Report on Proposed Redistricting Plan from the Pennsylvania Legislative Reapportionment Commission

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1 Introduction and Qualifications

I have been asked by counsel to review the Legislative Reapportionment Commission's proposed redistricting plan and compare it to a set of simulated redistricting plans across a number of factors commonly considered in the redistricting process and in redistricting litigation.

I am an associate professor of political science at Brigham Young University and faculty fellow at the Center for the Study of Elections and Democracy in Provo, Utah. I received my PhD in political science from Princeton University in 2014 with emphases in American politics and quantitative methods/statistical analyses. My dissertation was awarded the 2014 Carl Albert Award for best dissertation in the area of American Politics by the American Political Science Association.

I teach a number of undergraduate courses in American politics and quantitative research methods.[1] These include classes about political representation, Congressional elections, statistical methods, and research design.

I have worked as an expert witness in a number of cases in which I have been asked to analyze and evaluate various political and elections-related data and statistical methods. Cases in which I have testified at trial or by deposition are listed in my CV, which is attached to the end of this report. I have previously provided expert reports in a number of cases related to voting, redistricting, and election-related issues: *Nancy Carola Jacobson, et al., Plaintiffs, vs. Laurel M. Lee, et al., Defendants. Case No. 4:18-cv-00262 MW-CAS (U.S. District Court for the Northern District of Florida); Common Cause, et al., Plaintiffs, vs. Lewis, et al., Defendants. Case No. 18-CVS-14001 (Wake County, North Carolina); Kelvin Jones, et al., Plaintiffs, v. Ron DeSantis, et al., Defendants, Consolidated Case No. 4:19-cv-300 (U.S. District Court for the Northern District of Florida); Community Success Initiative, et al., Plaintiffs, v. Timothy K. Moore, et al., Defendants, Case No. 19-cv-15941 (Wake County, North Carolina); Richard Rose et al., Plaintiffs, v. Brad Raffensperger,*

[1]The political science department at Brigham Young University does not offer any graduate degrees.

Defendant, Civil Action No. 1:20-cv-02921-SDG (U.S. District Court for the Northern District of Georgia); Georgia Coalition for the People's Agenda, Inc., et. al., Plaintiffs, v. Brad Raffensberger, Defendant. Civil Action No. 1:18-cv-04727-ELR (U.S. District Court for the Northern District of Georgia); Alabama, et al., Plaintiffs, v. United States Department of Commerce; Gina Raimondo, et al., Defendants. Case No. CASE NO. 3:21-cv-00211-RAH-ECM-KCN (U.S. District Court for the Middle District of Alabama Eastern Division); League of Women Voters of Ohio, et al., Relators, v. Ohio Redistricting Commission, et al., Respondents. Case No. 2021-1193 (Supreme Court of Ohio); Harper, et al., Plaintiffs, v. Hall et al., Defendants. Case No. 21-CVS-015426 (Wake County North Carolina)

In my position as a professor of political science, I have conducted research on a variety of election- and voting-related topics in American politics and public opinion. Much of my research uses advanced statistical methods for the analysis of quantitative data. I have worked on a number of research projects that use "big data" that include millions of observations, including a number of state voter files, campaign contribution lists, and data from the US Census. I have also used geographic information systems and other mapping techniques in my work with political data.

Much of this research has been published in peer-reviewed journals. I have published nearly 20 peer-reviewed articles, including in our discipline's flagship journal, *The American Political Science Review* as well as the inter-disciplinary journal, *Science Advances*. My CV, which details my complete publication record, is attached to this report as Appendix A.

The analysis and opinions I provide in this report are consistent with my education, training in statistical analysis, and knowledge of the relevant academic literature. These skills are well-suited for this type of analysis in political science and quantitative analysis more generally. My conclusions stated herein are based upon my review of the information available to me at this time. I reserve the right to alter, amend, or supplement these conclusions based upon further study or based upon the availability of additional information. The opinions in this report are my own, and do not represent the view of Brigham Young

University.

2 Methods

To gauge the degree to which the Commission's proposed map is a partisan gerrymander, I conduct simulated districting analyses to allow me to produce a large number of districting plans that follow traditional redistricting criteria using small geographic units as building blocks for hypothetical legislative districts (election precincts). This simulation process ignores all partisan and racial considerations when drawing districts. Instead, the computer simulations are programmed to create districting plans that follow traditional districting goals without paying attention to partisanship, race, or the location of incumbent legislators. This set of simulated districts is helpful because it provides a set of maps to which we can compare the Commission's proposed map to see if it is biased in favor of either political party. This is because in comparing the Commission's map to the simulated districts, we are comping a map to a set alternative maps that we know to be unbiased. If the Commission's map produces a similar outcome as the alternative set of maps, we may reasonably conclude that the Commission's plan is also unbiased. Alternatively, if the Commission's proposed plan significantly diverges from the set of simulated maps, it may be the case that the proposed plan is biased in favor of one party.

The process of simulating districting plans has been recognized and used in a variety of redistricting cases, including in Pennsylvania.[2] While different people employ slightly different methods, the overall process is much the same. For my simulations, I use a program developed by Fifield et al. (2020).[3]

[2]See League of Women Voters of Ohio v. Ohio Redistricting Commission (2021); Harper v. Hall (2021); Common Cause v. Lewis (2019); Harper v. Lewis (2019); League of Women Voters of Pennsylvania v. Commonwealth of Pennsylvania (2018).

[3]Fifield, Benjamin, , Michael Higgins, Kosuke Imai, and Alexander Tarr. "Automated redistricting simulation using Markov chain Monte Carlo." Journal of Computational and Graphical Statistics 29, no. 4 (2020): 715-728.

Fifield, Benjamin, Kosuke Imai, Jun Kawahara, and Christopher T Kenny. 2020. "The essential role of empirical validation in legislative redistricting simulation." Statistics and Public Policy 7 (1): 52–68.

A significant advantage of the simulation-based approach is the ability to provide a representative sample of possible districting plans that accounts for the unique political geography of a state, such as the spatial distribution of voters or the location and number of administrative boundaries, such a counties. Simulation methods can also to a degree incorporate each state's unique redistricting rules. The simulation-based approach therefore permits us to compare a particular plan to a large number of representative districting plans in Pennsylvania. In the simulations I run, I instruct the model to generate plans that adhere to the redistricting criteria contained in the Pennsylvania Constitution.

Specifically, the model is constrained to conduct 50,000 simulations in which each simulation generates 203 districts that are of roughly equal population (<4.6% deviation above or below the target population of 64,053, which is the same range as in the commission proposal). The algorithm does this by assembling small geographic units — electoral precincts — into larger groups of precincts until a group of precincts is large enough to constitute a new legislative district. The model does this 203 times to create a full redistricting plan containing 203 legislative districts. It then repeats this process 50,000 times, generating a different set of 203 districts with each run of the model. In each of the 50,000 iterations, the model is instructed to generate districts that cross county boundaries as few times as possible. Of course, county populations do not always add up to round units of districts, and so of necessity some county boundaries will be split. The model is further instructed that when a county boundary needs to be crossed, it should avoid splitting the county more times than necessary. The model also includes instructions to generate districts that are geographically compact. The final constraint is an instruction to avoid splitting municipal and township boundaries.

Once the simulated district plans are complete, only then do I compute the partisan composition of each district in each plan. For the partisan composition of each district I rely

Kenny, Christopher T., Cory McCartan, Benjamin Fifield, and Kosuke Imai. 2020. redist: Computational Algorithms for Redistricting Simulation. https://CRAN.R-project.org/package= redist.

McCartan, Cory, and Kosuke Imai. 2020. "Sequential Monte Carlo for sampling balanced and compact redistricting plans." arXiv preprint arXiv:2008.06131.

on the election results from statewide elections disaggregated to the level of the precinct. I then reassemble these election results for each of the simulated districts in each of the 50,000 simulations to compute the proportion of votes across all statewide elections conducted between 2012 and 2020 that were won by the Democratic and Republican candidates in those districts.[4] In other words, the partisan index is the average vote share for Democratic candidates in each district for the statewide elections considered between 2012-2020. I choose 2012 as the starting date as this a full set of elections between the decennial census. Furthermore, averages of multiple elections have the benefit of "washing out" the impact of any particular election, since individual elections can vary due to particular candidate features and other idiosyncrasies, and particular years can vary due to national electoral waves (i.e. 2018 was an especially good year for Democrats while 2016 was an especially good year for Republicans nationwide).

[4]The particular races are 2020: President, Auditor, Attorney General, Treasurer; 2018: Governor, US Senate; 2016: President, US Senate, Auditor, Attorney General, Treasurer; 2014: Governor; 2012: President, US Senate, Auditor, Attorney General, Treasurer. I do not include statewide judicial elections in the index. It is uncommon in political science to use judicial elections to measure voters' partisan preferences as research suggests voters treat judicial elections very differently, even when judges run under party labels, than they do partisan elections to legislative and executive positions. Other commonly used measures indices such as Dave's Redistricting and PlanScore.com also omit judicial elections from their partisan indices.

3 Results

3.1 Population, Boundary Splits, and Compactness

Table 1 below compares the Commission proposal to the distribution of simulations for population deviation, boundary splits, and compactness. The Commission proposal and the simulations are within the same range of district population deviations from the target district size. The proposal splits 45 counties 184 times. This is in line with the simulations in terms of the number of counties split. The proposal divides 63 municipalities 102 times. This is also within the range produced by the simulations. On the whole, the proposal appears to perform well at having few municipal splits. However, later in the report I will show how the choice of *which* municipalities to split is informative of why the Commission's proposal is such an extreme partisan outlier compared to the set of simulation results. With regards to district compactness, the Commission proposal is similarly compact and largely in line with the results of the simulations.

Table 1: Commission Proposal and 50,000 Simulations: Population, Splits, and Compactness

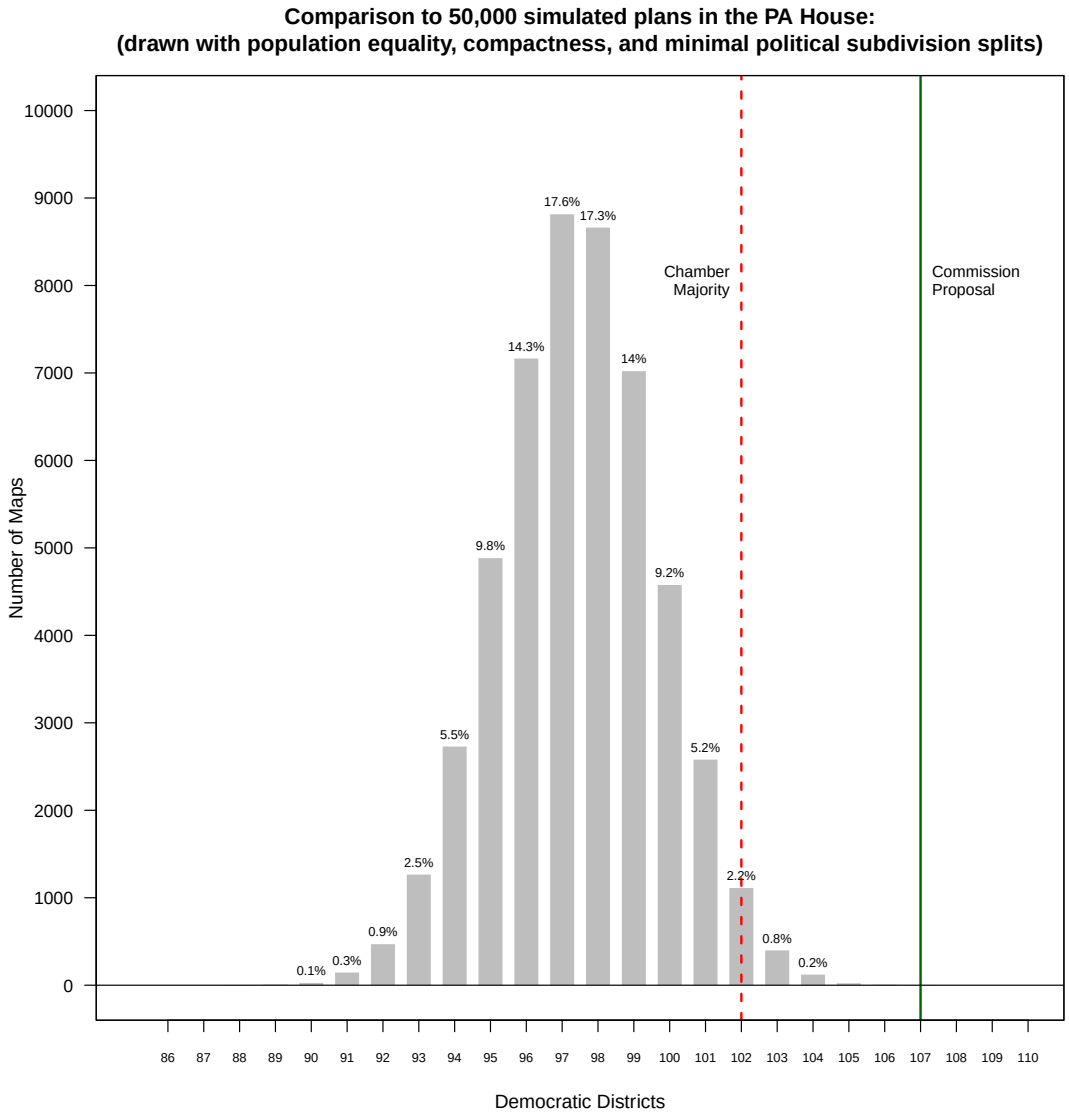
	Commission Proposal	Simulations Median	Simulations Range
Population Deviation			
Smallest District:	-4.62%	-4.61%	[-4.65., -4.25]
Largest District:	4.67%	4.62%	[4.21, 4.65]
Boundary Splits			
Counties Split:	45	46	[42, 52]
Total County Splits:	184	195	[183, 207]
Municipalities Split:	63	81	[60, 102]
Total Municipal Splits:	102	118	[97, 140]
Compactness			
Median Polsby-Popper:	0.34	0.32	[0.28, 0.34]

3.2 Partisanship

Figure 1 displays the distribution of Democratic leaning districts in both the simulations and the Commission's proposal using the partisan index discussed above. For reference the red dashed line in the plot is at 102, the number of seats needed for a majority in the Pennsylvania House of Representatives. The green line shows the results of calculating the partisan index for the Commission proposal. The Commission proposal generates 107 Democratic leaning districts (districts with a partisan index greater than 0.50), which is 10 seats larger than the most common outcome generated by the simulations, 97. The numbers above each bar in the histogram display the relative frequency of each outcome in the simulations. Beginning from the far left side of the figure and adding those numbers up as one moves to the right, we would find that the Commission's plan generates more Democratic leaning districts than 99.998% of the simulations.

Recall that in using the simulations we are comparing the Commission's proposed map to a set of maps drawn by the computer using only those criteria that I instructed the algorithm to follow - namely the pre-specified nonpartisan criteria of equal population, contiguity, geographic compactness and a preference for fewer county and municipal splits. And yet the degree to which the Commission's proposal diverges from the distribution of simulation results is extreme and represents a significant deviation from a fair outcome. Thus, the significant deviation observed here strongly suggests that the Commission's plan was drawn using some other, or additional criteria. This could, of course, include a motivation for Democratic partisan advantage given the incredibly large deviation between the number of Democratic districts generated by the proposal and the range of Democratic-leaning districts generated by the simulations.

Figure 1: **Partisan Composition of Commission Proposal and Simulations**



Note: The grey distribution is the number of Democratic seats generated from the 50,000 simulations. The vertical green line is the number of Democratic leaning seats in the Commission's proposal. The Commission's proposal generates more Democratic leaning districts than 99.998% of the simulations. The red dashed line is placed at 102, the number of seats needed for majority control in the Pennsylvania House of Representatives. The partisan lean of districts in the simulations and the Commission proposal are calculated as the two-party vote share of statewide partisan elections from 2012-2020.

4 Political Geography of Pennsylvania

Where are the discrepancies in partisanship arising? Given the geographic distribution of voters in Pennsylvania and the clustering of Democrats within the large and medium-sized cities of the state, there are only relatively few locations in which Democratic districts can be constructed.

Scholarship in political science has noted that the spatial distribution of voters throughout a state can have an impact on the partisan outcomes of elections when a state is, by necessity, divided into a number of legislative districts. This is largely the case because Democratic-leaning voters tend to cluster in dense, urban areas while Republican-leaning voters tend to be more equally distributed across the remainder of the state.[5] One prominent study of the topic (Chen and Rodden, 2013) finds that "Democrats are highly clustered in dense central city areas, while Republicans are scattered more evenly through the suburban, exurban, and rural periphery...Precincts in which Democrats typically form majorities tend to be more homogenous and extreme than Republican-leaning precincts. When these Democratic precincts are combined with neighboring precincts to form legislative districts, the nearest neighbors of extremely Democratic precincts are more likely to be similarly extreme than is true for Republican precincts. As a result, when districting plans are completed, Democrats tend to be inefficiently packed into homogenous districts."[6]

Rodden (2019) further discusses this with specific reference to Pennsylvania.[7] He

[5]See for example Stephanopoulos, N. O. and McGhee, E. M., Partisan Gerrymandering and the Efficiency Gap, *The University of Chicago Law Review* 82: 831-900, (2015); Chen, J. and Rodden, J., Unintentional Gerrymandering: Political Geography and Electoral Bias in Legislatures, *Quarterly Journal of Political Science* 8: 239-269, (2013); Nall, C., The Political Consequences of Spatial Policies: How Interstate Highways Facilitated Geographic Polarization, *Journal of Politics*, 77(2): 394-406, (2015); Gimple, J. and Hui, I., . Seeking politically compatible neighbors? The role of neighborhood partisan composition in residential sorting, *Political Geography* 48: 130-142 (2015); Bishop, B., *The Big Sort: Why the Clustering of Like-Minded America is Tearing Us Apart*, Houghton Mifflin Press (2008); and Jacobson, G. C., and Carson, J. L., *The Politics of Congressional Elections*, 9th ed. Lanham, MD: Rowman and Littlefield (2016).

[6]Chen, J. and Rodden, J., Unintentional Gerrymandering: Political Geography and Electoral Bias in Legislatures, *Quarterly Journal of Political Science* 8: 239-269, (2013)

[7]Rodden, Jonathan A. Why cities lose: The deep roots of the urban-rural political divide. Hachette UK, 2019.. While Rodden is specifically discussing Pennsylvania in this quote, the statement is true of any location with Democrats clustered in urban areas.

states:

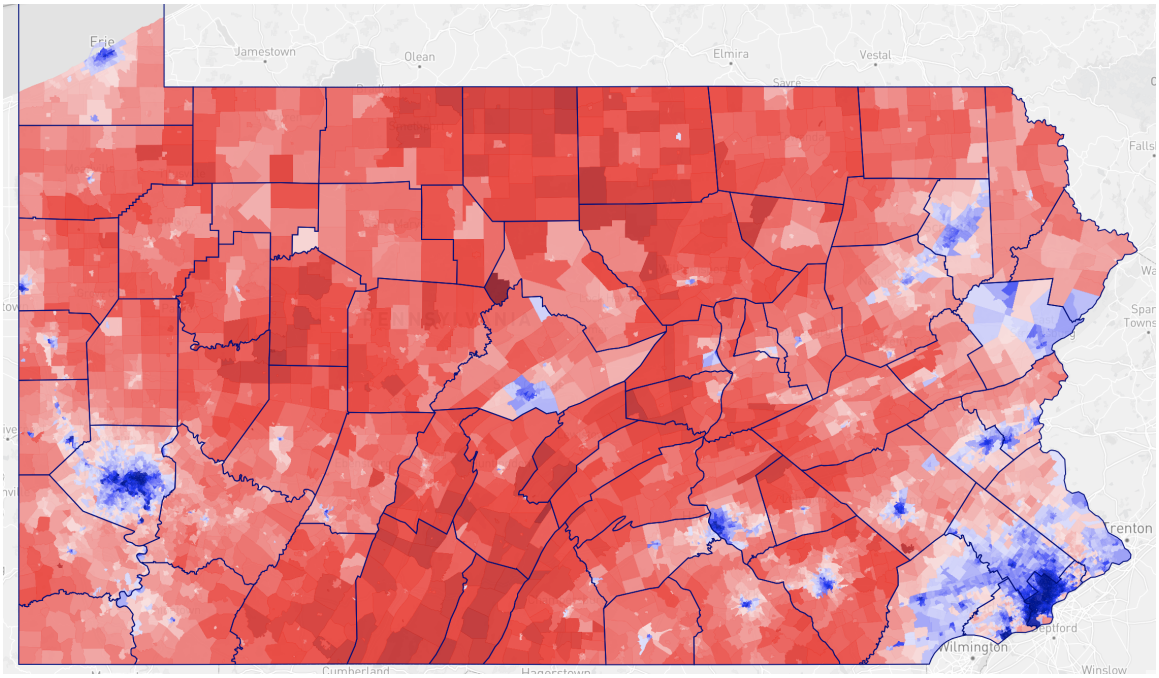
> Then and now, the Democrats have been plagued by a problem with geography. In the years following the New Deal, their supporters became concentrated in the core urban neighborhoods of Pennsylvania's nineteenth-century industrial cities and along the surrounding railroad tracks. They remain so today....Because of the scale and geographic arrangement of Pennsylvania's nineteenth-century cities, the Democrats' problem is severe when districts are very small—as in the state house of representatives—and even worse when they are medium-sized, as in the state senate.

The map below confirms that this is the case in Pennsylvania. We see large Democratic majorities shown in blue in and around Philadelphia and Pittsburgh as well as small pockets of densely populated Democratic voters in the other medium-sized industrial cities of the state. These areas are surrounded by large swaths of the state that are solidly Republican.

The upshot of this pattern is that political parties stand at a disadvantage when their voters are not "efficiently" distributed across the state. To understand what I mean by efficient, imagine two different scenarios. First, imagine a party with a slim majority of voters statewide in which every precinct's vote share perfectly reflected the overall state. In other words, the party has a slight majority in every precinct that adds up to a slight majority statewide. In this case, this party's voters are extremely efficiently distributed in such a way that the party will win every single district despite only a slim majority statewide. Now imagine a different arrangement, a party who still holds a slim majority statewide, but whose voters are heavily concentrated in a few areas and sparsely populated throughout the rest of the state. In this case, despite holding a majority of votes statewide, the party will only win a few seats where their voters are heavily concentrated. The political geography of Pennsylvania closely resembles the second scenario.

The geographic concentration of a party's voters tends to harm that party when single-member districts are drawn by creating districts that favor that party by very large

Figure 2: **Distribution of People and Partisan Preferences in Pennsylvania**



Note: Distribution of Partisan Preferences in Pennsylvania based on the average of statewide partisan elections. Blue = Democratic, Red = Republican

majorities, thus "wasting" many votes in running up large majorities far beyond 50%+1.[8] This occurs in Pennsylvania in the large and medium-sized cities of the state. These overwhelming margins for the party are what drives "wasted votes," which, in turn translate to fewer seats than the statewide proportion of the vote would suggest.[9]

Another way to consider this is to look at a lower level of geography, electoral precincts. Figure 3 shows the distribution of partisan preferences for recent statewide partisan elections for all precincts in Pennsylvania. The top panel notes precincts where there are strong majorities for either party and labels them as "inefficient" precincts (those precincts towards the outer edges of the figure). They are inefficient based on the discussion above

[8]McGhee, E. (2017). Measuring Efficiency in Redistricting. Election Law Journal: Rules, Politics, and Policy, 16(4), 417–442. doi:10.1089/elj.2017.0453

[9]The term "wasted votes" in political science is not to imply that a person's vote is not important or counted, but rather that the vote is less helpful in gaining an additional seat for their preferred party if it is an additional vote in favor of a candidate that has already won a substantial majority of the votes in their district. Technically, all votes beyond 50%+1 would be, as a result, "wasted". However, parties are interested in winning by majorities larger than 50%+1, but not by margins much beyond that point at which their candidate is all but assured to win.

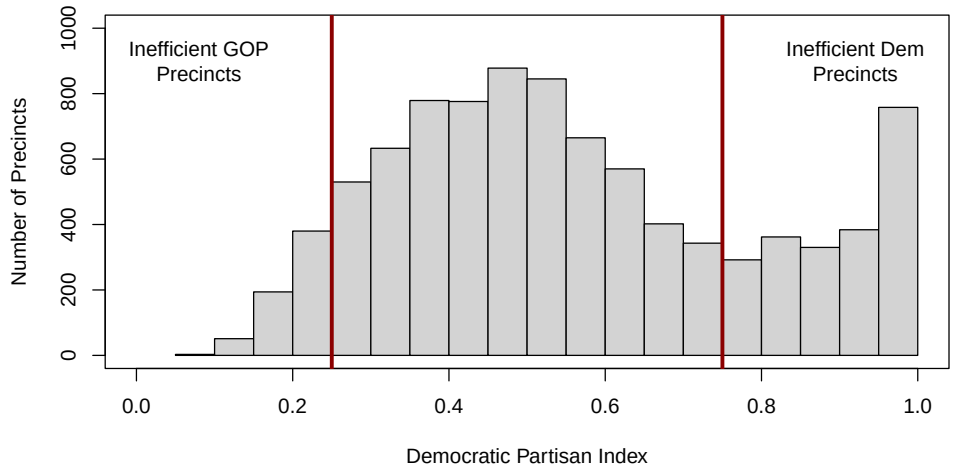
that a party wastes votes if it builds majorities far beyond the needed 50%+1. Note that the distribution is not symmetric and that there are many more precincts with very large Democratic majorities than there are precincts with equally large Republican majorities. The lower panel shows the same distribution but labels "efficient" precincts — those where a party has a majority, but not an overwhelming majority. Note here that there are many more precincts with efficient Republican majorities than there are precincts with efficient Democratic majorities.

This inefficient distribution of votes would not be a problem for Democrats if district boundaries were able to amble about the state and divide municipalities so as to create districts that had less overwhelming Democratic support. Rodden (2019) notes this by saying: "Democrats would need a redistricting process that intentionally carved up large cities like pizza slices or spokes of a wheel, so as to combine some very Democratic urban neighborhoods with some Republican exurbs in an effort to spread Democrats more efficiently across districts" (pg. 155).[10] However, the laws governing redistricting in Pennsylvania run counter to either of these strategies. Pennsylvania's redistricting rules that require districts to be geographically compact and to avoid county and municipal divisions prohibit the type of meandering districts that Rodden describes above. In the end, this means that Republicans begin the redistricting process with a natural geographic advantage due to the combination of laws requiring where and how districts are drawn combined with the particular spatial distribution of their voters.

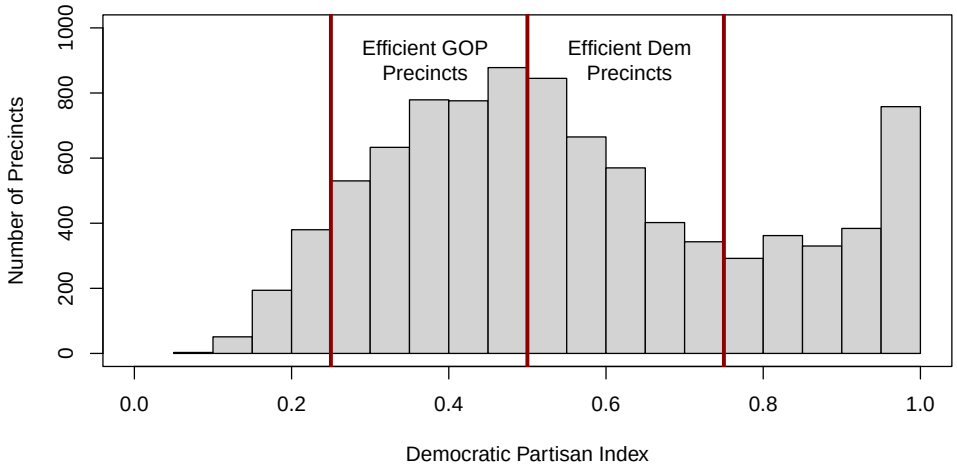
[10]Rodden, Jonathan A. Why cities lose: The deep roots of the urban-rural political divide. Hachette UK, 2019.

Figure 3: **Distribution of Votes Across Precincts in Pennsylvania**

(a) Inefficient precincts



(b) Efficient Precincts



Note: Partisan Index based on the average of statewide partisan races between 2012-2020.

5 Looking at Subsets of Pennsylvania

Given the discussion above, it is instructive to look at locations in the state that have urban clusters of Democratic voters. If the Commission's proposal is attempting to enact a Democratic gerrymander, we should see evidence of what Rodden (2019) discusses above, i.e. the intentional division of Democratic cities that are used to spread Democratic voters out more efficiently to overwhelm Republican votes in the adjacent suburbs and exurbs in order to create more Democratic districts than would otherwise be produced by keeping these municipalities whole.

To do this I focus on a number of counties (or groups of counties) in the state that contain large and medium-sized cities and compare the partisan outcomes in the Commission's proposed plan to the plans generated by the simulations. The table below summarizes these results. Looking at the table shows that the differences we observed between the simulations and the Commission's proposal are due to a systematic overrepresentation of Democrats in these counties with urban cores. Across the 7 groups of counties considered here, in 3 of the 7 cases the Commission's proposal generates one additional Democratic district than the most common outcome in the simulations, and in two regions the Commission's proposal generates 2 more Democratic seats than the most common outcome in the simulations. These deviations add up across the urban areas of the state to a collective deviation of seven seats, which accounts for a significant portion of the difference between the Commission's proposal and the most common outcome in the distribution of Democratic seats generated by the simulations statewide.

How does the Commission's proposed map generate an extra Democratic leaning seat in most of these counties considered in the table above? In the analysis below I show that the Commission's proposal follows exactly the strategy discussed by Rodden (2019) for how the Democratic party would have to work to overcome the disadvantage they face due to the geographic concentration of their voters. Recall the strategy he outlines, "Democrats would need a redistricting process that intentionally carved up large cities like pizza slices or

Table 2: County-by-County Analysis of Commission Proposal and 50,000 Simulations

	Number of Democratic Leaning Districts		
County:	Commission Proposal	Simulations Modal Outcome	% of Simulations Generating Fewer Democratic Seats Than Commission's Map
Philadelphia	25	25	0%
Allegheny	16	16	20.7%
Lehigh and Bucks	11	9	99.3%
Schuylkill, Berks, Lancaster, and Lebanon	5	4	83.5%
Dauphin, and Cumberland	3	2	73.9%
Susquehanna, Lackawanna, and Luzerne	12	10	98.5%
Centre and Clinton	2	1	72.3%

spokes of a wheel, so as to combine some very Democratic urban neighborhoods with some Republican exurbs in an effort to spread Democrats more efficiently across districts" (pg. 155).[11] This is exactly what the Commission's proposed plan does. In many of the largest cities in these counties the Commission unnecessary divides these cities when the population of these cities would not otherwise require them to be divided. The following section proceeds through each of these counties and shows the results of the simulations in the districts in these counties and compares them to the Commission's proposed districts in these counties. I then present maps of the Commission's map's district boundaries in these counties and show how in each case a heavily Democratic city is divided into more districts than its population would otherwise necessitate in order to more efficiently distribute Democratic voters across more districts and produce more districts with Democratic majorities. Furthermore, this is often accomplished by dividing cities that contain substantial minority populations. As a result, many of the districts created using this strategy crack minority populations and dilute their influence in the resulting districts.

[11]Rodden, Jonathan A. Why cities lose: The deep roots of the urban-rural political divide. Hachette UK, 2019.. While Rodden is specifically discussing Pennsylvania in this quote, the statement is true of any location with Democrats clustered in urban areas.

5.1 Lehigh and Bucks Counties

The combined population of Lehigh and Bucks counties is equal to approximately 16 legislative districts. In the 16 districts that cover this area, the Commission's proposal generates 11 Democratic leaning districts. The distribution of Democratic leaning districts based on the statewide partisan elections index calculated for each of the simulation results is shown in Figure 4. The black bars show the distribution from the simulation results, with the percentage of simulations that generate each of the various possible number of Democratic seats in the counties shown below each bar. The most common outcome in the simulations is 9 Democratic districts. The red vertical line at 11 represents the number of Democratic leaning seats in the Commission's map in the portion of the state. In 99% of the simulations there are fewer than 11 Democratic leaning districts in these counties. In only 1% of the simulations are there 11 Democratic leaning districts in these counties, as is the case in the Commission's proposed map.

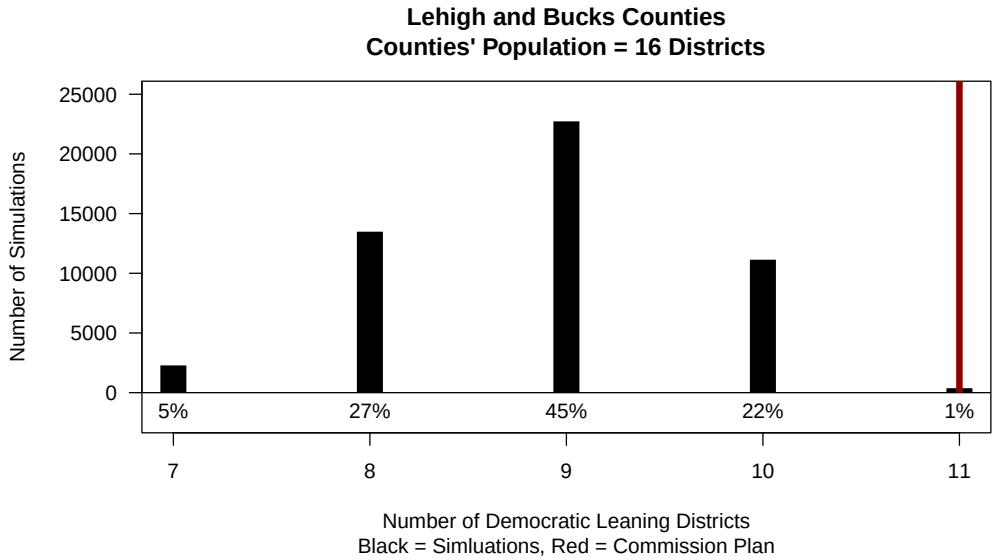
The Commission's plan achieves this by dividing the city of Allentown in Lehigh County more than is necessary so as to more evenly distribute the Democratic voters that live in the city across more districts. Allentown is heavily Democratic and has a population of 126,364, which when divided by the target district size of 64,053 comes to approximately 1.97 districts. Thus, Allentown is too large to be completely contained in one district and will need to be divided into two districts. However, the Commission's plan divides the city into three districts. Figure 5 below shows this using two maps. The top panel shows a map of the Commission's proposed district boundaries in Lehigh County where Allentown is located. The bottom panel focuses exclusively on the city of Allentown and shows how the city is split into three different districts.

The next set of maps shows how this division follows the gerrymandering strategy of dividing Democratic cities into "pinwheel" shapes where Democratic voters in the city can be combined with less Democratic areas outside of the city to make more Democratic districts with comfortable margins, but not the overwhelmingly Democratic margins that would occur

if fewer districts were drawn that were more geographically compact and split the city fewer times. In some cases this approach also has the effect of dividing minority communities that live in these cities and diluting their influence by distributing them across multiple legislative districts. Figure 6 shows a map of each of the three districts that intersect Allentown (HD-22, HD-134, HD-132). Each district is colored based on the partisan lean of the precincts in the district. The pattern we see, particularly in Districts 134 and 132, is exactly what I described earlier — the combination of heavily Democratic precincts in the center of the city with more Republican leaning precincts in the suburbs of the city. While Allentown itself is heavily Democratic (its partisan index based on the 2012-2020 statewide elections is 0.72), the inclusion of the more Republican leaning suburbs distributes Democrats more efficiently to create three Democratic leaning districts, two of which (HD-134 and HD-132) have less Democratic support, but are still comfortably Democratic.

The final map shows that this approach also divides the Latino population in the city. Figure 7. As a whole, Allentown has a Hispanic voting age population of 48.9%. While District 22 is majority Latino, Districts 134 and 132 have substantially lower Latino populations (38.5% and 18.1%, respectively) as a result of the districts dividing the city and reaching into more suburban areas with a lower concentration of Latinos.

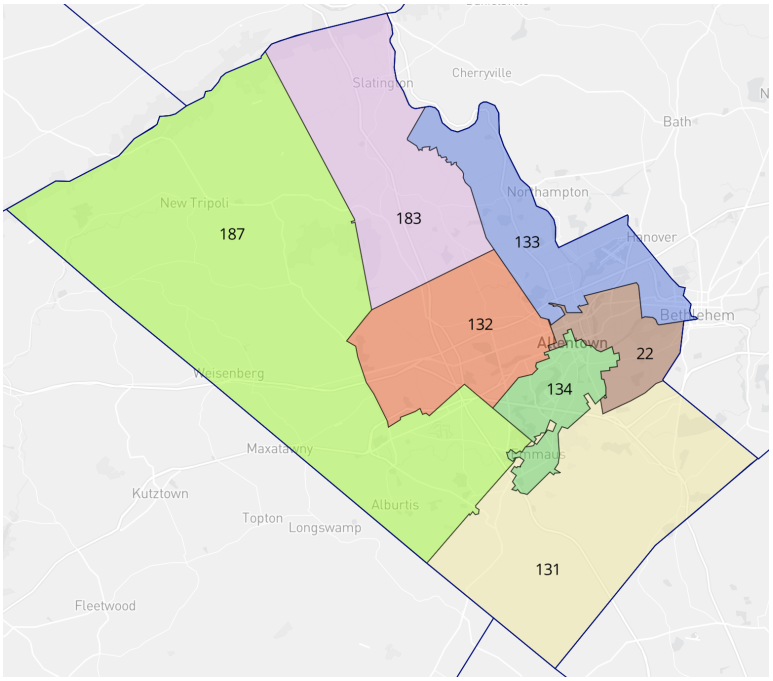
Figure 4: **Distribution of Partisan Districts from Simulations in Lehigh and Bucks Counties**



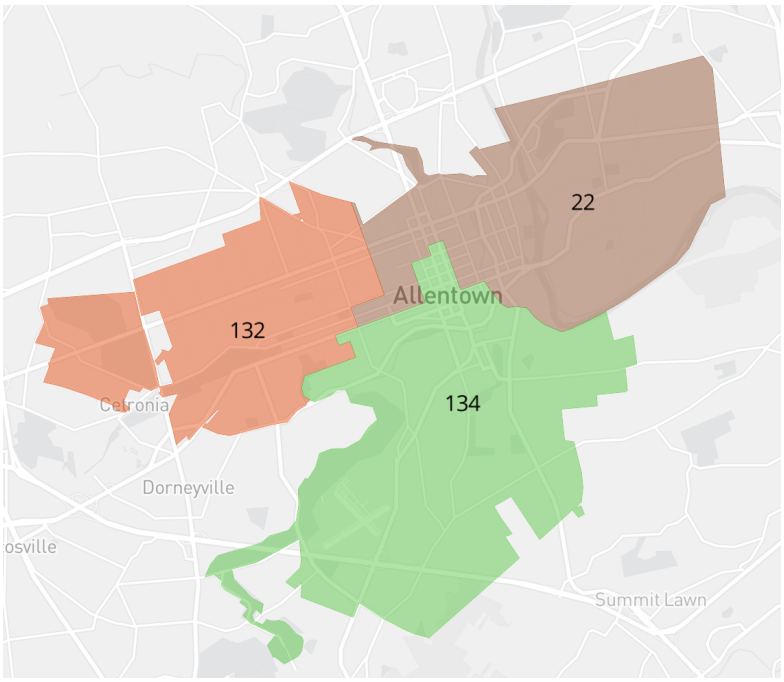
Note: Distribution of likely district partisanship based on the statewide partisan elections index calculated for each of the simulation results. The black bars show the distribution from the simulation results, with the percentage of simulations that generate each of the various possible number of Democratic seats in the cluster shown below each bar. The red vertical line shows the number of Democratic leaning seats in the Commission's proposed map in the same county.

Figure 5: **Commission Proposed Districts in Lehigh County**

(a) Proposal District Boundaries in Lehigh County

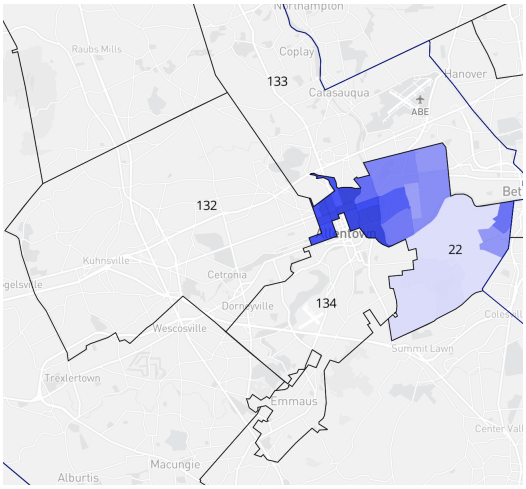


(b) District Boundaries within Allentown City Limits

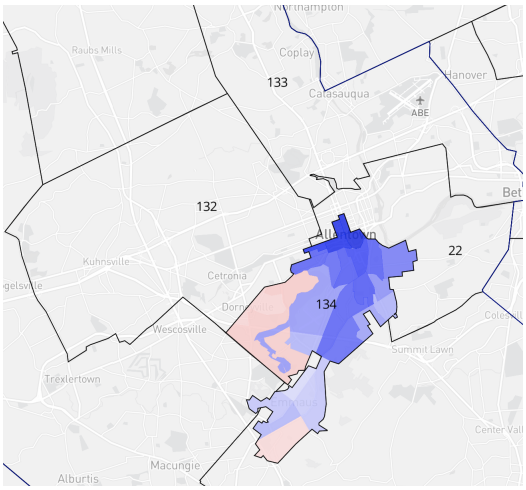


Note: The top figure shows the district boundaries within Lehigh County. The bottom figure shows how the city of Allentown is divided across three districts despite having a population that only requires it to be split into two districts. In each district we see a combination of heavily Democratic urban center with less Democratic suburban areas at the outer edges of the district.

District 22 - Partisan Index: 0.72



District 134 - Partisan Index: 0.63



District 132 - Partisan Index: 0.57

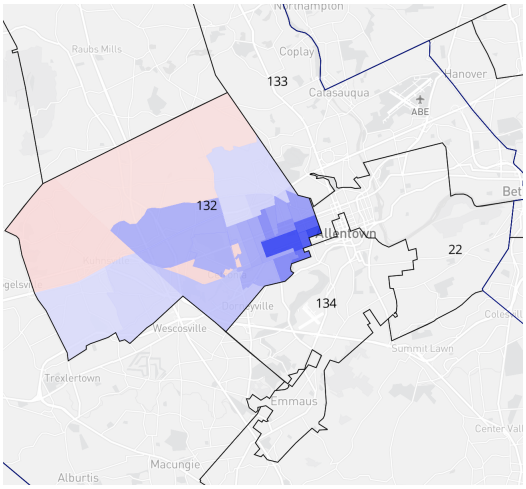
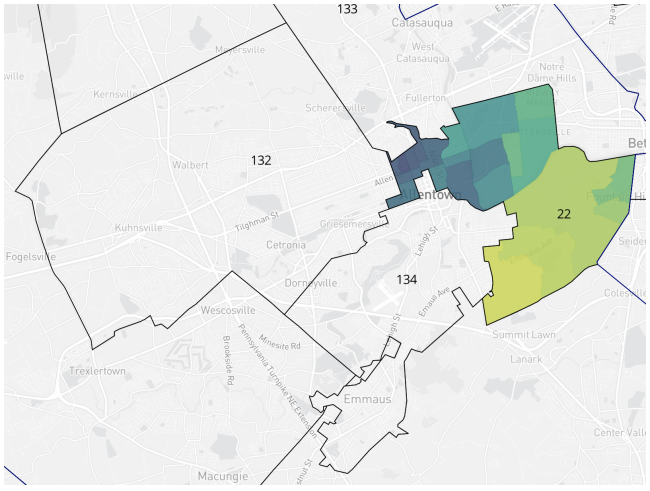
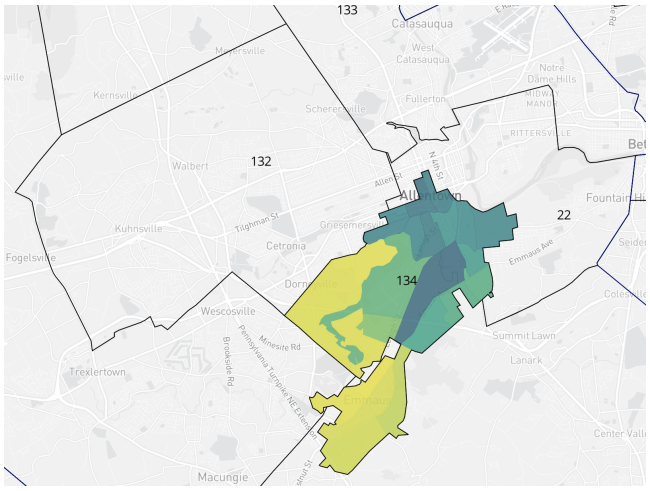


Figure 6: Note: Each panel shows one of the districts that intersect Allentown. The maps are colored according to the partisan composition of precincts in the district.

District 22 - Hispanic VAP: 50.8%



District 134 - Hispanic VAP: 38.5%



District 132 - Hispanic VAP: 18.1%

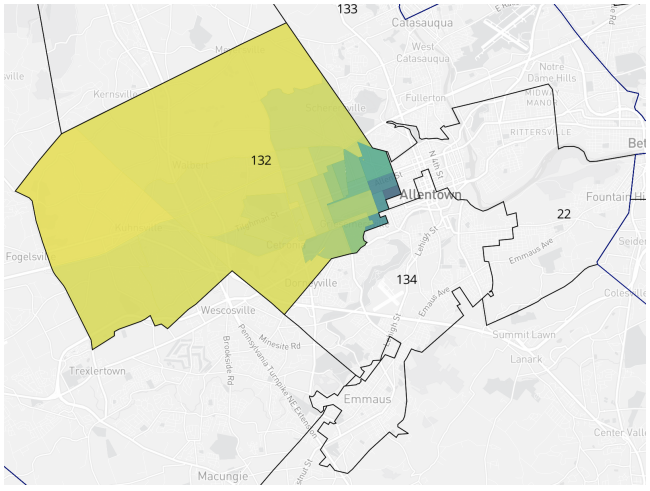


Figure 7: Each panel shows one of the districts that intersect Allentown. The maps are colored according to the Hispanic composition of precincts in the district. Darker shades indicate a greater proportion of Latinos. The city of Allentown has a 48.9% Hispanic voting age population.

5.2 Schuylkill, Berks, Lancaster, and Lebanon Counties

The combined population of Schuylkill, Berks, Lancaster, and Lebanon counties is equal to approximately 20 legislative districts. In the 20 districts that cover this area, the Commission's proposal generates 5 Democratic leaning districts. The distribution of Democratic leaning districts based on the statewide partisan elections index calculated for each of the simulation results is shown in Figure 8. The black bars show the distribution from the simulation results, with the percentage of simulations that generate each of the various possible number of Democratic seats in the counties shown below each bar. The most common outcome in the simulations is 4 Democratic districts. The red vertical line at 5 represents the number of Democratic leaning seats in the Commission's map in the portion of the state. In 83.5% of the simulations there are fewer than 5 Democratic leaning districts in these counties. In only 17% of the simulations are there 5 or more Democratic leaning districts in these counties, as is the case in the Commission's proposed map.

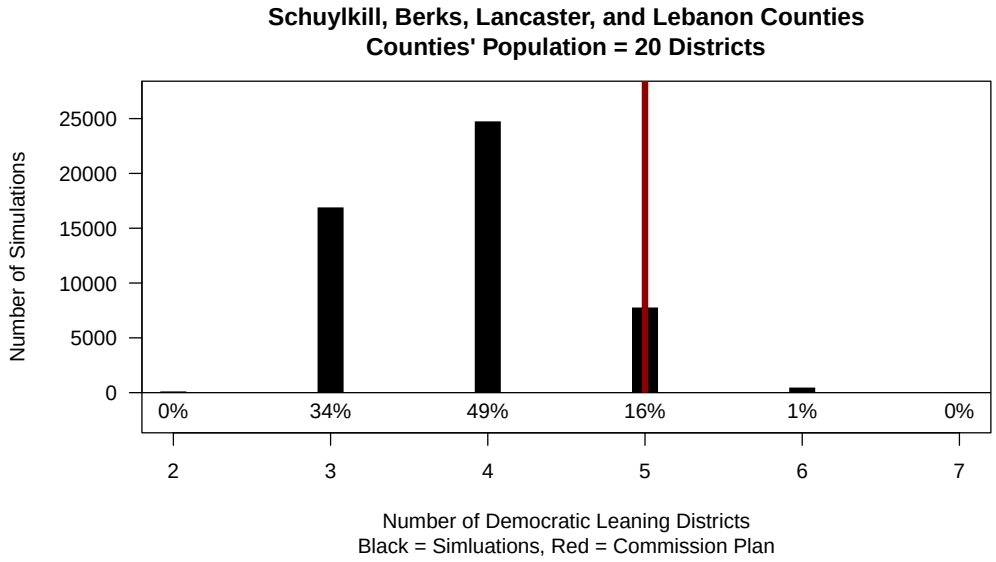
The Commission's plan achieves this by dividing the cities of Lancaster in Lancaster County and Reading in Berks County more than is necessary so as to more evenly distribute the Democratic voters that live in these cities across more districts. Lancaster is heavily Democratic and has a population of 58,431, which when divided by the target district size of 64,053 comes to approximately 0.91 districts. Thus, Lancaster is not larger than the target district population and could be kept whole. However, the Commission's plan divides the city nearly evenly into two districts. Figure 9 below shows this using two maps. The top panel shows a map of the Commission's proposed district boundaries in Lancaster County where the city of Lancaster is located. The bottom panel focuses exclusively on the city of Lancaster and shows how the city is split into two different districts.

The next set of maps shows how this division follows the gerrymandering strategy of dividing heavily Democratic cities and combining them with less Democratic areas outside of the city to make more Democratic districts with comfortable margins, but not the overwhelmingly Democratic margins that would occur if the city were kept whole. In Lancaster

this approach also has the effect of dividing and diluting the influence of the Latino community that lives in the city by distributing them across multiple legislative districts. Figure 10 shows a map of each of the two districts that intersect Lancaster (HD-50, HD-96). Each district is colored based on the partisan lean of the precincts in the district. The pattern we see is familiar — the combination of heavily Democratic precincts in the center of the city with more Republican leaning precincts in the suburbs of the city. While Lancaster itself is heavily Democratic (its partisan index based on the 2012-2020 statewide elections is 0.76), the inclusion of the more Republican leaning suburbs distributes Democrats more efficiently to create two Democratic leaning districts rather than one district that is overwhelmingly Democratic.

The final map shows that this approach also divides the Latino population in the city. Figure 11. As a whole, Lancaster has a Latino voting age population of 35.9%. Both Districts 96 and 50 have a lower Latino population (13.7% and 32.8%, respectively) as a result of the districts dividing the city and reaching into more suburban areas with a lower concentration of Latinos.

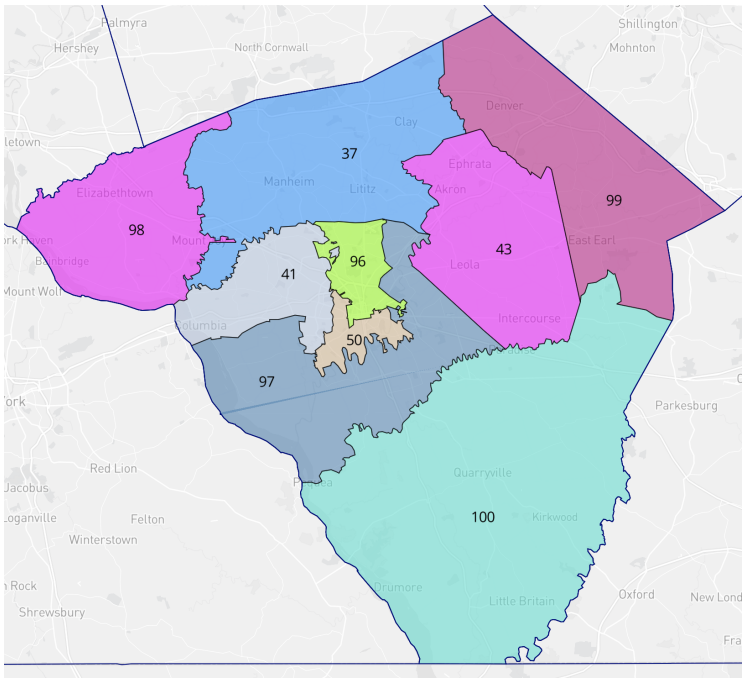
Figure 8: **Distribution of Partisan Districts from Simulations in Schuylkill, Berks, Lancaster, and Lebanon Counties**



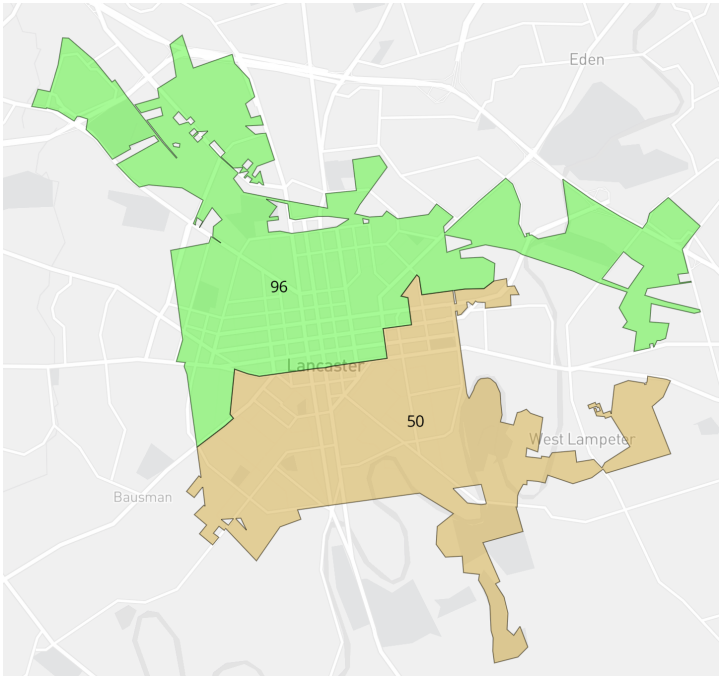
Note: Distribution of likely district partisanship based on the statewide partisan elections index calculated for each of the simulation results. The black bars show the distribution from the simulation results, with the percentage of simulations that generate each of the various possible number of Democratic seats in the cluster shown below each bar. The red vertical line shows the number of Democratic leaning seats in the Commission's proposed map in the same county.

Figure 9: **Commission Proposed Districts in Lancaster County**

(a) Proposal District Boundaries in Lancaster County

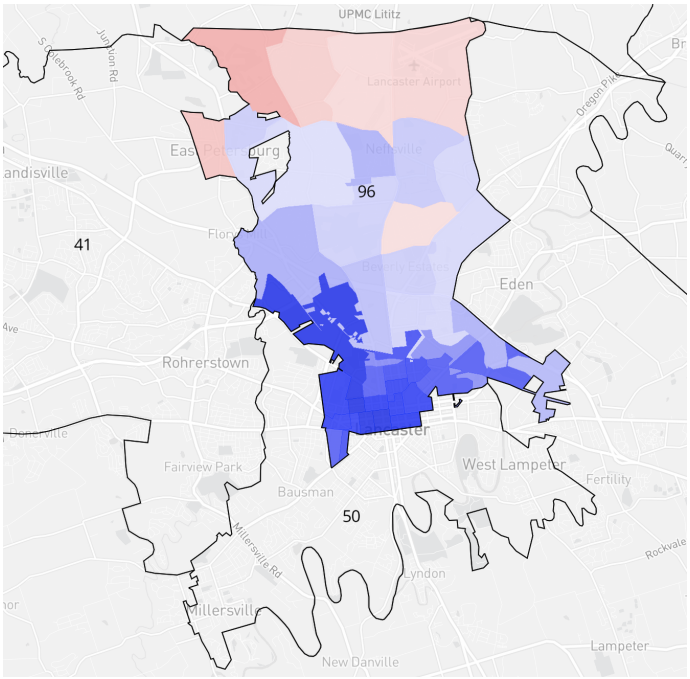


(b) District Boundaries within Lancaster City Limits



Note: The top figure shows the district boundaries within Lancaster County. The bottom figure shows how the city of Lancaster is divided nearly equally across two districts despite having a population that would allow the city to be entirely contained in one district.

District 96 - Partisan Index: 0.58



District 50 - Partisan Index: 0.67

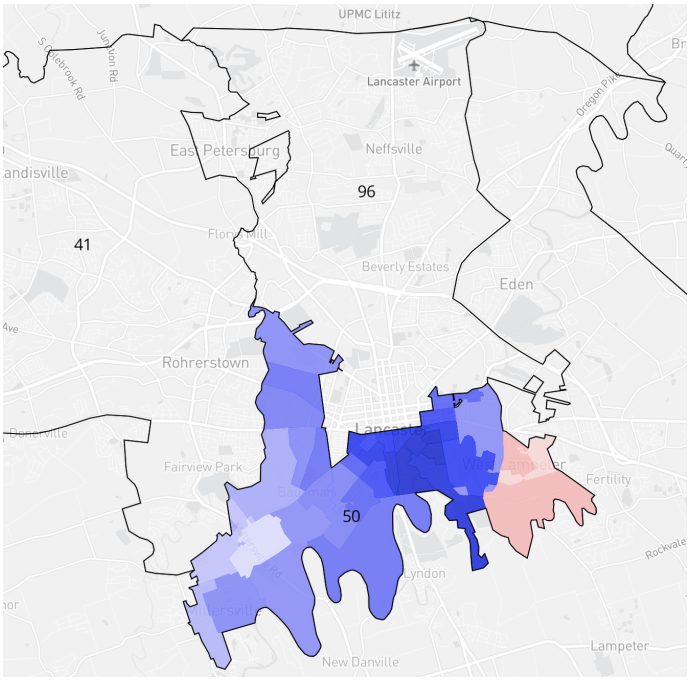
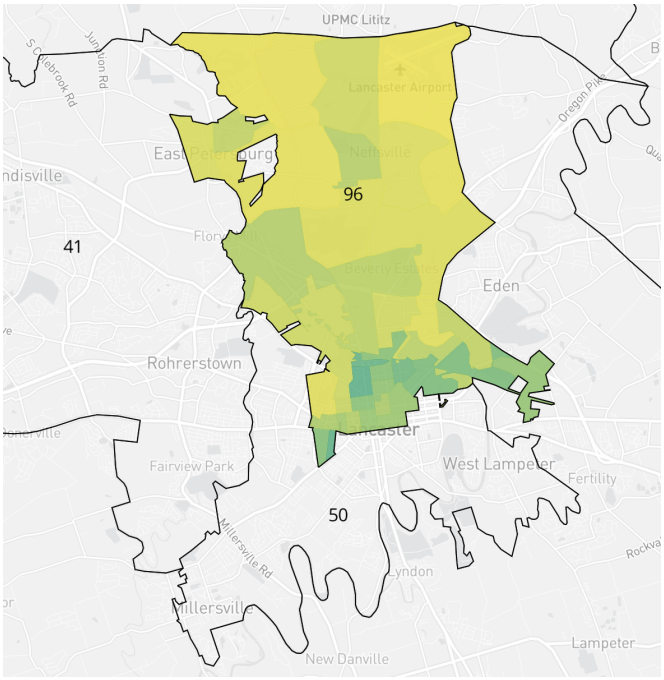


Figure 10: Each panel shows one of the districts that intersect Lancaster. The maps are colored according to the partisan composition of precincts in the district.

District 96 - Hispanic VAP: 13.7%



District 50 - Hispanic VAP: 32.8%

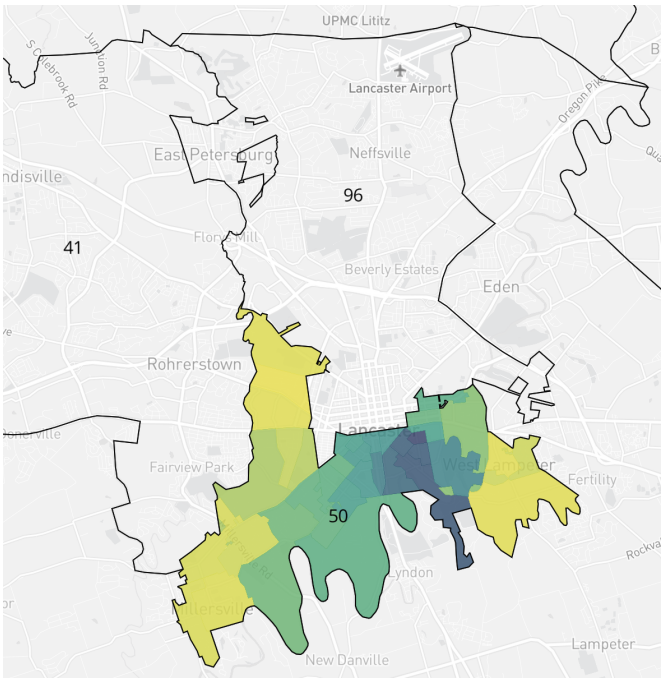


Figure 11: Each panel shows one of the districts that intersect Lancaster. The maps are colored according to the Hispanic composition of precincts in the district. Darker shades indicate a greater proportion of Latinos. The city of Lancaster has a 35.9% Hispanic voting age population.

In Berks County the Commission's plan creates an additional Democratic district by dividing the city of Reading more than is necessary. Reading is heavily Democratic and has a population of 95,719, which when divided by the target district size of 64,053 comes to approximately 1.49 districts. Thus, Reading is too large to be completely contained in one district and will need to be divided into two districts. However, the Commission's plan divides the city four different times into three different districts. Figure 12 below shows this using two maps. The top panel shows a map of the Commission's proposed district boundaries in Berks County where Reading is located. The bottom panel focuses exclusively on the city of Reading and shows how the city is split four times into three different districts.

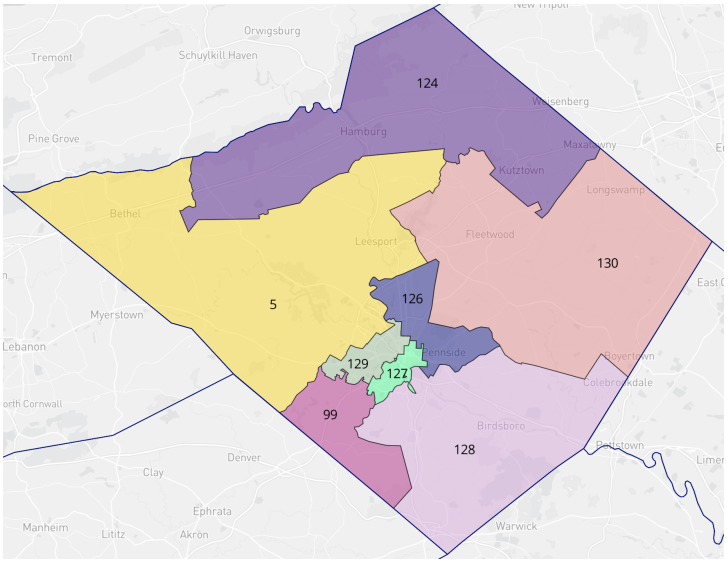
The next set of maps shows how this division follows the gerrymandering strategy of dividing Democratic cities into "pinwheel" shapes where Democratic voters in the city can be combined with less Democratic areas outside of the city to make more Democratic districts with comfortable margins, but not the overwhelmingly Democratic margins that would occur if fewer districts were drawn that were more geographically compact and split the city fewer times. In Reading this approach also has the effect of dividing and diluting the influence of the Latino community that lives in the city by distributing them across multiple legislative districts. Figure 13 shows a map of each of the three districts that intersect Reading (HD-126, HD-127, and HD-129). Each district is colored based on the partisan lean of the precincts in the district. The pattern we see is again repeated — the combination of heavily Democratic precincts in the center of the city with more Republican leaning precincts in the suburbs. While Reading itself is heavily Democratic (its partisan index based on the 2012-2020 statewide elections is 0.79), the inclusion of the more Republican leaning suburbs distributes Democrats more efficiently to create three Democratic leaning districts which all have less Democratic support than the city overall, but are still comfortably Democratic.

The final map shows that this approach also divides the Latino population in the city. Figure 14. As a whole, Reading has a Latino voting age population of 64.0%. All three Districts that intersect Reading have a lower Latino population (35.5% in HD-126, 35.4%

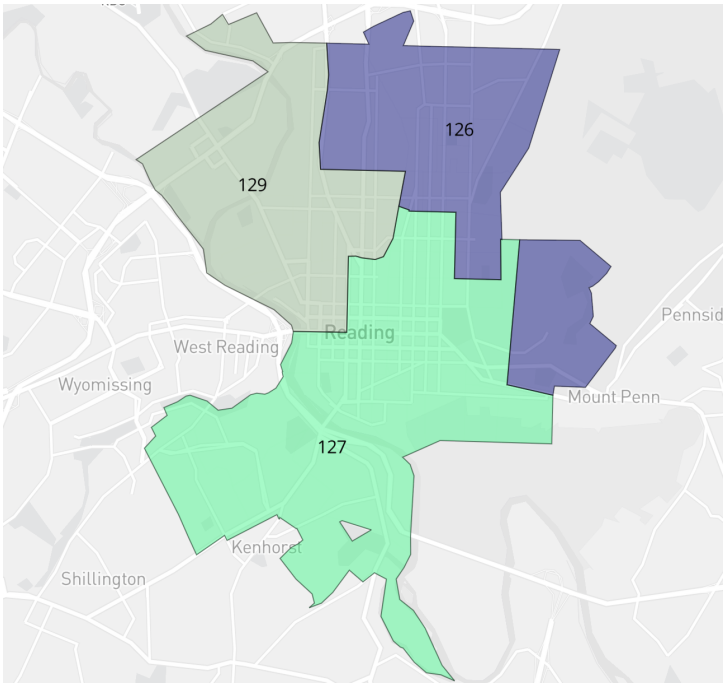
in HD-129, and 51.7% in HD-127) as a result of the districts dividing the city and reaching into more suburban areas with a lower concentration of Latinos.

Figure 12: **Commission Proposed Districts in Berks County**

(a) Proposal District Boundaries in Berks County

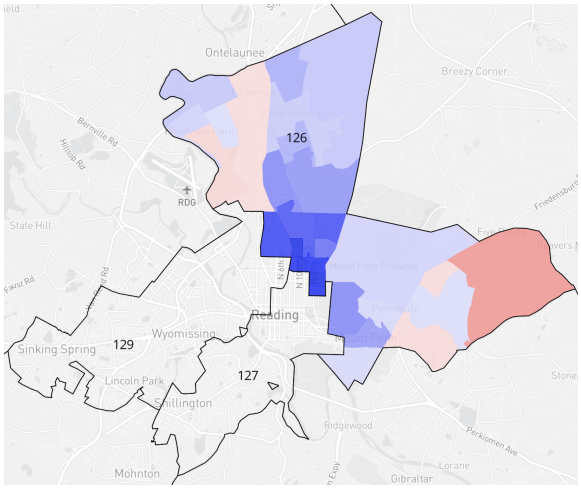


(b) District Boundaries within Reading City Limits

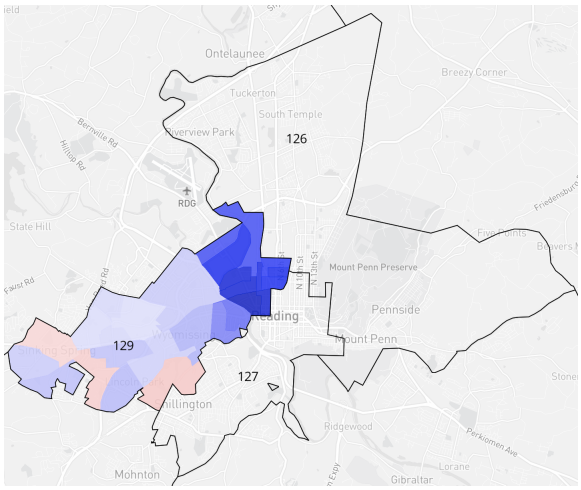


Note: The top figure shows the district boundaries within Berks County. The bottom figure shows how the city of Reading is divided four times into three districts despite having a population that would only require the city to be split into two districts.

District 126 - Partisan Index: 0.60



District 129 - Partisan Index: 0.60



District 127 - Partisan Index: 0.70

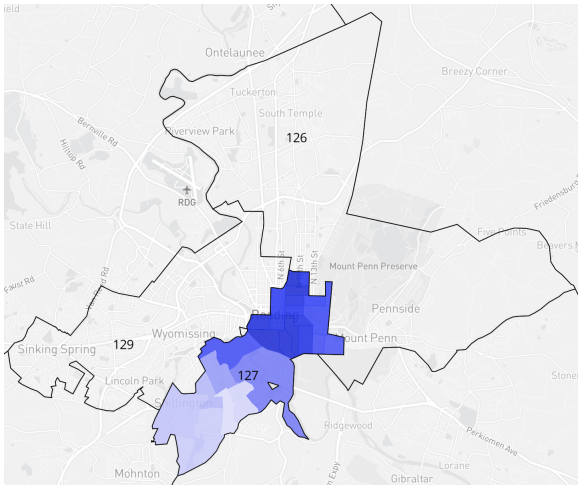
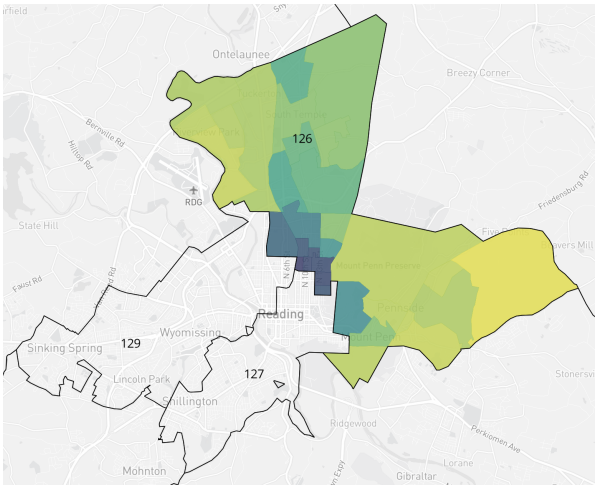
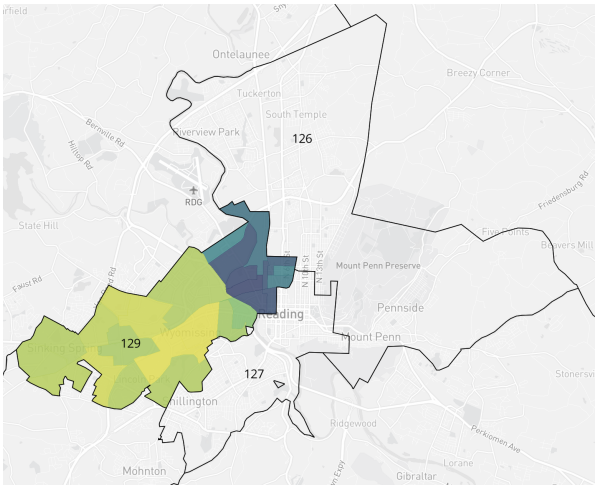


Figure 13: Each panel shows one of the districts that intersect Reading. The maps are colored according to the partisan composition of precincts in the district.

District 126 - Hispanic VAP: 35.5%



District 129 - Hispanic VAP: 35.4%



District 127 - Hispanic VAP: 51.7%

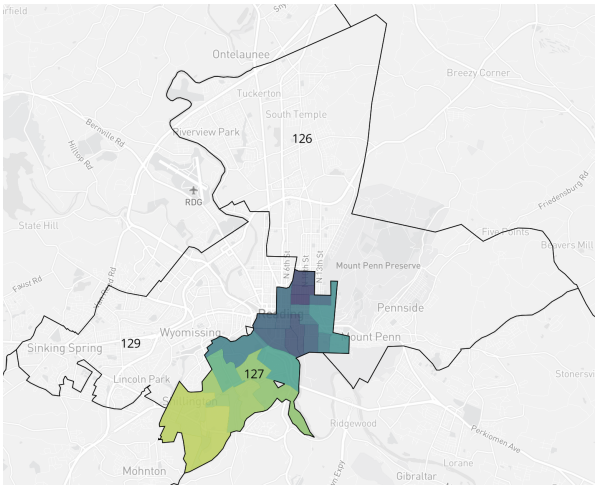


Figure 14: Each panel shows one of the districts that intersect Reading. The maps are colored according to the Hispanic composition of precincts in the district. Darker shades indicate a greater proportion of Latinos. The city of Reading has a 64.0% Hispanic voting age population.

5.3 Dauphin and Cumberland Counties

The combined population of Dauphin and Cumberland counties is equal to approximately 8.5 legislative districts. In the 8 complete districts that cover this area, the Commission's proposal generates 3 Democratic leaning districts. The distribution of Democratic leaning districts based on the statewide partisan elections index calculated for each of the simulation results is shown in Figure 15. The black bars show the distribution from the simulation results, with the percentage of simulations that generate each of the various possible number of Democratic seats in the counties shown below each bar. The most common outcome in the simulations is 2 Democratic districts. The red vertical line at 3 represents the number of Democratic leaning seats in the Commission's map in the portion of the state. In 74% of the simulations there are 2 Democratic leaning districts in these counties. There are 3 Democratic leaning districts in only 26% of the simulations in these counties, which is what the Commission's proposed map produces.

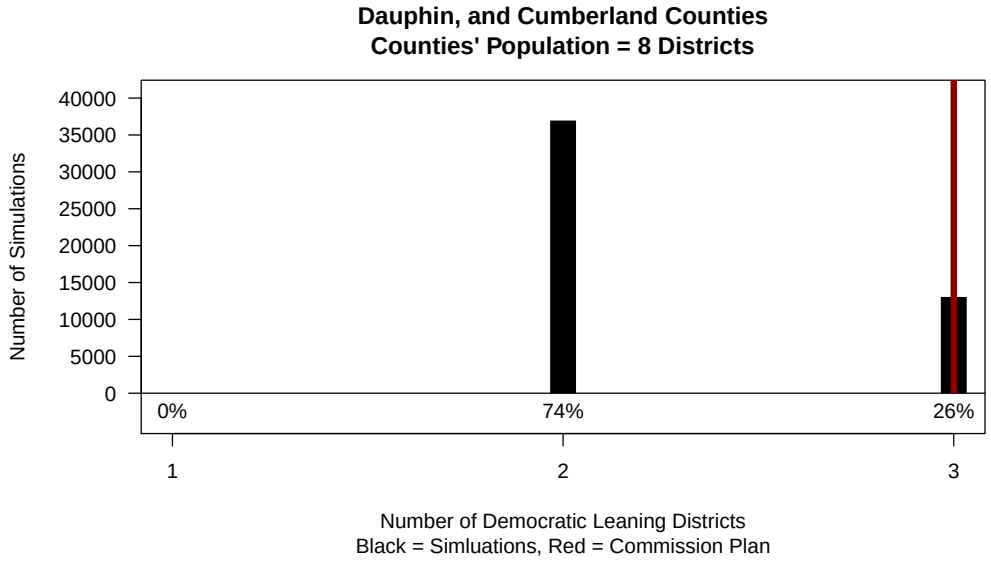
The Commission's plan achieves this by dividing the city of Harrisburg in Dauphin County more than is necessary so as to more evenly distribute the Democratic voters that live in Harrisburg across more districts. Harrisburg is heavily Democratic and has a population of 50,679, which when divided by the target district size of 64,053 comes to approximately 0.79 districts. Thus, Harrisburg is not larger than the target district population and could be kept whole. However, the Commission's plan divides the city into two districts. Figure 16 below shows this using two maps. The top panel shows a map of the Commission's proposed district boundaries in Dauphin County where the city of Harrisburg is located. The bottom panel focuses exclusively on the city of Harrisburg and shows how the city is split into two districts.

The next set of maps shows how this division follows the gerrymandering strategy of dividing Democratic cities into "pinwheel" shapes where Democratic voters in the city can be combined with less Democratic areas outside of the city to make more Democratic districts with comfortable margins, but not the overwhelmingly Democratic margins that

would occur if fewer districts were drawn that were more geographically compact and split the city fewer times. In Harrisburg this approach also has the effect of dividing the Black community that lives in the city and distributes them across multiple legislative districts. Figure 17 shows a map of each of the two districts that intersect Harrisburg (HD-103, HD-104). Each district is colored based on the partisan lean of the precincts in the district. The pattern we see is again repeated — the combination of heavily Democratic precincts in the center of the city with more Republican leaning precincts in the suburbs. While Harrisburg itself is heavily Democratic (its partisan index based on the 2012-2020 statewide elections is 0.86), the inclusion of the more Republican leaning suburbs distributes Democrats more efficiently to create two Democratic leaning districts that have less Democratic support, but are still comfortably Democratic-leaning.

Figure 18 shows that this approach also divides the Black population in the city. As a whole, Harrisburg has a Black voting age population of 47.3%. Both districts that intersect Harrisburg have a lower Black population (22.2% in HD-103, 31.0% in HD-104) as a result of the districts dividing the city and reaching into more suburban areas with a lower Black population.

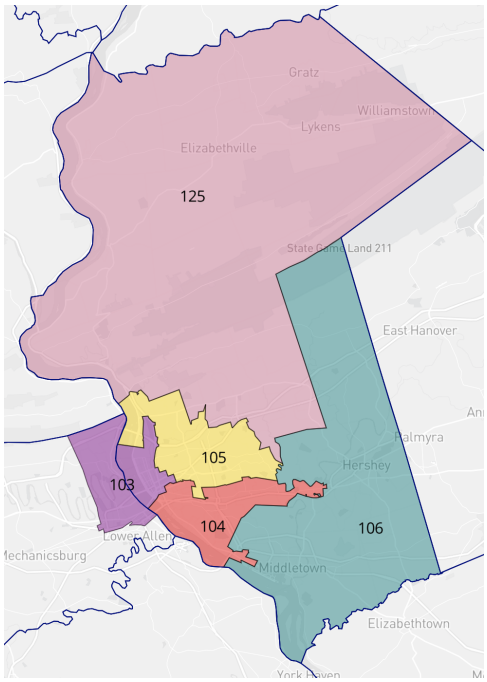
Figure 15: **Distribution of Partisan Districts from Simulations in Dauphin, and Cumberland Counties**



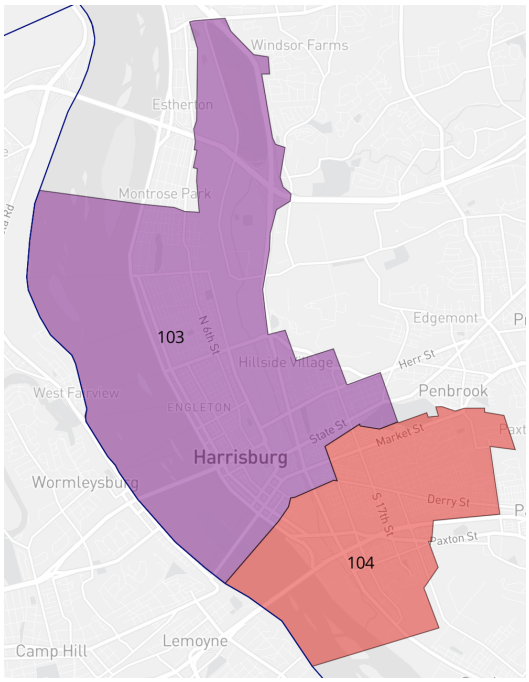
Note: Distribution of likely district partisanship based on the statewide partisan elections index calculated for each of the simulation results. The black bars show the distribution from the simulation results, with the percentage of simulations that generate each of the various possible number of Democratic seats in the cluster shown below each bar. The red vertical line shows the number of Democratic leaning seats in the Commission's proposed map in the same county.

Figure 16: **Commission Proposed Districts in Dauphin County**

(a) Proposal District Boundaries in Dauphin County

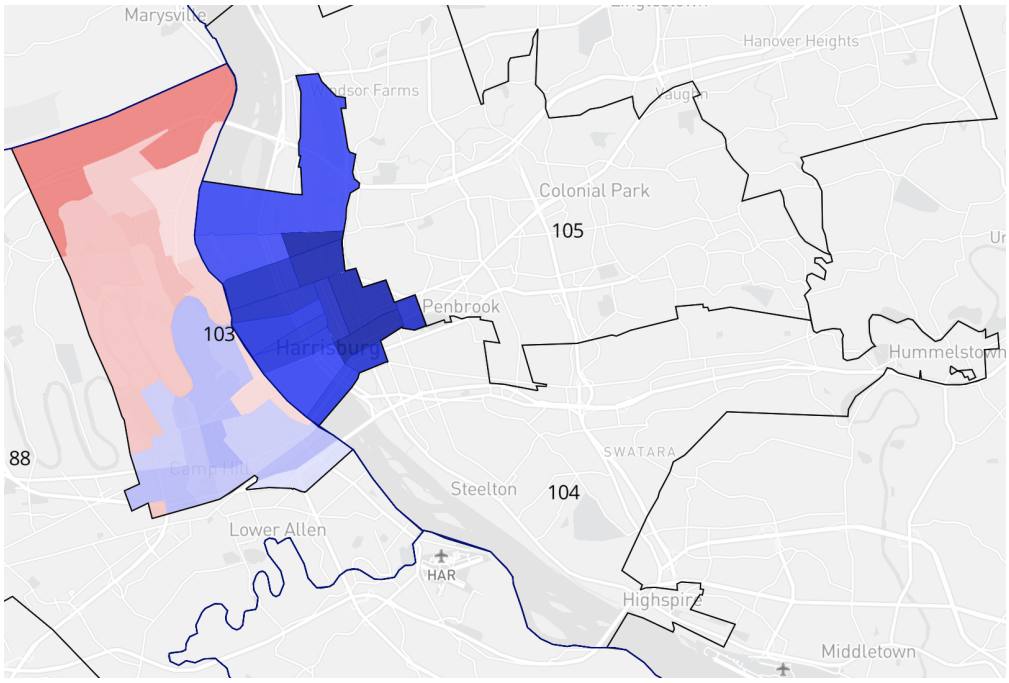


(b) District Boundaries within Harrisburg City Limits



Note: The top figure shows the district boundaries within Dauphin County. The bottom figure shows how the city of Harrisburg is divided across two districts despite having a population that would allow the city to be entirely contained in one district.

District 103 - Partisan Index: 0.62



District 104 - Partisan Index: 0.67

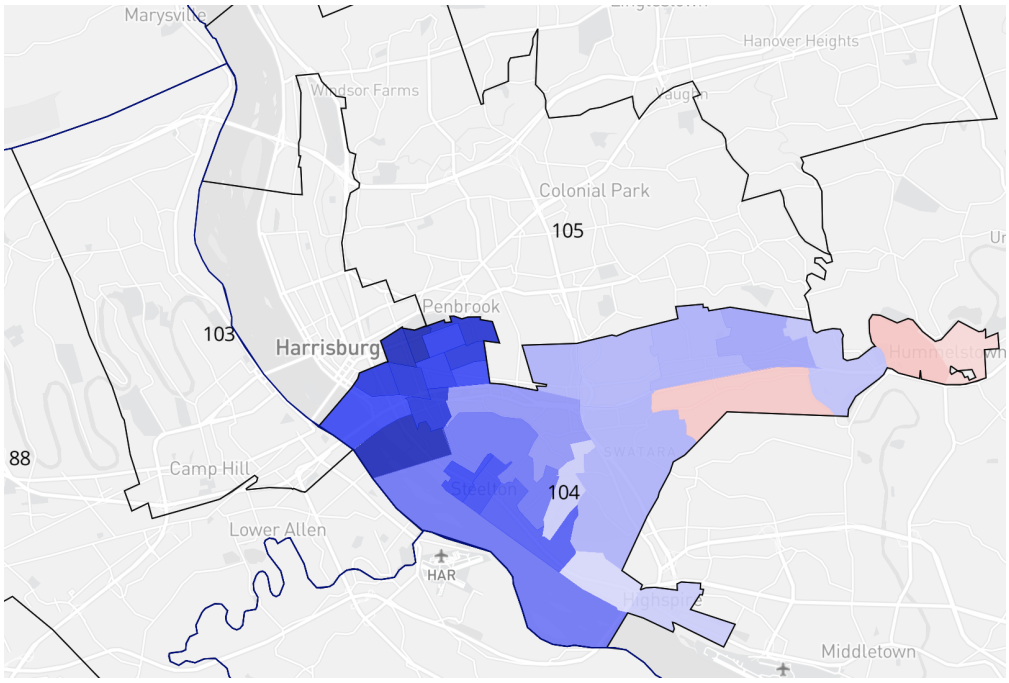
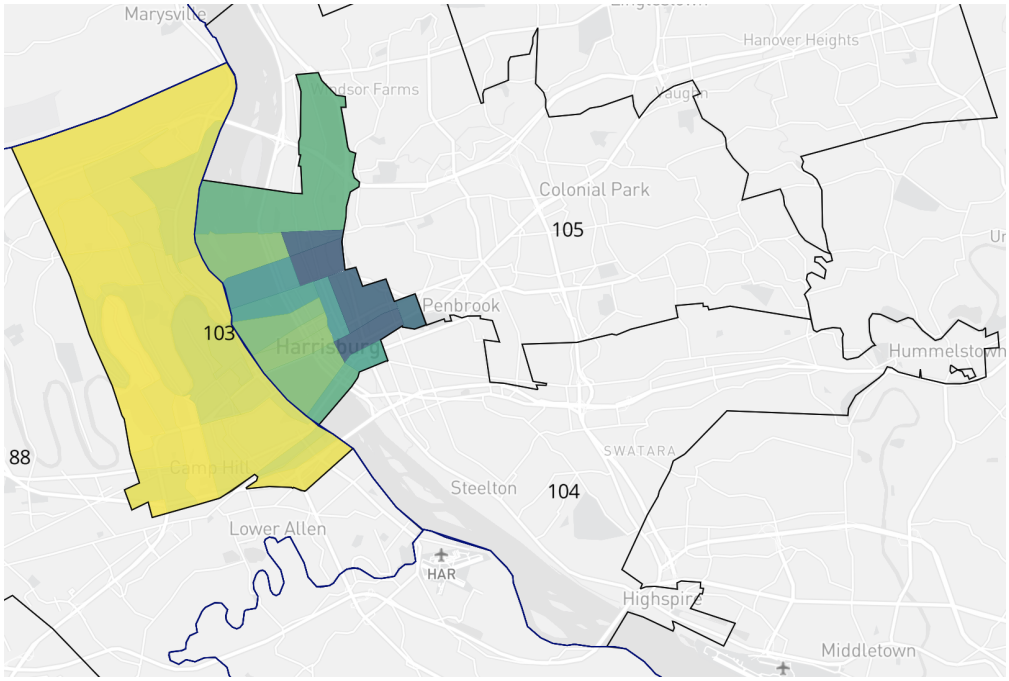


Figure 17: Each panel shows one of the districts that intersect Harrisburg. The maps are colored according to the partisan composition of precincts in the district.

District 103 - Black VAP: 22.2%



District 104 - Black VAP: 31.0%

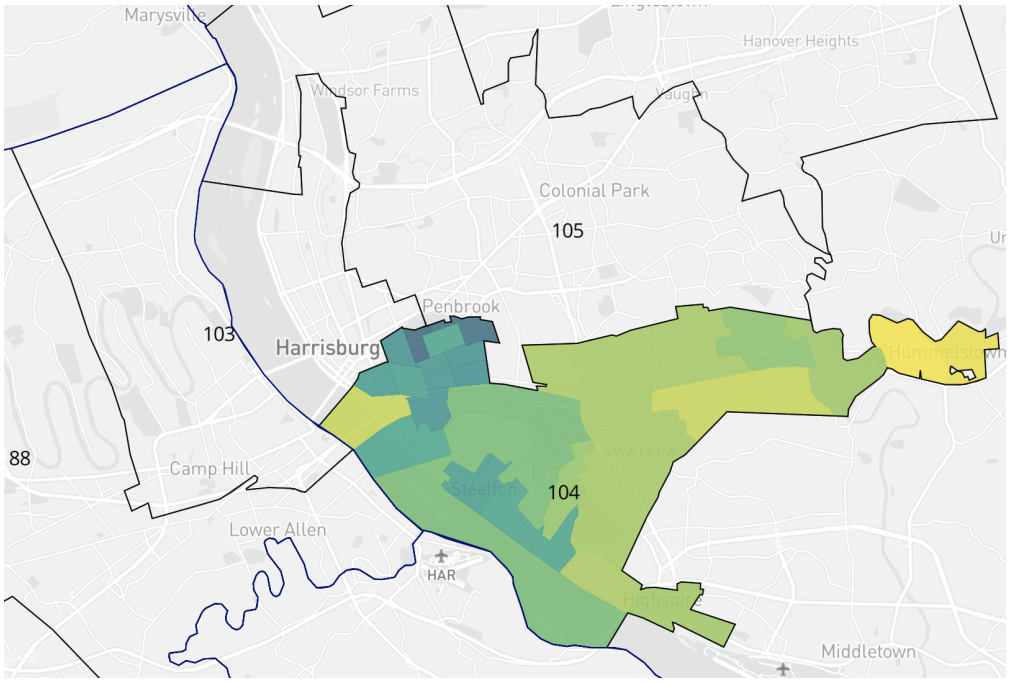


Figure 18: Each panel shows one of the districts that intersect Harrisburg. The maps are colored according to the Black composition of precincts in the district. Darker shades indicate a greater Black population. The city of Harrisburg has a 47.3% Black voting age population.

5.4 Northeastern Counties

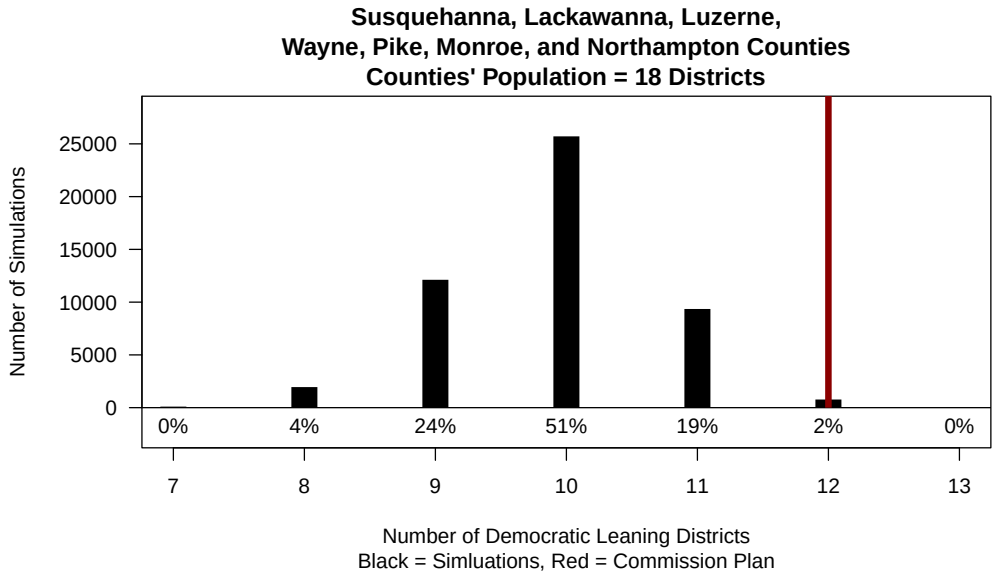
In this section I consider Susquehanna, Lackawanna, Luzerne, Wayne, Pike, Monroe, and Northampton counties. These counties are grouped together in the northeastern part of the state, and their combined population is equal to approximately 18 legislative districts. In the 18 complete districts that cover this area, the Commission's proposal generates 11 Democratic leaning districts. The distribution of Democratic leaning districts based on the statewide partisan elections index calculated for each of the simulation results is shown in Figure 19. The black bars show the distribution from the simulation results, with the percentage of simulations that generate each of the various possible number of Democratic seats in the counties shown below each bar. The most common outcome in the simulations is 10 Democratic districts. The red vertical line at 11 represents the number of Democratic leaning seats in the Commission's map in the portion of the state. In 98.5% of the simulations there are 10 or fewer Democratic leaning districts in these counties. In only 2% of the simulations are there 11 Democratic leaning districts in these counties, as is the case in the Commission's proposed map.

The Commission's plan achieves this by dividing the city of Scranton in Lackawanna County more than is necessary so as to more evenly distribute the Democratic voters that live in Scranton across more districts. Scranton is heavily Democratic and has a population of 76,627, which when divided by the target district size of 64,053 comes to approximately 1.2 districts. Thus, Scranton is too large to be completely contained in one district and will need to be divided into two districts. However, the Commission's plan divides the city five different times across four different districts. Figure 20 below shows two maps. The top panel shows a map of the Commission's proposed district boundaries in Lackawanna County where Scranton is located. The bottom panel focuses exclusively on the city of Scranton and shows how the city is split five times into four different districts.

The next set of maps shows how this division follows the gerrymandering strategy of dividing Democratic cities into "pinwheel" shapes where Democratic voters in the city can be

combined with less Democratic areas outside of the city to make more Democratic districts with comfortable margins, but not the overwhelmingly Democratic margins that would occur if fewer districts were drawn that were more geographically compact and split the city fewer times. Figure 21 shows a map of each of the four districts that intersect Scranton (HD-112, HD-113, HD-114, HD-118). Each district is colored based on the partisan lean of the precincts in the district. The pattern we see is yet again repeated — the combination of heavily Democratic precincts in the center of the city with more Republican leaning precincts in the suburbs around the city. While Scranton itself is heavily Democratic (its partisan index based on the 2012-2020 statewide elections is 0.70), the inclusion of the more Republican leaning suburbs distributes Democrats more efficiently to create four Democratic leaning districts that have less Democratic support, but are still comfortably Democratic-leaning. Scranton does not have a large or geographically concentrated minority population to warrant a specific analysis on how the districts in this county divide specific minority groups in the city (the city has a 71.9% White voting age population, 12.9% Hispanic VAP, 8.5% Black VAP, and 6.1% Asian VAP).

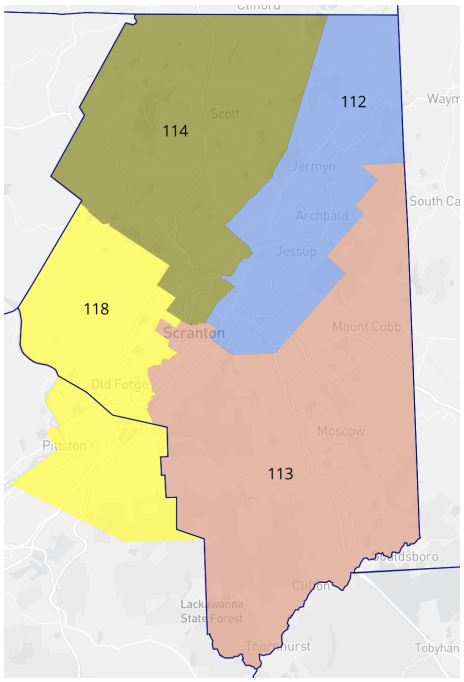
Figure 19: **Distribution of Partisan Districts from Simulations in Susquehanna, Lackawanna, and Luzerne Counties**



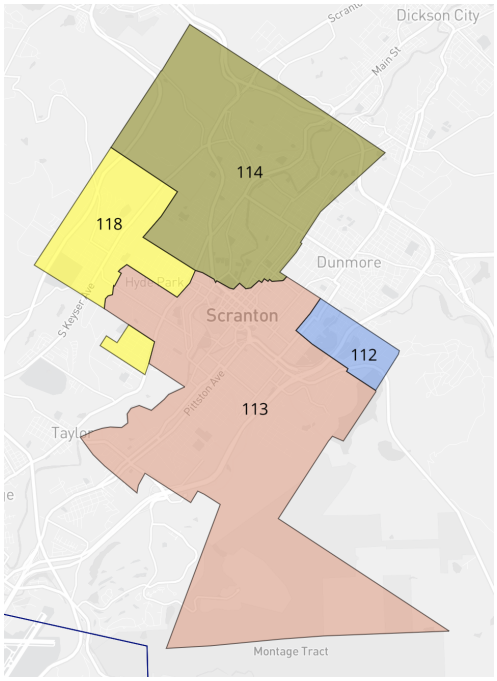
Note: Distribution of likely district partisanship based on the statewide partisan elections index calculated for each of the simulation results. The black bars show the distribution from the simulation results, with the percentage of simulations that generate each of the various possible number of Democratic seats in the cluster shown below each bar. The red vertical line shows the number of Democratic leaning seats in the Commission's proposed map in the same county.

Figure 20: **Commission Proposed Districts in Lackawanna County**

(a) Proposal District Boundaries in Lackawanna County



(b) District Boundaries within Scranton City Limits



Note: The top figure shows the district boundaries within Lackawanna County. The bottom figure shows how the city of Scranton is divided five times across four districts despite having a population that would only require the city to be divided into two districts.

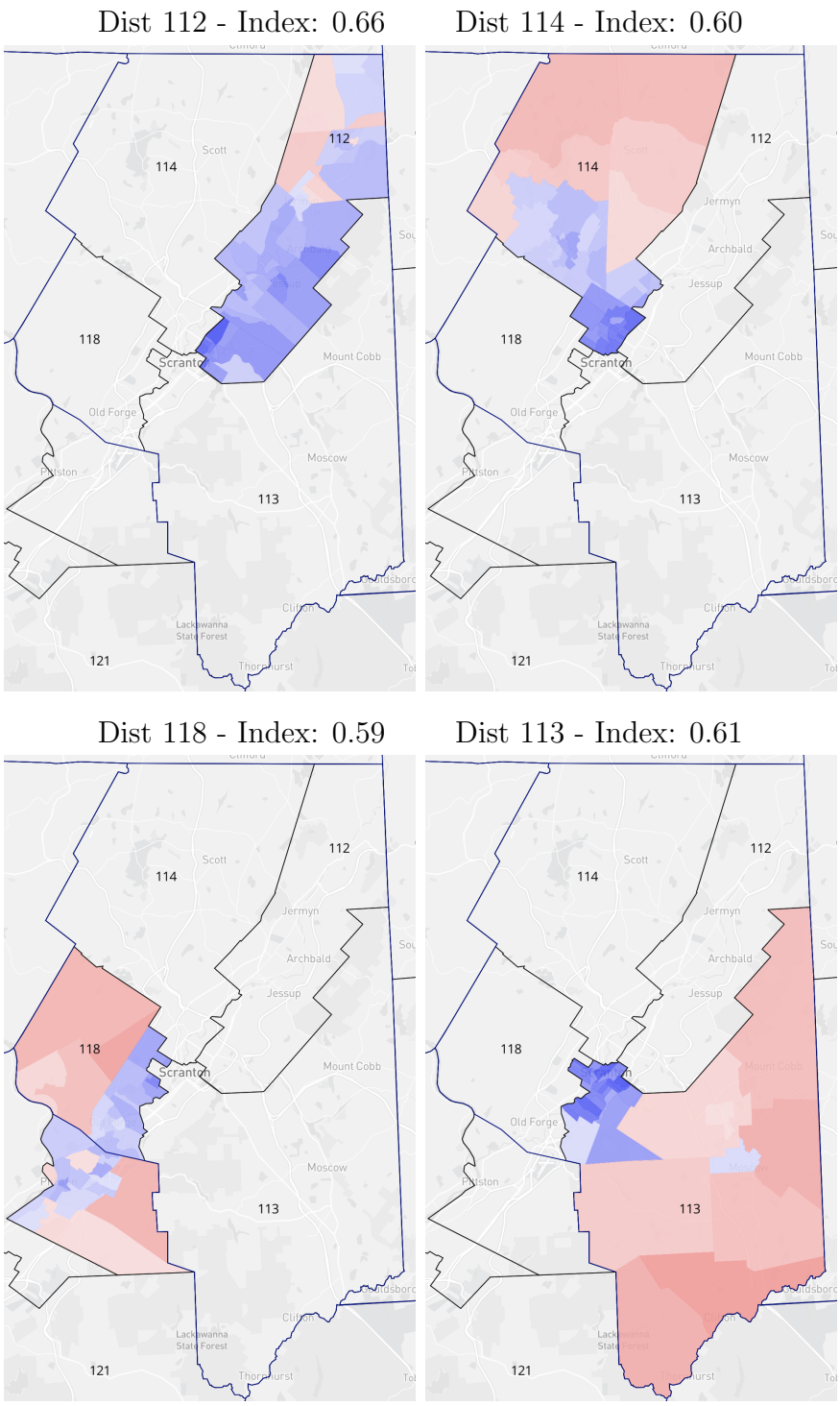


Figure 21: Each panel shows one of the districts that intersect Scranton. The maps are colored according to the partisan composition of precincts in the district.

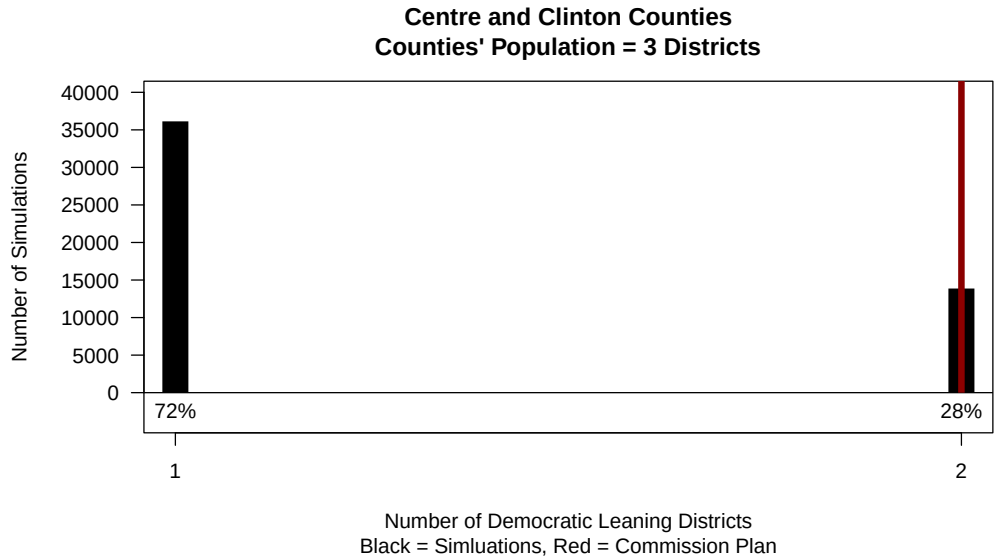
5.5 Centre and Clinton Counties

The final area I consider is the middle of the state in Centre and Clinton counties. The combined population of Centre and Clinton counties is equal to approximately 3 legislative districts. In the 2 complete districts that are included in these counties and the 2 additional districts that are partially in these counties, the Commission's proposal generates 2 Democratic leaning districts. The distribution of Democratic leaning districts based on the statewide partisan elections index calculated for each of the simulation results is shown in Figure 22. The black bars show the distribution from the simulation results, with the percentage of simulations that generate each of the various possible number of Democratic seats in the counties shown below each bar. The most common outcome in the simulations is 1 Democratic district. The red vertical line at 2 represents the number of Democratic leaning seats in the Commission's map in the portion of the state. The simulations generate 1 Democratic leaning district in these counties 72% of the time. There 2 Democratic leaning districts in only 28% of the simulations, as is the case in the Commission's proposed map.

The Commission's plan achieves this by dividing the borough of State College in Centre County more than is necessary so as to more evenly distribute the Democratic voters that live in this city across more districts. State College is heavily Democratic and has a population of 40,508, which when divided by the target district size of 64,053 comes to approximately 0.63 districts. Thus, State College is not larger than the target district population and could be kept whole. However, the Commission's plan divides the city nearly equally into two districts. Figure 23 below shows two maps. The top panel shows a map of the Commission's proposed district boundaries in Centre County where the borough of State College is located. The bottom panel focuses exclusively on the city of State College and shows how the city is split into two different districts. The Commission's plan takes most of the Penn State University campus and combines it with the more rural part of western Centre County as District 77 while the rest of State College is placed in a district with the rural northern and southern portions of the county in District 82.

The next set of maps shows how this division follows the gerrymandering strategy of dividing Democratic cities into "pinwheel" shapes where Democratic voters in the city can be combined with less Democratic areas outside of the city to make more Democratic districts with comfortable margins, but not the overwhelmingly Democratic margins that would occur if fewer districts were drawn that were more geographically compact and split the city fewer times. Figure 24 shows a map of each of the two districts that intersect State College (HD-77, HD-82). Each district is colored based on the partisan lean of the precincts in the district. The pattern we see is yet again repeated — the combination of heavily Democratic precincts in the center of the city with more Republican leaning precincts in the suburbs. While State College itself is heavily Democratic (its partisan index based on the 2012-2020 statewide elections is 0.70), the inclusion of the more Republican leaning suburbs distributes Democrats more efficiently to create two Democratic leaning districts that have less Democratic support, but are still comfortably Democratic-leaning. State College does not have a large or geographically concentrated minority population to warrant a specific analysis on how the districts in this county divide specific minority groups in the city (the city has a 77.6% White voting age population, 5.5% Hispanic VAP, 3.6% Black VAP, and 12.0% Asian VAP).

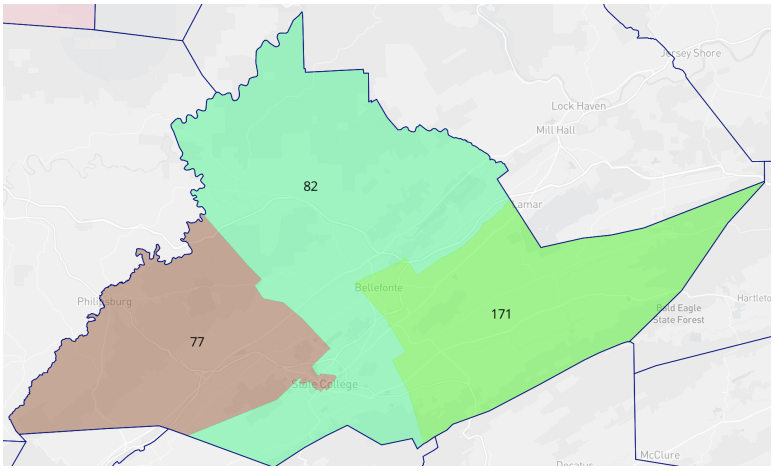
Figure 22: **Distribution of Partisan Districts from Simulations in Centre and Clinton Counties**



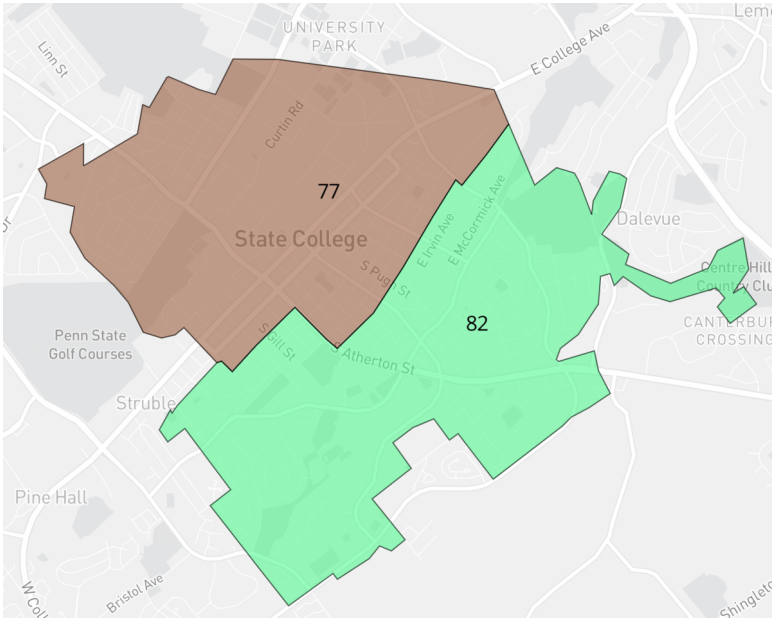
Note: Distribution of likely district partisanship based on the statewide partisan elections index calculated for each of the simulation results. The black bars show the distribution from the simulation results, with the percentage of simulations that generate each of the various possible number of Democratic seats in the cluster shown below each bar. The red vertical line shows the number of Democratic leaning seats in the Commission's proposed map in the same county.

Figure 23: **Commission Proposed Districts in Centre County**

(a) Proposal District Boundaries in Centre County

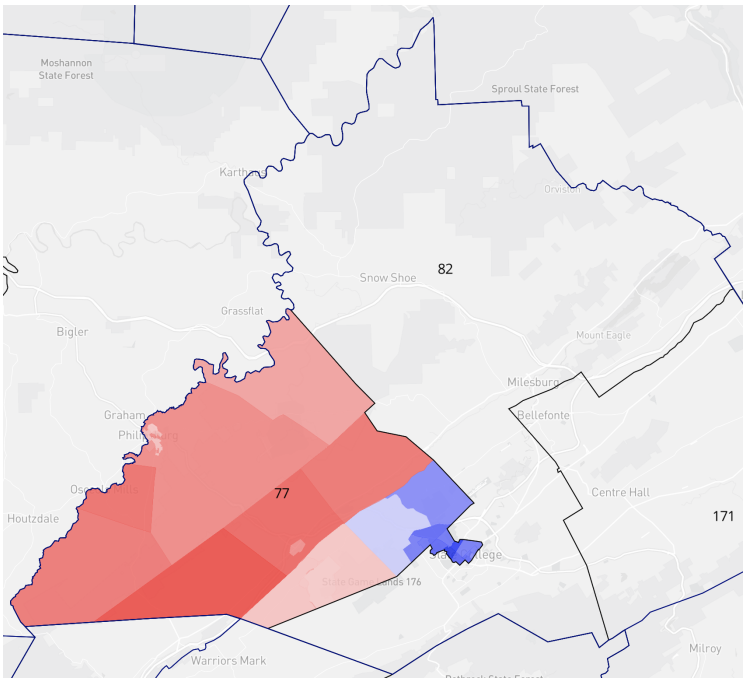


(b) District Boundaries within State College Limits



Note: The top figure shows the district boundaries within Centre County. The bottom figure shows how the city of State College is divided across two districts despite having a population that would allow it to be kept entirely within one district.

District 77 - Partisan Index: 0.59



District 82 - Partisan Index: 0.53

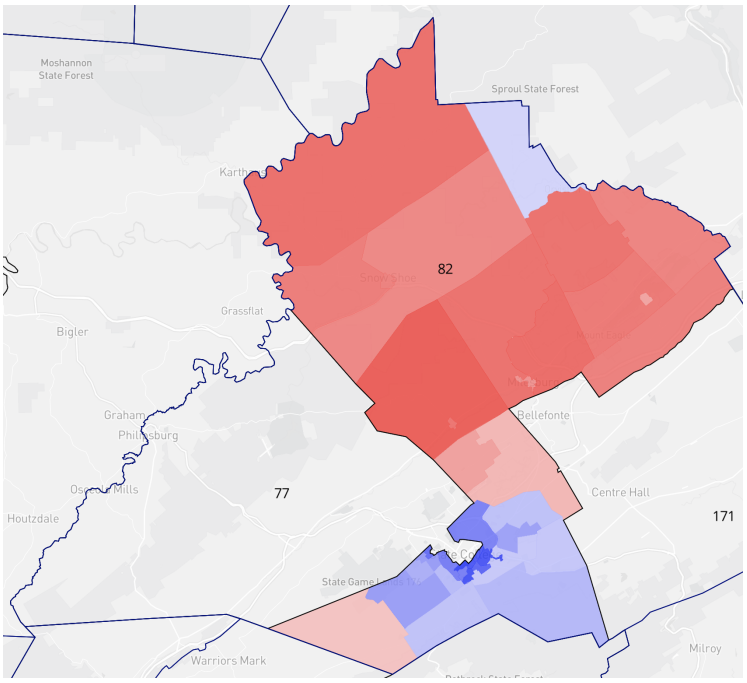


Figure 24: Each panel shows one of the districts that intersect State College. The maps are colored according to the partisan composition of precincts in the district.

6 Comparison to Other District Scoring Programs

To validate the predicted seat shares produced by my analysis, I upload the proposed plan into a commonly used redistricting program - Dave's Redistricting (DRA).[12] This program has been used extensively in redistricting and in redistricting litigation. After uploading the plans, I compare the number of seats the program predicts will lean Democratic to the predictions produced by my analysis. There is perfect agreement when the same elections are used. Table 3 shows the results. In each case I take the proportion of the total two-party vote cast in the elections being included for each district. I then classify each district as a Democratic-leaning district if the Democratic two-party vote share is larger than 0.50.

The DRA uses an index of elections to generate predictions, in a similar way to the indices I described using above. As I noted above, the benefit of an index is that it helps to "wash out" the idiosyncratic features of any particular election, the specific issues in that race, the candidate's qualities (for better or worse), and other factors of the electoral environment. However, the DRA program uses a different combination of elections. The DRA index uses a combination of the 2020 and 2016 presidential elections, the 2018 and 2016 US Senate elections, the 2020 attorney general election, and the 2018 gubernatorial election. When I compute partisan measures that match the DRA index, I get the same results as they do. The DRA index predicts 106 Democratic leaning seats.

Because the choice of elections can have an impact on the predicted seat share for a party, my preferred method is to include all available elections. As discussed above, the main results I present throughout this report use all statewide elections between 2012-2020.[13] I choose 2012 as a starting point because that range incorporates an entire decade, or one decennial census period in which population enumeration and reapportionment take place.

[12] https://davesredistricting.org

[13] I do not include statewide judicial elections in the index. It is uncommon in political science to use judicial elections to measure voters' partisan preferences as research suggests voters treat judicial elections very differently, even when judges run under party labels, than they do partisan elections to legislative and executive positions. Other commonly used measures indices such as Dave's Redistricting and PlanScore.com also omit judicial elections from their partisan indices.

For completeness, I also present the results of the Commission's plan and the distribution of simulations using two alternative indices of statewide elections. First, I recompute an average for all statewide races between 2014-2020 to start after the Holt case in which districts in Pennsylvania were altered as a result of litigation. Finally, I consider an index of statewide elections held in 2020. This measure gives weight to more recent elections and does not include elections from cycles prior to 2020. However, it has the drawback of being heavily influenced by the national political environment of a single election year. Using these indices the Commission's plan contains between 104-107 Democratic leaning districts.

I note that these predictions are independent of the simulations discussed earlier. The predicted seat shares shown below are only a function of different election results and the map put forward by the Legislative Reapportionment Commission. The simulations discussed above provide a comparison of alternative maps that are drawn without consideration of any criteria other than population equality, compactness, and minimizing splits of political subdivisions. They are helpful because they provide a benchmark by which to make an "apples-to-apples" comparison to other districts that are drawn using the same geographic distribution of voters in the state.

Table 3: Comparison of Seat Composition Under Different Elections/Indices

	Commission Plan		% of Simulations Generating Fewer Democratic Seats Than Commission's Map
Election Indices:	Number D Districts	Number R Districts	
DRA index	105	98	
Barber Replication of DRA Index	105	98	
Barber 2012-2020 index	107	96	99.998%
Barber 2014-2020 index	105	98	99.932%
Barber 2020 index	104	99	99.996%

Michael Jay Barber

Appendix A: Curriculum Vitae

Michael Jay Barber

CONTACT INFORMATION

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ACADEMIC APPOINTMENTS

Brigham Young University, Provo, UT

August 2020 - present Associate Professor, Department of Political Science
2014 - July 2020 Assistant Professor, Department of Political Science
2014 - present Faculty Scholar, Center for the Study of Elections and Democracy

EDUCATION

Princeton University Department of Politics, Princeton, NJ

Ph.D., Politics, July 2014

- Advisors: Brandice Canes-Wrone, Nolan McCarty, and Kosuke Imai
- Dissertation: "Buying Representation: the Incentives, Ideology, and Influence of Campaign Contributions on American Politics"
- 2015 Carl Albert Award for Best Dissertation, Legislative Studies Section, American Political Science Association (APSA)

M.A., Politics, December 2011

Brigham Young University, Provo, UT

B.A., International Relations - Political Economy Focus, April, 2008

- *Cum Laude*

RESEARCH INTERESTS

American politics, congressional polarization, political ideology, campaign finance, survey research

PUBLICATIONS

19. **"Ideological Disagreement and Pre-emption in Municipal Policymaking"** with Adam Dynes
Forthcoming at *American Journal of Political Science*
18. **"Comparing Campaign Finance and Vote Based Measures of Ideology"**
Forthcoming at *Journal of Politics*
17. **"The Participatory and Partisan Impacts of Mandatory Vote-by-Mail"**, with John Holbein
Science Advances, 2020. Vol. 6, no. 35, DOI: 10.1126/sciadv.abc7685
16. **"Issue Politicization and Interest Group Campaign Contribution Strategies"**, with Mandi Eatough
Journal of Politics, 2020. Vol. 82: No. 3, pp. 1008-1025

15. **"Campaign Contributions and Donors' Policy Agreement with Presidential Candidates"**, with Brandice Canes-Wrone and Sharece Thrower
Presidential Studies Quarterly, 2019, 49 (4) 770–797

14. **"Conservatism in the Era of Trump"**, with Jeremy Pope
Perspectives on Politics, 2019, 17 (3) 719–736

13. **"Legislative Constraints on Executive Unilateralism in Separation of Powers Systems"**, with Alex Bolton and Sharece Thrower
Legislative Studies Quarterly, 2019, 44 (3) 515–548
Awarded the Jewell-Loewenberg Award for best article in the area of subnational politics published in *Legislative Studies Quarterly* in 2019

12. **"Electoral Competitiveness and Legislative Productivity"**, with Soren Schmidt
American Politics Research, 2019, 47 (4) 683–708

11. **"Does Party Trump Ideology? Disentangling Party and Ideology in America"**, with Jeremy Pope
American Political Science Review, 2019, 113 (1) 38–54

10. **"The Evolution of National Constitutions"**, with Scott Abramson
Quarterly Journal of Political Science, 2019, 14 (1) 89–114

9. **"Who is Ideological? Measuring Ideological Responses to Policy Questions in the American Public"**, with Jeremy Pope
The Forum: A Journal of Applied Research in Contemporary Politics, 2018, 16 (1) 97–122

8. **"Status Quo Bias in Ballot Wording"**, with David Gordon, Ryan Hill, and Joe Price
The Journal of Experimental Political Science, 2017, 4 (2) 151–160.

7. **"Ideologically Sophisticated Donors: Which Candidates Do Individual Contributors Finance?"**, with Brandice Canes-Wrone and Sharece Thrower
American Journal of Political Science, 2017, 61 (2) 271–288.

6. **"Gender Inequalities in Campaign Finance: A Regression Discontinuity Design"**, with Daniel Butler and Jessica Preece
Quarterly Journal of Political Science, 2016, Vol. 11, No. 2: 219–248.

5. **"Representing the Preferences of Donors, Partisans, and Voters in the U.S. Senate"**
Public Opinion Quarterly, 2016, 80: 225–249.

4. **"Donation Motivations: Testing Theories of Access and Ideology"**
Political Research Quarterly, 2016, 69 (1) 148–160.

3. **"Ideological Donors, Contribution Limits, and the Polarization of State Legislatures"**
Journal of Politics, 2016, 78 (1) 296–310.

2. **"Online Polls and Registration Based Sampling: A New Method for Pre-Election Polling"** with Quin Monson, Kelly Patterson and Chris Mann.
Political Analysis 2014, 22 (3) 321–335.

1. **"Causes and Consequences of Political Polarization"** In *Negotiating Agreement in Politics*. Jane Mansbridge and Cathie Jo Martin, eds., Washington, DC: American Political Science Association: 19–53. with Nolan McCarty. 2013.

- Reprinted in *Solutions to Political Polarization in America*, Cambridge University Press. Nate Persily, eds. 2015
- Reprinted in *Political Negotiation: A Handbook*, Brookings Institution Press. Jane Mansbridge and Cathie Jo Martin, eds. 2015

Available Working Papers

"Misclassification and Bias in Predictions of Individual Ethnicity from Administrative Records" (Revise and Resubmit at *American Political Science Review*)

"Taking Cues When You Don't Care: Issue Importance and Partisan Cue Taking"
with Jeremy Pope (Revise and Resubmit)

"A Revolution of Rights in American Founding Documents"
with Scott Abramson and Jeremy Pope (Conditionally Accepted)

"410 Million Voting Records Show the Distribution of Turnout in America Today"
with John Holbein (Revise and Resubmit)

"Partisanship and Trolleyology"
with Ryan Davis (Under Review)

"Who's the Partisan: Are Issues or Groups More Important to Partisanship?"
with Jeremy Pope (Revise and Resubmit)

"Race and Realignment in American Politics"
with Jeremy Pope (Revise and Resubmit)

"The Policy Preferences of Donors and Voters"

"Estimating Neighborhood Effects on Turnout from Geocoded Voter Registration Records."
with Kosuke Imai

"Super PAC Contributions in Congressional Elections"

Works in Progress

"Collaborative Study of Democracy and Politics"
with Brandice Canes-Wrone, Gregory Huber, and Joshua Clinton

"Preferences for Representational Styles in the American Public"
with Ryan Davis and Adam Dynes

"Representation and Issue Congruence in Congress"
with Taylor Petersen

"Education, Income, and the Vote for Trump"
with Edie Ellison

Invited Presentations

"Are Mormons Breaking Up with Republicanism? The Unique Political Behavior of Mormons in the 2016 Presidential Election"

- Ivy League LDS Student Association Conference - Princeton University, November 2018, Princeton, NJ

"Issue Politicization and Access-Oriented Giving: A Theory of PAC Contribution Behavior"

- Vanderbilt University, May 2017, Nashville, TN

"Lost in Issue Space? Measuring Levels of Ideology in the American Public"

- Yale University, April 2016, New Haven, CT

"The Incentives, Ideology, and Influence of Campaign Donors in American Politics"

- University of Oklahoma, April 2016, Norman, OK

"Lost in Issue Space? Measuring Levels of Ideology in the American Public"

- University of Wisconsin - Madison, February 2016, Madison, WI

"Polarization and Campaign Contributors: Motivations, Ideology, and Policy"

- Hewlett Foundation Conference on Lobbying and Campaign Finance, October 2014, Palo Alto, CA

"Ideological Donors, Contribution Limits, and the Polarization of State Legislatures"

- Bipartisan Policy Center Meeting on Party Polarization and Campaign Finance, September 2014, Washington, DC

"Representing the Preferences of Donors, Partisans, and Voters in the U.S. Senate"

- Yale Center for the Study of American Politics Conference, May 2014, New Haven, CT

Conference Presentations

Washington D.C. Political Economy Conference (PECO):

- 2017 discussant

American Political Science Association (APSA) Annual Meeting:

- 2014 participant and discussant, 2015 participant, 2016 participant, 2017 participant, 2018 participant

Midwest Political Science Association (MPSA) Annual Meeting:

- 2015 participant and discussant, 2016 participant and discussant, 2018 participant

Southern Political Science Association (SPSA) Annual Meeting:

- 2015 participant and discussant, 2016 participant and discussant, 2017 participant

Teaching Experience

Poli 315: Congress and the Legislative Process

- Fall 2014, Winter 2015, Fall 2015, Winter 2016, Summer 2017

Poli 328: Quantitative Analysis

- Winter 2017, Fall 2017, Fall 2019, Winter 2020, Fall 2020, Winter 2021

Poli 410: Undergraduate Research Seminar in American Politics

- Fall 2014, Winter 2015, Fall 2015, Winter 2016, Summer 2017

Awards and Grants

2019 BYU Mentored Environment Grant (MEG), American Ideology Project, $30,000

2017 BYU Political Science Teacher of the Year Award

2017 BYU Mentored Environment Grant (MEG), Funding American Democracy Project, $20,000

2016 BYU Political Science Department, Political Ideology and President Trump (with Jeremy Pope), $7,500

2016 BYU Office of Research and Creative Activities (ORCA) Student Mentored Grant x 3

- Hayden Galloway, Jennica Peterson, Rebecca Shuel

2015 BYU Office of Research and Creative Activities (ORCA) Student Mentored Grant x 3

- Michael-Sean Covey, Hayden Galloway, Sean Stephenson

2015 BYU Student Experiential Learning Grant, American Founding Comparative Constitutions Project (with Jeremy Pope), $9,000

2015 BYU Social Science College Research Grant, $5,000

2014 BYU Political Science Department, 2014 Washington DC Mayoral Pre-Election Poll (with Quin Monson and Kelly Patterson), $3,000

2014 BYU Social Science College Award, 2014 Washington DC Mayoral Pre-Election Poll (with Quin Monson and Kelly Patterson), $3,000

2014 BYU Center for the Study of Elections and Democracy, 2014 Washington DC Mayoral Pre-Election Poll (with Quin Monson and Kelly Patterson), $2,000

2012 Princeton Center for the Study of Democratic Politics Dissertation Improvement Grant, $5,000

2011 Princeton Mamdouha S. Bobst Center for Peace and Justice Dissertation Research Grant, $5,000

2011 Princeton Political Economy Research Grant, $1,500

Other Scholarly Activities

Expert Witness in Nancy Carola Jacobson, et al., Plaintiffs, vs. Laurel M. Lee, et al., Defendants. Case No. 4:18-cv-00262 MW-CAS (U.S. District Court for the Northern District of Florida)

Expert Witness in Common Cause, et al., Plaintiffs, vs. LEWIS, et al., Defendants. Case No. 18-CVS-14001 (Wake County, North Carolina)

Expert Witness in Kelvin Jones, et al., Plaintiffs, v. Ron DeSantis, et al., Defendants, Consolidated Case No. 4:19-cv-300 (U.S. District Court for the Northern District of Florida)

Expert Witness in Community Success Initiative, et al., Plaintiffs, v. Timothy K. Moore, et al., Defendants, Case No. 19-cv-15941 (Wake County, North Carolina)

Expert Witness in Richard Rose et al., Plaintiffs, v. Brad Raffensperger, Defendant, Civil Action No. 1:20-cv-02921-SDG (U.S. District Court for the Northern District of Georgia)

Georgia Coalition for the People's Agenda, Inc., et. al., Plaintiffs, v. Brad Raffensberger, Defendant. Civil Action No. 1:18-cv-04727-ELR (U.S. District Court for the Northern District of Georgia)

Expert Witness in Alabama, et al., Plaintiffs, v. United States Department of Commerce; Gina Raimondo, et al., Defendants. Case No. CASE No. 3:21-cv-00211-RAH-ECM-KCN (U.S. District Court for the Middle District of Alabama Eastern Division)

Expert Witness in League of Women Voters of Ohio, et al., Relators, v. Ohio Redistricting Commission, et al., Respondents. Case No. 2021-1193 (Supreme Court of Ohio)

Expert Witness in Regina Adams, et al., Relators, v. Governor Mike DeWine, et al., Respondents. Case No. 2021-1428 (Supreme Court of Ohio)

Expert Witness in Rebecca Harper, et al., Plaintiffs, v. Representative Destin Hall, et al., Defendants (Consolidated Case). Case No. 21 CVS 500085 (Wake County, North Carolina)

Additional Training

EITM 2012 at Princeton University - Participant and Graduate Student Coordinator

Computer Skills

Statistical Programs: R, Stata, SPSS, parallel computing

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