whole becomes more liberal. In contrast, North Dakota displays variation among the rural-urban areas, but inconsistently. The locations trend in different directions and switch positions, such that in 2019, the most rural area was actually the most liberal. Utah also does not display the conventional rural-urban opinion pattern; it is split across most of these years, with its two most urban areas the furthest

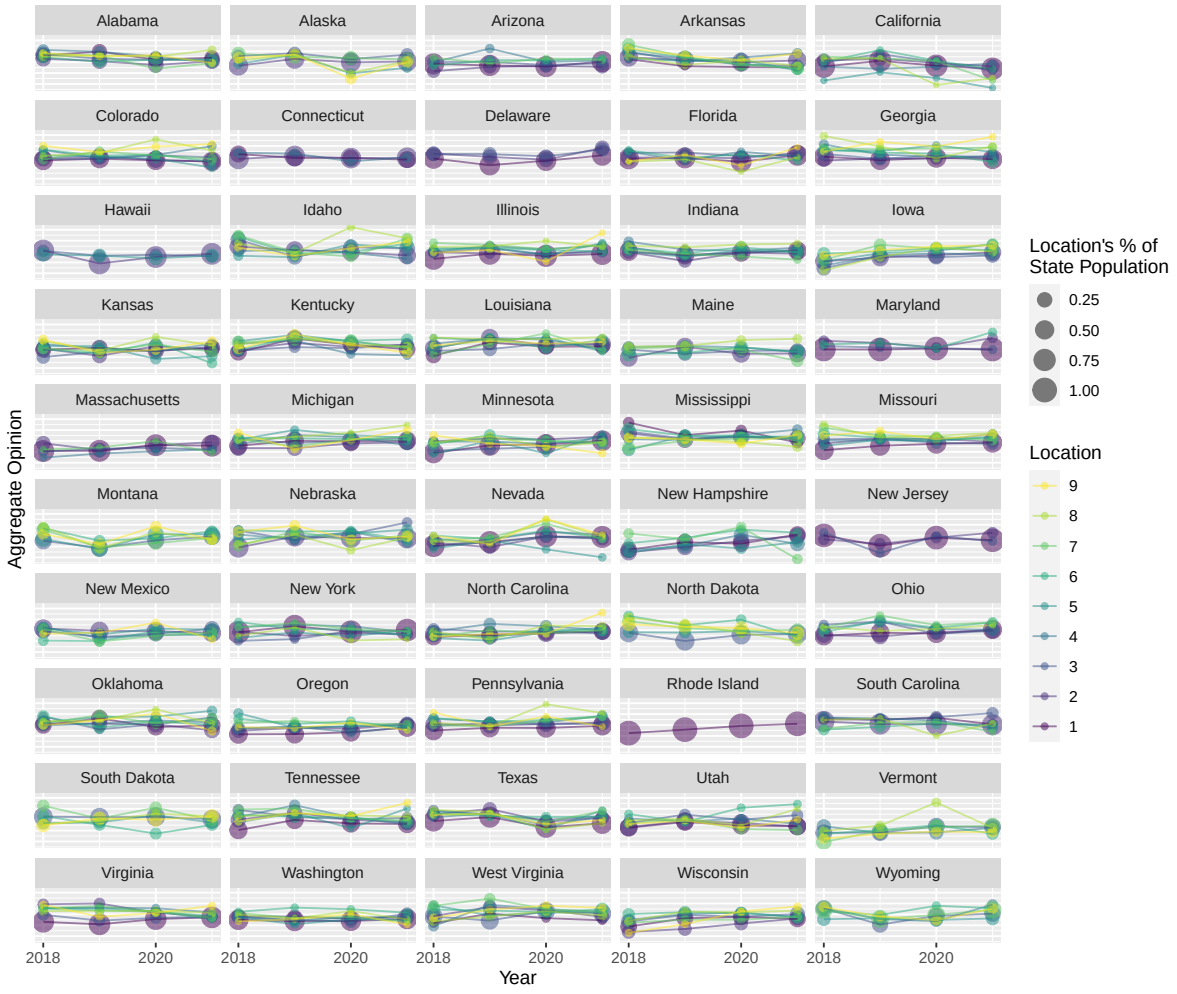

Figure 39: Change in Trade Opinion Over Time

apart on environmental issues and the rural areas in between. There is also some variation over time, such as Vermont's gradual liberal shift and South Dakota becoming markedly more conservative in 2021.

Environmental polarization estimates are displayed in Figure 42. Unlike previous issues, there is not a trend towards increasing or decreasing polarization over time. Instead, there is a single year of high polarization values: 2019. This spike applies to the perennially polarized states, such as Montana and the Dakotas, as well as states that have been less polarized over previous issues, such as Kansas and Kentucky. All other years are comparatively non-polarized, across nearly all states. It is possible this result is an artifact of data availability;

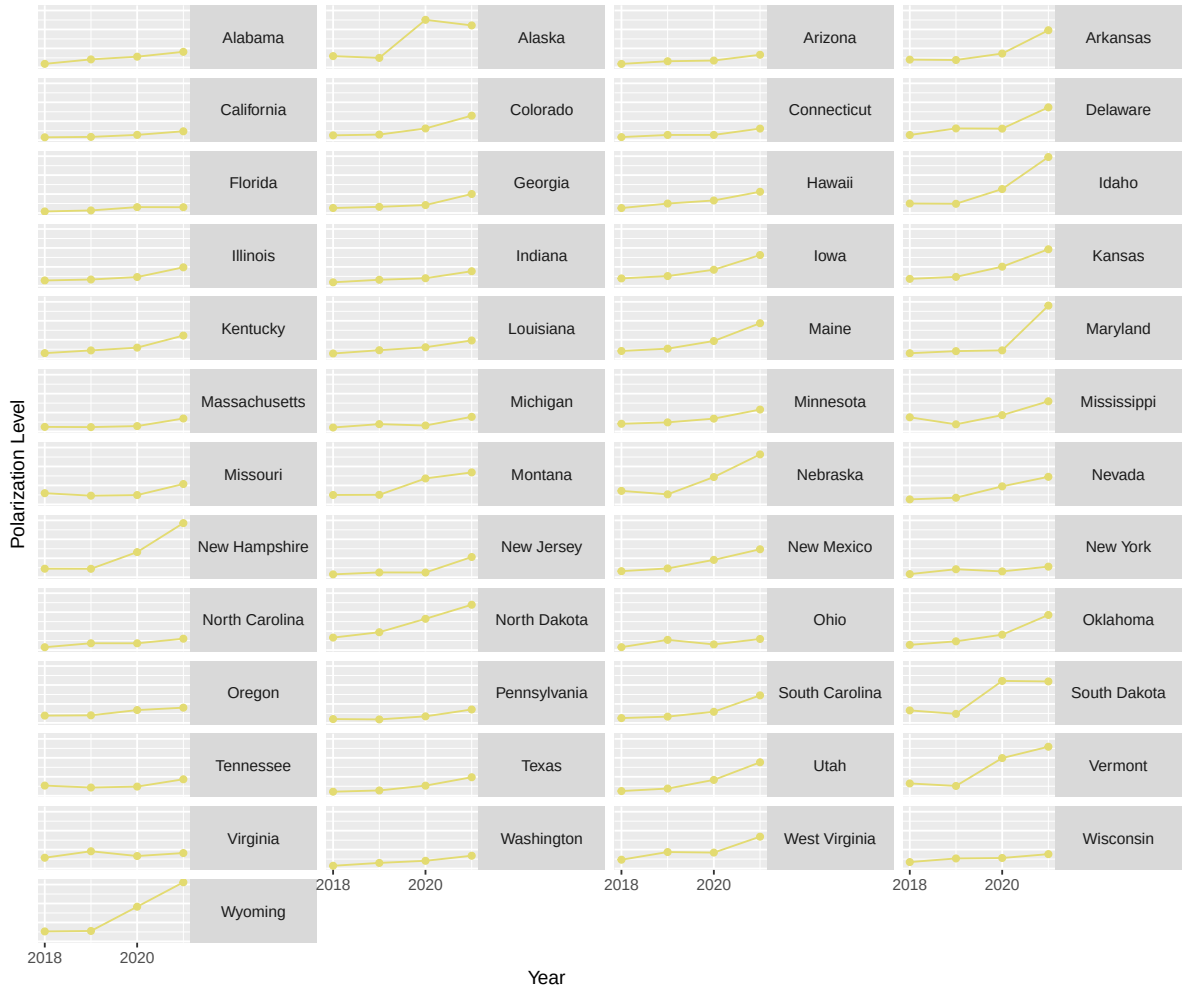

Figure 40: Change in Trade Polarization Over Time

while the CES environmental policy questions are generally consistent from year to year, one question is missing from the 2019 survey. Unlike every other wave, the 2019 survey did not ask respondents if they supported requiring higher automobile fuel efficiency. If this particular question did not cut across geographic lines, it would suppress geographic polarization when included in the index and increase polarization when excluded. Data availability likely only explains part of the 2019 spike, as this is only one of four questions comprising the environmental policy index and the spike does not apply to all states (i.e. Oregon, Washington, Ohio).

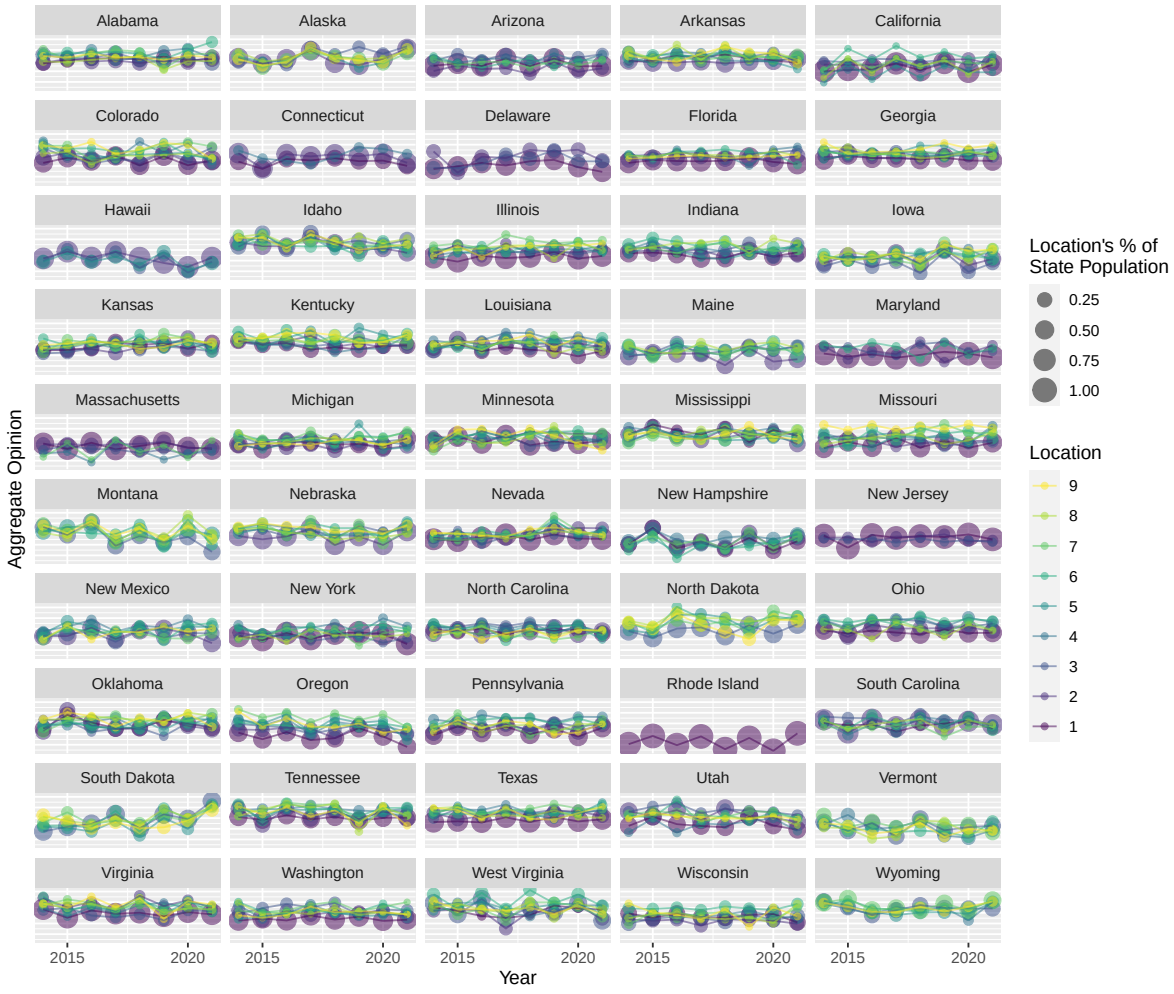

Figure 41: Change in Environment Opinion Over Time

Military

Like trade, military questions have not been consistently included in the CES. They were included in the 2014-2016 waves and the 2020 wave. Nearly all of these questions concern the use of military force for a particular objective, such as aiding allies or preventing genocide. I plot the opinion of each state-location in each year in Figure 43, in which higher values represent more hawkish positions. Compared to the previous seven topics, this topic displays the weakest conventional relationship between rurality and ideology. In several states, such as Texas and Arizona, the urban areas are more right-wing (hawkish) than the rural areas.

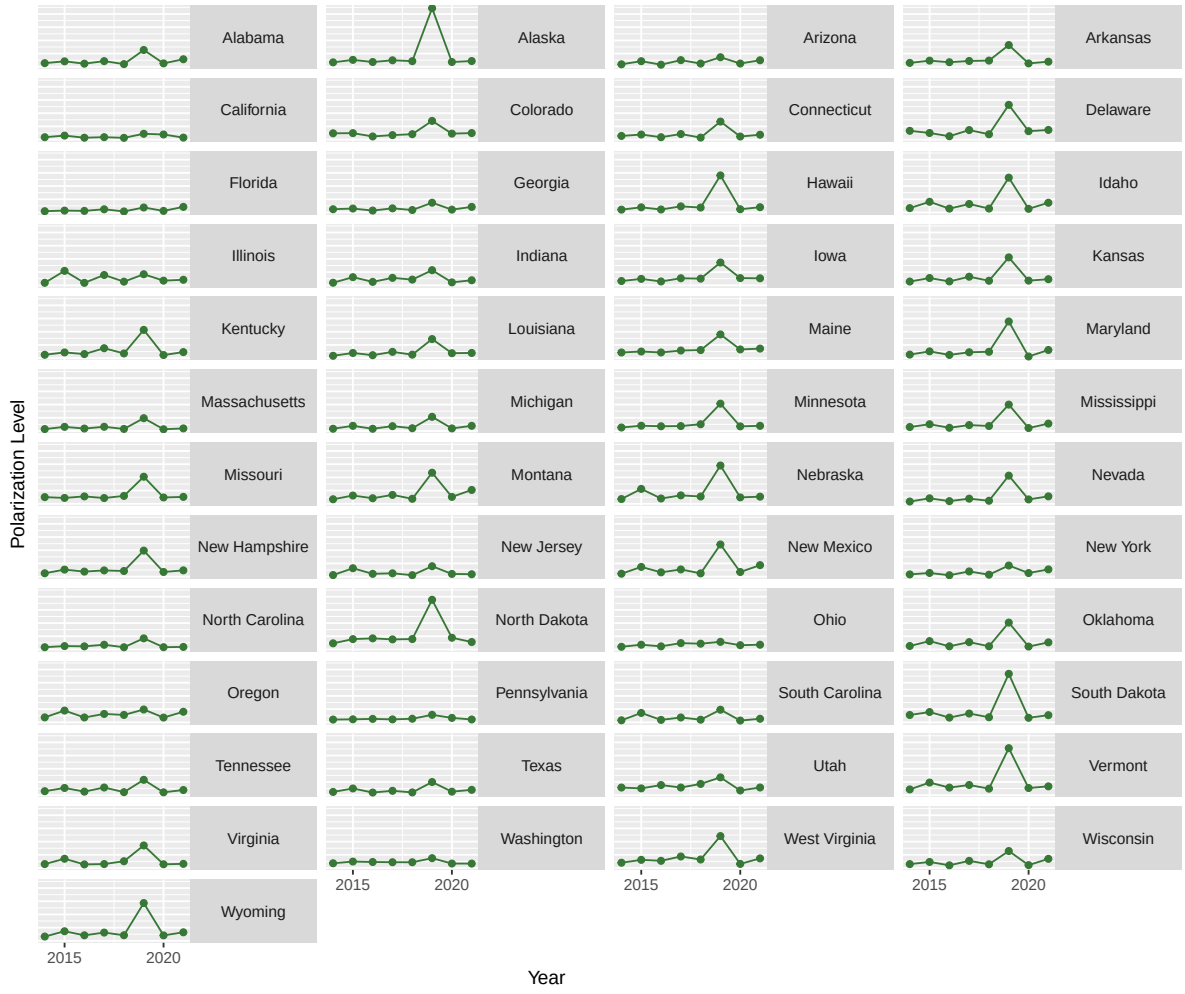

Figure 42: Change in Environment Polarization Over Time

The traditional left-wing/right-wing states are also muddled. For example, West Virginia appears as dovish as Washington and Rhode Island is more hawkish than South Carolina.

There are at least three possible explanations for these surprising opinion results. First, military affairs lacked much salience during this period, beyond the public's disinterest in foreign affairs generally (Almond 1950). Second, this issue lacked a clear partisan valence by 2014 and especially by 2020. Compared to a decade earlier, it was no longer clear that Republicans owned the hawkish foreign policy position. As an example, during the 2016 presidential campaign, NPR reported on Donald Trump's foreign policy approach, stating that "there's more overlap than you might think with President Obama" (Horsley 2016). Fi-

nally, the variety of questions included by the CES may not capture true "hawkishness," but rather preference for military intervention generally. For example, while one of the questions asks whether the respondent would support/oppose use of the military to destroy a terrorist camp, other questions ask about military use to spread democracy or help the United Nations uphold international law, neither of which cleanly fit into the traditional conception of "hawkishness". Considering the actual questions included in the index, it is less surprising to see urban areas and traditionally left-wing states more "hawkish" than traditional right-wing areas.

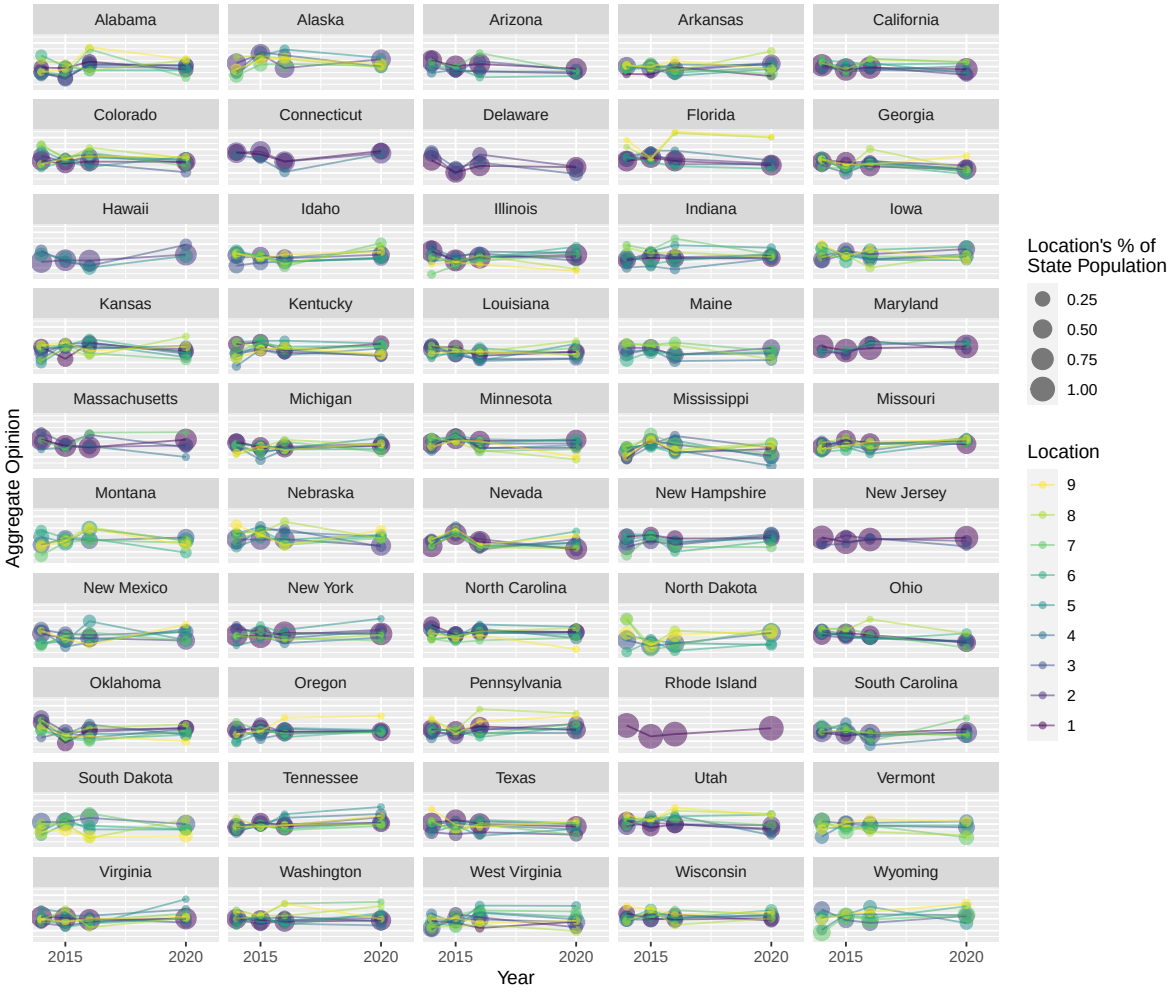

Figure 43: Change in Military Opinion Over Time

The polarization results in Figure 44 show that polarization over military issues increased

in a couple states in 2016, but has remained relatively flat in most states. However, the states with flat polarization levels are not necessarily non-polarized; several states have the same moderate polarization level across all four years (i.e. Idaho, Kansas, Iowa). This consistency is surprising given the relative volatility of opinions shown in Figure 43. Despite locations' changing opinion positions within each state, the variation within the state stays roughly constant. As discussed previously, this may reflect the diminished salience or partisan valence of military issues over this period. If rural and urban residents look to political elites for cues to ground their issue opinions, but those cues disappear, the opinions will become disordered and incoherent. But if the opinions are essentially randomly determined, the variation among them will remain constant.

Topic Comparison

I have examined each topic individually, but have not compared them to one another. Like the analyses in Chapter 5, I now wish to understand polarization from the perspective of each state, so I aggregate the polarization estimates for all eight topics within each state. Because the polarization estimates of the most polarized states dwarfs those of the least polarized — and I am most interested in examining each state individually, rather than comparing them to one another — I separate the states into three groups for the following visualizations: low, medium, and high polarization.[15]

Figure 45 plots the polarization of each topic for the states with the lowest levels of polarization (e.g. relative to the other 33 states, they are not very polarized). These tend to be large states, with a supermajority of their populations in metropolitan areas. Several states experience spikes in polarization during odd years, which may be due to the lower sample size (and thus noisier parameter estimates) or differing survey questions during non-election years. Despite the noise, there are several consistent patterns found across these sixteen states. Military questions are nearly always less polarizing than the other topics within a state. Party ID is less consistently non-polarizing, but still frequently at the bottom. The environment is roughly as polarizing as the military and party ID in all years except 2019,

[15] see Section A4 of the Appendix for a visual that includes all 49 states on the same scale.

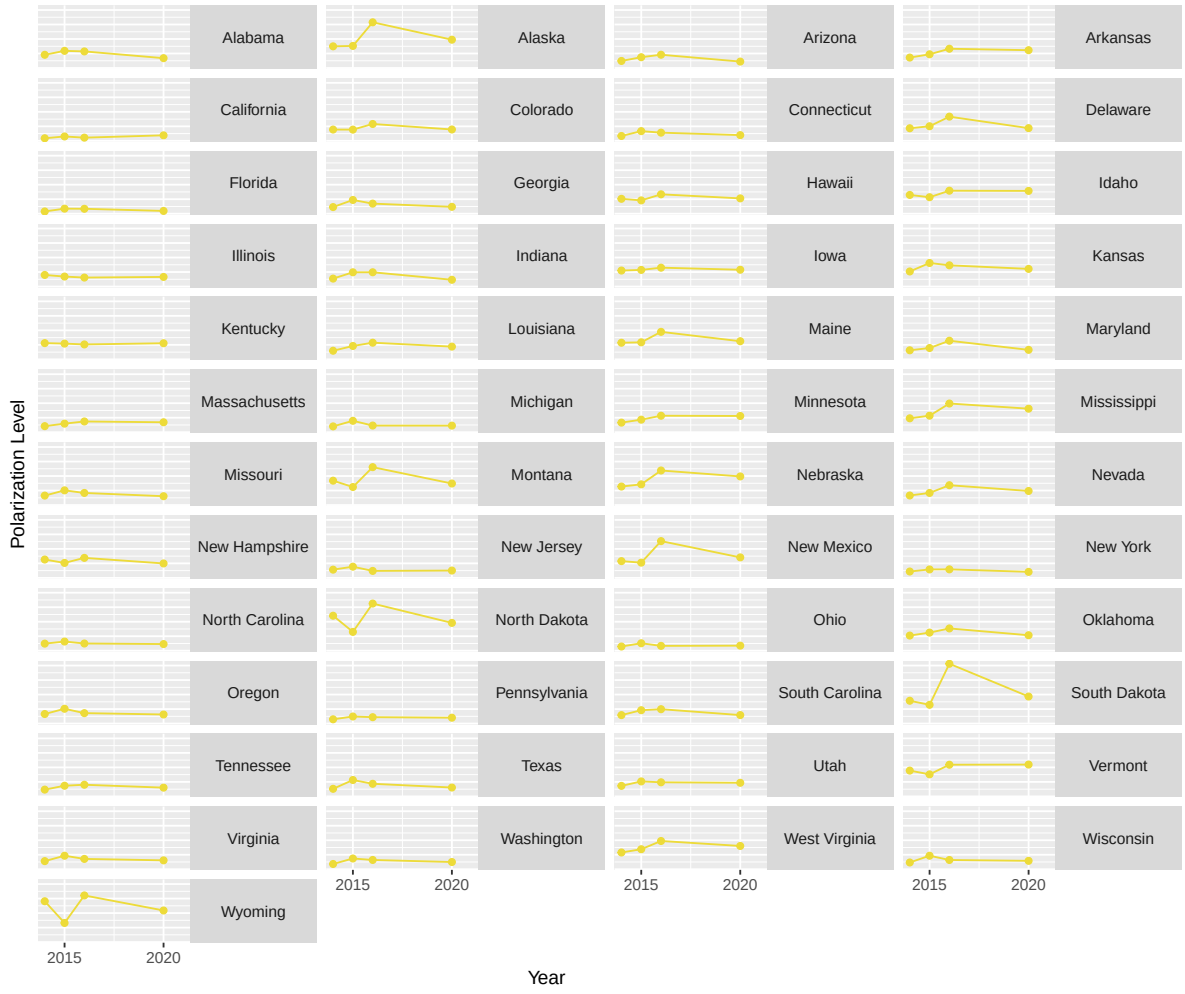

Figure 44: Change in Military Polarization Over Time

when it sees a spike as one of the most polarizing issues. Health care polarization has grown in recent years, particularly in the 2019 wave. Abortion polarization has trended downward, while trade polarization has trended upward over time.

The same patterns apply to the states that are moderately polarized, as shown in Figure 46. Military and party ID are low, health care and trade are rising, and abortion is falling. Immigration does not display a clear pattern over time. In most of these states (i.e. Arkansas, Iowa, Mississippi), immigration polarization spikes in 2015 and 2019, becoming one of the most polarizing topics in those years, while falling to one of the least polarizing during the intervening years.

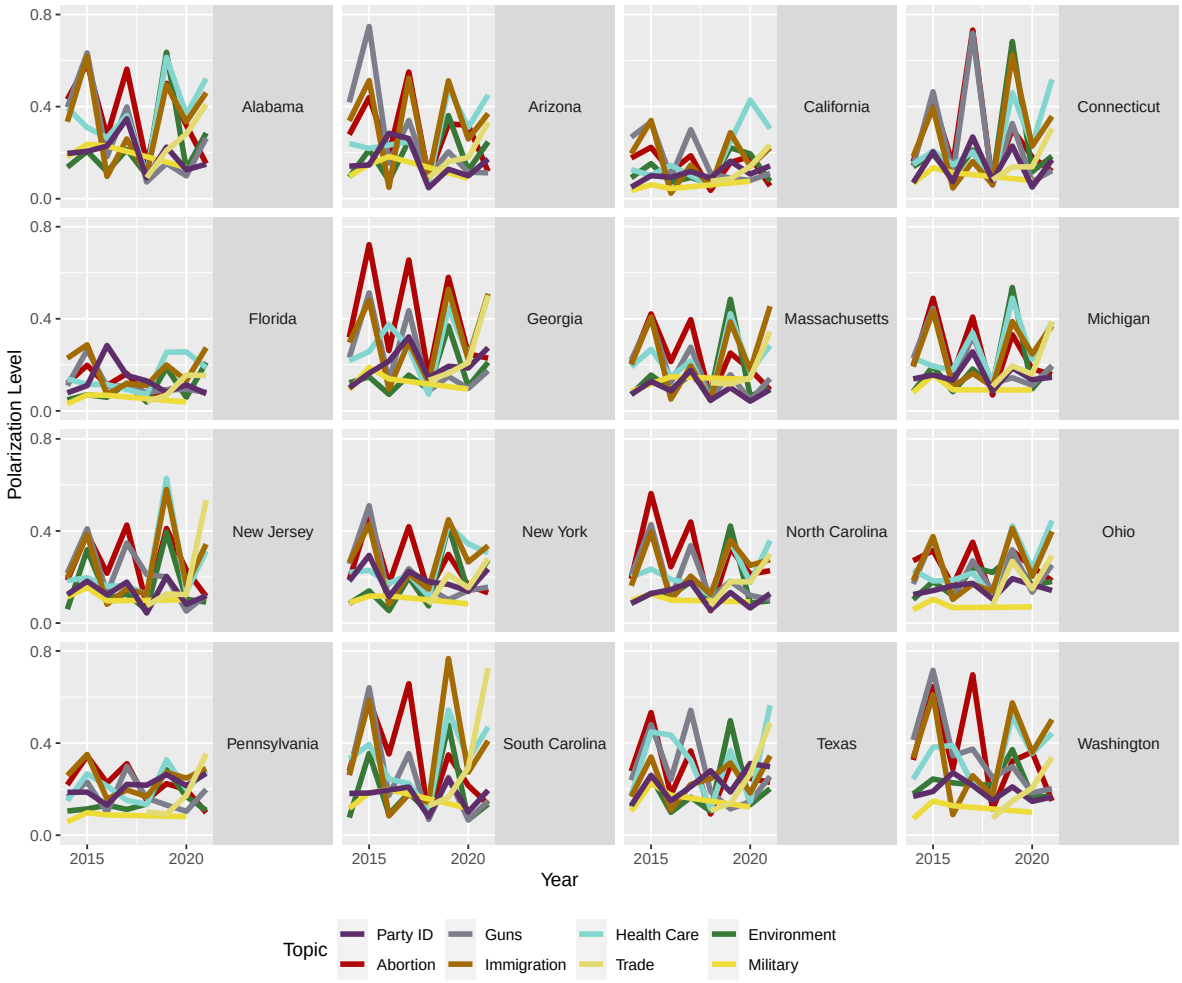

Figure 45: Change in Polarization Estimates Over Time By Issue (Low Polarization States)

The polarization estimates for the remaining 17 states are displayed in Figure 47. As indicated by the y-axis scale, these states tend to be more polarized than those in Figures 45 and 46. These states tend to be smaller and more rural, with more even population distributions. Despite the increased level of polarization, the trends are roughly similar. For example, polarization over the military use of force and party ID — while not always lower than the other topics — tends to be relatively low and flat over time. Polarization over the environment is low, except when it spikes in 2019. Abortion and gun control polarization decreases over time, while trade and health care polarization increases over time.

What might explain the similarity in polarization trends over time? Naively, we might

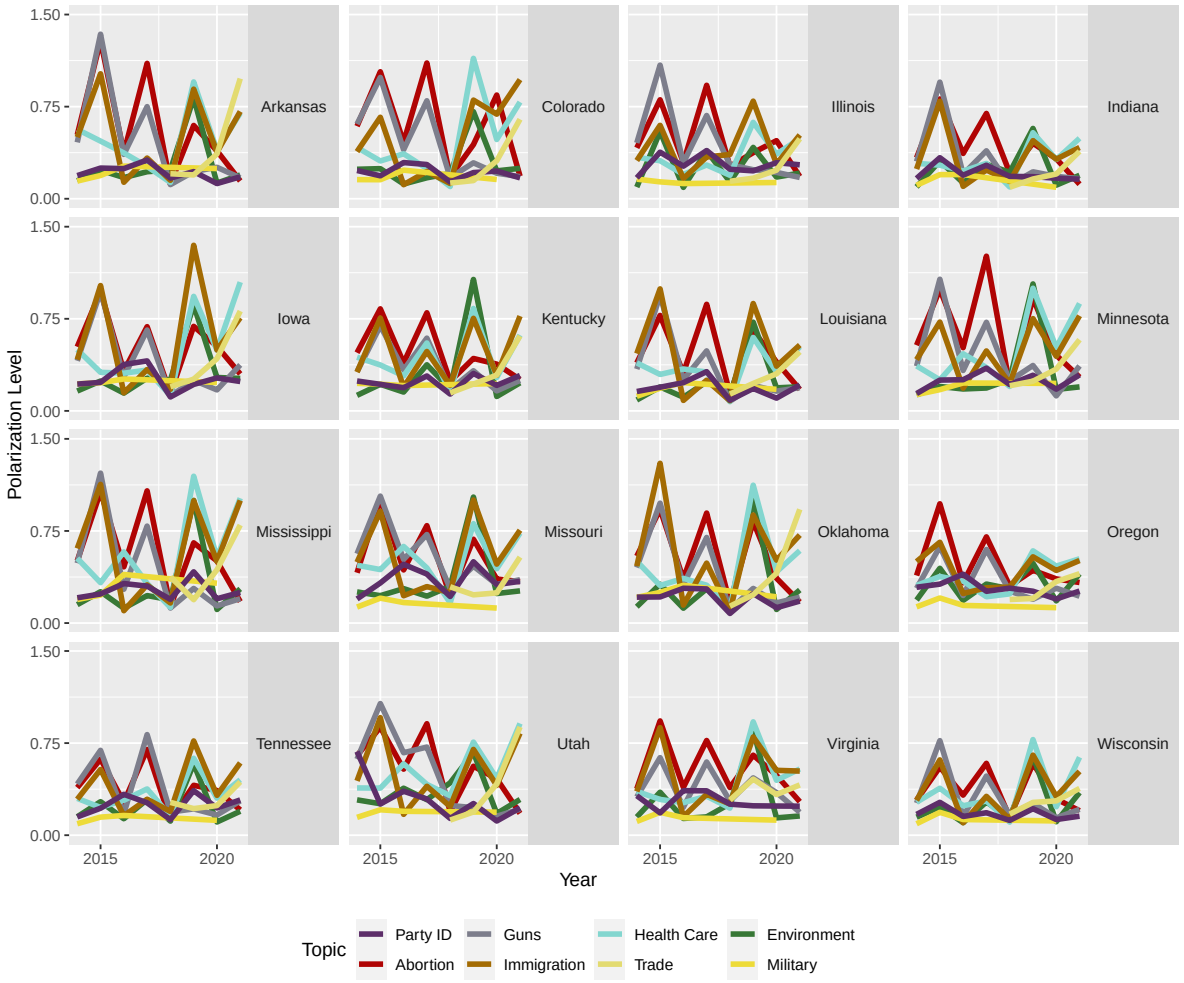

Figure 46: Change in Polarization Estimates Over Time By Issue (Medium Polarization States)

expect the parochial politics of each state to influence how polarization changes across different issues. It is possible that the nationalization of politics flattens the differences between states, such that the contours of national politics filter down to the constituent states (D. J. Hopkins 2018). For example, if immigration policy captures the attention of national political elites, it will become the central focus of residents of all fifty states, despite the policy's disparate impact. This would cue rural and urban residents to revert to their ideological positions, increasing geographic polarization across the country. The degree of increase may differ from state to state, as shown in Figure 47 for example, but the directional change is uniform. This is not meant to overstate between-state similarity. There are still very ob-

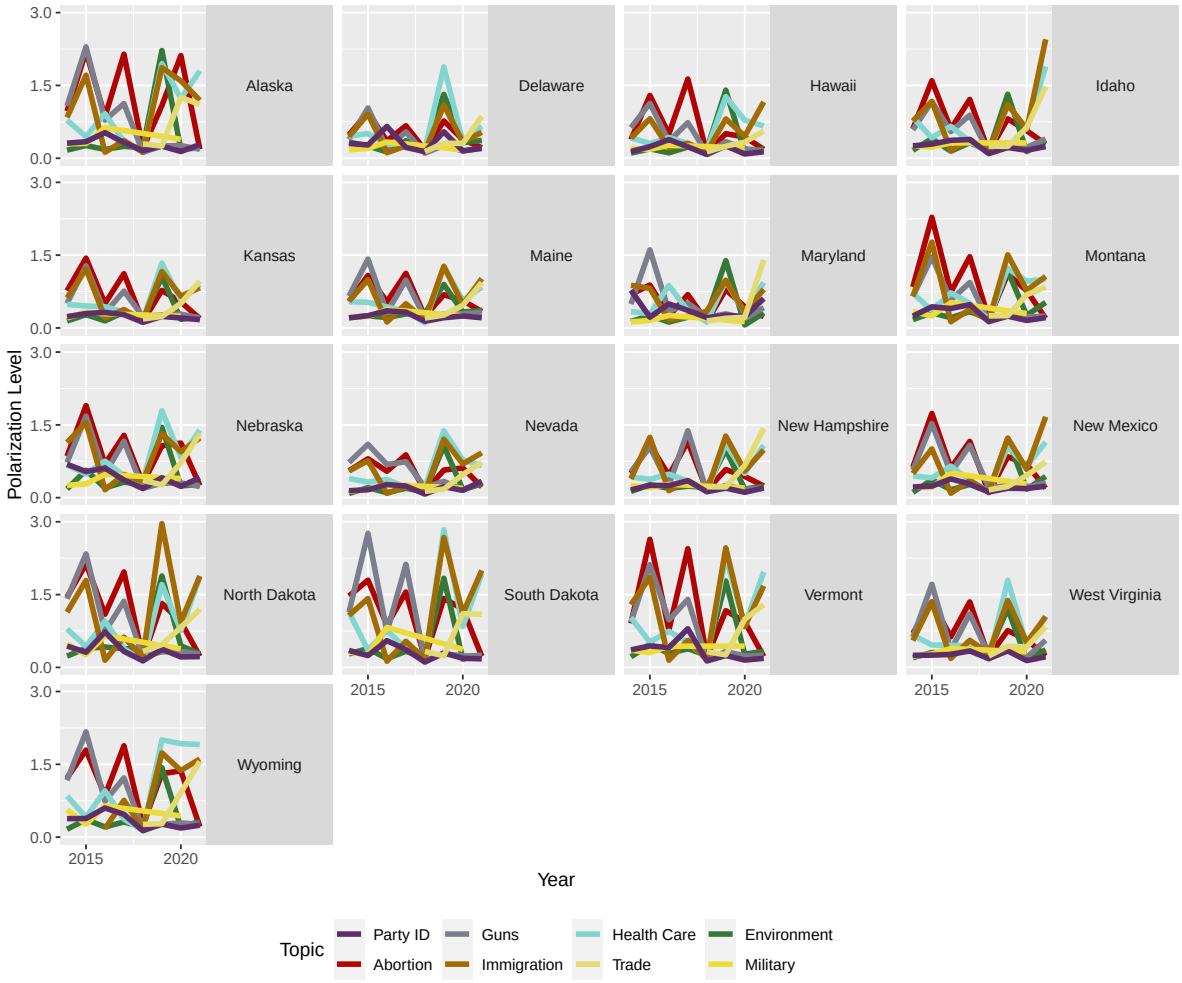

Figure 47: Change in Polarization Estimates Over Time By Issue (High Polarization States)

vious differences between states, both in the degree of polarization change and the topics' polarization levels relative to one another, which I investigate next.

Most/Least Polarizing Topic

Like in the previous chapter, I will now describe the most and least polarizing topics within each state. This will shed greater light on the degree to which states move together, as the nationalization theory would suggest, or chart their own unique paths. To find the most polarizing topics, I simply take all 2744 polarization estimates and find the topic with the

highest value for each state-year combination. The results are displayed in Figure 48. Consistency across rows indicates that a state is perennially polarized by the same issue, such as abortion in Kentucky. Consistency across a column indicates that a topic dominated the national scene in a particular year, such as abortion in 2017. This figure also reinforces the general trends from the previous section, such as the decline of gun control polarization and the reemergence of immigration polarization. It is also striking that no state is ever most polarized by military affairs and very few are ever most polarized by party ID.

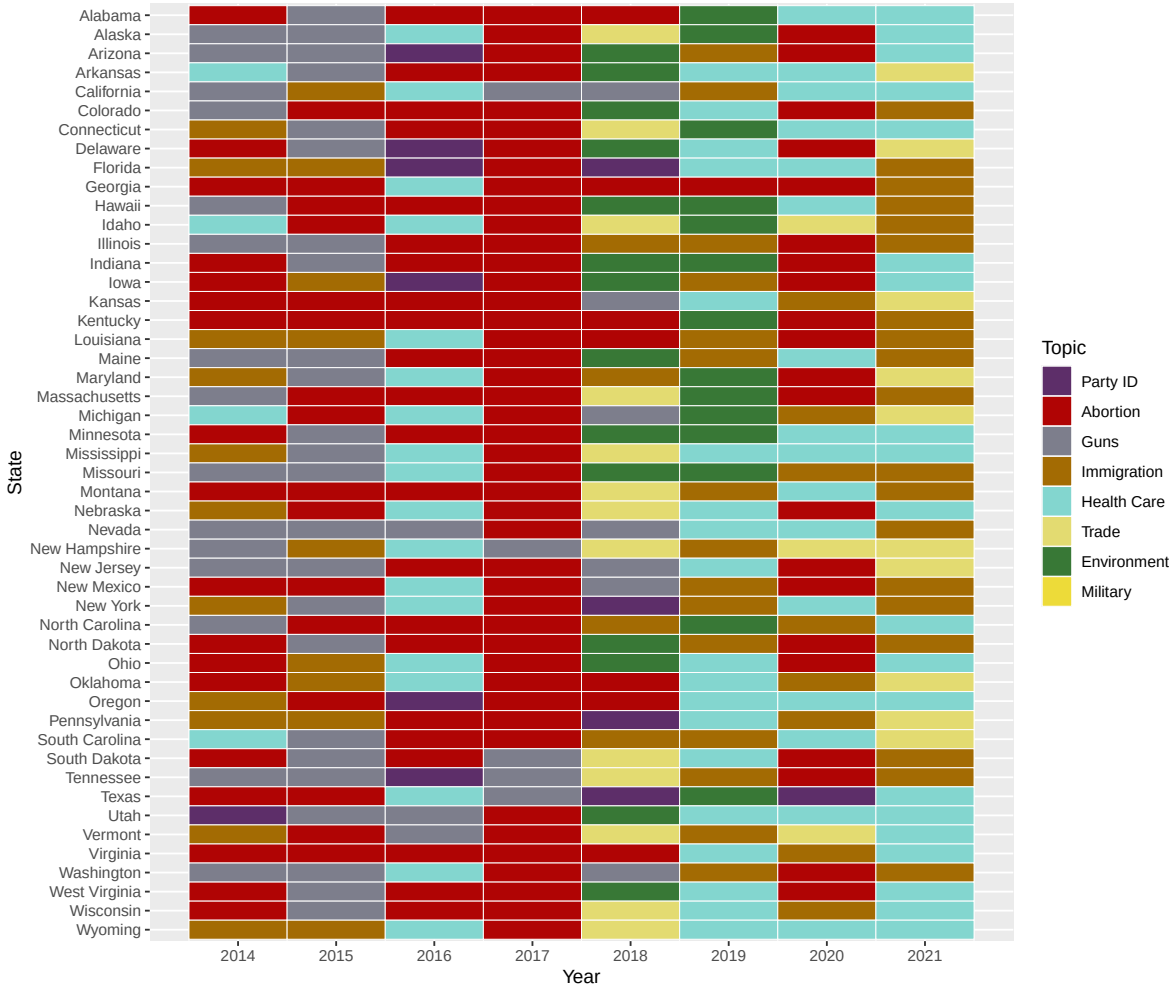

Figure 48: Most Polarizing Topic Over Time

Figure 49 provides a similar visual for the least polarizing topic in each state in each year. Again, this highlights the general non-polarization of the military and party ID. There

are also relatively strong patterns across years, such as the lack of military polarization in 2015 or immigration polarization in 2016. This figure also shows that polarization over the environment tended to be lowest during earlier years and polarization over guns and abortion was lowest in later years.

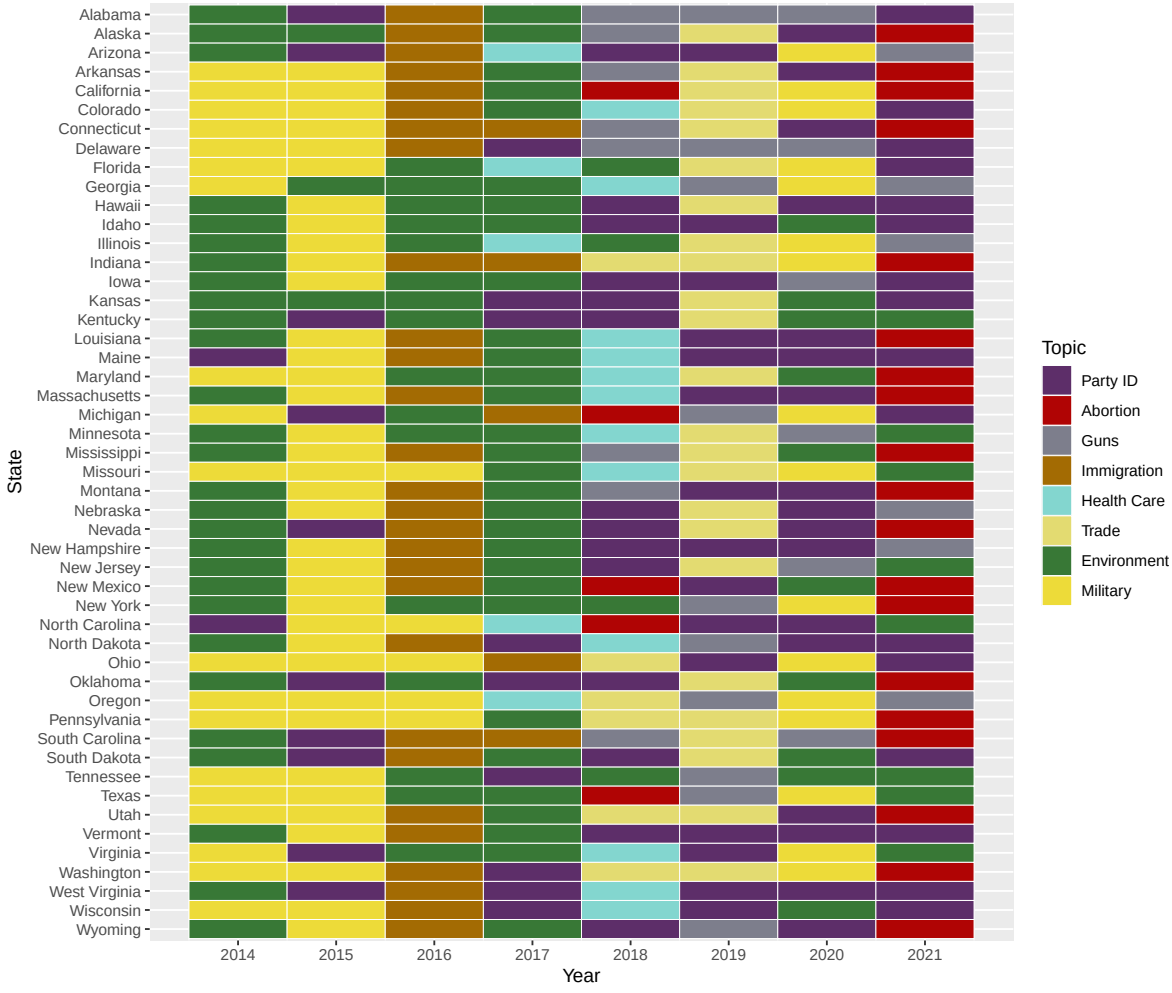

Figure 49: Least Polarizing Topic Over Time

Total Polarization

Finally, I combine each state's polarization scores across all topics within each year to estimate the level of total polarization.[16] These polarization totals are plotted in Figure 50 and suggest that, surprisingly, most states are fairly consistent over time, despite the substantial variation in polarization across the topics individually. For example, a low polarization state like Florida remains at the same low level and a moderately polarized state like Oregon remains at the same moderate level. A few states, such as Vermont and the Dakotas, display high variation over time, but even their least polarized years are more polarized than many other states' most polarized year.

The polarization estimates in Figure 50 also show an alternating pattern of polarization within each state, in which odd years tend to have higher values than even years. This could be due to the smaller survey samples in non-election years, increasing the dispersion of rural-urban location opinion estimates and therefore the resulting polarization estimates. The pattern could also be a function of response bias in odd years, such that more politically engaged (and perhaps ideologically extreme) individuals are more likely to participate in a survey. Regardless, the within-state wave-like pattern does not alter our substantive takeaways; the most polarized states remain the most polarized and there is remarkable consistency in polarization scores within even and odd years separately.

What can explain this relative consistency within individual states? Perhaps each state has a theoretical limit on the amount it can be geographically polarized, and the allocation of that polarization simply moves between issues. For example, imagine that geographic polarization is a function of political attention. As previously described, elite attention on an issue causes rural and urban residents to retreat from their previously moderate (or ill-informed) positions to more ideologically extreme positions in order to signal allegiance to one side of the elite debate. This increases geographic polarization over the issue at hand, but because attention is zero-sum, polarization for a separate issue decreases. As trade and

[16] Technically, I divide the topic sum by the number of topics included in that year's CES wave. Otherwise, a year would appear more polarized simply because more topics were included in the survey, such as 2020 when both trade and military questions were included.

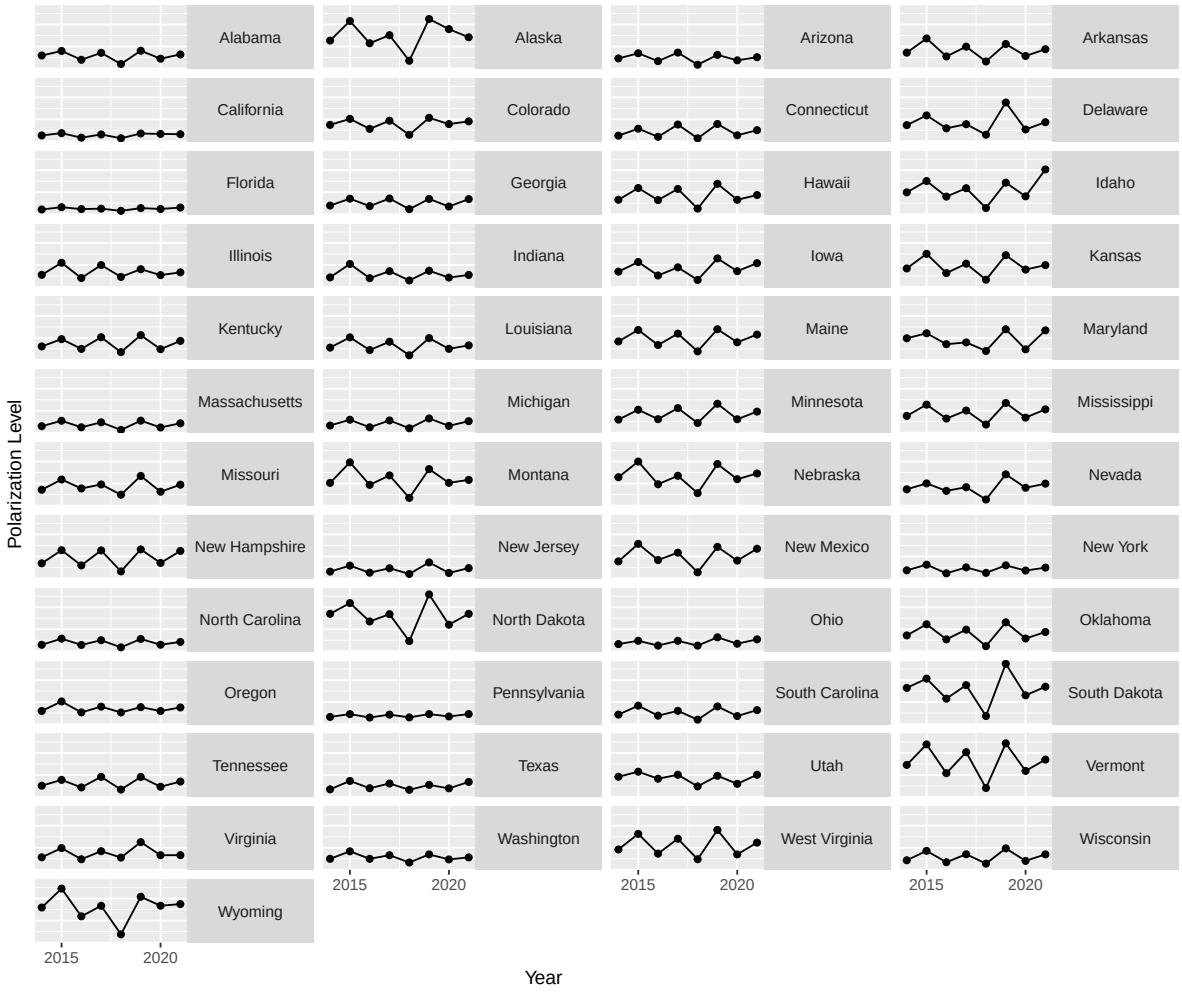

Figure 50: Total Polarizing Topic Over Time

health care receive greater attention over time, their polarization values rise, whereas the attention and polarization of guns and abortion fall.

This theory relies on the assumption that each state possesses some upper limit on geographic polarization. But why would this limit differ from state to state? As discussed previously, my operationalization of geographic polarization limits the polarization of states with highly skewed population distributions. If the vast majority of a state lives in a single metropolitan area, the population weighted variance of its opinion estimates will almost certainly be small. In addition, many other variables might explain differences in the upper limit of polarization, such as a state's geographic location within the U.S., immigrant history,

informal political norms, demographic homogeneity, or economic development. Further research is necessary to untangle the individual effects of these and other factors. The following chapter will apply my polarization estimates to demonstrate how political scientists might answer these and related questions.

Chapter 7: Applications

The previous four chapters employ a method of estimating state-level geographic polarization across a range of issues. While this descriptive exercise is no doubt valuable in itself, we can apply these estimates to answer additional questions of interest and further develop theories of political polarization. The following sections demonstrate how the polarization estimates can be used.

Elite Attention and Polarization

The theory of polarization sketched out at the end of the previous chapter posits that geographic polarization is downstream of elite attention; as ideologically polarized politicians focus on an issue, they encourage their spatially sorted supporters to take less moderate positions, which increases geographic polarization. This theory is consistent with Zaller's "Receive-Accept-Sample" model (1992), in which public opinion is heavily influenced by elite discourse, particularly when the individual is receptive to the discourse (such as when hearing from an elite co-partisan). Zaller argues that individuals are more likely to accept messages that align with their prior attitudes. If this is true, it would follow that, when faced with two extreme messages (one from the left and one from the right), an individual on the center-left or center-right would adopt the message that merely intensifies their current belief (rather than contradicts the current belief).

We could evaluate this theory by measuring both elite attention and polarization at the national level, but this would limit our sample size to $N = 1$. Fortunately, the polarization estimates created in the previous four chapters effectively increase our sample size by fifty-fold. In doing so, we can more robustly determine the size and direction of the correlation between elite attention and geographic polarization.

For this exercise, I measure elite attention as how often Senators from each state mention a topic in their congressional speeches. I first collect every speech given on the floor of the Senate from 2014 through 2020, which are available in the daily editions of the congressional

record on the congress.gov website.[17] I then parse these files to identify which speeches were given by which Senators. Once I have a Senator associated with each speech, I categorize the speeches according to my eight topics, by looking for keywords belonging to each topic. For example, a speech is categorized as relating to abortion policy if it contains one of the following terms: abortion, reproductive, pro-choice, pro-life, fetus, contraception, roe v. wade, planned parenthood, crisis pregnancy. Once I categorize each speech, I count the number of speeches related to each topic for each state-year. For example, Senators from California mentioned immigration policy eleven times in 2018. Figure 51 provides a visualization of this data.

Because the theory above posits that *changes* in elite attention lead to *changes* in polarization, I next calculate the year-over-year change for each of these variables. For example, California's mentions of immigration policy increased from eleven in 2018 to thirty-three in 2019, representing a change of twenty-two additional speeches.[18]

With the variables created, I then simply find the Pearson correlation coefficient between the change in speeches and the change in polarization. If the theory were correct, we would expect a positive relationship, such that a state's Senators speaking about a topic more frequently is associated with that topic becoming more geographically polarizing.[19] I estimate the correlation coefficient as 0.04, with a p-value of 0.043, indicating a statistically significant relationship at the conventional 0.05 threshold. Figure 52 provides a visualization of the correlation, illustrating the slight positive relationship.

The above correlation combines all eight issues together, though we might expect the relationship between elite attention and geographic polarization to vary across issues. For example, Senators speaking about military policy more frequently may not affect the public's polarization over the issue, due to general disinterest in foreign affairs or the unclear partisan

[17]Due to data availability issues, I exclude 2021 from this analysis.

[18]I use the absolute year-over-year difference to measure the change of these variables, rather than the percent change, because some state-years do not mention a topic at all, leading to a speech count of zero. This would cause the change value to be undefined.

[19]I do not split these results by Senator party because, while it is conceivable that the tendency to give speeches could differ by party, there is no obvious theoretical reason the relationship between Senator speeches and state polarization would differ by party. In addition, splitting the results by party would decrease the sample size and increase the probability of Type I errors.

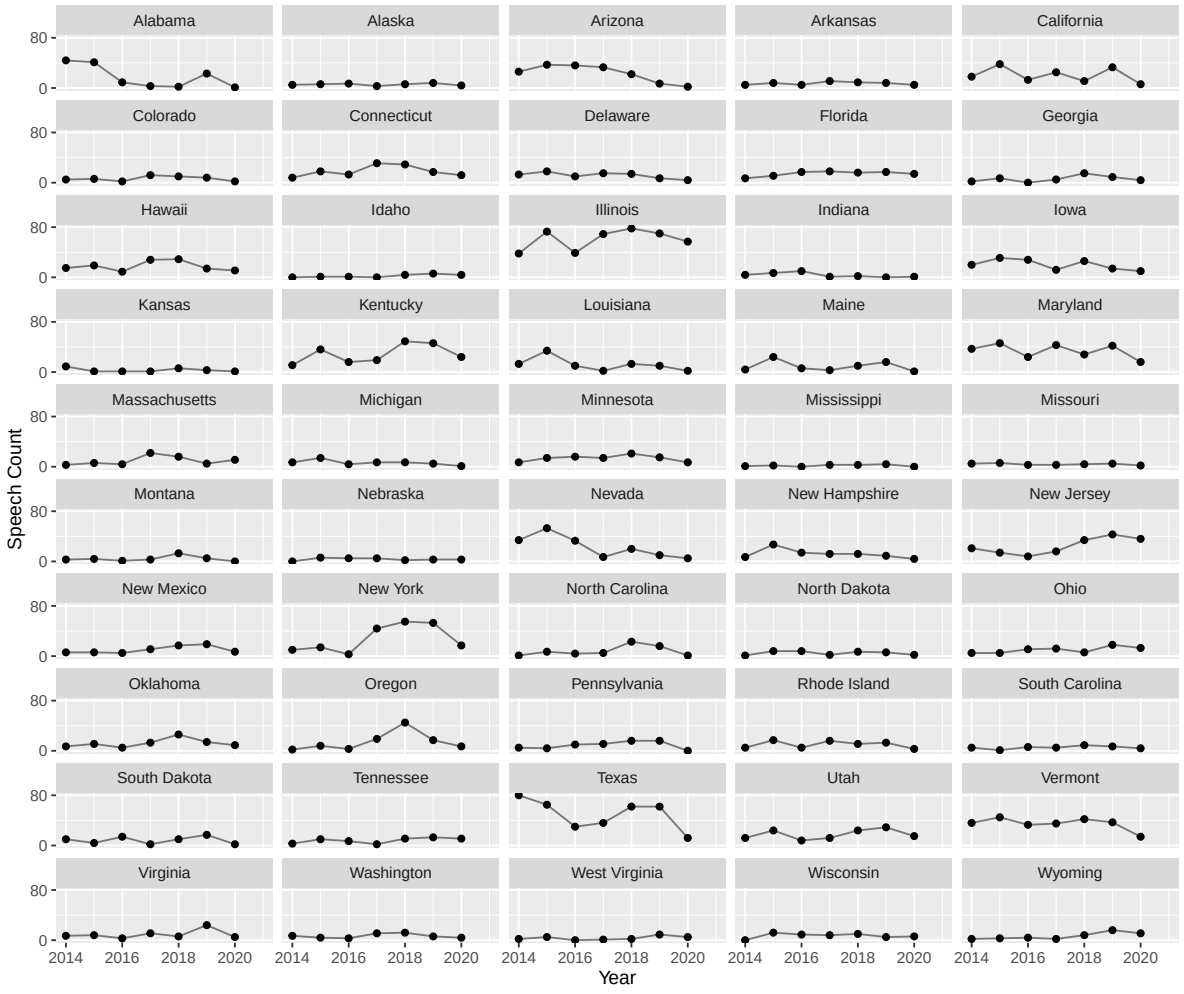

Figure 51: Change in Elite Attention Toward Immigration Over Time

valence of the issue (i.e. if you don't know what side of the issue your team is on, you won't move from your position). To probe these potential differences, I rerun the correlation for each topic individually, providing the raw statistics in Table 4 and illustrations in Figure 53.

These results indicate fairly substantial differences across issues. The correlation is positive and statistically significant for abortion, immigration, and the environment, suggesting that when Senators increase their attention toward one of these issues, their states also tend to be more geographically polarized over the issue. None of the other five topics are statistically significant at the 0.05 level, though guns/gun control does have a relatively low p-value. Surprisingly, this correlation is negative, meaning an increase in elite attention is associated

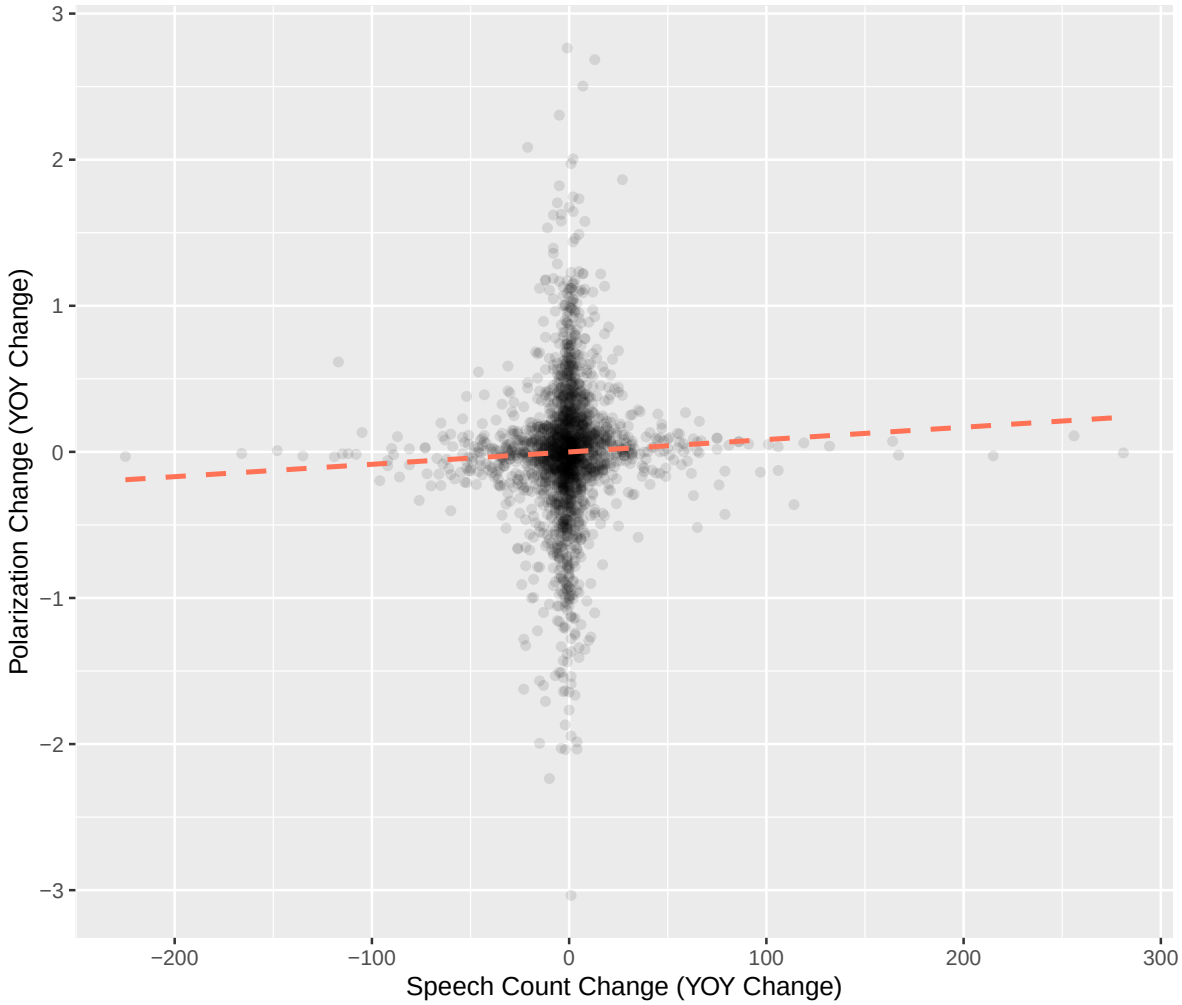

Figure 52: Correlation of Change in Elite Attention and Polarization (All Topics)

with a *decrease* in geographic polarization. Of course, this could be attributable to statistical noise or unrepresentative outliers, but it may also reflect a genuine relationship unique to this issue. For example, the origin of changes in elite attention may be different for guns. Politicians may only discuss guns after tragedies, such as mass shootings, which may also decrease geographic polarization over the issue as citizens are more receptive to gun control policies. In contrast, a similar process is much less likely to drive attention and polarization of issues like abortion and the environment.

This section has provided a simple demonstration of how my state-level issue polarization

Table 4: Correlation of Change in Elite Attention and Polarization (Each Topic)

Topic	Correlation	P-Value	95% low	95% high
Abortion	0.267	0.000	0.158	0.370
Environment	0.177	0.002	0.063	0.285
Guns	-0.109	0.063	-0.220	0.006
Health Care	0.032	0.582	-0.082	0.146
Immigration	0.213	0.000	0.101	0.320
Military	-0.004	0.965	-0.165	0.158
Party ID	0.048	0.413	-0.067	0.161
Trade	0.064	0.534	-0.137	0.259

estimates can be employed to probe relevant questions in the political science literature, such as the degree to which polarization is elite-driven. It is important to note, of course, that these results are mere correlations; they do not imply that a change in elite attention *causes* a change in geographic polarization (or vice versa). It is possible that an unobserved variable causes a change in both, in addition to many other more complex causal chains. For example, the issue's salience may increase exogenously, such that both elite attention and polarization increase independent from one another. In the abortion context, this may have occurred when the Supreme Court overturned *Roe v. Wade* in 2022. It is plausible that the decision would have occurred irrespective of politicians' discussions of abortion or the public's polarization over the issue. In the next section, I provide a demonstration of how to exploit this type of exogeneity to estimate the effect of issue salience on geographic polarization.

Issue Salience and Polarization

In order to determine how issue salience affects geographic polarization, I need to find an example of a change in issue salience that is plausibly exogenous, i.e. it is not dependent on polarization. For example, the introduction of gun control bills in Congress would not be an appropriate measure of the salience of gun policy, because the likelihood of introduction could plausibly be caused by geographic polarization. If gun control is highly geographically polarizing, members of Congress may be pressured or incentivized to introduced gun

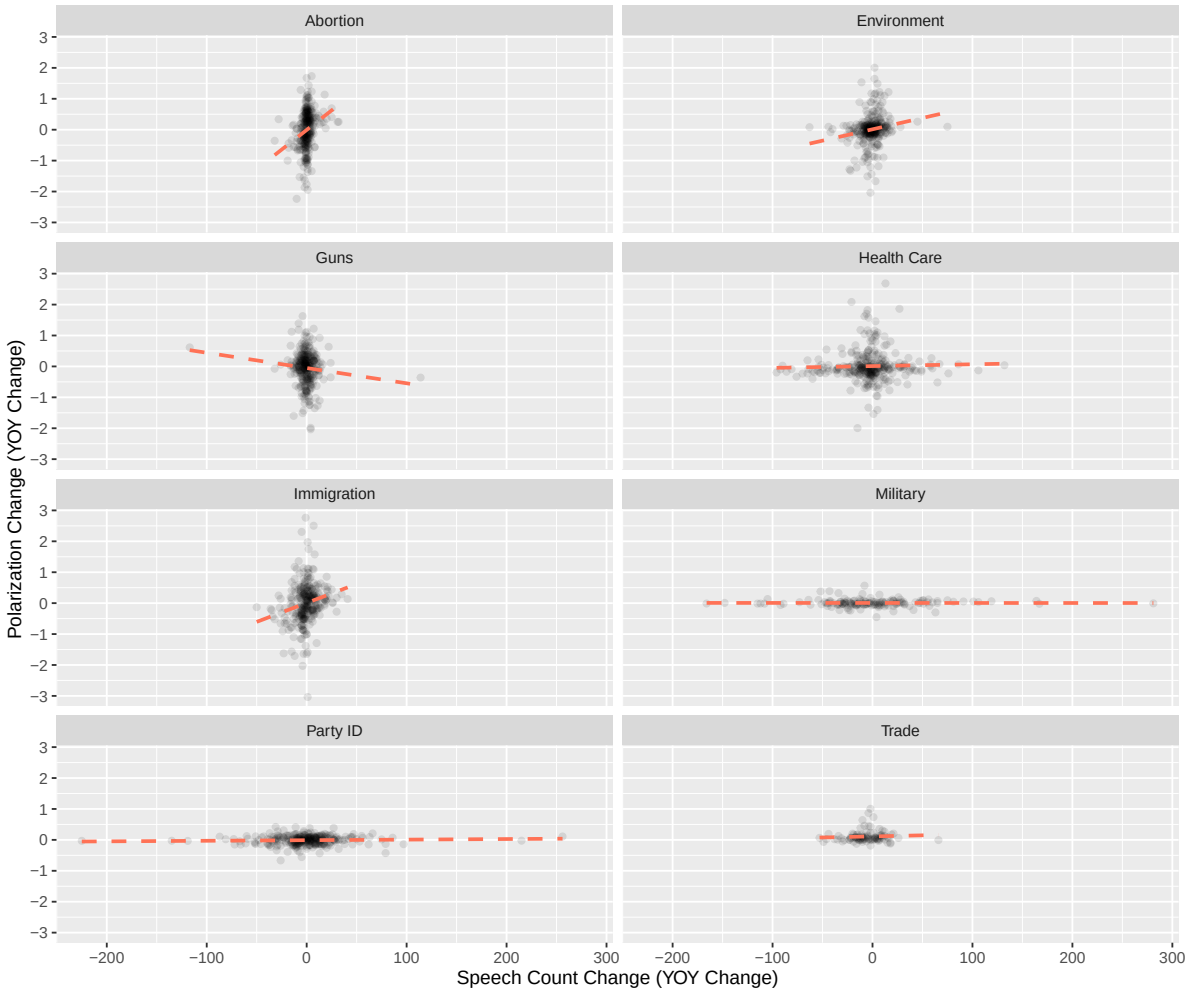

Figure 53: Correlation of Change in Elite Attention and Polarization (Each Topic)

control bills. I propose that the incidence of a mass shooting within a state is both 1) exogenous and 2) plausibly related to the salience of gun policy. It is reasonable to assume that mass shootings are quasi-random events, such that they are not determined by the degree of geographic polarization within a state. It is also reasonable to assume, given the extensive media coverage following such events, that mass shootings directly increase the salience of gun policy.

For this exercise, I use the Violence Project's database on mass shootings, which records the date and location of 190 mass shootings in the United States since 1966. I use this dataset because its definition of mass shooting — a homicide event with four or more victims, in a

Table 5: Difference in Means of Polarization in Years With/Without Mass Shooting

Topic	Non-Shooting Mean	Shooting Mean	Difference	P-Value	95% low	95% high
Abortion	0.562	0.309	0.253	0.000	0.158	0.348
Environment	0.293	0.214	0.079	0.009	0.021	0.137
Guns	0.434	0.289	0.145	0.000	0.068	0.223
Health Care	0.502	0.313	0.189	0.000	0.111	0.267
Immigration	0.547	0.333	0.214	0.000	0.127	0.302
Military	0.211	0.123	0.088	0.000	0.051	0.125
Party ID	0.236	0.189	0.047	0.001	0.021	0.073
Trade	0.383	0.250	0.134	0.004	0.044	0.223

public place, unrelated to other criminal activity — best captures the kind of activity most likely to capture media attention and increase the salience of gun policy. Other publicly available datasets use broader inclusion criteria, such as shootings in which four or more people were shot, that can also include gang violence and domestic disputes that capture less media attention.

After downloading the data, I find the state-years that experienced a mass shooting (39 in total) and merge them with my issue polarization estimates. To assess the causal relationship between issue salience and geographic polarization, I conduct simple t-tests to compare the average polarization of states that experienced a shooting in a given year and those that did not. If issue salience increases geographic polarization, we would expect states that experience a shooting to be more polarized over gun policy than those that do not experience a shooting.

The results in 5 suggest that there is a significant difference in the polarization scores between the two groups; however, the difference is the *opposite* of what the theory would suggest. States with a mass shooting are *less* polarized over gun policy than states without a mass shooting. Figure 54 provides kernel density plots of the polarization values for the two groups across all eight topics; it is clear that state-years with a mass shooting are consistently less polarized than those without, though with substantial overlap. It is possible that this is because mass shootings reduce, rather than inflame, ideological divisions over gun policy. The original theory postulated that an increase in issue salience would increase polarization by reminding the public of their cultural/ideological allegiances. But mass shootings and

gun policy may work differently; perhaps conservative areas become more amenable to gun control policy after a tragedy close to home. This theory is supported by work from Newman and T. K. Hartman (2019), which finds increased support for gun control following a nearby public shooting, regardless of partisanship.

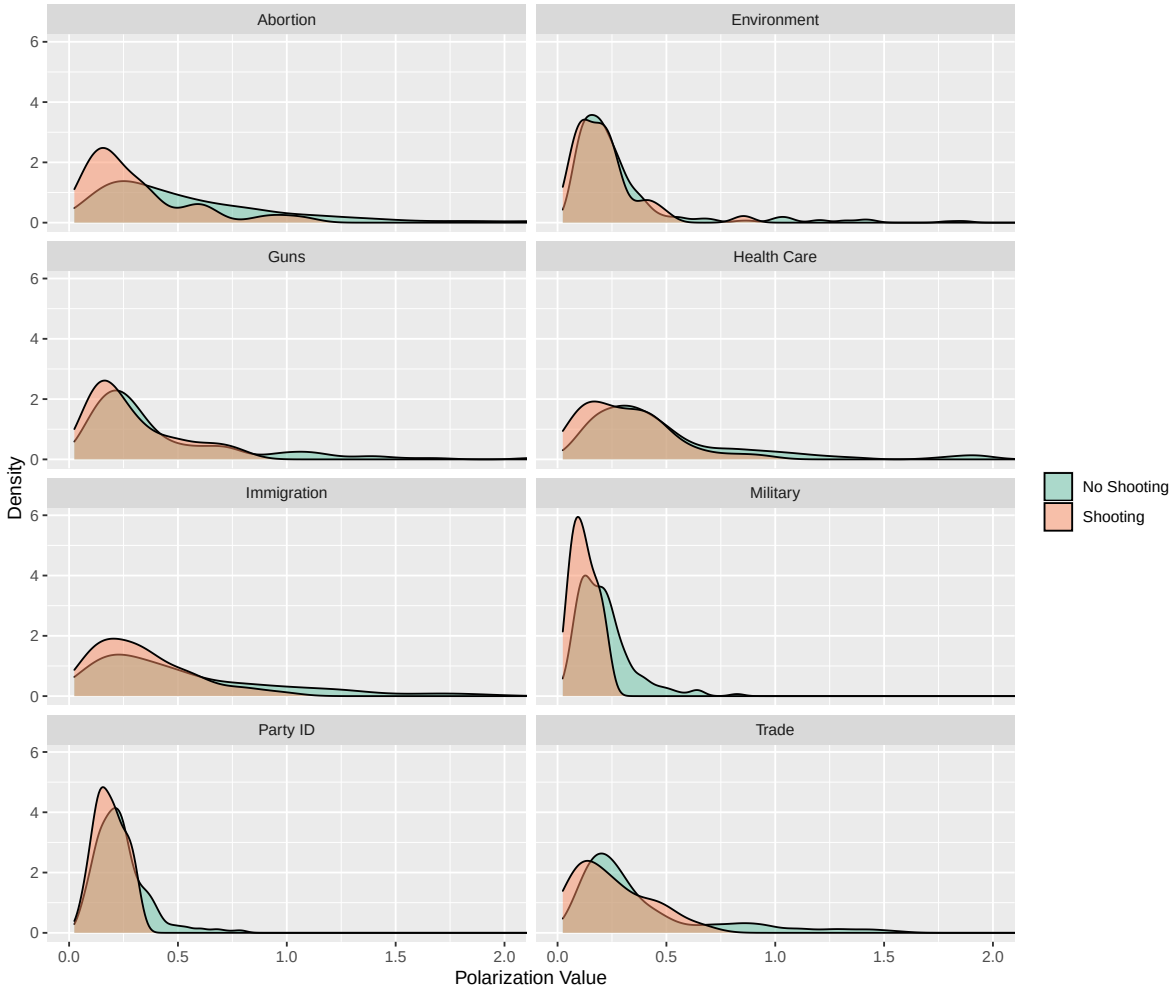

Figure 54: Polarization by Years With/Without Mass Shooting

While plausible, this explanation does not explain the significant differences in polarization across all other policy areas. Even if a mass shooting reduced polarization over gun policy, it is unclear how it would also reduce polarization over abortion, the environment, immigration, etc. It is more likely that the states that experience a mass shooting are already less polarized, even before the shooting takes place. This is likely because the states that

experienced a mass shooting since 2014 are, on average, larger and more urban, and therefore less geographically polarized (given our conceptualization of polarization incorporates a state's population distribution). For example, the states that most frequently experience a mass shooting — Texas, California, and Florida — are also consistently non-polarized due to their large urban populations.[20] Because the urban areas comprise an overwhelming majority of the state's population, the polarization measure (population weighted variance across rural-urban locations) is smallest in these states. Even if the relationship between a state's size/population distribution and its likelihood of mass shooting is simply due to a larger population increasing the probability that any one person is mentally unhinged, this weakens our previous assumption of exogeneity. Contrary to our assumption, the likelihood of a mass shooting is not unrelated to geographic polarization, as both are influenced by state size. This exercise serves as a demonstration of the potential pitfalls of using these polarization estimates for causal inference. It is essential that practitioners understand their origins (in this case, the role of population weighting) in order to determine possible avenues of endogeneity. Nonetheless, this application also outlines how the polarization estimates can be combined with additional data and simple analyses to estimate causal effects, which will be reinforced in the following demonstration.

Political Competition and Polarization

This section reuses the method described in the previous section to identify causal effects, while maintaining the exogeneity assumption. The previous theory posits that a state becomes more geographically polarized over an issue because the issue's salience increases, perhaps due to greater attention from elites; however, it is possible that polarization is not a function of salience per se, but instead of political competition generally. In a competitive political environment, members of the public are pushed into their ideological corners across all issues, not just those that are discussed the most. During an election year, individuals can support their political team by shifting their issue positions toward the extremes in order to signal allegiance. In non-election years, the stakes are lower and individuals can drift back

[20]For a full breakdown of the number of mass shootings by state, see Section A5 of the Appendix.

Table 6: Difference in Means of Polarization in Election Years and Non-Election Years

Topic	Non-Election Year Mean	Election Year Mean	Difference	P-Value	95% low	95% high
Abortion	0.357	0.410	-0.053	0.221	-0.138	0.032
Environment	0.160	0.162	-0.002	0.838	-0.024	0.020
Guns	0.268	0.296	-0.028	0.418	-0.098	0.041
Health Care	0.335	0.380	-0.044	0.248	-0.120	0.031
Immigration	0.286	0.322	-0.037	0.362	-0.116	0.043
Military	0.195	0.214	-0.019	0.473	-0.072	0.034
Party ID	0.214	0.208	0.006	0.796	-0.039	0.051
Trade	0.245	0.300	-0.055	0.227	-0.144	0.035

to the ideological center.

We can leverage exogenous variation in the timing of Senate elections to estimate the causal affect of political competition on polarization. Because Senate classes are codified in the Constitution and determined only when a state joins the Union, we can reasonably assume that the timing of a state's Senate election does not depend upon its degree of polarization. I download data for Senate elections from the Harvard Dataverse (MIT Election Data and Science Lab 2017) and then join to my state-year-issue polarization estimates in order to compare the polarization values of states with an election in a given year to those without. I also include only even-numbered years in order to exclude special elections that may receive national media attention and to mitigate the effect of smaller survey samples during odd-numbered years.

As before, I conduct t-tests to compare the means of the two groups, with results reported in Table 6. This table shows that polarization is higher during election years on average, though the difference is not statistically significant for any of the eight topics. The kernel density plots in Figure 55 underscore the similarity across the two groups, as evidenced by the two curves' substantial overlap.

These results contradict the theory that political competition causes an increase in polarization. Perhaps the omnipresence of national politics dilutes the otherwise cyclical nature of polarization; as politics has become entertainment, an individual's level of attention towards politics is more constant, whether constantly low or high. It is still conceivable that elite discourse affects geographic polarization, but it does not appear to work through campaigns.

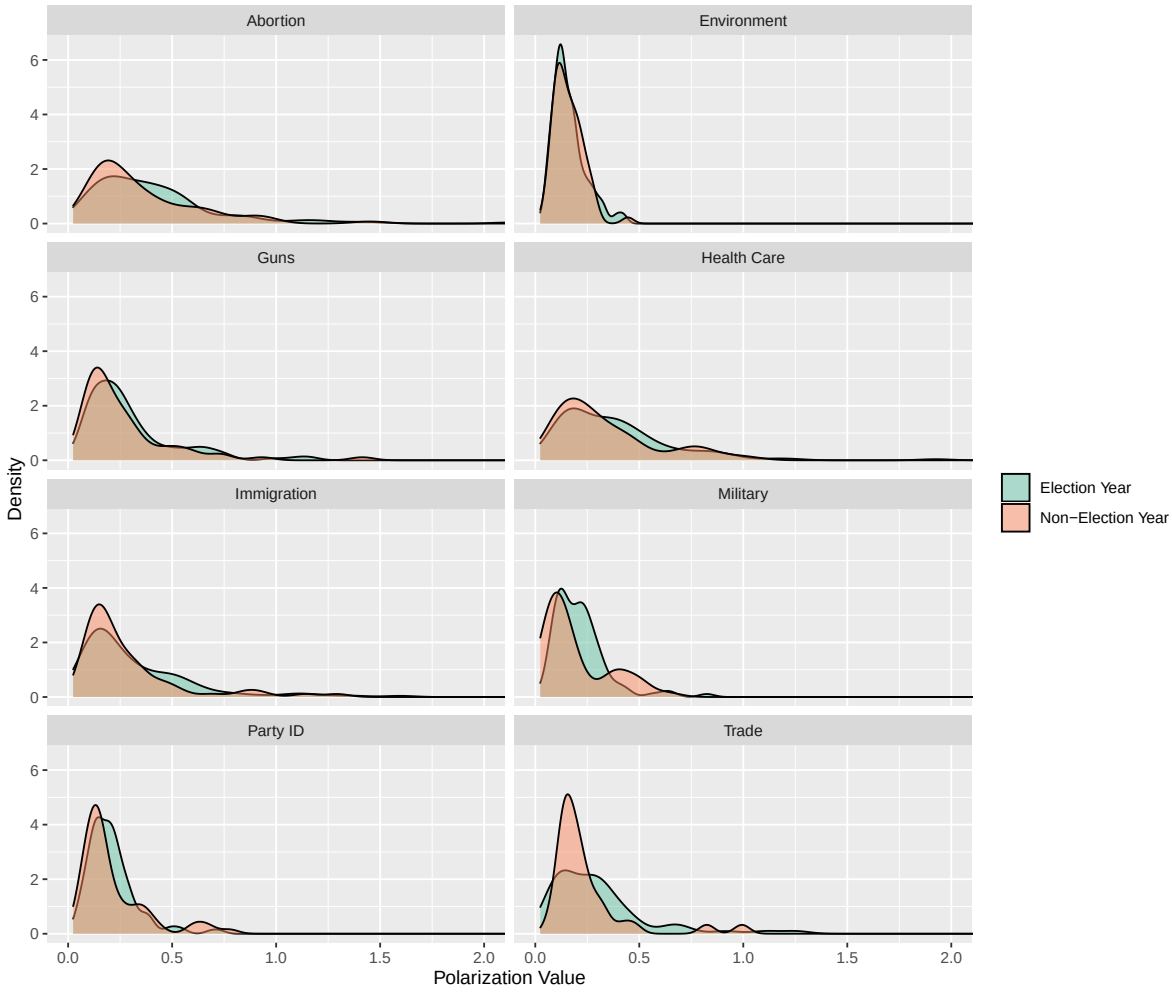

Figure 55: Polarization by Senate Election Year Type

For example, politicians might maintain relatively high levels of geographic polarization during non-election years via direct communication with constituents and media appearances.

The above exercises demonstrate how my polarization estimates can be used for causal identification and theory building. The first section discovered a correlation, that led to a rudimentary theory. The causal claims of the theory were then probed by devising measures with plausible exogeneity. Exogeneity is crucial in order to make causal claims and can break down upon further scrutiny. We can tweak the theory, propose new measures, and reassess. This iterative process gradually zeroes in on the causes behind polarization, but is built upon descriptive claims. This future research would not be possible without credible estimates of

the variation of geographic polarization.

Chapter 8: Conclusion

This project has contributed to the political science literature by introducing a new method of estimating geographic political polarization, employing the method to describe the spatial variation of polarization over time and across issues, and demonstrating how the resulting polarization estimates can be used for theory building and causal inference. I will conclude by briefly reviewing the project's main findings and then turn to avenues of future research.

Primary Findings and Implications

While this project provides many details on the nature of geographic polarization, there are five main takeaways that have the largest implications for political science and normative theory. The first result is that the results themselves are dependent on one's conception of geographic polarization. As shown in Chapter 3, viewing geographic polarization as divisions between people or divisions between places has a substantial effect on the spatial variation of polarization (e.g. which states are polarized and by how much). In this project, I consider geographic polarization as representing differences between groups of people, in which the relative sizes of the groups matter, and thus weight the variance calculations by population. However, future researchers must keep this finding in mind when developing their own measures of polarization and especially when comparing the results of different measures to one another.

The second main finding is that a handful of states are consistently more polarized than others, often (though not always) due to their size and population distribution. Because my operationalization of polarization accounts for differences in the populations of rural-urban areas, less populous states and states with a more even distribution of their population across rural and urban areas are often the most polarized. In short, states like Vermont and the Dakotas are geographically polarized, whereas states like Florida and California are not. This finding highlights the importance of considering the spatial variation of polarization. If we measure and discuss polarization exclusively at the national level, we will understate the degree of polarization in Vermont and overstate it in Florida.

Third, there is substantial variation in the relative polarization of issues within each state. While some issues become more polarized across many states at once (such as abortion in 2017), the polarization profiles of each state are generally distinct. In some states, the environment and trade divide rural and urban residents, whereas other states are divided by abortion and guns. The lack of any clear pattern across states suggests that the mechanisms behind polarization are complex and likely vary state to state. Contrary to conventional wisdom, geographic polarization is likely *not* driven by partisanship. If this were the case, polarization over partisan identity would be consistently higher than polarization over other topics, which is not what I find when comparing topics in Chapter 5.

Fourth, the changes in polarization over time differ across topics, with some topics increasing, some decreasing, and others remaining constant. This again runs contrary to the conventional narrative of ever-increasing political divides. For example, polarization over gun control has tended to decrease in most states, whereas polarization over trade has tended to increase. This suggests that the mechanisms behind polarization may differ across issues. For example, if geographic sorting — in which right-wingers systematically moved to rural areas and liberals moved to urban areas — determined geographic polarization, we would expect the same direction of polarization change across all issues. Instead, it is possible that geographic sorting affects some issues, such as abortion and gun control, while having little effect on other issues, such as trade and the military.

The fifth and final stylized fact from this project is that the total level of polarization within each state remains fairly constant over time. While the trends across issues differ, their combined trend is generally flat. This suggests the presence of a substitution effect; over time, the issue du jour changes, but there is some upper limit on the degree of division within a population. The presence of a polarization ceiling is supported by the political competition example in Chapter 7, which found no significant differences in polarization between election years and non-election years. If the system is already at an equilibrium state, the addition of a political campaign will not increase geographic polarization.

Applications and Future Research

This research has several applications both inside and outside of political science. First, other political scientists can employ my polarization estimation method to other contexts. For example, while my measurements begin in 2014 due to question consistency in the CES, other researchers can use surveys with greater consistency over time to measure polarization changes over several decades. Future researchers can also apply the same method to future waves of the CES, assuming the questions and topics remain consistent. This could check the sensitivity of my findings and increase the variance in the polarization scores, which would be useful for causal inference.

In addition to applying the method to other time periods, future work could apply the estimation method to other issues. Again, my choices here were constrained by the questions asked on the CES, but other surveys may ask about less common topics of interest. For example, it would be interesting to find an early survey asking about support for a policy before the topic received much attention in the press, such as international terrorism prior to 2001. We could then evaluate if geographic polarization increased following the increase in issue salience.

Future work can also apply my polarization estimation method to other geographies. For example, comparative scholars could estimate sub-national polarization in other countries or compare countries to one another. Scholars of American politics can apply the same method to other geographic scales, such as estimating the geographic polarization within regions, counties, or neighborhoods. Because the method relies only on survey data and census data, it can be flexibly applied to many different contexts.

In addition to the method, my polarization estimates themselves can be used for causal inference. Because I have created an estimate for each state in each year, across multiple issues, there is sufficient variation for use as an independent or dependent variable. Other researchers can use these polarization values to estimate the causes or effects of geographic polarization, as briefly demonstrated in Chapter 7. For example, future work can investigate how geographic polarization interacts with related phenomena, such as filter bubbles and inter-personal networks.

Political scientists may also use these methods to better understand the connections between geographic polarization and other types of political polarization, as discussed in Chapter 2. For example, my state-level geographic polarization estimates could be compared to state-level mass polarization, either by issue or in total. It is conceivable that a state could be highly polarized among individuals (e.g. the distribution of political opinions is not single-peaked with low variance), while containing little geographic polarization. If the population is divided into two groups with distinct political opinions, but those groups are not correlated with geography, there would be a discrepancy in the two measures of polarization.

This line of inquiry could be extended to specifically compare issue and partisan polarization for geographic and non-geographic polarization types. For example, my research finds that polarization over issues is nearly always greater than that over partisan identification, while the existing literature on mass polarization tends to find the opposite (Hare and Poole 2014; Layman, Carsey, and Horowitz 2006). It is possible that this discrepancy arises because issue attitudes are built around and supported by geographically-specific cultural norms, whereas partisan identification and vote choice are more heavily influenced by non-geographic factors, such as social networks, mass media, and get-out-the-vote efforts. It may be the case, for example, the National Democratic Party's canvassing, recruitment, and marketing efforts may be more successful convincing some subset of rural America to vote for the Democratic candidate rather than abandon the prevailing conservative cultural norms that impact residents' policy opinions. Future research, both qualitative and quantitative, is required to fully explicate the causal theories behind the discrepancies across different types of polarization.

These results can also initiate and inform work on normative theories of federalism and representation. Our federal system assumes that geographic locations share common interests, but my opinion plots repeatedly showed greater similarity among rural-urban locations across states rather than within the same state[21]. If the issue positions of rural Wisconsin are more similar to those of rural Indiana than urban Wisconsin, why does it share represen-

[21]This could be formally estimated using the same population-weighted variation measure used for polarization, but applied within each location category across all states rather than across locations within each state.

tatives with urban Wisconsin? If rurality is more closely associated with policy preference than geographic proximity, our current system may be inadequate. Perhaps these results would encourage calls for more federalism, providing greater autonomy for smaller geographic units. While the literature on affective political polarization worries about its effects on democracy (Kingzette et al. 2021; Fishkin et al. 2021; Druckman et al. 2023), perhaps geographic political polarization offers opportunnity for democratic renewal, in which residents have a greater voice in local affairs and are more likely to approve of their local representative.

Finally, portions of this project could be used outside of academia entirely, put to use in the private sector. Companies could use my opinion estimation technique to produce sub-national estimates of consumer interest or brand loyalty. This could be especially useful to companies with multiple brands or product lines, such that they can emphasize different offerings in different places. For example, General Motors may find that urban consumers are more attracted to the Cadillac brand than the Chevrolet brand. In addition, they could use my polarization measurement to identify states where opinions on Cadillac are most divided between rural and urban, and tailor their marketing accordingly, such as avoiding state-wide marketing campaigns. Because firms want to promote their product where it is most likely to sell, my method of measuring the spatial variation of latent opinions is applicable to a variety of businesses.

The range of possible future applications highlights the primary goals of this project. I intended to develop a quantitative method of estimating sub-national geographic polarization that could be used for a variety of political topics. The purpose was to describe the facts on the ground, providing basic research that theorists and causal analysts can build upon to answer their own questions. I hope to have shed light on the nature of geographic polarization as it actually exists, as it is one of the defining features of the current political moment.

Appendix

A1: Most Homogeneous Counties

One potential criticism of using county-level data to measure rurality is that counties are internally spatially heterogeneous. One part of a county can be quite urban, while the surrounding area is rural; therefore, it is unreasonable to use a single measure of rurality for an entire county. In addition to the practical and theoretical reasons described in Chapter 3, this section provides empirical justification for the use of county-level data. I select the most internally homogeneous counties, recreate my opinion and polarization estimates using these counties, and then compare my results with those obtained in Chapter 3.

I first measure the spatial homogeneity of each county. Using the *tidycensus* R package, I download the shapefile of every census tract in the United States. This file contains the population and geometry of each tract. Using this information, I find the population density of the tract by dividing its population by its area. For each county, I find the variance of the population density of its constituent census tracts. Thus, each county is assigned a single value representing its spatial homogeneity.

I next select the most homogeneous counties. I cannot simply select the counties with the lowest density variance because these are almost exclusively rural counties. Urban counties (those with at least a city) necessarily have at least one part that is high density. Unless the entire county is the same level of high density, the county will have more variance than a county that is rural throughout (which is necessarily most rural counties, because otherwise they wouldn't be rural). This is a problem because I need variance in the rurality of counties in order to compute polarization values. Thus, I separate the counties into dichotomous rural and urban groups according to the USDA continuum codes described in Chapter 3. I then select the top 50% most homogeneous within each group. A map of these counties is shown in Figure 56.

Using this set of homogeneous counties, I select the CES respondents who reside in these counties and rerun the party ID polarization analysis described in Chapter 3. The distributions of polarization estimates are shown in Figure 57. These distributions are more uniform

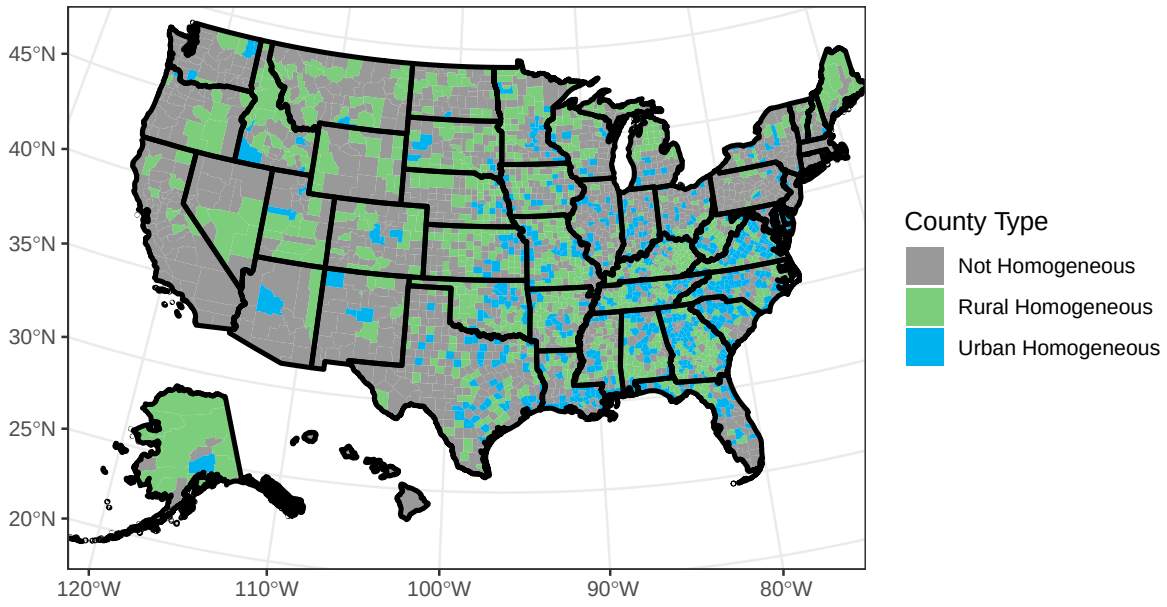

Figure 56: Map of Spatially Homogeneous Counties

and more similar to one another compared to those in Figure 2 from the original analysis. This is likely due to the smaller dataset, which increases uncertainty; rather than using nearly 60,000 respondents, I am forced to use only the approximately 10,000 who reside in the selected homogeneous counties.

In order to more directly compare the results from my original analysis and this second analysis, I save the mean of each state's polarization distribution from each analysis. I then plot these polarization scores against one another in subplot A of Figure 58. The results of the two analyses are not identical, but they are positively correlated, such that a higher polarization score for the original analysis is associated with a higher polarization score when using only the most homogeneous counties. Subplot B of Figure 58 uses the state's polarization rank rather than raw polarization value, yet also shows a positive correlation between the two analyses. These associations are not tremendously strong and may be sensitive to design decisions, such as dichotomizing counties as rural/urban or by selecting 50% as the homogeneity cutoff; however, we also shouldn't expect perfect correlations when discarding

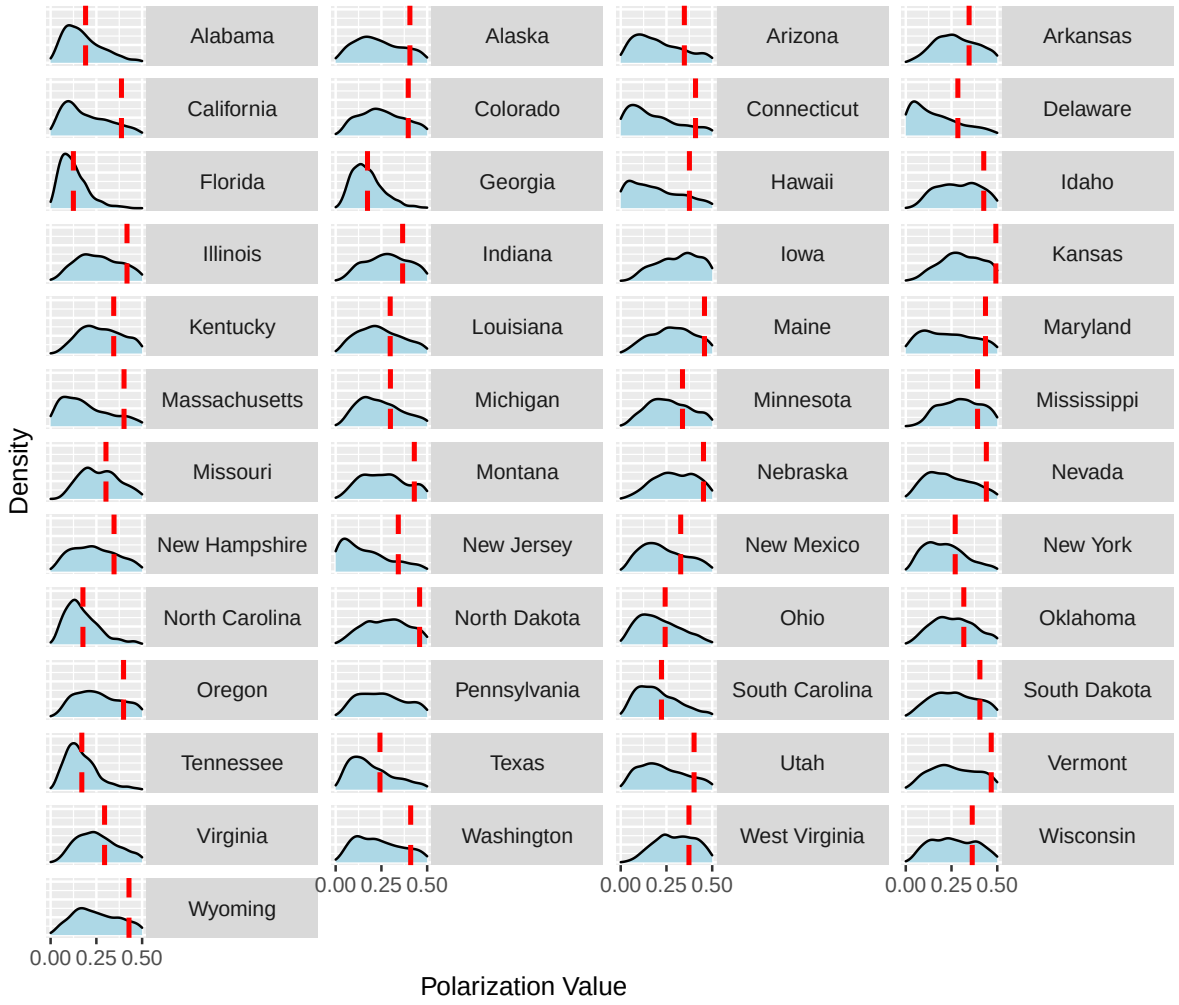

Figure 57: Distribution of Party ID Polarization Estimates (Residents of Homogeneous Counties)

large swaths of the original survey dataset. Nonetheless, this exercise ought to increase our confidence that the original analysis' use of county-level data is appropriate, as we attain similar results when using only the counties that are most spatially homogeneous.

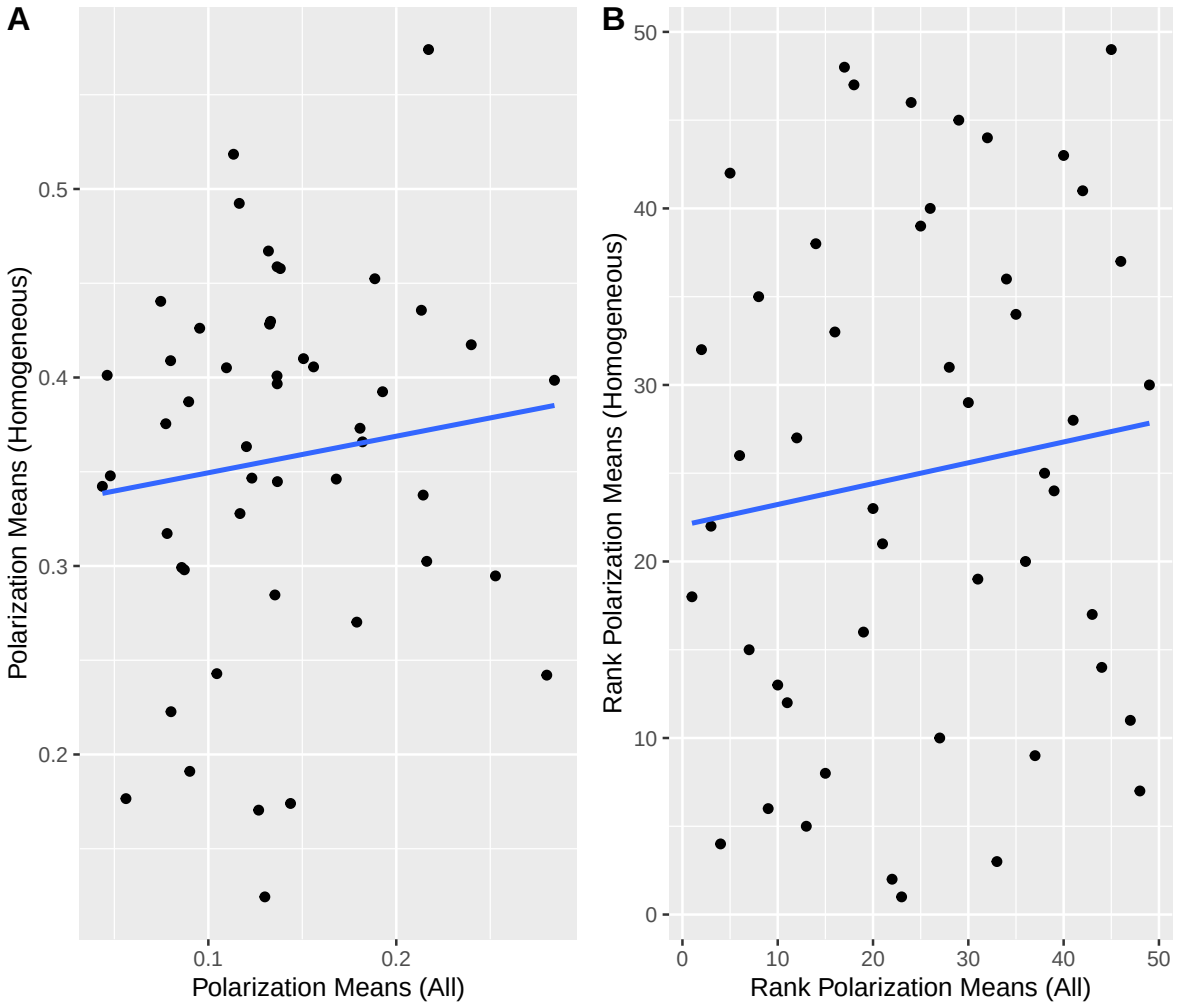

Figure 58: Mean Polarization Estimate Comparisons

A2: MCMC vs. Variational Inference

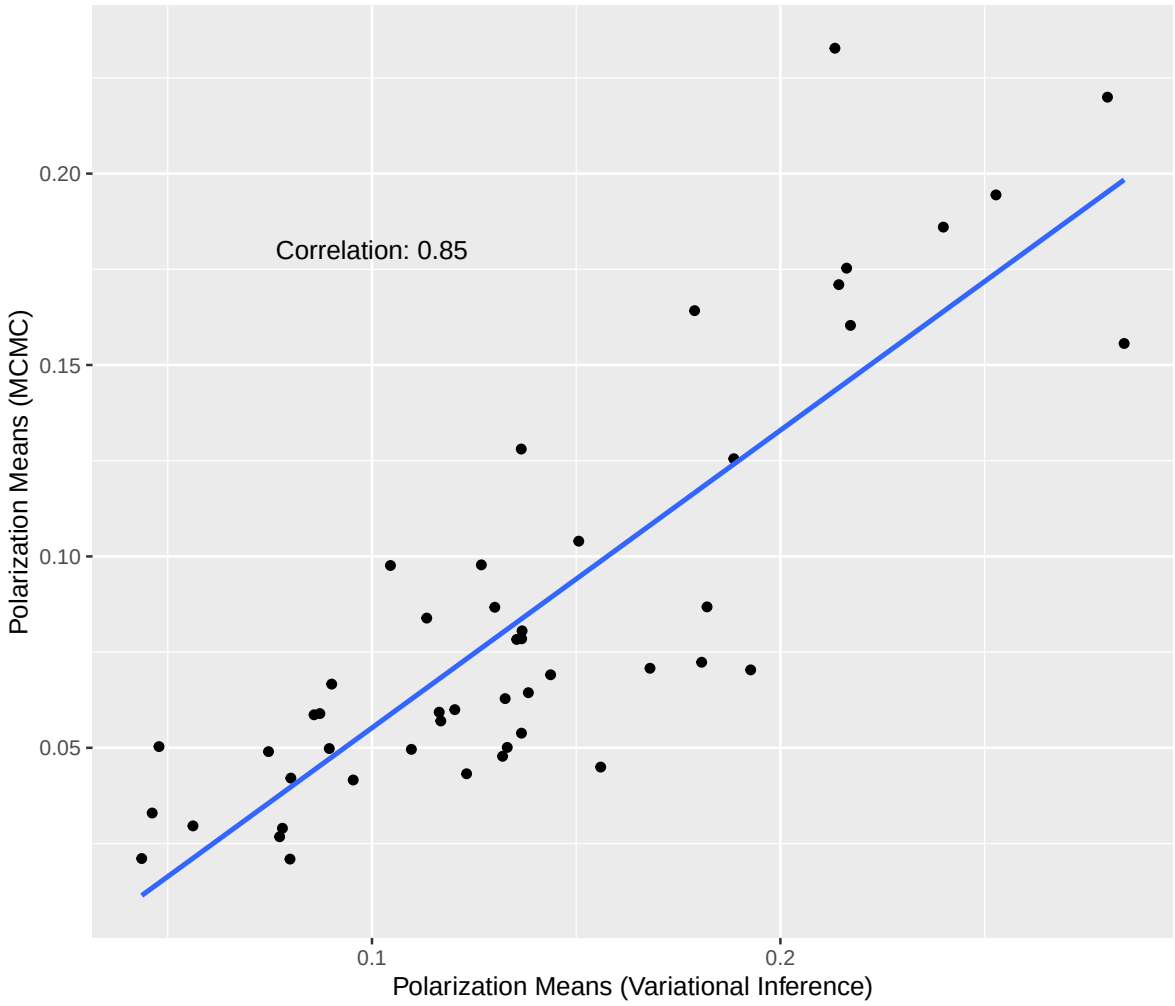

Figure 59: Comparison of Polarization Estimates from MCMC and Variational Inference

A3: 2018 Policy Questions

Table 7: 2018 Policy Questions

Topic	Question
Abortion	Always allow a woman to obtain an abortion as a matter of choice.
Abortion	Ban abortions after the 20th week of pregnancy.
Abortion	Allow employers to decline coverage of abortions in insurance plans.
Abortion	Prohibit the expenditure of funds authorized or appropriated by federal law for any abortion.
Abortion	Make abortion illegal in all circumstances.
Guns	Background checks for all sales, including at gun shows and over the Internet.
Guns	Ban assault rifles.
Guns	Make it easier for people to obtain concealed-carry permit.
Immigration	Withhold federal funds from any local police department that does not report to the federal government anyone they identify as an illegal immigrant.
Immigration	Reduce legal immigration by eliminating the visa lottery and ending family-based migration.
Immigration	Increase spending on border security by 25 billion, including building a wall between the U.S. and Mexico.
Health Care	Repeal the entire Affordable Care Act.
Health Care	Provide Medicare for all Americans.
Trade	Tariffs on 200 billion dollars worth of goods imported from China.
Trade	25 percent tariffs on imported steel and 10percent on imported aluminum, EXCEPT from Canada and Mexico.
Trade	25 percent tariffs on all imported steel and 10percent on imported aluminum, INCLUDING from Canada and Mexico.
Environment	Give the Environmental Protection Agency power to regulate Carbon Dioxide emissions.
Environment	Lower the required fuel efficiency for the average automobile from 35 mpg to 25 mpg.
Environment	Require that each state use a minimum amount of renewable fuels (wind, solar, and hydroelectric) in the generation of electricity even if electricity prices increase.
Environment	Strengthen the Environmental Protection Agency enforcement of the Clean Air Act and Clean Water Act even if it costs US jobs.

A4: All Polarization Estimates

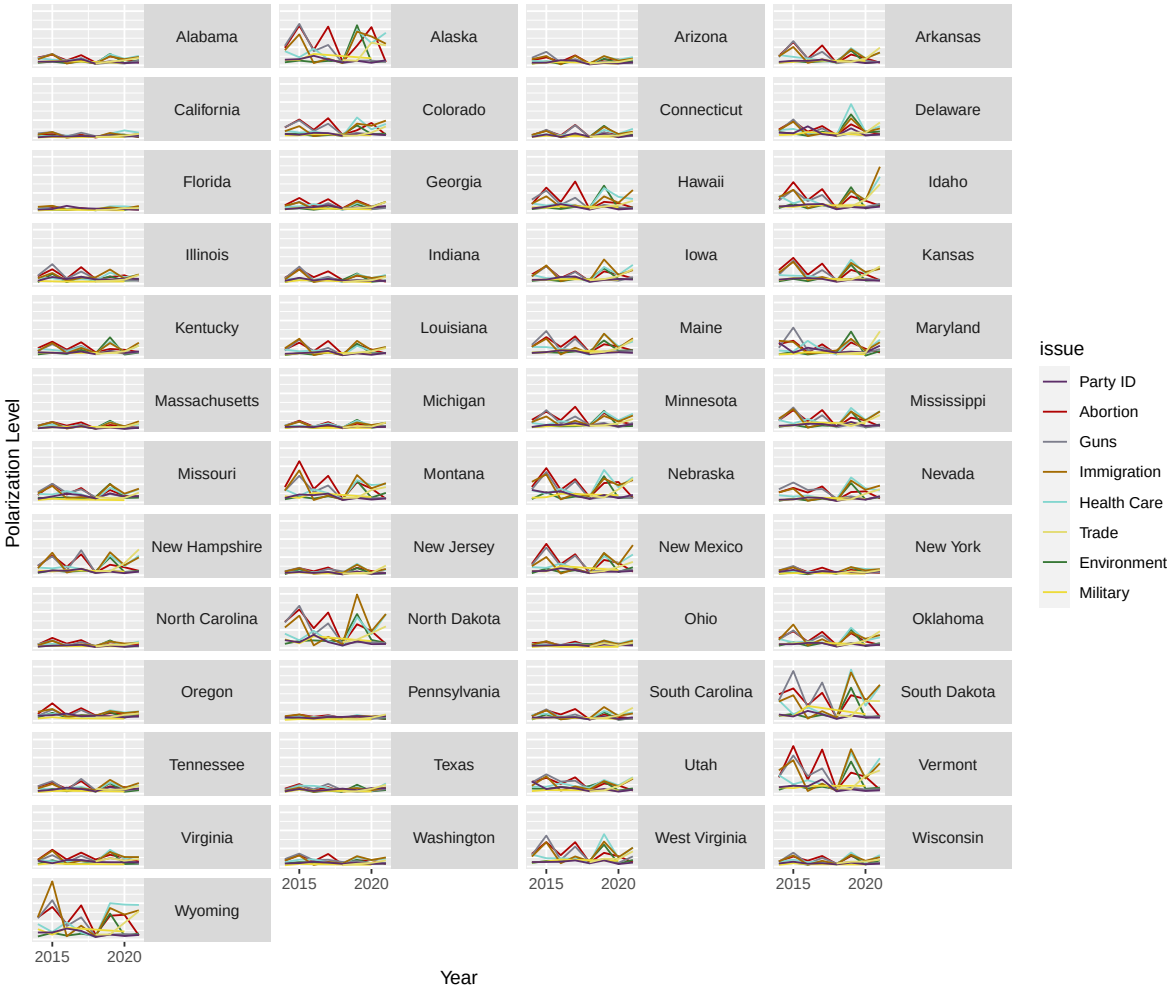

Figure 60: Change in Polarization Estimates Over Time By Issue (All States)

A5: Number of Years with Mass Shooting

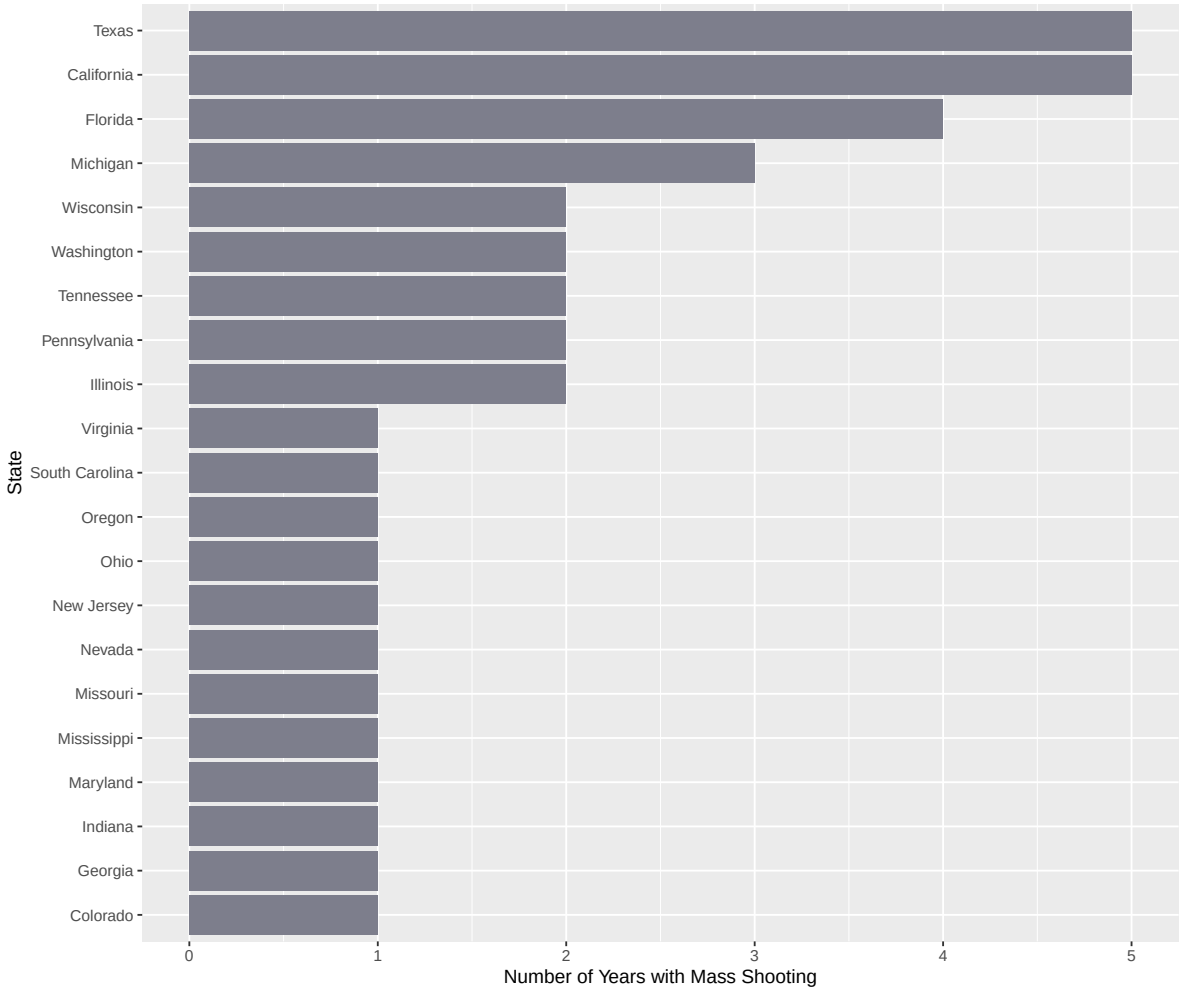

Figure 61: Number of Years with Mass Shooting, by State

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