

Redistricting in Virginia: Identifying a Gerrymandered Map using County Levels

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ABSTRACT

This paper analyzes redistricting in Virginia between the 2010 and 2020 election cycles. While existing redistricting research proposes solutions to gerrymandering, identifies gerrymandered maps, and reviews the local effects of redistricting, there lacks research using smaller levels of analysis. Thus, this study employs a meta-analysis, comparing a partisan index of each of Virginia's 134 counties to the congressional district that county was a part of, in both 2010 and 2020. The results demonstrate an average 3 percent decrease in the disparity between a county's partisanship and the entire district from 2010 to 2020. This change in the average distance between a county's partisanship and its district indicates that the 2020 redistricting made Virginia's districts more representative. This conclusion is corroborated by other Virginia-focused studies. By using counties as levels of analysis, this study delves deeper into how to identify gerrymandering using smaller groups. Given how important redistricting is to the American voting system, more research is needed to better understand the best way to identify a gerrymandered map.

Introduction

Every ten years, following the Census, US congressional districts are required to be readjusted to match population distribution changes, in a process called reapportionment. Reapportionment divides the 435 House of Representative seats among the 50 states—based on population. However, the process of drawing these new district boundaries, called redistricting, can be done unfairly. Redistricting happens every ten years, so whatever map is decided upon is used for all of the elections during that time up until the next reapportionment. That redistricting is typically done by the state's legislature. This presents a problem. It's common for a party to abuse its majority power in a state's legislature to redistrict that state in a way that favors that party in future elections. This is called gerrymandering, or more specifically partisan gerrymandering. There is also racial gerrymandering where politicians draw districts to dilute the power of a certain racial or ethnic group.

The name "gerrymandering" goes all the way back to the 19th century, when Elbridge Gerry, governor of Massachusetts in 1811, redrew the state's districts so it favored the Republican party over the Federalist party (Encyclopaedia Britannica, 2022). Gerrymandering has since become a common redistricting strategy that makes our elections unfair. The basis of a successful democracy is equal representation. But if people's votes are made less powerful than others from gerrymandering, equal representation is lost.

There are two common ways to gerrymander: cracking and packing. Cracking refers to when groups of people with similar characteristics (such as race or party affiliation) are split across multiple districts, dividing that group's voting strength so it's more difficult for them to elect their preferred candidate in any of the districts. Packing is the opposite: certain groups of people are packed into as few districts as possible. While that group will almost certainly win that packed district, their voting strength is diluted everywhere else (Kirschenbaum & Li, 2021).

Though courts have imposed restrictions on racial gerrymandering, the Supreme Court ruled in *Rucho v Common Cause* (2019) that partisan gerrymandering was beyond the federal court's decision and that addressing

gerrymandering should be handled by Congress or state courts (*Redistricting and the Supreme Court, 2021*). Delivering the dissent of the 5-4 majority rule, Justice Elena Kagan perfectly expresses the sadness that comes with this ruling:

Of all times to abandon the Court's duty to declare the law, this was not the one. The practices challenged in these cases imperil our system of government. Part of the Court's role in that system is to defend its foundations. None is more important than free and fair elections (Liptak, 2019).

Following several other states, the state of Virginia recently reformed its redistricting procedures, removing them from the control of the state legislature. When it came around for the state to be redistricted following the 2020 US Census, Virginia redistricting was set to be done by an independent commission for the first time. While redistricting had always been done by the legislature, which in recent cycles had been controlled by Republicans, the 2020 Virginia Amendment 1 Section 6-A created an independent commission. Made up of 16 members, eight legislative and eight citizen members, the commission was free to draw the districts as they saw fit, besides following some basic provisions (Loyola Law School, 2022). Like other states, Virginia districts had to be evenly populated, as close as possible to the same number of people in each district. Another federal requirement was that districts upheld racial and ethnic communities so that they had opportunities to elect candidates of their choice. This derives from the 1993 *Shaw v. Reno* Supreme Court ruling that said districts could not be gerrymandered on the basis of race (JUSTIA, 2023). Combined with *Rucho v Common Cause*, this creates difficulty as states must not gerrymander on the basis of race, but the court chose not to interfere when it came to gerrymandering on the basis of political parties.

Beyond federal rules, Virginia's commission had to follow a few basic provisions laid out in the State constitution: contiguity and compactness. Contiguity means a district is physically connected and you can travel from any point in the district to another point without going across the district's borders. Compactness is not precisely defined, but it generally means that people within a district live near each other and that the district is not too oddly shaped (Loyola Law School, 2021). With fairly vague provisions, the 16-member independent commission went through several plans. However, in the end, the group failed to come to an agreement by the deadline.



Figure 1. Virginia Redistricting Commission's Proposed Plans

The State Supreme Court then appointed two special masters, Republican Sean Trende and Democrat Bernard Grofman. The two special masters were the ones who created the final map, approved by the Virginia Supreme Court in 2021 (Best and Bycoffe, 2022).

Literature Review

In order to understand why this study aimed to identify a gerrymandered map using smaller levels of analysis, it is important to look at the existing body of research on the subject. There are few studies that examine redistricting at a smaller level.

Solution-Based

One branch of study in districting research is proposed ways to solve the problem of gerrymandering—whether through redistricting standards or new voting methods. For example, Brams’ 2020 study used content analysis to discuss a new way to address the United States’ gerrymandering problem. Brams’ idea is unique. To make districting fair, he suggests each state is split into two, reflecting the partisan makeup of the state as a whole, and allowing each party (Democrats and Republicans) to gerrymander its half. Brams calls this “fair gerrymandering” because each party can gerrymander a portion of the state, but the results will still match the statewide partisan proportions. This method is quicker than relying on an independent commission. However, it doesn’t work well for small states and might create too much manipulation in the districting process (Brams, 2020). Another solution to gerrymandering is proposed by Balinski in a 2008 study. Balinski noted that it is hard to rule on gerrymandering when there are no established criteria, besides the vague criterion that there should be “equal representation for equal numbers of people.” Thus, Balinski developed a new way to count votes. First, voters cast ballots for their candidate in their district (just as we do today) but voters also give a vote to their candidate’s party. Then, the requisite number of representatives for each party is calculated on the basis of the total party votes. Then, each party elects the number of candidates it deserves based on party proportions, taking representatives with the highest percentages (with no winners from the same district) (Balinski, 2008).

Identifying a Gerrymandered Map

Most studies on redistricting or gerrymandering focus on identifying a gerrymandered map. A 2020 study, for example, analyzed the disproportionality of the percentage of total Republican votes compared to the percentage of Republican seats won in the 2012 House elections. This study used content analysis to identify seven states—Michigan, North Carolina, Pennsylvania, Ohio, Wisconsin, Virginia, and Florida—that caused the Republicans to win more House seats, even though Democrats won more total votes (Engstrom, 2020). Similarly, a 2006 study by McKee and colleagues reviewed the partisan effects of five proposed plans for Texas’ 2003 congressional redistricting: plans 1180C, 1268C, 1327C, 1362C, and 1374C (the enacted plan). This study used content analysis and regression modeling methods to analyze if these five plans were a knowable gerrymander by Republicans. Utilizing data from the Texas Legislative Council, McKee applied the *JudgeIt* statistical program (developed by Gelman and King) to measure bias and responsiveness in all five proposed plans. McKee’s measurement for bias is very similar to Engstrom’s, comparing a “party’s seat yield beyond what its aggregate vote share would dictate if there were partisan symmetry.” The study found that all five plans—including the one enacted—had a bias towards Republicans. Plan 1374C was the most favorable to Republicans in the short term, while plans 1374C and 1180C were more favorable in the long term (McKee, et al., 2006). Researchers at Binghamton University also set out to identify gerrymandering, specifically in Florida’s 2012 redistricting plan, created by Republicans. Their study applied the McDonald-Best equal vote standard, which is also similar to the standards used by Engstrom and McKee: comparing the percentage of total Republican

votes compared to the percentage of Republican seats won. It also measured asymmetry, or when the median district vote percentage for one party is consistently lower than its mean district vote percentage. Researchers then compared the 2012 Florida map to 25,006 neutral computer-generated (by Magleby and Mosesson) maps (population variances ± 1 percent). The researchers found that Democrats won vote majorities but carried the minority of districts and that they won their seats by larger margins because Democratic voters had been packed into those districts. They then calculated an asymmetry bias coefficient, determining that both the 2012 and 2014 plans were anomalous, with the 2012 enacted plan asymmetry bias of -3.6. Only three percent of the neutral computer-generated maps had a bias of -3.6 or below. Best concluded that because of how unique the plans were from computer-generated possibilities, they had been gerrymandered to favor Republicans (Best, et al. 2020). In a similar area, a 2012 study by Brunell measured “the extent to which those in charge of redistricting use population deviations across districts in state legislative redistricting.” Brunell challenges a widely used idea, the allowed 10 percent deviation in district populations. Looking at voter data in all 50 states in a content analysis, he coded each seat in every state as either Democrat or Republican (third-party victories were dropped) based on the 2002 election. Brunell then calculated the average population of Republican districts subtracted from the average population of Democratic districts, divided by the ideal population for districts in each state (the state population divided by the number of districts). He determined that the accepted 10 percent deviations can still make elections unfair by allowing the party in control to under-populate their districts and overpopulate their opponents. (Brunell, 2012).

Local Effects

The last branch of study within districting research looks at the local effects of gerrymandering. Lawrence and Huffmon set out to see if voters even knew their district had been redrawn, and how they felt about it. In the 2015 study, 981 registered voters were asked about their awareness of being placed in South Carolina’s new seventh district in a telephone poll. Respondents were also asked about their expected vote choice and how they thought their personal values would be represented in the new district, compared to their previous district. Using descriptive data analysis, supplemented with binary regression models, the researchers found that respondents with higher education levels, higher incomes, and greater political knowledge were more likely to know they lived in the new district. Most respondents said they didn't think the new district would make a difference when it came to their representation (Lawrence and Huffmon, 2015). Similarly, Hood and McKee also measured how much voters knew about their changed district, specifically what they knew about that district incumbent. The researchers applied probit regression and empirical analysis to see if voters in a redrawn district and voters who had previously been in that district could identify its incumbent. They found that redrawn voters were much less likely to identify the district’s incumbent. This is powerful research, as it demonstrates that while redistricting does not directly affect vote choice, it does so indirectly because of its impact on incumbent recognition rates (Hood and McKee 2010). Another study that looked at the local effects of redistricting was Niven’s 2021 work on constituents' proximity to district offices. In six states, Niven determined whether the closest district office to a voter’s residence was in their actual district, or if it was in another district (meaning it is the wrong office). He then calculated the percentage of constituents whose closest office was in the wrong district, determining through an ordinal logistic regression that gerrymandered states had higher percentages of mismatch. Niven then surveyed 1,046 voters from those six states and found that people in mismatched districts were deterred from talking to members of Congress. This is valuable, as it demonstrates another link between individual representation and redistricting (Niven, 2021).

It’s clear that there’s no obvious way to determine if gerrymandering has occurred in a state. While some studies have tried to establish standards, there’s no clear-cut or standardized method that could be applied to every possible case of gerrymandering. This makes regulating it very difficult. Because of the ruling in *Rucho v Common Cause*, the issue of gerrymandering has been left to state courts, state legislatures, or Congress. This makes it a highly political issue that has produced predictable outcomes.

This research introduces counties as a new level of analysis. Counties are a representation of communities. Going deeper than just states or districts, counties provide better insight into voters' identities and how they relate to the people in that community. By analyzing voters by their smaller community, this research set out to find if local communities are represented by the districts they're a part of. This leads to the gap in redistricting research. While there are a few studies on the individual effects of districting and gerrymandering, there are none using smaller levels of analysis—like individual counties—to determine if a state has been gerrymandered. Thus, this research project answered the question: **how do Virginia counties' voting results differ from the corresponding federal district results they were a part of in 2010 compared to 2020?** The state of Virginia was chosen for a few reasons. It is a swing state which has had both Democrats and Republicans in charge of redistricting in recent cycles. It is also the state in which this research took place, which provides an opportunity to make the study unique. By looking at 2010 and 2020, this study set out to determine if the 2020 redistricting was more fair than the previous 2010 round of redistricting, using Virginia counties as levels of analysis.

Methods

This study used a meta-analysis. Because this study looked at voter data, it required large-scale data collection, which is not possible for one researcher to conduct. Therefore, four data sets from the Virginia Department of Elections were used. The Virginia Department of Elections is a State Agency that “promotes and supports accurate, fair, open and secure elections for the citizens of the Commonwealth.” The Department guarantees accurate reports of primary and election results for all federal offices (Presidential, US Senate, and US Congress), and state offices (Governor, Lt. Governor, Attorney General, and General Assembly seats) within Virginia (Virginia Department of Elections, 2022). This paper uses election results from 2011, 2012, 2021, and 2022. Each was a separate data set from the Department that was put together for this study. The selection criteria for these sources were made explicit, and methods used by the sources to collect data were stated. This data is publicly available, and the four data sets share common ground, making them possible to be put together in this study. The large sample sizes used in these sources also provide high statistical power to reach conclusions.

Research started with gathering a list of all 134 Virginia counties from the US Census. Virginia is divided into 95 counties and 39 independent cities, but for census purposes cities are considered county-equivalents. Between 2010 and 2020 the previously independent Bedford City combined with Bedford County. Bedford City numbers for the 2010 data were combined with Bedford County for the purposes of this research (US Census Bureau, 2019). District maps from 2010 and 2020 were then sourced from FiveThirtyEight. Virginia had 11 House of Representatives districts in both years (Best and Bycoffe, 2022).

Next, election results within each county were sourced from the Virginia Department of Elections, which lists the votes for each candidate of a House of Representatives District in a county and the votes for each House of Delegates in a county. Write-in votes were not associated with a party and thus excluded from the totals. However, they made up a very small portion of the total votes. Since ballot secrecy is guaranteed by law in all states, voters' personal information was not shared. The Virginia Freedom of Information Act (FOIA), §2.2-3700 et. seq. of the Code of Virginia, allows Virginia Commonwealth residents access to public records held by public bodies (§ 2.2-3700).

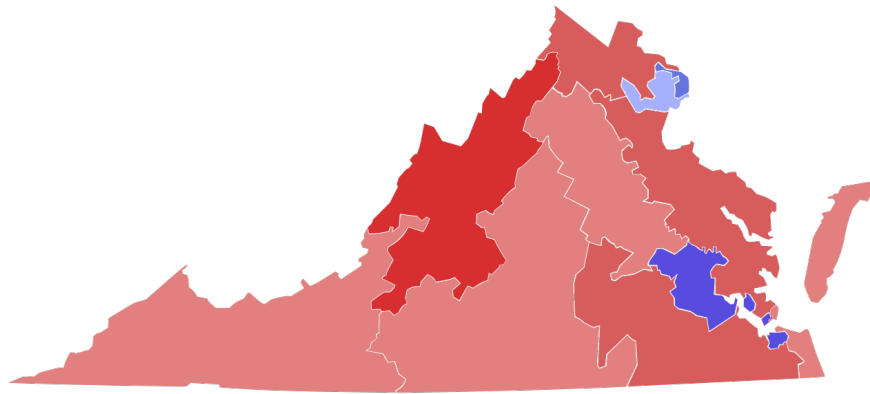


Figure 2. Virginia's 11 House of Representative Districts after 2010

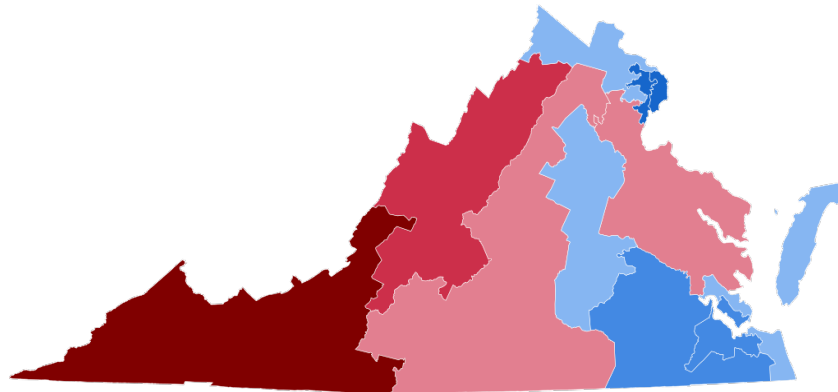


Figure 3. House of Representatives Districts after 2020

The Republican win percentage for each county was then determined. This was calculated by dividing votes for the Republican candidate by total votes, multiplied by 100 to make a percentage. This was first done for entire districts in the 2012 and 2022 congressional elections to determine a basis for comparison. Then, to determine a county's partisan index, average Republican win percentages in the House of Delegates (2011 and 2021) and House of Representatives (2012 and 2022) were determined. This gave a percentage for how each county individually voted, using averages from two elections for more indicative numbers of each county's partisanship. Winning seats isn't just about parties, it also depends on a candidate and their campaign, so using more than one election is more representative of the voting trends of a county. For counties split into more than one district, each part was measured separately.

Next, for each county, that county's partisan index was compared to its entire district's percentage. This gave a value for the disparity between each county's own voting choices and the district that county was represented by. This disparity percentage was determined for every county in the 2010 grouping and the 2020 grouping.

Finally, the change in that disparity percentage from 2010 to 2020 was determined for each county. Taking an average of that change for all counties gave a final percentage for how the partisan disparity between a county and its district changed from 2010 to 2020. A negative change reflected counties being closer to their district after the 2020 redistricting, while a positive change reflected them having a larger disparity.

Using one county as an example can make the methods easier to understand. For this, the county of Greensville in Southern Virginia is a good example. After 2010, Greensville was part of the Fourth Virginia district. District

Four had an overall Republican win percentage of 57% in the 2012 House of Representatives election, which elected Republican candidate Randy Forbes. However, Greenville had a partisan index of 37%, calculated using Greenville voting in the 2011 House of Delegates and 2012 House of Representatives, which were 30% and 44% respectively. Not only did Greenville and District Four want to elect different parties, but the disparity between Greenville’s partisan index and District Four was alarming, at 20%. The number after the 2020 redistricting, however, tells a different story. The newly redrawn District Four now had a Republican win percentage of 36%, electing Democrat Donald McEachen. Greenville County had a partisan index of 48%, averaging the 47% from the House of Delegates and 48% from the House of Representatives. Thus, the disparity in partisanship between the individual county of Greenville and the district it was a part of decreased by 8% between 2010 and 2020. This indicates that District Four became more representative for Greenville voters following the 2020 redistricting.

Results

Using a quantitative difference test, there was found to be an average 3 percent decrease in the disparity between a county’s partisanship and its entire district from 2010 to 2020. The change from 2010 to 2020 of the average distance between a county’s partisanship and its district being negative indicates that the 2020 redistricting made Virginia’s districts more representative. On average, counties were better represented by their districts with the new map.

The results of this research are statistically significant, determined using a paired two-tailed t-test, which came out with a p-value of 0.03. As this is less than the standard alpha p-value of 0.05, a null hypothesis is rejected and the results are statistically significant. Another notable part of the results was that the median was also -3%.

Table 1. Sample table of select counties (134 in total)

County	2011/12 Partisan Index	2012 HR District	2010 Disparity	2021/22 Partisan Index	2022 HR District	2020 Disparity	Change 2010/2020
Arlington	15%	31%	16%	22%	25%	3%	-13%
Greenville	37%	57%	20%	48%	36%	12%	-8%
Radford	48%	61%	14%	55%	73%	18%	+4%
Stafford	53%	48%	5%	73%	56%	17%	-12%

Discussion

The results that the 2020 map is more fair are backed up by other Virginia-focused analyses using other methods to identify gerrymandering. For example, Princeton’s “Redistricting Report Card” gave the final special masters’ map an overall grade of an A, looking at partisan fairness, geographic features, and minority composition (Redistricting Report Card, 2021). FiveThirtyEight also corroborated these results, measuring the median seat, efficiency gap, and competitiveness to determine that the new map was more fair (Best and Bycoffe, 2022).

This research fills the gap by using smaller levels of analysis to identify a gerrymandered map. While previous redistricting literature has set out to see if a map is gerrymandered using other, larger-scale methods, this paper zeroes in on each county as a level of analysis. This effectively combines two branches of redistricting research: local effects and gerrymandered map identification. By using counties as these smaller levels of analysis, this paper aims to be more representative of communities within a state by looking at individual counties. There is no clear-cut way to decide if redistricting has been done unfairly. This research presents a new way.

Limitations

To determine a percentage for each county's partisan index, this research takes the average voting within a county for the House of Representatives and the House of Delegates elections. Multiple elections were used to have a better representation of a county's voting habits. However, only using two sets of voting data for each year was not necessarily the most indicative of a county's partisanship. Thus, one limitation of this study was that only two elections were used. Averaging each county's voting data in several elections would be more representative of that county's partisanship. This would solidify the paper's results.

Another limitation of this study is that it does not account for the differences in population among counties. This research uses each Virginia county as a level of measurement. However, the number of people in each county can be vastly different; not every county is equal. Adjusting the values by population so counties with more people are stronger would be more accurate to the state as a whole.

Implications and Future Research

The methods used in this paper could open up several avenues for further research in the redistricting field. One approach would be to apply these methods to other states. This study uses Virginia, but similar methods could certainly be employed in any other state to determine if a redistricted map is more fair. This could be especially significant in states where anti-gerrymandering measures like Virginia's independent commission/special masters have been put in place in order to study their effectiveness. States where similar research could be valuable include Colorado, Pennsylvania, Wisconsin, and North Carolina, all of which had their most recent redistricting done by independent commissions or the states' Supreme Court. Another future inquiry for study would be addressing the aforementioned limitations, whether it be for Virginia or another state, especially using more elections within a county to determine that county's partisanship. A county's voting history for President, Governor, and senator could all be used to gather a more accurate partisan index.

It's fundamental to understand that redistricting affects every aspect of the voting process. Whether it's the politicians Americans elect, the laws that are enacted, or any decisions made, it all starts with the vote. When the fairness of that vote is infringed upon, our political systems suffer. Democracy can never function successfully if the basis—voting—is not fair.

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